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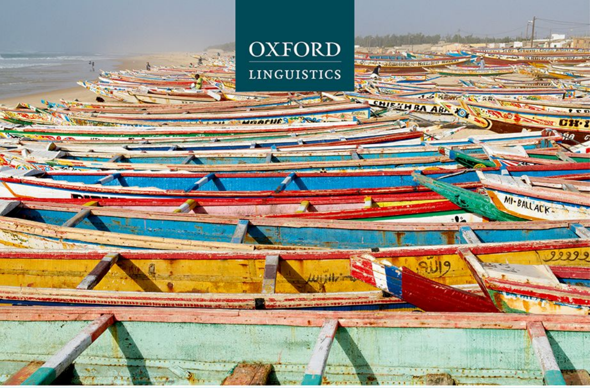

Morphological Length & Prosodically Defective Morphemes

EVA ZIMMERMANN

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Series preface

Oxford Studies in Phonology and Phonetics provides a platform for original research on sound structure in natural language within contemporary phonological theory and related areas of inquiry such as phonetic theory, morphological theory, the architecture of the grammar, and cognitive science. Contributors are encouraged to present their work in the context of contemporary theoretical issues in a manner accessible to a range of people, including phonologists, phoneticians, morphologists, psycholinguists, and cognitive scientists. Manuscripts should include a wealth of empirical examples, where relevant, and make full use of the possibilities for digital media that can be leveraged on a companion website with access to materials such as sound files, videos, extended databases, and software.

This is a companion series to Oxford Surveys in Phonology and Phonetics, which provides critical overviews of the major approaches to research topics of current interest, a discussion of their relative value, and an assessment of what degree of consensus exists about any one of them. The Studies series will equally seek to combine empirical phenomena with theoretical frameworks, but its authors will propose an original line of argumentation, often as the inception or culmination of an ongoing original research programme.

In this book, Eva Zimmerman investigates a phenomenon known as morphological length manipulation, or instances where segmental length alternations (e.g. vowel shortening or lengthening) rely on morphological information. She proposes that all morphological derivation is at its root additive. Writing in the theory of Prosodically Defective Morphemes, Zimmermann ably demonstrates how to derive apparently non-concatenative morphology from the affixation of prosodically defective morphemes. She further extends the proposal to subtractive length manipulation, where the prosodically defective integration of morphemes can result in non-realization of underlying phonological elements when they ‘usurp’ a prosodic node from their base that they lack underlyingly. All variation in such patterns thus derives from the underlying prosodic structure of defective morphemes and constraints that regulate their integration. This timely monograph provides a large dataset of length-alternation phenomena that is typologically balanced and representative. Zimmermann’s elegant approach does justice to the complexity of the topic and provides a solid foundation for researchers who are interested in exploring this central aspect of the phonology-morphology interface.

Andrew Nevins
Keren Rice

Acknowledgements

This book is based on the dissertation I defended in 2014 at Leipzig University. While the main claim remains the same, the book differs substantially from the thesis, both in structure and some specific argumentations and analyses. I would like to thank my supervisors Nina Topintzi and Stuart Davis, not only for their helpful criticisms and comments on the original PhD thesis, but also for their support and encouragement for the plan to turn it into a book. I'm also very grateful to Andrew Nevins and Keren Rice, the series editors, for their support and excellent suggestions on the original manuscript.

The grounding of this book is the joint work I did with Jochen Trommer over the years: his influence on this book and his support while writing it can hardly be overestimated and I am deeply grateful.

Most parts of this work were presented at various conferences or in different colloquia during the last few years and I am thankful for all the the input and criticisms I received at, for example, several Old World Conferences in Phonology and Manchester Phonology Meetings. To name just a few people to whom I am indebted for many helpful comments and discussions over the years: John Alderete, Eric Baković, Ricardo Bermúdez-Otero, Chuck Cairns, Laura Downing, Caroline Féry, Gunnar Hansson, Sharon Inkelas, Pavel Iosad, Junko Ito, Larry Hyman, Yuni Kim, Björn Köhnlein, Marc van Oostendorp, Jaye Padgett, Douglas Pulleyblank, and Sharon Rose.

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List of glosses, abbreviations, and symbols

Glosses

1, 2, 3	first, second, and third person
1>3	first person acting on third person
2>3	second person acting on third person
2<–>3	second person acting on third person or vice versa
ABL	ablative
ACC	accusative
AFF	affirmative
ALL	allative
ANT	anticipatory
BEN	benefactive
BFR	category buffer
COMPL	completive
CONT	continuative
CT	change of topic
DETA	detailed action
DPST	deductive past
DUB	dubitative
F	feminine
FUT	future
IMPF	imperfect
INF	infinitive
IR	interrogative
NMLZ	nominalizer
O	object
PASS	passive
PL	plural
PST	past
REV	reversive
S	subject
SF	stem formative

Sg	singular
Smlf	semelfactive
Stat	stative
Subord	subordinate
Top	topic
Vb	verbalizer

Abbreviations

Affr	Affricate
C	Consonant
CL	Compensatory Lengthening
CT	Cophonology Theory
Fric	Fricative
Gem	Gemination
H	high tone
IO	Input–Output (relation)
L	low tone
MLM	Morphological Length-Manipulation
NoCr	NoCrossingCondition
NKK	NoKickingCondition
OO	Output–output (relation)
OT	Optimality Theory
PDM	Prosodically Defective Morphemes
RMO	RecoverableMorphemeOrderPrinciple
S	Segment
SSM	Southern Sierra Miwok
TAF	Transderivational Antifaithfulness
V	Vowel
VL	Vowel lengthening

Symbols

☛	empirically correct but wrongly suboptimal under the given ranking
☞	the winning candidate
ϟ	excluded by GEN
μ	mora
σ	syllable
Φ	foot
ω	prosodic word

1

Introduction

In this book, the phenomenon of Morphological Length-Manipulation is investigated and it is argued that it is best analysed in a theoretical framework termed 'Prosodically Defective Morphemes': if all possible prosodically defective morpheme representations and their potential effects for the resulting surface structure are taken into account, instances of length-manipulating non-concatenative morphology and length-manipulating morpheme-specific phonology are predicted. The argumentation in this book is hence in line with the general claim that all morphology results from combination and that non-concatenative exponents arise from an 'enriched notion of affix that allows the inclusion of autosegmental tiers' (Stonham, 1994: 27). Although this position has been defended various times for specific phenomena, it has rarely been discussed against the background of a broad typological survey. In contrast to most existing claims, the argumentation in this book is based on a representative data set for attested morphological length-manipulating patterns in the languages of the world that serves as a basis for the theoretical arguments. It is argued that alternative accounts suffer from severe under- and overgeneration problems if one tests them against the full range of attested phenomena.

Before an overview of this book is presented in section 1.3, the phenomenon of Morphological Length-Manipulation (MLM) is introduced and defined in section 1.1 and it is discussed why it is interesting and challenging from a theoretical perspective in section 1.2.

