Morphotactics in Affix Ordering: Typology and Theory

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Abstract

This dissertation discusses the empirical distribution and systematicity of morphotactic rules on the relative order of verbal affixes. In the literature, the exact role of morphology and its interaction with other factors affecting affix order is still under debate. More specifically, syntactic (Baker 1985, 1988) and semantic approaches (Muysken 1986, Rice 2000, Stiebels 2003) to affix order assume that some underlying grammatical structure, the syntactic derivation or the semantic composition, is mapped transparently onto the surface, such that the relative order of affixes on the surface matches the underlying order of the elements. However, phenomena like nontransitive affix order or templatic morphology suggest that morphological rules may overwrite the surface order provided by syntax or semantics. In this dissertation, I examine exactly these phenomena to investigate the empirical scope of these morphological rules. I demonstrate that there are crosslinguistically stable, systematic rules of morphology, which are in direct competition with rules of syntactic or semantic transparency. Concretely, I conclude that there is a morphological rule that requires the realization of causatives in proximity of the verb root.

The role and systematicity of morphotactics in affix order is highly relevant for linguistic theory: if seemingly arbitrary rules influence affix order without any restriction, it is impossible to build restrictive theories. Thus, uncovering the crosslinguistic patterns of morphological rules help to build empirically adequate, restrictive theories about affix order.

Furthermore, I demonstrate that the interaction of affix order with phonology suggests a cyclic model of the morpho-phonology interface. More specifically, I assume that phonology has temporarily limited access to morphological structure, thus deriving well-attested cases of phonologically conditioned affix order. To model the competition between rules of morphology on the one hand and rules of syntax and semantics on the other hand, I suggest a concrete mechanism that translates the underlying semantic composition into a restricted set of constraints. Consequently, the simultaneous interaction between these constraints implementing transparency requirements and morphotactic constraints derives the variety of transparency patterns found in combinations of valency markers.

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To my dad

Table of contents

List of Tables

Acronyms

CCC	Causatives-Close-Constraint
HPSG	Head-driven Phrase Structure Grammar
HS	Harmonic Serialism
LF	Logical Form
LLL	Luise's language linearizer
OT	Optimality Theory
PCAO	phonologically condtioned affix order
PrWd	prosodic word
SPOT	Standard Parallel Optimality Theory
StratOT	Stratal Optimality Theory

Abbreviations used in glosses

ABIL abilitive
ABS absolutive
ACC accusative
ADV adverb
AFFECT affected
AFFIRM affirmative
AGR agreement
APPL applicative
ASP aspect
ASSIST assistive
AUG augmentative
AUX auxiliary
AV agent voice
BEN benefactive
CAUS causative
CIS cislocative
CL noun class
COLL collective
COMPLET completive
COM comitative
COND conditional
CONT continuative
COP copula
COS change of state
DAT dative
DEF definite
DESID desiderative
DET determiner
DIM diminutive
DIR directional
DIST.PST distant past
DISTR distributive
DIST distant (tense)
DUB dubitative
DU dual
DYN dynamicity
EG epenthetic glide
EMPH emphatic
ERG ergative
EVID evidential
EV epenthetic vowel
FC final clitic
FEM feminine
FIN finite
FOC focus
FUT future
HAB habilitive
HEDGE hedged epistemic modality
HUMAN human
IMPFV imperfective
IMP imperative
INANIM inanimate
INCH inchoative
INCL inclusive
IND indicative
INF infinitive
INST instrumental
INTENT intentional
INTR intransitive
INTSF intensifier
INV inverse
IRLS irrealis
ITER iterative
JUSS jussive
LOC locative
MASC masculine

MID middle voice
NEAR.FUT near future
NEG negation
NEUT neuter
NOM nominative
NONFUT non-future
OBJ object
OBL oblique
PART partitive
PASS passive
PC paucal
PFV perfective
PL plural
POSS possessive
PRES present
PROG progressive
PROPER property
PST past
PTCP participle
PUNCT punctual
PURP purpose
PV patient voice
QUOT quotative
Q question marker
REC.PST recent past
REC reciprocal
RED redundant
REFL reflexive
REF referential
REL relative
REP repetitive
REQ requestative
RLS realis
SEP separative
SG singular
STAT stative
SUBJ subject
SUB subordinator
TMA tense, mood, aspect
TNS tense
TRANS transitivizer
TR transitive
TV thematic vowel
VBLZ verbalizer
YET yet

Chapter 1

Introduction

In languages with complex verbal morphology, affixes are combined with one another and the verb to provide a variety of meanings. Consider the examples from Yagua (Peba-Yagua, Peru) in (1). In these examples, there are four different affixes attaching to the root *junaay* - 'to cry'. There is a desiderative marker *ruuy* that can roughly be translated as 'wanting to X', a causative marker *taniy*, as well as a subject agreement marker *sa* and an object agreement marker *nii*. In the examples in (1), the position of the agreement affixes with respect to the derivation affixes is fixed, while the relative order of the desiderative and the causative is flexible. Moreover, the interpretation of the sentences changes when the order of the derivational affixes is changed.

(1) Order of DESID and CAUS in Yagua (Payne 1985: 280)

a. Sa-junaay-ruuy-taniy-nii.
3SG.SUBJ-cry-DESID-CAUS-3SG.OBJ
'She made him want to cry.'

b. Sa-junaay-taniy-ruuy-nii.
3SG.SUBJ-cry-CAUS-DESID-3SG.OBJ
'She wants to make him cry.'

Out of the 120 possibilities in which the four affixes may be combined with the root, only the two in (1) are actually attested. This observation gives rise to the question what factors affect the relative order of affixes within a morphological word. Specifically, affix order in languages with complex morphology has been said to be influenced by different factors and, crucially, each factor seems to explain only a subset of affixes. The exact role of these factors and the interaction thereof are still under debate.

A great body of research on affix order has argued that affix order is determined mainly by grammatical factors, such as syntax and semantics (Baker 1985, 1988, Bybee 1985, Pesetsky 1985, Muysken 1986, Speas 1991a,b, Alsina 1999, Rice 2000, Stiebels 2003, Zukoff 2022). The most prominent approaches are the syntax-based *Mirror Principle* (Baker 1985, 1988) and the semantics-based approaches, like scope-based accounts (Muysken 1986, Rice 2000), or the *Relevance Principle*. Of these approaches, the *Mirror Principle* refers to the generalization that morphological derivation and consequently also the relative order of affixes on the verb result from cyclic head movement in the syntax, therefore reflecting the hierarchy of heads in the syntactic derivation. The general observation which led to the emergence of the *Mirror Principle* comes from the relative order of valency-changing morphology. Consider the examples in (2) for Zulu (Bantoid, South Africa).

(2) Order of REC and APPL in Zulu (Buell 2005: 26)

a. I-zigebengu zi-fihl-an-el-a a-bangani ba-zo.
CL10-thieves CL10.SUBJ-hide-REC-APPL-TV CL2-friends CL2-CL10
'The thieves hide each other for their friends.'
NOT: 'The thieves hide their friends from each other.'

b. I-zigebengu zi-fihl-el-an-a a-bangani ba-zo.
CL10-thieves CL10.SUBJ-hide-APPL-REC-TV CL2-friends CL2-CL10
'The thieves hide their friends from each other.'
NOT: 'The thieves hide each other for their friends.'

In Zulu, there is an applicative marker *-el*, which introduces an additional object argument to the argument structure of the original predicate *fihl* 'to hide'. The affix *-an* expresses reciprocity. Verbal reciprocals are typically valency-decreasing and carry a variety of meanings (Dalrymple et al. 1998), all of which require coindexation of two arguments such that either argument occupies both the role of the agent and of the patient with respect to each other. In that sense, both applicative and reciprocal are valency-changing, since the applicative adds an argument while the reciprocal decreases the valency of a predicate by coindexation. The relative order of application of reciprocal and applicative on a transitive predicate yields two possible interpretations: if the reciprocal is applied on a transitive predicate before the applicative adds a new object argument to the structure, it can only be the agent and the theme of the original predicate that end up in a mutual relationship, as in (2b). If the applicative introduces a new argument first, however, the reciprocal encodes a mutual relationship between the newly introduced beneficiary argument and the agent argument of the original predicate, as exemplified in (2a). Crucially, the relative order of the markers on the verb varies from (2a) to (2b) such that the applicative is external to the reciprocal in (2a) but internal to the reciprocal in (2b). Baker (1985, 1988) argues that the relative order of application of valency-changing operations can be read off from the surface order of the relevant markers. Concretely, it is assumed that the relative order of affixes results from cyclic head movement along the syntactic hierarchy. Thus, the order of affixes indirectly reflects the hierarchy of heads in the derivation, such that syntactic heads high in the syntactic derivation are farther away from the verbal root than syntactic heads low in the derivation.

Just as the *Mirror Principle*, the *Relevance principle* by Bybee (1985) makes claims about the relative surface order of verbal categories. The general idea behind the *Relevance principle* is that categories whose meanings are semantically more relevant are realized closer to the root than categories with less relevance. For example, lexical aspect (or *Aktionsart*) clearly affects the semantics of the verb more pervasively than grammatical aspect, since the semantic classes defined by lexical aspect differ with respect to their event structure. Consequently, affixes encoding lexical aspect are predicted to be realized in positions internal to markers of grammatical aspect. Rice (2000) argues that these observations should be derived assuming *scope-based ordering*, where the relative order of affixes correlates with the relative scope that the respective affixes have over one another. The notion of *scope* which is typically adopted in the literature on affix order deviates from the definition generally assumed in formal semantics, where the term *scope* is used to refer to the semantic object to which a semantic operator, i.e. a quantifier or a negative element, applies (Reinhart 1978, Kratzer & Heim 1998, Szabolcsi 2010). When discussing semantic effects on affix order, the term *scope* typically refers to the compositional history of the underlying semantic representation. In that sense, scope refers to a clear semantic relationship that is independent of their structural relationship in the syntax. The notion of *scope* adopted by Rice (2000), in contrast, refers to a syntactified relation of the semantic subset relation, such that the scopal relationship between two elements is defined as an asymmetrical subset relation. This asymmetry is assumed to be reflected in the syntactic structure by means of a c-command relation. In that sense, a scope-bearing element is taken to asymmetrically c-command all elements it scopes over. The approach by Rice (2000) makes predictions about the crosslinguistic variation within the area of affix order: in areas where scopal relations are variable or undetermined, affix order is expected to vary, as well. If, however, semantic scope is fixed, affix order is expected to be invariable, as well. An example of variable affix order, as expected by Rice (2000), is shown in (3) for the relative order of the locative *pu* and the immediate action marker *fem* in Mapudungun (Araucanian, Chile). Specifically, the locative specifies the location of the action whereas the immediate action marker specifies the point in time when the action was undertaken. Crucially, the locative and the immediate action marker are not in a scopal relation to each other, since the location does not affect the starting time of the event and vice versa. Consequently, the relative order of the two markers is variable, hence giving rise to optionality between patterns in which the locative is internal to the immediate action marker, as in (3a), and patterns where the immediate action marker is internal to the locative, as in (3b).

(3) Variable order of LOC and IMM in Mapudungun (Marquardt 2014)

a. Treka-pu-fem-ün.
   walk-LOC-IMM-1SG

b. Treka-fem-pu-n.
   walk-IMM-LOC-1SG
   'I immediately walked there.'