1.1 Morphological Length-Manipulation

1.1.1 Additive MLM

Segment lengthening and epenthesis are common phonological strategies to optimize the phonological structure of a surface form. In Hixkaryana, for example, we find an instance of iambic lengthening ensuring that all vowels in even-numbered, non-final syllables in a string of CV-syllables are long. Examples are given in (1-a) where two morphemes are shown in different morphological contexts and different vowels surface as long depending on the number of syllables preceding the base. In (1-a-i), the second vowel of the stem/hananɨhɨ/ is long if it surfaces in the second syllable,

Morphological Length and Prosodically Defective Morphemes. First edition. Eva Zimmermann.

whereas it is short if it surfaces in the third syllable (Derbyshire, 1979, 1985; Hayes, 1995). In Kuuku-Yaʔu, on the other hand, an intervocalic consonant following a main-stressed vowel is geminated (Thompson, 1976; Hayes, 1995; McGarrity, 2008; Bye and de Lacy, 2008). The language employs a default-to-opposite stress system where main stress is on the rightmost long vowel if there is one (1-b-ii) and otherwise on the initial syllable (1-b-i). The gemination can hence be interpreted as a strategy to ensure that the main-stressed syllable is heavy (=bimoraic).

(1) *Segment lengthening*

a. *Vowel lengthening in Hixkaryana* (Hayes, 1995: 206)

	Underlying	Surface	
i.	kɨ—hananɨhɨ—no	khana:nɨhno	'I taught you'
	mɨ—hananɨhɨ—no	mɨha:nanɨhno	'you taught him'
ii.	owto—hona	owtoho:na	'to the village'
	tohkur^{j}e—hona	tohkur^{j}e:hona	'to Tohkurye'

b. *Consonant lengthening in Kuuku-Yaʔu* (McGarrity, 2008: 58+64)

	Underlying	Surface	
i.	pama	pám:a	'Aboriginal person'
	waliʔi	wál:iʔi	'spotted lizard'
	kacinpinta	kác:inpinta	'female'
	mukana	múk:ana	'big'
ii.	wi:mumu	wí:mumu	'large number of ants'
	muma:ŋa	mumá:ŋa	'rub'

The examples in (2), on the other hand, show contexts where an additional non-underlying segment is realized. In Mohawk (2-a), an additional /e/ surfaces if a consonant is expected to directly follow a single sonorant or a /ʔ/ (Michelson, 1983; Piggott, 1995).[1] And in Selayarese (2-b), an additional /ʔ/ surfaces between two identical vowels that are otherwise expected to be adjacent (Mithun and Basri, 1986; Lombardi, 2002). It can be seen that adding vowel-initial suffixes or vowel-final prefixes[2] can trigger /ʔ/-insertion (2-b-i). If two adjacent non-identical vowels are expected to surface, no epenthesis surfaces (2-b-ii).

(2) *Phonologically motivated insertion*

a. *Vowel insertion in Mohawk* (Piggott, 1995: 292)

Underlying	Surface	
k—runju—s	kerúnjus	'I sketch'
ʌ—k—r—ʌ—ʔ	ʌkerʌʔ	'I will put it into a container'
te—k—rik—s	tékeriks	'I put them together'
ʌ—k—arat—ʔ	ʌkárateʔ	'I lay myself down'
ro—kut—ot—ʔ	rokútoteʔ	'he has a bump on his nose'

[1] The pattern of vowel epenthesis in Mohawk is far more complex and involves more contexts. See, for example, Piggott (1995).

[2] Note that only the relevant morpheme boundaries are marked in the examples.

b. *Consonant insertion in Selayarese* (Mithun and Basri, 1986: 242)

	Underlying	Surface	
i.	amalːi–i	amalːiʔi	'(s)he bought'
	aʔliŋka–a	aʔliŋkaʔa	'I walked'
	ku–uraŋi	kuʔuraŋi	'I accompany him'
ii.	amalːi–a	amalːia	'I bought'
	aʔliŋka–i	aʔliŋkai	'(s)he walked'
	ku–inuŋi	kuinuŋi	'I drink it'

The four processes in (1) and (2) apply in a certain phonological context and receive a straightforward phonological explanation: vowel lengthening in Hixkaryana (1-a) is an instance of iambic lengthening that ensures that every stressed vowel is long, consonant gemination in Kuuku-Yaʔu (1-b) ensures that all main-stressed syllables are heavy, vowel insertion in Mohawk avoids illicit consonant clusters (2-a), and consonant epenthesis in Selayarese (2-b) avoids two adjacent identical vowels.

Now let's take a look at the data in (3), from the Pama-Nyungan language Gidabal (Geytenbeek and Geytenbeek, 1971; Kenstowicz and Kisseberth, 1977). As in the Hixkaryana data in (1-a), a length alternation for vowels can be observed that surface as short in one context and long in another. However, there is a crucial difference to the patterns in (1) and (2), namely the fact that the length alternation in Gidabal cannot be explained by referring only to phonological structure. Stress in Gidabal is on the first syllable and on syllables containing long vowels; the vowel lengthening in (3) hence applies not in all stressed positions. And even more crucially, short final vowels are attested in non-imperative forms in the same phonological contexts. If the structure /gida/ were under some interpretation more marked than /gidaː/ and final vowel lengthening were a general phonological process of Gidabal, we would expect this lengthening to apply in the non-imperative as well. The same holds for the reverse analysis that /gidaː/ is the underlying form and /gida/ the phonologically more unmarked form—a short vowel would be expected in the imperative form.

In contrast, the length alternation is bound to morphological contexts: Whereas verbs end in a short final vowel in their non-imperative form, the final vowel of the imperative form is always long.[3]

[3] It is clear that a detailed understanding of the phonology and morphology of a language is necessary to be sure that such instances are indeed morphologically triggered and not phonologically predictable. For reasons of space, such a detailed background information is not given for all the languages discussed here. The reader is referred to the Appendix for some more facts about all the languages discussed in the following. The transcription of the data is standardized to IPA in most cases and hence often deviates from the original source; see again the Appendix for details. The sources for all data in this book are given in the line above all examples. The page where the examples can be found is given either there or in the same line as the example. If more than one source is listed, the respective sources are abbreviated with the first/the first two letters of the author(s) before the page number.

(3) *Vowel lengthening in Gidabal* (Geytenbeek and Geytenbeek, 1971: 21–24)

Base		Imperative
gida	'to tell'	gidaː
ma	'to put'	maː
jaga	'to fix'	jagaː
gaːda—li—wa	'to keep on chasing'	gaːdaliwaː

In fact, we can find morphologically induced counterparts to all four operations discussed so far. In Shoshone (Numic) (4a), the durative aspect for verbs is marked by geminating the medial consonant of the verb stem (a pattern common in many other Numic languages, see, for example, Crum and Dayley, 1993; Haugen, 2008; McLaughlin, 1982).[4] In the data from Upriver Halkomelem (Salishan) (4-b), the continuative form of verbs realizes the additional sequence /hɛ/ before the stem. A closer look at the data reveals that this is in fact only one of four predictable allomorphs to realize the continuative; most of them add additional segments or length to the initial syllable. The /hɛ/-insertion in (4-b) can hence reasonably be analysed as epenthesis (see section 5.3.1 for more details). Finally, in Shizuoka Japanese, emphatic adjective formation involves one of three length-manipulating operations, among them insertion of an additional nasal segment that surfaces as homorganic to an adjacent consonant (4-c-i) (Davis and Ueda, 2002, 2005, 2006). Realization of this segment alternates predictably with vowel- and consonant lengthening (4-c-ii, iii) and can hence—absolutely parallel to the argumentation for Upriver Halkomelem above—reasonably analysed as epenthesis (see section 2.1.1 for some more details).