Apart from these factors, it has been debated whether there are phonological rules conditioning affix order or at least phonological correlates of affix order. The empirical observations from individual languages typically adduced to argue for a phonological impact on affix order fall into two groups. First, there are languages in which the position of a specific affix depends on phonological properties of other affixes. More specifically, the rules determining the relative order of affixes make reference to phonological features. In Choguita Rarámuri (Uto-Aztecan, Mexico), for example, the relative order of the desiderative marker and the evidential marker depends on the position of the primary stress on the verbal stem, which is indicated by the acute accent in (4). That is, the evidentiality marker is closer to the root than the desiderative if the root carries penultimate stress, as in (4a). If the stress falls on the final syllable of the root, as in (4b), the desiderative is closer to the root than the evidentialitiy marker.

(4) Order of DESID and EVID in Choguita Rarámuri (Caballero 2008: 348f)

a. Á birá čikle kéči-ča-nale.
AFFIRM really gum chew-EVID-DESID
'It sounds like the kids want to chew gum.'

b. wikará-n-čane
sing-DESID-EVID
'It sounds like they want to sing.'

Crucially, it does not seem to be the case that a synchronically active phonological rule governs the relative order of the two markers in Choguita Rarámuri, since the pattern is not phonologically optimizing. Rather, the positioning preference of those affixes seem to be phonologically defined. However, there are also cases in which phonology seems to actively reorder entire affixes. A prominent case of phonologically optimizing affix mobility is described by Kim (2008, 2010) for Huave (Huavean, Mexico).

(5) Phonologically conditioned affix mobility in Huave (Kim 2010: 143)

a. t-a-jch-ius
COMPLET-TV-give-1
'I gave'

b. pajk-a-t-us
face.up-EV-COMPLET-ITER-1
'I laid face up.'

In Huave, the placement of certain affixes depends on the phonological structure of the verb root. In (5b), the completive marker *-t* is attached as a suffix to the verb root *pajk*. Due to a general dispreference against consonant clusters, the epenthetic vowel *a* is inserted to resolve the resulting consonant cluster. In (5a), however, the verb stem *ajch*, which consists of the verb root *jch* preceded by a theme vowel, begins with a vowel and ends in a consonant. In that case, the completive marker *t-* is attached as a prefix. Kim (2010) concludes that this mobility in the placement of the completive marker is phonologically optimizing in the sense that attaching the completive as a prefix is an alternative strategy to resolve consonant clusters, thus preventing the application of vowel epenthesis.

Recent work by Hay (2002), Hay & Baayen (2002, 2005), Hay & Plag (2004), Plag (2002) and Plag & Baayen (2009) suggests that extra-grammatical factors, such as the parsability or the frequency of affixes, have an impact on affix order, as well. Hay (2002) and Hay & Baayen (2002) introduce the theory of *Complexity-based ordering* of affixes. The central claim behind this approach is that affix order corresponds to the **parsability of affixes**.

The innovative idea is that affixes can roughly be ordered along a hierarchy of processing complexity, where affixes that are easily separable sit at one end of the hierarchy, and affixes that are harder to separate lie at the other end. Concretely, Hay & Baayen (2002) adopt a dual-root model of morphological processing (Baayen 1992), which assumes that a complex morphological word can either be parsed as a whole, restoring the entire form from the lexicon, or be decomposed into smaller morphological units under parsing. There are two major cues to determine whether a complex word is separated under parsing or not: first, if a morpheme boundary comprises a phonological structure which is uncommon word-internally, it is very likely that the word is separated, since speakers will posit a morpheme boundary. Hay (2002) discusses this assumption by the example of the English word *pipeful*. The morpheme boundary between *pipe* and *ful* involves the marked consonant combination /pf/. Consequently, it is likely that *pipeful* is separated into smaller units under parsing. A second factor determining the parsing route is the relative frequency of the derived, complex form with respect to the frequency of the base. If the derived form is more frequent than its base, it is assumed that it is accessed as a whole. In contrast, if the base is more frequent than the derived form, the word is likely to parsed in smaller units. As a general rule, affixes that are harder to separate from its base cannot be realized in a position outside affixes that are easier to parse. The idea has been implemented for well-researched languages like English (Hay & Baayen 2002, Hay & Plag 2004, Zirkel 2010), Bulgarian (Manova 2010), German (Zirkel-Hilkenbach 2011), Italian (Gaeta 2005, Talamo 2015) and Russian (Sims & Parker 2015). Talamo (2015) implements the statistical mechanism suggested by Hay (2002), Hay & Baayen (2002, 2005), Hay & Plag (2004), Plag (2002), Plag & Baayen (2009) for Italian and argues that its explanatory power is rather limited. Concretely, Talamo (2015) shows that ordering the affixes along the parsability hierarchy creates predictions that are only slightly more correct than if the affixes were ordered by chance. Moreover, Talamo (2015) and Manova & Talamo (2015) point out that enormous amounts of data are required in order to evaluate this hypothesis for a given language. Thus, it is simply not possible to test this for under-described languages, which is why I will not consider this hypothesis further in this dissertation.

In addition to those grammatical and extra-grammatical impacts on affix order, numerous surface patterns have been observed that do not seem to be driven by either of these principles. These patterns comprise phenomena such as *non-transitivity* and *non-cumulativity* of affixes, *templatic morphology* or *lack of semantic variability*. I will illustrate each phenomenon by means of a relevant example.
Consider the examples in (6) from Kuna (Chibchan, Panama) instantiating a case of *nontransitivity*. In this language, the future marker *o(e)* precedes the negative marker *sur* in (6a). The negative marker *sur* precedes the plural marker *mala* in (6b). The plural marker, however, does not follow but precedes the future marker in (6c). In that sense, the relative order of plural, future and negation is *non-transitive*, since marker A precedes B, marker B precedes marker C, but, crucially, C precedes marker A. Importantly, this pattern of nontransitivity lacks a semantic explanation which is why it is attributed to arbitrary, language-specific rules on linearization.

(6) Nontransitivity of FUT, NEG and PL in Kuna (Newbold 2013)

a. Nu-gu-o-sur-iye.
good-COP-FUT-NEG-QUOT
'It was said that he wouldn't get better.'

b. dak-sur-mala.
see-NEG-PL
'to not see (pl.)'

c. Oyo-na-mal-oe.
show-go-PL-FUT
'They will go show (the place to you).'

The phenomenon of *noncumulativity* was introduced by Newbold (2013) to describe patterns in which an affix A precedes an affix B which itself precedes an affix C. If all three morphemes are combined, however, the order is not A-B-C. One example of noncumulativity comes from Kavalan (Austronesian, Taiwan). In negative sentences in Kavalan, only a few markers appear on the negation, rather than on the verb: the absolutive agreement markers and five different TMA markers: the future marker *pa*, the change-of-state marker *ti*, the imperative marker *ka*, the hedge marker *ma* and an aspectual marker *pama* with a meaning similar to English 'yet' (Yen & Billings 2012). Out of the five TMA markers, only four combinations are attested, two of which are shown in (7). Crucially, the order of these affix pairs is fixed, while the reverse order is ungrammatical.

(7) Fixed order of two TMA markers (Yen & Billings 2012)

a. Mai=pa=ti (*=ti=pa) qainəp ti aßas anuqaχaßi.
NEG=FUT=COS sleep PROPER Abas tonight
'Abas won't sleep tonight.'

b. Assi=ka=ti (*=ti=ka) q<m>an.
NEG=IMP=COS <AV>drink
'Don't keep drinking!'

When one of the five TMA markers occurs with an absolutive agreement marker, the TMA marker strictly precedes the ABS marker, as shown in (8). This generalization holds for all five different TMA markers and all absolutive markers.

(8) Fixed orders of TMA and ABS (Yen & Billings 2012)

a. Mai=pa=isu (*=isu=pa) qainəp χaßi zau.
NEG=FUT=ABS.2SG sleep night DET
'Won't you sleep tonight?'

b. Assi=ka=imi (*=imi=ka) pukun-an.
NEG=IMP=ABS.1PL beat-PV
'Don't beat us!'

When the two pairs of TMA markers illustrated in (7) cooccur with absolutive markers, there is consistent optionality between TMA-TMA-ABS in (9a) and (9c), and TMA-ABS-TMA, see (9b) and (9d). Crucially, the order in which the absolutive clitic intervenes between the two TMA clitics is *non-cumulative*, since the combination of examples in (7) and (8) suggests that only the order TMA-TMA-ABS should surface. Thus, Kavalan exhibits optional noncumulativity in verbal forms that contain two TMA markers and an absolutive marker.

(9) Variable orders of two TMA markers and ABS (Yen & Billings 2012)

a. Qainəp=pa=ti=iku.
sleep=FUT=COS=ABS.1SG
'I'm going to bed.'

b. Qatiw=pa=iku=ti.
go=FUT=ABS.1SG=COS
'I'm going fishing.'

c. Assi=ka=ti=imi pukun-an.
NEG=IMP=COS=ABS.1PL beat-PV

d. Assi=ka=imi=ti pukun-an.
NEG-IMP-ABS.1PL-COS beat-PV
'Don't beat us!'

Some languages have been argued to exhibit so-called *templatic morphology*. In these languages, the relative order of affixes seems arbitrary, and lacking syntactic, semantic or phonological correlates. To describe the affix ordering patterns in those languaes, the affixes are associated with arbitrary *position classes*. These position classes are slots in relative distance to the verbal root that may be filled by at most one affix. Evidence for the existence of position classes are cases where two, otherwise semantically compatible, affixes do not cooccur. This is exemplified in (10) for Oneida (Iroquoian, USA & Canada). In this language, the negative marker and the partitive never cooccur. The examples in (10) constitute a minimal pair since the sentence in (10b) is the negated version of (10a). However, the partitive marker, which is present in (10a), is not realised in (10b). As argued by Diaz et al. (2019), the root *ot* 'to be so' cannot occur without the partitive. However, in the context of a negative, the partitive is blocked. This incompatibility of the negative marker and partitive is argued to arise from a morphological blocking resulting from the fact that the negative marker and the partitive marker compete for the same *position class*.

(10) NEG suppressing PART in Oneida (Diaz et al. 2019: 433)

a. tho ni-y-ót
that.is PART-NEUT-be.so(STAT)
'the way it is'

b. yah tho té-y-ot
not that NEG-NEUT-be.so(STAT)
'it's not the way'

Another example where syntactic and semantic principles of affix order seem to make incorrect predictions are patterns where the relative order of affixes is fixed although two different semantic representations are involved, thus exhibiting a *lack of semantic variability*. This is exemplified for the relative order of the directionality marker and the repetitive marker in Udihe (Tungusic, Russia) in (11). The directionality marker is interpreted as having the meaning 'go to X' , whereas the repetitive encodes repeated execution of an action. These affixes are in a scopal relationship, since their relative order of semantic composition may yield either the interpretation: 'to go [to do something again]' or 'to again go [to do something]'. In fact, Udihe allows for both interpretations, yet the relative order between the two affixes is fixed. This lack of variability is commonly ascribed to language-specific rules on linearization enforcing a certain surface form, thus preventing the expected affix variability.

(11) Order of DIR and REP in Udihe (Nikolaeva & Tolskaya 2001: 318, 586)
egbesi-ne-gi
swim-DIR-REP
'go again to swim' *or* 'go to swim again'

In the past, these patterns have been attributed to independent, **morphological rules** on affix order, thus suggesting a morphological component in the grammar that puts additional, morphotactic requirements on the well-formedness of a word. The different factors that seem to be relevant in affix order – syntax, semantics, phonology, extra-grammatical factors and morphology – have been summarized by Rice (2011) and Inkelas (2016), illustrated here in (12).