(4) a. *Consonant gemination in Shoshone* (Crum and Dayley, 1993: 94)

Stem		Durative
nɨmi	'travel'	nɨmːi
maka	'feed'	makːa
taik^{w}a(h)	'speak'	taikː^{w}a
ɨk^{w}i('')	'smell'	ɨkː^{w}i
hapi('')	'lie (down)'	hapːi
jɨk^{w}i('')	'say'	jɨkː^{w}i

b. *Vowel (and consonant) epenthesis in Upriver Halkomelem* (Galloway, 1993)

Non-Continuative		Continuative		
mə́q'ət	'swallow sth.'	hə́mq'ət	'swallowing sth.'	60
wə́q'^{w}	'drown, drift downstream'	hə́wq'^{w}	'drowning'	273
jə́q'əs	'file'	hɛ́jq'əs	'filing'	61
lə́qəm	'dive'	hɛ́lqəm	'diving'	61

[4] Note that the superscript '(h)' and '('')' notate the common Numic 'final features': certain morphemes trigger a change (nasalizing, preaspirating, doubling) on a following consonant.

c. *Consonant epenthesis in Shizuoka Japanese* (Davis and Ueda, 2005: 3)

	Base		Emphatic form
i.	hade	'showy'	hande
	ozoi	'terrible'	onzoi
	nagai	'long'	naŋgai
	karai	'spicy'	kanrai
ii.	katai	'hard'	kat:ai
	osoi	'slow'	os:oi
iii.	zonzai	'impolite'	zo:nzai
	sup:ai	'sour'	su:p:ai

As in Gidabal, there is no context for these operations that can be determined by phonological factors alone. In contrast, they are all crucially bound to contexts that can be characterized by a specific morpho-syntactic information that is not marked by affixation of segmental material. Given that the absence of a segment is taken to be the length zero, all these examples have in common that the length of a segment is affected in some way, hence they are instances of 'length-manipulation'. In Gidabal and Shoshone, a short segment alternates with a long one (S → S:), and in Upriver Halkomelem and Shizuoka Japanese, a zero segment alternates with a segment (ø → S).

The example in (5) is yet different from the data in (4) since an additional segmental affix is present in the context where a segmental lengthening operation applies. Affixation of the reversive suffix /—i/ in Wolof (Atlantic) results in gemination of a preceding stem consonant (5-a). The examples in (5-b) show that phonologically similar suffixes do not trigger the length-manipulation. This is especially apparent since the two suffixes are homophonous and only the reversive /—i/ triggers degemination whereas the base is realized unchanged[5] before the inchoative suffix /—i/. As before, the phonological context alone is insufficient to account for the length-alternation but crucial reference to the morpho-syntactic category is necessary. In contrast to the examples in, (3)–(4), however, the morphological category in question is also marked by a segmental affix.

[5] Note that there are additional vowel changes for some stems. It is concluded in Ka (1994) that those 'stem vowel changes are a morphologized phenomenon' (p. 96). If those changes are indeed instances of morpheme-specific phonology, an analysis assuming floating vocalic features would nicely account for those facts and would perfectly be in line with the PDM claim defended here. Since we are only concerned with the MLM, these changes are ignored in the following.

(5) *Gemination in Wolof* (Ka, 1994: 87, 88)

a.

Base	Reversive	
ub	ubːi	'to open'
teg	tegːi	'to remove
lem	lemːi	'to unfold'
lal	lalːi	'to take off (a sheet)'

b.

Base	Inchoative	
takː	tekːi	'to untie'
gəmː	gimːi	'to open eyes'

In the following, instances such as the gemination in Wolof are termed *Additive Affixation*: a segmental affix triggers an additional length-manipulating operation. The patterns in (3)–(4) where the manipulation of segment length alone is the sole marking for a certain morpho-syntactic context, on the other hand, are termed *Addition*. The latter is standardly assumed to be an instance of non-concatenative morphology where a morphological information is not marked by the addition of segmental material but some operation that, for example, manipulates the sub- or suprasegmental structure of the base (for discussion and a definition see, for example, Bye and Svenonius, 2012). The former phenomenon is termed 'morphologically conditioned phonology' (Anttila, 2002), the 'dominance effect' of certain affixes (Alderete, 2001*a*), or 'morpheme-specific phonology' (Pater, 2009) since a phonological operation applies only in the context of adding of a certain segmental affix. Additive Affixation and Addition are what is termed additive *Morphological Length-Manipulation* in the following: lengthening or addition of segments is bound to a specific morpho-syntactic context and cannot be explained with reference to the phonological context alone.

1.1.2 Subtractive MLM

In all the examples discussed so far, the length of a segment was affected in an additive way: a segment became longer or a whole segment was added. The logical counterpart to these patterns are processes that affect the length of a segment in a subtractive way. In the domain of purely phonologically triggered processes, it is not difficult to come up with examples that show the subtractive mirror image of the additive phonological processes given in (1) and (2).

In Yokuts (Yokuts-Utian), for example, a process of vowel shortening can be observed (6-a). Long vowels in closed syllables are illicit in the language and whenever an underlyingly long vowel is expected to surface in a closed syllable, vowel shortening applies (Newman, 1932; Noske, 1985; Archangeli, 1991). And in Diola-Fogny (Sapir, 1969; Kager, 1999*b*; McCarthy, 2008*b*), we see a process of consonant deletion (6-b). Illicit consonant clusters in Diola-Fogny are avoided via deletion of a consonant.

(6) *Phonologically motivated shortening*

a. *Vowel shortening in Yokuts* (Archangeli, 1991: 239)

Underlying	Surface	
taːn—sit	tansit	'will go toward'
doːs—hat'—iːn	doshot'en	'will want to tell'
taːwt̥—aː—al	tawt̥al	'might kill'
taxaː—t	taxat	'was brought'

b. *Consonant deletion in Diola-Fogny* (Sapir, 1969: 17)

Underlying	Surface	
lɛt—ku—jaw	lɛkujaw	'they will not go'
na—manj—manj	namamanj	'he knows'
ɛ—rɛnt—rɛnt	ɛrɛrɛnt	'it is light'

As for segment lengthening and segment insertion, morphologically triggered counterparts to these shortening and deletion operations are attested as well. And quite parallel to the distinction into Addition and Additive Affixes, a distinction into *Subtraction* and *Subtractive Affixes* can be made. In Yine (Maipurean), vowels directly preceding certain suffixes are systematically deleted (7-a). This vowel deletion is no regular phonological process of the language but only triggered by an arbitrary class of suffixes that share no obvious common feature in terms of their semantics or phonology. The latter fact is apparent since pairs of homophonous suffixes exist where one suffix triggers deletion (e.g. nominalizing /—<u>nu</u>/) and the other does not (e.g. anticipatory /—nu/). Examples of non-triggering suffixes are given in (7-a-ii) and to facilitate reading, the morpho-syntactic meaning is added as index to the homophonous pairs of suffixes. The operation of segment deletion is hence bound to specific morphological contexts that are marked by certain segmental suffixes. Quite parallel to Additive Affixation, this is termed an instance of Subtractive Affixation. Subtractive Affixes like these vowel-deletion triggering affixes in Yine are always underlined in this book. In Wolof (Atlantic), the causative suffix /—<u>al</u>/ triggers degemination of a preceding long consonant (Ka, 1994; Bell, 2003) (7-b-i).[6] As the vowel deletion in Yine, this degemination is not phonologically predictable. This is most apparent in the data (7-b-ii) where it can be seen that the homophonous benefactive suffix /—al/ does not trigger degemination. The degemination is hence an instance of MLM, more concretely of Subtractive Affixation. Interestingly, the data in (5) showed us that the language also employs Additive Affixation. As discussed in some more detail in section 3.2.2, such a coexistence of additive and subtractive MLM in one language is not uncommon and follows straightforwardly in the theory of *Prosodically Defective Morphemes* (=PDM) proposed in this book.

[6] Some pairs of singleton–geminate alternations in Wolof are not entirely regular. The geminate /pː/, for example, always alternates with the singleton continuant /f/. An alternation that is not unexpected in this example since the stop /p/ is impossible intervocalically (Ka, 1994).

In the Chadic language Hausa (Hayes, 1990; Wolff, 1993; Smirnova, 1985; Schuh, 1989; Newman, 2000; Jaggar, 2001; Crysmann, 2004; Álvarez, 2005), the formation of a proper noun from a common noun involves only shortening of a final long vowel (7-c). In Canela Krahô (Macro-Ge), on the other hand, segment deletion[7] can be observed that is not accompanied by addition of a segmental affix (Popjes and Popjes, 2010). Non-realization of the base-final consonant forms finite verbs from infinite bases (7-d). That the process can not reasonably be analysed as insertion is apparent since the consonant quality of the putative inserted final consonant is not predictable. Non-realization of the final consonant is hence the only exponent for a certain morpho-syntactic category in Canela Krahô.

(7) *Morphological subtractive operations*

a. *Morphological vowel deletion in Yine* (Matteson, 1965)

	Underlying	Surface		
i.	neta—ja	netja	'I see there'	M36
	pawata—maka	pawatmaka	'I would have made a fire'	M74
	çema—çe—ta	çemçeta	'to have never, never heard'	M79
	homkahita—ka$_{\text{PASS}}$	homkahitka	to be followed'	M80
	tsapo—ta$_{\text{DETA}}$	tsapta	'to have repeated cramps'	M87
ii.	tçiɾika—ka$_{\text{SMLF}}$	tçiɾikaka	'to ignite'	M85
	nika—ta$_{\text{SF}}$	nikata	'to terminate'	M88

b. *Morphological consonant shortening in Wolof* (Ka, 1994: 96, 97)

i.

Base		Causative	
seg:	'to filter'	segal	'to press oily products'
son:	'to be tired'	sonal	'to tire, bother'
top:	'to follow'	tofal	'to add'
sed:	'to be cold'	seral	'to cool'
muc:	'to be safe'	musəl	'to save'

ii.

Base		Benefactive	
bət:	'to pierce'	bət:al	'to pierce for'
dug:	'to enter'	dug:əl	'to enter for'

c. *Morphological vowel shortening in Hausa* (Schuh, 1989: 38)

Proper noun		Common Noun	
marka:	'height of rainy season'	marka	'name of woman born at this time'
ba:ko:	'stranger'	ba:ko	'man's name'
baki:	'black'	baki	'Blackie'
kuma:tu:	'cheeks'	kuma:tu	'name of so. with fat cheeks'

[7] For theoretical reasons that are discussed in section 2.2.2, 'deletion' in the present framework is in fact 'non-realization'. Both terms are used in free variation.

d. *Morphological consonant deletion in Canela Krahô*

(Popjes and Popjes, 2010: 192)

LONG		SHORT
ihkulan	'(so.) kills it'	ihkula
tɔn	'(so.) makes it'	tɔ
ihkahːɯl	'(so.) whips it'	ihkahːɯ
katɔl	'he arrives'	katɔ

The patterns in (7) all have in common that a process that is crucially bound to a certain morpho-syntactic context reduces the length of a segment: it becomes shorter (Sː → S) or remains completely unrealized (S → ø).

1.1.3 A definition of the phenomenon

The examples of Addition, Subtraction, Additive Affixation, and Subtractive Affixation discussed in the previous sections 1.1.1 and 1.1.2 in fact illustrate the full range of what is taken to be Morphological Length-Manipulation (=MLM) in the following. This empirical area is a subset of what is termed 'morphologically conditioned phonology' in Inkelas (2014) where an insightful study and empirical overview of similar phenomena at the phonology–morphology boundary is given.

The different patterns of MLM can be classified with at least three relevant parameters. For one, either an additive (ø → S or S → Sː) or a subtractive (S → ø or Sː→ S) length-manipulating operation has applied. Secondly, the length-manipulation targets either a vowel or a consonant.[8] A cross-classification of these differences results in eight basic length-manipulation operations that are summarized in (8) together with the terms used throughout the book.

(8) *Morphological length-manipulating operations*

	Additive		**Subtractive**	
	S → Sː	ø → S	Sː → S	S → ø
Vowel	Vowel lengthening	Epenthesis	Vowel shortening	Deletion
Consonant	Gemination		Degemination	

[8] Deletion and epenthesis can target more than one segment and some patterns delete/insert a segmental string CV, hence target a consonant and a vowel at the same time. It is abstracted away from these complex patterns for now.

Together with the difference between non-concatenative morphology (=Addition and Subtraction) and morpheme-specific phonology (=Additive and Subtractive Affixes), a typology of sixteen possible patterns of MLM arises. Most of them are attested in the languages of the world and all these different types are discussed and analysed throughout this book. In (9), an example for every pattern in one language is listed, some of which were illustrated above.

(9) *16 Morphological length-manipulating patterns*

	Addition	**Additive Affix**
Vowel lengthening	1 Gidabal	2 Bukusu
Gemination	3 Shoshone	4 Pulaar
Vowel epenthesis	5 Southern Sierra Miwok	6 Arbizu Basque
Consonant epenthesis	7 Shizuoka Japanese	8 Standard Japanese
	Subtraction	**Subtractive Affix**
Vowel shortening	9 Oromo	10 Kashaya
Degemination	11 ???	12 Wolof
Vowel deletion	13 Lardil	14 Yine
Consonant deletion	15 Canela Krahô	16 West Greenlandic

For only one of the sixteen expected patterns of MLM, could no convincing attested instance be found, namely degemination as a non-concatenative operation. However, this might receive a straightforward independent explanation in the fact that geminate consonants are cross-linguistically more marked than singleton consonants. The lack of an example for pattern 11 is hence taken as an accidental gap.

In this book, a unified theoretical account of all these types of MLM is proposed. As is shown in detail in the following chapters, the difference between Additive/Subtractive Affixation and Addition/Subtraction is irrelevant for most parts of the theoretical analysis and the different terms are used merely to facilitate the empirical description of data. This follows the insight in the detailed study in Inkelas (2014) where MLM falls under a subset of the phenomena discussed there as 'morphologically conditioned phonology'.

The empirical aim of this book is to provide a representative data collection of attested instances of MLM. Such an empirical base allows us to make a strong argument for a specific theoretical framework that predicts all attested patterns and excludes imaginable patterns that are generally unattested. For such an empirical survey that backs up a theoretical claim, one needs a clear definition of the empirical phenomenon in question which is as theory-neutral as possible. A first definition of morphological length-manipulating *operations* that summarizes the preceding discussion is given in (10).

(10) *Morphological length-manipulating operations*
Two output forms A and B are related via a length-manipulating operation iff
a. one form is morphologically derived from the other,
(i.e. the morpho-syntactic features expressed by the two forms are in a subset-superset relation)
and
b. there is a segmental length difference between both forms, i.e. either (i) or (ii) applies,
(i) a segment in A is longer than its correspondent in B (=*Long-Short-Alternation*),
(ii) a segment is present in A but not in B that is not part of the underlying representation of the morphemes in A (=*Segment-Zero-Alternation*),
and this segmental length difference cannot be explained in purely phonological terms.