(12) Principles of affix ordering (Rice 2011, Inkelas 2016)

1.Grammatical factors

- Syntax and semantics
- Phonology

2.Arbitrary, stipulated via language-specific position classes

3.Extra-grammatical factors (frequency, parsability, productivity)

These different factors on affix order make considerably different predictions:

- While the strongest arguments in favour of syntactic approaches have mainly been gathered from the relative order of valency markers, their empirical predictions extend to the area of inflectional morphology, as well. Crucially, syntactic approaches predict that the relative order of affixes should be relatively fixed in this area, given that the order of functional heads in the syntax is fixed. It is worth noting that a match between the syntactic hierarchy of heads and the observed order of affixes serves only as a compelling argument in favor of syntax being the driving factor if the relative order of heads in the syntax is motivated independently of affix order.
- Semantic approaches, on the other hand, predict that the order of affixes within a language should match their underlying semantic representation, which is often referred to as the scopal relationship between two affixes. Semantic approaches differ from syntactic approaches in predicting that affixes which are not in scopal relationship may in principle be ordered freely across languages, thus predicting **semantically vacuous/syntactically irrelevant** affix variabilitiy.
- The predictions by syntax on the one hand and semantic scope on the other hand overlap to some extent, especially in the area of derivational morphology. Recall the example of the relative order of reciprocal and applicative in Zulu in (2), where the relative order of the two markers corresponds to a difference in the interpretation of the sentence. The relative order of reciprocalisation and applicativization is reflected both in the semantic composition and in the syntactic derivation. In that sense, both syntactic and semantic approaches to affix order predict **semantically meaningful/syntactically relevant** affix variability.

As a consequence, the following empirical observations might aid to evaluate the empirical adequacy of the models:

1. If the order of semantically vacuous affix combinations is variable within a language, semantic approaches are more precise, since Rice (2000) makes the explicit prediction that the relative order may be flexible in this area, while syntactic accounts do not provide a native explanation for this type of variability.

Rather, syntactic accounts need to exploit theory-internal mechanisms such as (potentially not independently motivated) movement operations (see also chapter 8.6).

2. If the relative order of semantically meaningful affix combinations is fixed although it yields two different interpretations, both accounts are faced with problems. This situation then suggests that a complementary module, i.e. morphology or phonology, requires a fixed order of affixes.

Syntax and semantics focus mainly on the relative order of two or more categories. Thus, these combinations are expected to occur on either side of the verbal root. The decision on the **affixal status**, that is, whether an affix will be attached to the left or the right side of the root, is assumed to be driven by independent rules on linearization. In fact, empirical observations from Bantu languages suggest that these language-specific rules on linearization do not only complement semantic and syntactic requirements on affix order but also seem to be in competition with them. A well-described example of the simultaneous interaction between requirements on semantic transparency and language-specific rules on linearization is instantiated by the *CARP template* found in Bantu languages. As described in detail by Hyman (2003), Good (2005), there are independent rules on the relative order of valency markers requiring them to follow the order Causative-Applicative-Reciprocal-Passive (in short: CARP), independent of their underlying semantic composition. In Bantu languages like Chichewa, there is consistent optionality between affix ordering patterns matching the predictions by semantic and syntactic approaches and patterns implementing the CARP requirement. This is illustrated in (14) for the relative order of the causative *-its* and the applicative *-il*. The causative is a valency-increasing operation which introduces a new external argument that causes the agent of the original predicate to do something. The applicative is also valency-increasing, since it adds an instrument to the argument structure of the predicate. Depending on the relative order of application, the combination of causative and instrumental applicative may yield two different underlying semantic forms.[1]

(13) Combination of causative and applicative, following Stiebels (2003: 304)

a. [[[V]CAUS]APPL]

$$\lambda z\ \lambda y\ \lambda u\ \lambda s'\ \exists s[[\textsc{act}(u)\ \&\ V(x,y)(s)](s')\ \&\ \textsc{appl}(s', z)]$$

b. [[[V]APPL]CAUS]

$$\lambda z\ \lambda y\ \lambda u\ \lambda s'\ \exists s[[\textsc{act}(u)\ \&\ [V(x,y)(s)\ \&\ \textsc{appl}(s, z)]](s')$$

If the applicative applies before causativization, as illustrated in (13b), the instrument necessarily modifies the causativized subevent. If the applicative applies after causativization, however, it refers to the event of causation, as shown in (13a). Semantic

[1]Not all applicatives allow to easily distinguish the two possible underlying representations from the interpretation of the sentences, as discussed in further detail in 5.1.

and syntactic approaches predict that this difference is mapped onto the morphological structure of the affixes, such that the applicative affix should be internal to the causative affix in the former case and external to the causative in the latter case. The example in (14a) yields an interpretation which suggests that the applicative applies after causativization. Since the applicative affix is outside causative morphology, the relative order of valency markers in (14a) fulfils both requirements on semantic transparency and the language-specific rule that causatives have to precede applicatives. The sentence in (14b), in contrast, is interpreted with the applicative scoping below the causative, yet the applicative is external to causative morphology. In this sentence, the relative order of causative and applicative violates the syntactic and semantic requirements on affix order but fulfils the CARP requirement. In the sentence in (14c), the interpretation suggests that the instrument refers to the causativized subevent, as well. In this sentence, the relative order of affixes violates the CARP requirement, but fulfils semantic and syntactic predictions. In (14d), the interpretation suggests that the applicative takes scope over the causative, yet the applicative affix is internal to the causative affix. Thus, the relative order of affixes violates both the CARP template and rules on semantic transparency, which is why it is ungrammatical since. This pattern found in many Bantu languages is also called *asymmetric compositionality* (Hyman 2003), since only one surface order allows unique inference to the underlying order of the semantic operations.

(14) Templates vs. scope in Chichewa (Hyman 2003)

a. Alenje a-ku-lil-its-il-a mwami ndodo.
hunters 3PL-PROG-cry-CAUS-APPL-FV child sticks
'The hunters use sticks to make the child cry.'

b. Alenje a-ku-takas-its-il-a mkazi mthiko.
hunters 3PL-PROG-stir-CAUS-APPL-FV woman spoon
'The hunters make the woman stir with a spoon.'

c. Alenje a-ku-takas-il-its-a mkazi mthiko.
hunters 3PL-PROG-stir-APPL-CAUS-FV woman spoon
'The hunters make the woman stir with a spoon.'

d. *Alenje a-ku-lil-il-its-a mwami ndodo.
hunters 3PL-PROG-cry-APPL-CAUS-FV child sticks
'The hunters use sticks to make the child cry.'