It is clear that the definition is not completely theory-neutral. The identification of an MLM operation requires a morphological analysis both in terms of expressed morphological and/or semantic features and in terms of segmentation into morphemes.[9]

This definition, however, only allows us to identify surface alternations that can be described as morphologically triggered length-manipulations, it is not sufficient for unambiguously relating a morphological context with one MLM *pattern*. For an illustration of this problem, let's briefly consider examples of MLM in Leggbo and Upriver Halkomelem.

Progressive formation in Leggbo involves addition of the suffix /—i/ in addition to two processes of gemination that apply to the first and the second base consonant as can be seen in (11) (the pattern discussed and analysed in detail in section 6.2.4.1). According to the definition in (10), these two gemination processes are two MLM operations. However, both of them are unambiguously associated with one morpheme and an analysis is hence preferably where both operations are part of the same MLM *pattern*, triggered in the same morphological context or by the same morpheme.

[9] Especially the issue of segmentation into morphemes is a task far from being trivial and is notoriously biased by the analyst (for a general discussion of this subsegmentation problem see, for example, Bank and Trommer (to appear) or Bank and Trommer (2015)). In the following, the segmentation into morphemes follows the one given in the descriptive sources in most cases. However, since the distinction into Addition-Additive Affix and Subtraction-Subtractive Affix is not relevant for the general logic of the present analysis, the morpheme segmentation problem is not crucial for the arguments made in this book.

(11) *Progressive in Leggbo: Gemination* (Hyman, 2009: 16)

Base		Progressive
bal	'to remove oil/palmnut'	bːalːi
dum	'to bite'	dːumːi
kum	'to pierce, stab'	kːumːi
vɔŋ	'to want, look for'	fɔŋːi
sɛŋ	'to go'	sɛŋːi

On the other hand, it is possible that different instances of MLM apply in the same morphological context and the choice between them is phonologically predictable given the structure of the base.

An example is the continuative formation in Upriver Halkomelem that is analysed in detail in section 5.3.1. Two of the four allomorphs that form the continuative are given in (12): vowel lengthening and reduplication of an initial CV sequence. The choice between the allomorphs in Upriver Halkomelem is predictable given the phonological structure of the base: when the base starts with a glottal consonant, vowel lengthening surfaces (12-a) and when the base starts with a non-glottal consonant and has a full stressed vowel in the initial syllable, reduplication can be observed (12-b). Since one of the allomorphs is a Long-Short-Alternation, the pattern is part of the MLM data sample.

(12) *Continuative allomorphy in Upriver Halkomelem* (Galloway, 1993)

a. *Vowel lengthening*

Non-Continuative		Continuative		
ʔíməç	'walk'	ʔíːməç	'walking'	66
ʔíχət	'scrape sth./so.'	ʔíːχət	'scraping sth./so.'	67
hílt	'roll sth. over'	híːlt	'roll sth. over'	67
hákʷəç	'use sth.'	háːkʷəç	'using sth.'	270

b. *Reduplication*

Non-Continuative		Continuative		
q'ísət	'tie sth.'	q'íq'əsət	'tying sth.'	68
p'ɛ́tθ	'sew'	p'ɛ́p'ətθ	'sewing'	266
t'ɛ́jəq'	'get angry'	t'ɛ́t'əjəq'	'getting angry'	136
jíq	'fall (of snow)'	jíjəq	'falling (of snow)'	135

Continuative formation in Upriver Halkomelem shows hence different MLM operations in complementary distribution that mark the same morphological category and should reasonably be analysed as a single MLM pattern.

A definition of MLM pattern hence takes into account the possibility of multiple MLM operations that constitute a single MLM pattern: either those operations are in complementary distribution since they are phonologically predictable allomorphs for a morpheme or they are expected to cooccur as part of a more complex MLM. The definition in (13), of course, does not exclude that the set of M_x only contains a single MLM operation. As will becomes clear in the following chapters, this is in fact the most frequent default pattern of MLM.

(13) *MLM pattern, preliminary*
A set M_x of MLM operations M_1–M_n constitutes a pattern of MLM iff their context of application is bound to the presence of the same morpho-syntactic features.

With this definition of MLM pattern in mind, let's return to the definition for MLM operation given in (10). There are in fact several apparent MLM phenomena that are not or only under special circumstances part of the MLM data sample presented here. This is mainly due to the fact that for several processes, the decision whether they are instances of MLM or not hinges to a certain degree on their theoretical implementation. A second important consideration is the (partial) exclusion of MLM operations for which extensive empirical and theoretical discussions already exist and which straightforwardly follow under the general framework of PDM.

One of these MLM operations is reduplication. It increases the number of segments if one compares a base and its reduplicated form and hence should be considered an instance of MLM. Even more so since the theoretical significance of (empty) prosodic nodes in the analyses for reduplication has been discussed extensively over the last few decades (see, for example, Marantz (1982), or McCarthy and Prince (1986/1996) et seq.). On the other hand, the added segments could be interpreted as being already present in the underlying base since they are copies of existing base segments. For the data sample that is the basis for the theoretical arguments in this book, reduplication is disregarded for most parts. This choice is motivated by two main points. *First*, reduplication is a far more well-studied phenomenon than the remaining segmental-lengthening operations. There are a lot of comprehensive studies about attested reduplication phenomena and their theoretical account (for literature and discussion see, for example, Spaelti, 1997; Raimy, 2000; Hurch, 2005; Samuels, 2010; Saba Kirchner, in press). And, *second*, it is trivially necessary to restrict the number of relevant data to a reasonable size if one claims to have a representative sample for a specific phenomenon. Reduplication is hence only included in the data sample and discussed throughout this book if it is one phonologically predictable allomorph in a morphological context where a Long-Short-Alternation can be found in other phonological contexts.

Another note is in order regarding morphological epenthesis as instance of MLM. Given the reasoning above, a process of segment insertion is expected as counterpart to segment deletion as an instance of length-manipulating morphology. And indeed it is argued here that such cases exist (see the description of Upriver Halkomelem in (4-b)). On the other hand, it is clear that they are hard to identify based on surface observations about the paradigms in a language. This follows from the simple fact that on the surface, nothing distinguishes underlying segments that are assumed to be part of the lexical representation of a morpheme from epenthetic segments. If more segments are present in a morphologically more complex form than in its base, the default assumption would presumably be that an affix consisting of segments was added. One criterion to distinguish underlying from epenthetic segments could be the fact that epenthetic segments in a language have either an unmarked default value or a quality that depends partially or completely on the quality of neighbouring segments (for discussion see, for example Hall, 2011). However, this criterion only allows us to exclude segments that are not epenthetic, it does not allow the reverse conclusion that all instances of unmarked default segments or segments that underwent harmony are epenthetic. Quite parallel to reduplication, morphological epenthesis is hence only included as an instance of MLM into the data sample if it alternates phonologically predictable with a Long-Short-Alternation.

In addition, instances that are standardly described as templatic morphology are generally excluded. The best-known example is probably Semitic morphology but there are also instances of templatic morphology attested in, for example, Southern Sierra Miwok, a language that is discussed in this book in some detail since it also exhibits non-templatic morphological lengthening patterns. The exclusion of templatic length-manipulation also excludes many instances of subtractive morphology, namely truncation.[10] All instances of morphological deletion considered in the following are hence instances where the deleted portion can be characterized prosodically, not instances where words are stripped down to a certain fixed size. It is clear that under the general account of PDM, it is expected that templatic morphology follows in principle from the same mechanism. Templatic morphology is nevertheless excluded for two reasons which are very similar to the reasonings that led to an exclusion of most reduplication patterns. *First*, claims that templatic morphology follows from adjusting a base to a certain prosodic category have been made elsewhere (for discussion and literature see, for example, McCarthy and Prince, 1994*b*) and, *second*, these phenomena have received considerably far more attention in the (theoretical) literature (see, for example, McCarthy, 1981; McCarthy and Prince, 1986/1996, 1990; Bensoukas, 2001; Ussishkin, 2003, 2005; Bye and Svenonius, 2012) and this book aims to focus on an area where the empirical base is less clear.

[10] Following the distinction into truncation and subtraction developed in Arndt-Lappe and Alber (2012).

These above discussed restrictions are included in the revised definition of MLM pattern in (14). In contrast to the definition in (13), all phonologically predictable allomorphs for a morpheme are counted as one MLM pattern. In addition, templatic morphology is completely excluded and epenthesis and reduplication alone are not sufficient to define a pattern of MLM. It is clear that this definition still leaves space for interpretation and the restriction 'no prosodic restriction on the number of syllables or segments holds for all bases' is presumably not a sufficient characterization for all templatic patterns excluded here. A straightforward example is the broken plural formation in Arabic that has been argued not to be 'templatic' in this sense but is nevertheless excluded (see, for example, McCarthy, 1983*b*; McCarthy and Prince, 1990; McCarthy, 2000*a*) mainly to avoid a reimplementation of existing analyses for a well-known phenomenon that already follow the general logic of the account proposed here.

(14) *MLM pattern, revisited*
A set M_x of MLM operations M_1–M_n constitutes a pattern of MLM iff
a. their context of application is bound to the presence of the same morpho-syntactic features, and
b. one MLM operation in M_x is a Long-Short-Alternation (10-b-i), and
c. no prosodic restriction on the number of syllables or segments holds for all bases that results from the application of M_1 to M_x.
(If no such restriction holds in the rest of the language.)

Given this definition, it is clear that a language can have different patterns of MLM, either in different morphological contexts or as lexically marked allomorphs for the same morpheme. Aymara, for example, which is discussed in detail in section 4.2 employs four different MLM patterns: Addition, Subtraction, Additive Affixes, and Subtractive Affixes and all these different patterns are associated with different morphological contexts. On the other hand, in Murle, two different Subtraction patterns coexist in the same morphological context. In this Kwa language (for an analysis, see sections 3.2.2.2 and 3.2.3), two productive plural formations involve non-realization of base-final material (Arensen, 1982; Haspelmath, 2002). As can be seen in (15), either the base-final consonant or the base-final VC sequence remains unrealized. The choice between these two allomorphs realizing the same morphological feature is unpredictable and hence must be lexically marked—according to the definition in (14); two Subtraction patterns are thus listed for Murle in the data sample.

(15) *Subtraction in Murle: plural formation* (Arensen, 1982: 40–43)

	Base		Plural
a.	keloc	'flea'	kel
	ziza:coc	'termite'	ziza:c
	cinotot	'moustache'	cinot
	mininit	'spirit'	mininŋ

b. bawot	'goat'	bawo
zoːc	'foot'	zɔː
idiŋ	'meat'	idi
korton	'anthill'	korto

Given this definition of MLM patterns, a representative data sample was conducted that serves as the empirical base for the theoretical argumentation in this book. In chapter 6, this data sample is described in more detail and the crucial empirical generalizations about attested and unattested MLM patterns are summarized. This discussion is located after the theoretical discussion of PDM since the ultimate goal is to show that this theoretical framework is able to predict all and only the attested patterns of MLM. Consequently, the theoretical background assumptions and the PDM account of MLM is discussed in chapters 2 to 5 before we return to the complete picture of attested MLM patterns.

1.2 MLM as a challenge for theoretical accounts

The most obvious challenge that MLM poses for any theoretical account is the existence of subtractive MLM (Martin, 1988; Mel'čuk, 1991; Anderson, 1992; Dressler, 2000; Steins, 2000; Inkelas, 2014) since it apparently undermines the common background assumption that morphology is additive (for example, Bye and Svenonius, 2012). Or as Inkelas (2014) puts it: 'Subtractive morphology has served as the strongest argument that morphological constructions are, at least in some cases, processual, in the sense that they cannot be analyzed by means of the addition of a morpheme' (p. 64). In this book, the claim originally made in Trommer and Zimmermann (2014) (see also Trommer, 2011*a*) is extended that this assumption can indeed be maintained and that the affixation of prosodic nodes might result in subtractive MLM as well as in additive MLM. For this first attempt to reduce subtractive non-concatenative operations to simple affixation, the coexistence of additive and subtractive MLM patterns in a single language is a new challenge. This point and especially the problems for the original Generalized Mora Affixation account in Trommer and Zimmermann (2014) is addressed in section 3.2.2 (see especially 3.2.2.1) where several languages are discussed where additive and subtractive MLM patterns coexist.

The existence of morpheme-specific phonology as the application of phonological processes that are only triggered by the presence of some morpheme is another challenge for theoretical accounts of phonology. From a standpoint of theoretical economy and restrictiveness, it is clear that a theory is preferable where the different modules of the grammar do not have direct access to all information of other modules (formulated for the phonology as the 'Indirect Reference Hypothesis' in, for example, Inkelas, 1990). The challenge is hence to account for morpheme-specific phonology in a theory where the phonology has no direct access to specific morphological information.

In addition, a unified account for the non-concatenative morphology and morpheme-specific phonology (see the discussion in 1.1.3) is desired. Mainly because in the domain of MLM, the same generalizations and restrictions about frequency and non-existing patterns hold in both domains. The theory of PDM is exactly such a unified theoretical account to non-concatenative morphology and morpheme-specific phonology involving length-manipulations that predicts this parallel behaviour in a straightforward manner.

A crucial generalization about MLM in the data sample concerns the possible base positions that can be affected by MLM in the languages of the world. A pattern of MLM always affects one specific base position and only a restricted set of base positions can be affected by MLM, absolutely parallel to the findings for segmental infixation in Yu (2007). In chapter 7, the most prominent OT-alternatives to non-concatenative morphology and/or morpheme-specific phonology are summarized that all over-generate in this respect (namely REALIZEMORPHEME-based account, Cophonology Theory, morpheme-specific constraints, and Transderivational Antifaithfulness; see section 7.1 for an introduction).

1.3 Structure of the book

Chapter 2: The theory of Prosodically Defective Morphemes The theoretical background for the theory of PDM is presented. PDM is based on the simple insight that if all possible prosodically defective morpheme representations and their potential effects on the phonological structure are taken into account, instances of length-manipulating non-concatenative morphology and length-manipulating morpheme-specific phonology are predicted. The chapter begins with discussing previous accounts which argue that the affixation of prosodic nodes may result in specific MLM phenomena in a certain language. Later, the concrete theoretical background assumptions for the proposed theory of PDM are presented. It is an optimality-theoretic system based on containment for phonological primitives and association lines. New theoretical assumptions are made about the linearization of morphemes that in particular implement a severe restriction on the ordering possibilities of morphemic prosodic nodes. This theory correctly predicts that MLM operations can only affect a restricted set of base positions. As an independent argument for containment theory, the issue of opacity problems in the domain of MLM and the solution containment offers are discussed. Finally, a first general overview is given of how this theory accounts for all MLM patterns.