In linguistic theory, the role ascribed to the morphological influence on affix order is heavily discussed. While some scholars take morphology to complement other grammatical factors on affix order in areas where these do not make specific predictions about linearization (Baker 1985, 1988, Rice 2000), so-called *templatic* approaches to affix order (Simpson & Withgott 1986, Kari 1989, Stump 1993, Nordlinger 2010, Crysmann & Bonami 2016) claim that affix order is a result of arbitrary, language-specific rules making reference to position classes, which lack a deeper motivation from grammatical factors, such as syntax, semantics or phonology. However, this different

treatment of morphological impact on affix order has immediate consequences for the predictive power of the theoretical model: if a model is equipped with unlimited, language-specific and arbitrary rules, it is not possible to make empirical predictions on possible or impossible affix ordering patterns based on this model. In simpler terms, the more powerful the rules governing the relative order of affixes turn out to be, the more difficult it is to make precise empirical claims on attested patterns. As a consequence, it is crucial to investigate the empirical limitations and theoretical make-up of morphological rules on affix order in order to create an empirically adequate theoretical model of affix order.
In this dissertation, I tackle this problem by disentangling the empirical scope and limitations, as well as the theoretical make-up of morphotactic rules on affix order. Concretely, I pursue the following research questions in this dissertation:

1. **To what extent do previous analyses implementing grammatical factors on affix order (Bybee 1985, Baker 1985, 1988, Rice 2000) succeed in predicting the observed patterns in affix order?**

To investigate this question, I review the empirical predictions of scholars implementing these assumptions in chapter 3. In chapter 4, I examine the empirical predictions by examining the relative order of affixes and variable affix order by means of a sample of 21 languages. In general, I use the templates in the descriptive literature to test the predictons about the relative order of affixes. In some cases, descriptive grammars did not provide a descriptive template. In these cases, I calculated the relative order of affixes from the existing examples in the descriptive literature using a Python script, which is described in more detail in chapter 2.2. While the relative order of verbal categories has already been examined in considerable detail by Bybee (1985), the predictions by Rice (2000) regarding variable affix order has not been studied across language families. This dissertation fills this gap by testing her predictions by means of the sample of this dissertation in chapter 4.3. The results indicate that variable affix order occurs less often than predicted, thus providing evidence for the existence of independent rules on linearization.

2. **Are morphological rules in complementary distribution or rather in competition with other principles of affix order?**

To tackle this question, I investigate the transparency in combinations of valency markers since other scholars, most prominently Hyman (2002, 2003) and Stiebels (2003), observe that the requirements of semantic transparency in the relative order of valency markers is not inviolable but in competition with rules of morphological well-formedness. In chapter 5.1, I show that this phenomenon is not rare at all. However, some categories are more likely to be transparent than others. As for the interaction between causatives and applicatives, in particular, all attested patterns arise from a tension between requirements on semantic transparency and universal positioning preferences of the respective categories.

3. **Are morphological rules entirely arbitrary or are there biases pointing towards universal tendencies in these rules?**

It has previously been shown by Trommer (2001, 2003, 2008) and Julien (2002) that the affixal status of certain verbal categories is not arbitrary. Specifically, Trommer (2001, 2003, 2008) observes that there is an overwhelming crosslinguistic tendency that person features gravitate maximally to the left of the word while number features tend to be expressed towards the right edge of the word. Julien (2002) investigates the distribution of tense and aspect markers within the morphological word and concludes that only tense can be a prefix if aspect is a suffix while the reverse case is not attested. In this dissertation, I show that there are more universal biases among morphotactic rules. Concretely, I argue in chapter 4.6 that morphological causatives show a prefixation tendency. Moreover, evidence from opaque combinations of causatives and other derivational markers reveals an overwhelming tendency of causatives to occur in proximity to the verb, as discussed in chapter 5.1. The generalization taken from non-compositional combinations of valency markers and the results from chapter 4.3 indicating that semantically meaningful affix combinations are fixed suggest that semantic/syntactic requirements on affix order can in fact be overwritten by morphotactic rules.

4. **Do phonological rules affect affix order?**

Although this objective does not directly concern the role of morphotactics on affix order, it is crucial to disentangle the interaction between morphological and phonological conditions on affix order and, therefore, also the theoretical make-up of the morphology-phonology interface. In chapter 6, I review previously described cases of phonologically conditioned affix order. I show that most of these cases are phonologically optimizing in the sense that the surface position of the affix prevents the emergence of a phonologically marked structure. I take these observations to be compelling evidence for the existence of true phonologically-conditioned affix order, which necessitates a theoretical model of the morphology-phonology interface where phonology has access to morphological structure.

5. **How can the rules of morphology on affix order and its interaction with other factors be modeled in linguistic theory?**

In chapters 4.5, 4.6 and 5.1, I present empirical evidence for the existence of independent morphological rules. In chapter 5.1, I further show that the observed patterns of combinations of valency markers arise from tensions between exactly these morphotactic rules and requirements on semantic transparency. In chapter 7, I review previous approaches implementing morphological rules on affix order and discuss the empirical adequacy and conceptual problems of these approaches. In chapter 8, I suggest that the different factors conditioning affix order require a theoretical model that allows simultaneous interaction of these factors with temporarily limited access of phonology to morphological structure.