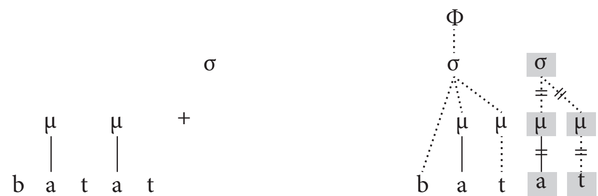
Chapter 3: Subtractive MLM and Prosodically Defective Morphemes This chapter discusses how the theory of PDM accounts for instances of subtractive MLM—the empirical phenomenon that is notoriously challenging for the claim that morphology is additive. Two general mechanisms inside PDM can predict subtractive MLM: usurpation of moras and the defective integration of morphemic prosodic nodes. Usurpation can arise if a segment underlyingly lacks a mora and 'usurps' it from a neighbouring segment that is hence deprived of it (16-a). In the second scenario, a prosodic node that is underlyingly not integrated into the higher/lower prosodic structure is affixed to a base and remains defectively integrated in the output (16-b). Given the standard assumption that only elements properly integrated under the highest prosodic node of the prosodic hierarchy are visible for the phonetics, this affix node and everything it dominates remain phonetically uninterpreted.

(16) *PDM and subtractive MLM*

a. *Morpheme-specific vowel deletion in Yine*

UNDERLYING	SURFACE
/neta/ /–lu/	[netlu]
stem + V-deletion triggering suffix	final stem-V is deprived of its mora and remains phonetically unrealized

b. *Segment deletion in Alabama*



UNDERLYING	SURFACE
/batat/ /ø/	[bat]
stem + subtractive plural morpheme (=affix syllable)	syllable is not prosodically integrated and remains phonetically unrealized

Both these mechanisms are discussed in detail in this chapter and it is shown how all attested types of subtractive MLM in the representative data set fall out from the theory. The upshot is that subtractive morphology is purely epiphenomenal and involves addition of a (prosodically defective) morpheme. A crucial prediction of PDM is that subtractive and additive MLM should easily coexist in one language. It is shown that this prediction is indeed borne out.

Chapter 4: Prosodically Defective Morphemes and blocking This chapter investigates the predictions that arise in the theory of PDM if multiple prosodically defective morphemes interact with each other. In particular, such interactions predict blocking of MLM: one prosodically defective morpheme bleeds the effect of another. Those effects are indeed borne out. For one, there are instances where several morphemes in a language are lexically marked exceptions to an MLM process. This can follow, it is shown, if those morphemes are prosodically defective themselves. A very interesting instance of such an effect can be found in Aymara where a so-called 'rescuer morpheme' exists whose only surface effect is to block an expected MLM pattern. A detailed case study for Aymara is presented in this chapter and it is shown how such a complex pattern of MLM falls out under the theory of PDM. On the other hand, there are cases where allomorphy between different MLM processes can be found and this alternation can not be predicted given the phonological form of the morphemes in question. It is shown that again the exceptional behaviour of some morphemes in the presence of a triggering prosodically defective morpheme follows if those morphemes themselves are prosodically defective. The chapter hence strengthens the role of phonological representation and shifts the burden of various (apparently morphological) idiosyncratic lexical information to the phonological representation of the morphemes in question.

Chapter 5: Morpheme contiguity One new constraint family argued for in this book are constraints ensuring a 'morph-contiguous' projection of prosodic nodes. It is argued that the phonological representation of a morpheme strives to be contiguous across different tiers, i.e. phonological elements affiliated with one morpheme avoid being dominated by a phonological element that is affiliated with another morpheme. In the simplest case, this results in classic Contiguity effects of the sort that there is no interleaving: a prosodic affix node is, for example, preferably only realized at the absolute edge of its base. In the first section, it is shown how different patterns of phonologically predictable allomorphy involving MLM follow from such a preference. In addition, this constraint type allows us to solve a general opacity problem that OT-accounts assuming floating prosodic nodes face. The relevant constraint demanding morph-contiguous mora licensing ensures that an epenthetic mora is inserted in contexts where a vowel would otherwise only be dominated by a mora with a different morphological affiliation. This constraint not only solves an opacity problem of OT, it also predicts an interesting typology of languages where all or only some vowels undergo morphological lengthening. As is shown with several examples, this typology is indeed borne out. Special attention is paid to a detailed case study of long epenthesis in Southern Sierra Miwok that poses a particular problem for alternative accounts. A final effect that is addressed in this chapter concerns additive MLM that follows from the affixation of prosodic feet. This is particularly interesting since it extends the mechanism of affixed 'floating' prosodic nodes from moras to elements higher in the prosodic hierarchy and hence generalizes this theoretical mechanism. If an affix-foot strives to dominate as few base segments as possible, epenthesis and/or lengthening can be predicted in order to fill the foot with enough prosodic weight to be well-formed but to avoid integration of more base segments than absolutely necessary. It is shown how this mechanism predicts interesting cases of non-concatenative allomorphy in the domain of MLM.

Chapter 6: The complete empirical picture of MLM and the linearization of morphemes This chapter presents the representative data set of MLM phenomena which was the base for all the preceding theoretical arguments and discusses the empirical generalizations about (un)attested MLM patterns one can draw from this data set. After giving some general background information about the data set and how it is genetically and areally balanced, the discussion of empirical generalizations mainly focusses on the positions in the base that are possible and frequent targets for MLM operations. Two main generalizations hold for the MLM patterns in the data set: MLM patterns show a strong edge bias and are far more frequently attested at the right edge of their base than on the left edge. Both these generalizations follow straightforwardly from adopting the claim that MLM results from affixation. The dispreference for infixation and the preference for suffixes that is well-established for segmental affixes then predicts these generalizations about MLM patterns. How the locality restriction for MLM follows from the theoretical assumptions about morpheme linearization, and especially the assumption of the RecoverableMorphemeOrderCondition proposed in this book account for all the attested MLM patterns and excludes unattested non-local ones, is shown in detail. Special attention is paid to some interesting case studies of multiple MLM operations found in one morphological context. Since the theory of PDM predicts the existence of multiple prosodic nodes in the representation for a single morpheme (on the same/different tier and affixed to the same/different edge of their base), such patterns are straightforwardly expected.

Chapter 7: A critical review of alternative accounts Whereas the previous chapters argued that the framework of PDM, implemented in containment-based OT, is able to predict all and only the attested instances of MLM in the languages of the world, this chapter argues that it is also preferable over alternative accounts both in terms of theoretical economy and empirical coverage. The most important existing theoretical OT alternatives are introduced which includes analyses for which it has been claimed that they are able to account for non-concatenative morphology in general and/or length-manipulation in specific: Transderivational Antifaithfulness (Alderete, 2001*b*, *a*), a Realize Morpheme-based theory (Kurisu, 2001), Cophonology Theory (Inkelas and Zoll, 2007), and lexically indexed constraints (Pater, 2009). It is shown that all these four accounts suffer from severe over- and/or undergeneration problems if they are tested against the full typology of attested MLM patterns. An additional and more general argument against the alternative accounts is based on theoretical economy: the introduction of powerful new mechanisms adopted in all these alternative accounts is unnecessary at least in the domain of MLM. The independently motivated primitives of the prosodic organization together with the assumption that prosodically defective structures exist and might have crucial consequences for the surface interpretation for segments allows us to predict all attested patterns of MLM.

2

The theory of Prosodically Defective Morphemes

In this chapter, the theoretical background for the analyses in this book is presented. Before the framework of *Prosodically Defective Morphemes* (=PDM) is defined, an overview of existing claims in the line of reasoning pursued in this book is given, namely claims that MLM is the result of simple concatenation of morphemes (section 2.1).

The necessary theoretical background for the unified theory of PDM is presented in section 2.2. One central theoretical assumption is containment (section 2.2.2). It is emphasized at various points in the theoretical discussion that the analyses presented for subtractive MLM inside PDM are only possible in an OT system where deletion is impossible but elements may remain invisible for the phonetic interpretation. Closely related is the assumption of morphological colours (section 2.2.3) that will become crucial in the proposed extension of morpheme contiguity to dominance relations in a prosodic tree (discussed in chapter 5). Another crucial background assumption concerns the linearization of morphemes that is argued to be severely restricted by the inherent impossibility of metathesis in containment and by the newly proposed RecoverableMorphemeOrderCondition, discussed in section 2.2.6. How these theoretical background assumptions interact in the framework termed PDM and predict different patterns of MLM is sketched in section 2.2.7.

2.1 Previous accounts: MLM as an epiphenomenon

There are two general approaches to non-concatenative morphology: it is either stated that these phenomena cannot follow in the regular phonology and/or morphology and morpheme-specific (word-formation) rules (Matthews, 1974; Anderson, 1992; Stump, 2001) or constraints (Kurisu, 2001; Horwood, 2001) are assumed, or the view is defended that non-concatenative morphology is epiphenomenal and follows from the affixation of phonological primitives that are independently motivated (Lieber, 1992; Stonham, 1994; Saba Kirchner, 2010; Trommer, 2011*a*; Bermúdez-Otero, 2012; Bye and Svenonius, 2012). A term summarizing this latter line of research arguing that non-concatenative morphology is epiphenomenal is 'Generalized Nonlinear Affixation' (Bermúdez-Otero (2012), extending the term 'Generalized Mora Affixation' in Trommer and Zimmermann (2010)). For mutation, these primitives of the phonological theory are the subsegmental phonological features that are independently motivated as target and context of phonological rules (Akinlabi, 1996; Wolf, 2007). For length-manipulation, the relevant phonological primitives are necessarily suprasegmental and hence the prosodic nodes. The framework of PDM is crucially based on exactly this argumentation and can be understood as yet another generalization of the 'Generalized Nonlinear Affixation' framework that not only takes affixes consisting of floating prosodic nodes into account but also, for example, morpheme representations where segments lack an association with a higher prosodic node underlyingly.

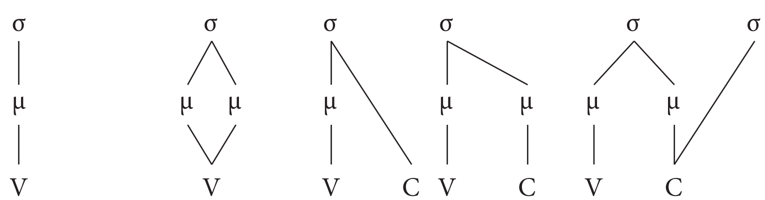
The second empirical domain termed 'morpheme-specific phonology' above has not been discussed as extensively as non-concatenative morphology in the domain of length-manipulations and all approaches I am aware of crucially rely on morpheme-specific mechanisms (for example, Alderete, 2001*b*; Pater, 2009; Finley, 2009). In the following subsections, existing accounts of MLM are summarized that are in line with the theory of PDM defended in this book.

2.1.1 *Mora affixation*

Since the influential paper by Hayes (1989) where it is argued that segmental quantity is encoded on a non-segmental tier, the mora is one standard means to represent the quantity of segments and/or syllables (for an overview and literature see, for example, Broselow et al., 1997; Szigetvári, 2011; Davis, 2011*b*). A standard nonlinear representation of segmental length is given in (1), based crucially on the adoption of moras: short vowels are dominated by one mora, long vowels by two moras, short coda consonants are either dominated by a mora or directly associated with the syllable node, and geminate consonants are dominated by a mora and associated with the following onset position as well (Hyman, 1985; McCarthy and Prince, 1986/1996; Hayes, 1989).[1]

(1) *Segmental length in terms of moras*

Short Vowel **Long Vowel** **Short Consonant** **Long Consonant**



[1] This is only a summary of the most basic insights of segmental length representation. Especially the representation of geminates is often rather controversial and a structure where consonantal length is represented in terms of the number of segmental root nodes has been proposed as the more adequate model for geminates in several languages (see, for example, Selkirk, 1991; Tranel, 1991; Ringen and Vago, 2011). In section 2.2, a more detailed discussion and introduction of prosodic nodes and the prosodic hierarchy is given.

These autosegmental representations allow an intriguing representation for morphemes that are expressed only by lengthening a segment: they are represented as a mora. In the following, such prosodic nodes that are assumed to be affixed, hence are (part of) the underlying representation for a morpheme, are termed *morphemic*. The first analysis that proposes that additive MLM results from affixing a mora can be found in Lombardi and McCarthy (1991). Since then, numerous other analyses have followed that argue for mora affixation in different languages. In this section, the general logic of these existing mora affixation accounts is discussed, the facts they capture and the potential problems they have. It is concluded that there are two major problems with all existing mora affixation accounts in standard OT: one of them is the more or less prominent problem of 'opaque mora assignment' in standard OT (see section 2.2.4), the other is a locality problem.

The mora affixation analysis proposed in Lombardi and McCarthy (1991) accounts for morphological lengthening in Choctaw, Alabama, Balangao, and Keley-i and it is implemented inside the framework of prosodic circumscription (Lombardi and McCarthy, 1991; McCarthy and Prince, 1990; McCarthy, 2000*a*). Prosodic circumscription theory crucially assumes that bases can be recursively delimited to certain prosodically defined portions resulting in an 'outparsed' portion and a 'remainder'. Both these parts can then be targeted by further (morphological) operations like 'prefix mora'. In the analysis of medial gemination in Choctaw, for example, a mora affix is prefixed to a base form that is created by making the first mora of the base extraprosodic (see section 5.3.3 for an account of Choctaw).

The first mora affixation analysis inside the framework of OT is the proposal in Samek-Lodovici (1992) that analyses the morphological lengthening in Keley-i and Alabama. Two constraint (types) are crucial in this OT analysis for mora affixation: a constraint demanding that the affixed mora must be realized (2-a), i.e. integrated into the base, and constraints demanding that the mora strives to be realized at the leftmost/rightmost edge of their base (2-b, c) (Samek-Lodovici, 1992: 6, 10). For these constraints, Samek-Lodovici (1992) defines that a 'syllable unit is *affected* by the moraic affix iff it directly dominates the affix mora or if it dominates directly or indirectly the segment directly dominated by the affix mora' (Samek-Lodovici, 1992: 10).[2]

(2)	a.	ParsM	Avoid unparsed moras.
	b.	Left	One violation for each syllable intervening between the left edge and the first syllable *affected* by the affix.
	c.	Right	One violation for each syllable intervening between the right edge and the first syllable *affected* by the affix.

[2] A point that remains unclear in the analysis in Samek-Lodovici (1992) is whether 'Left' and 'Right' are sensitive to 'affix moras' in general or whether these constraints are marked for being sensitive to specific morphemes. In a language where a μ-prefix and a μ-suffix exist, the latter would obviously be necessary.