6. **What are possible explanations for morphological rules?**

It is often assumed that the rules triggering phonological processes have a phonetic motivation in the sense that some phonological rules are phonetically more plausible then others. Thus, phonological rules often have a phonetic motivation (Archangeli & Pulleyblank 1994). As for rules of morphology, the evidence for the existence of morphological rules calls for a discussion about the origin of or motivation of this type of rules. In chapter 9, I discuss potential diachronic origins of unexpected affix ordering patterns, since morphological idiosyncrasies show striking similarites with grammaticalized auxiliary verb constructions. In that sense, it seems that many morphological anomalies are remnants of syntactic structure that became fossilized by grammaticalization.

These objectives serve to carefully examine the empirical patterns and theoretical make-up of morphotactic rules on affix order. By answering these questions, this dissertation aims at improving the empirical adequacy of theoretical models of affix order by allowing to build more restrictive theories. This dissertation is structured as follows. Chapter 2 discusses methodological preliminaries of the empirical study. In chapter 3, I summarize the empirical predictions in the existing literature. I evaluate these predictions in chapter 4 and discuss to what extent deviations from the predictions can be attributed to morphotactics. Moreover, I discuss patterns in the area where morphotactics are expected, such as biases in the affixal status of certain categories. Chapter 5 is dedicated to cases in which morphotactic rules are not expected, such as nontransitivity or noncumulativity. Chapter 6 provides an overview on the patterns of phonologically-conditioned affix order. These empirical chapters are used to evaluate previous analyses implementing morphotactics in affix order in chapter 7. In chapter 8, I suggest a new approach to morphotactics in affix order using a cyclic model of the morphology-phonology interface in Stratal OT. In chapter 9, I discuss diachronic change as a potential source of morphotactic rules.

Chapter 2

Methodology

As outlined in the previous chapter, it is crucial to deeply examine five affix ordering phenomena in order to meet the objectives of this dissertation: the relative order of grammatical categories, variable affix order, nontransitivity and noncumulativity and finally, the semantic transparency of valency markers. To investigate these phenomena, I reviewed language-individual reports on these phenomena in the existing literature and further examined these patterns by means of a sample of 21 languages. In this chapter, I provide further details about the composition of the sample in chapter 2.1. Additionally, I used a Python script to gain data about the relative order of affixes and variable affix order. The exact procedure of the script and problemes related to the method are described in chapter 2.2. In chapter 2.3, I discuss notational ambiguities and methodological issues.

2.1 The sample

Since this dissertation investigates various questions in the domain of affix order, languages exhibiting a complex verbal morphology are particularly relevant. Consequently, the major criterion for the composition of the sample is a high degree of synthesis in a language (roughly following Brown et al. 2009). As highly synthetic languages are not equally distributed over the world, a geographic balance of the sample is not possible. For reasons of genetic diversity, however, at most two languages of each language family can be considered for the sample. Muysken (1986) and Speas (1991a) note that the eurocentric bias in linguistic research is causing distortion particularly in the field of the morphology of complex words, since Indo-European languages do not exhibit particularly complex morphology (see Croft 1990, Hale 1998, Hale & Platero 1996 and Rice 2000 for a similar argumentation), which is why the focus of this typological study lies clearly on non-European languages.
Note also that the focus of this typological study is to gain data from non-European languages, as explained in the previous section. The genetic information for each language is taken from Glottolog (Hammarström et al. 2019). WALS feature 22A 'Inflectional Synthesis of the Verb' (Nichols & Bickel 2013) served as a starting point

for the composition of the sample, but also references within the relevant literature or recommendations by other linguists were taken into account when choosing the languages. In WALS feature 22A (Nichols & Bickel 2013), languages are categorized according to the number of inflectional categories which are expressed synthetically. An overview of the sample is presented in table 2.1. The data from these languages comes from descriptive grammars as well as related articles with the exception of the North-West Caucasian language Adyghe. The data for this language comes from fieldwork based on joint work with Imke Driemel and Ahmet Bilal Özdemir in Driemel et al. (2020a,b).

Language	**Language family**	**Glottocode**	**Macro area**	**References**
Caddo	Caddoan	cadd1256	North America	Melnar (1998)
Otomí	Otomanguean	tila1239	North America	Hernández Green (2015)
Mixtec	Otomanguean	sanm1295	North America	Macaulay (1996)
Southern Pomo	Pomoan	sout2984	North America	Walker (2013)
Choctaw	Muskogean	choc1276	North America	Broadwell (2006)
Misantla Totonac	Totonacan	yecu1235	North America	MacKay (1999)
Apurinã	Arawakan	apur1254	South America	Facundes (2000)
Wanano	Tucanoan	guan1269	South America	Stenzel (2004)
Kuna	Chibchan	sanb1242	South America	Smith (2014)
Huallaga Quechua	Quechuan	hual1241	South America	Weber (1983)
Yagua	Peba-Yagua	yagu1244	South America	Payne (1985)
Nambikwara	Nambiquaran	sout2994	South America	Kroeker (2001)
Zulu	Bantoid	zulu1248	Africa	Buell (2005)
Tukang Besi	Austronesian	tuka1248	Papunesia	Donohue (2011)
Bukiyip	Torricelli	buki1249	Papunesia	Conrad & Kepas (1991)
Alamblak	Sepik	alam1246	Papunesia	Bruce (1984)
Tiwi	isolate	tiwi1244	Australia	Osborne (1974)
Mawng	Iwaidjan	maun1240	Australia	Singer (2006)
Chukchi	Chukotko-Kamchatkan	chuk1273	Eurasia	Dunn (1994)
Udihe	Tungusic	udih1248	Eurasia	Nikolaeva & Tolskaya (2001)
Adyghe	North-West Caucasian	adyg1241	Eurasia	own fieldwork

Table 2.1: Composition of the sample

Another crucial criterion for the composition of the sample is the affixing tendency of each language. It is widely known that there is vast preponderance of suffixes over prefixes, as observed by Greenberg (1957), Bybee et al. (1990) or Himmelmann (2014), among many others. WALS feature 26a (Dryer 2013a) examines the affixing index of 969 languages, therefore being the largest available sample of affix distributions. The exact criteria applied to classify a certain category as synthetic (as opposed to analytic) differ slightly from the criteria adopted by Nichols & Bickel (2013). In WALS feature 26a, the affixing index is assigned by investigating 10 categories of nominal and verbal inflection, while derivation is disregarded. Languages are grouped into six categories:

weakly prefixing	60-80% prefixes	94 languages
strongly prefixing	>80% prefixes	58 languages
equal prefixing and suffixing	40-60% prefixes and suffixes	147 languages
weakly suffixing	60-80% suffixes	123 languages
strongly suffixing	>80% suffixes	406 languages
little affixation		141 languages

Table 2.2: WALS 26A (simplified) (Dryer 2013a)

Table 2.3 shows how this asymmetry is represented in the sample of this study. The third column provides the value of WALS feature 26A for each of the examined languages. The fourth column provides the exact numbers of prefixes and suffixes of each language as calculated by the Python script (see chapter 2.2). Importantly, the value given in the fourth column might deviate from the affixing tendency in the third column. This is expected since WALS feature 26A refers only to inflectional affixes within the verbal and nominal domain, while the LLL script described in chapter 2.2 takes only derivational and inflectional affixes of verbs into account.

Language	**Language family**	**Affixing index WALS 26A**	**No. of pref. vs. suff.**
Apurinã	Arawakan	equal pref. and suff.	4 pref. & 51 suff.
Wanano	Tucanoan	strongly suff.	0 pref. & 53 suff.
Kuna	Chibchan	strongly suff.	1 pref. & 33 suff.
Otomí	Otomanguean	weakly pref.	39 pref. & 12 suff.
Mixtec	Otomanguean	strongly pref.	11 pref. & 7 suff.
Bukiyip	Torricelli	weakly pref.	14 pref. & 9 suff.
Mawng	Iwaidjan	weakly pref.	14 pref. & 17 suff.
Caddo	Caddoan	weakly pref.	83 pref. & 13 suff.
Zulu	Bantoid	strongly pref.	25 pref. & 9 suff.
Southern Pomo	Pomoan	strongly suff.	1 pref. & 28 suff.
Choctaw	Muskogean	equal pref. and suff.	14 pref. & 38 suff.
Tukang Besi	Austronesian	weakly pref.	22 pref. & 8 suff.
Nambikwara	Nambiquaran	strongly suff.	5 pref. & 47 suff.
Chukchi	Chukotko-Kamchatkan	weakly suff.	7 pref. & 11 suff.
Misantla Totonac	Totonac	equal pref. and suff.	12 pref. & 11 suff.
Yagua	Peba-Yagua	strongly suff.	2 pref. & 25 suff.
Alamblak	Sepik	strongly suff.	4 pref. & 25 suff.
Udihe	Tungusic	strongly suff.	0 pref. & 44 suff.
Huallaga Quechua	Quechuan	strongly suff.	0 pref. & 71 suff.
Tiwi	isolate	strongly pref.	14 pref. & 6 suff.

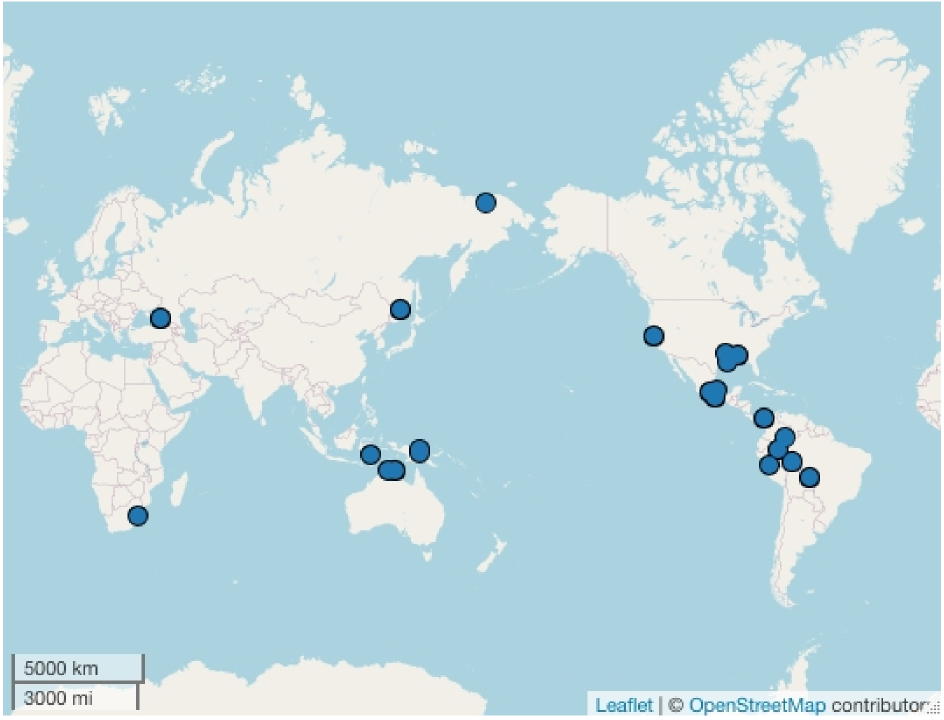
Table 2.3: Prefixing vs. suffixing in the sample

It is worth noting that the preponderance of suffixes over prefixes is higher in the data produced by the LLL script than in the WALS feature.[2] As an impressive example, Apurinã has been assigned the value 'equal prefixing and suffixing' in WALS 26A, but shows 93% suffixes in the evaluation of the script. Since the determination of

[2]It should be noted that the numbers given in table 2.3 are determined simply by counting all existing affixes (excluding mobile affixes) while the values in WALS26A are assigned by counting tendencies of ten different categories of inflectional morphology. Therefore, deviations from the value of WALS feature 26A are expected to a certain extent.

the affixal status is typically attributed to morphology, it is crucial that the sample allows us to make statements about prefixing languages, as well. Therefore, prefixing languages are overrepresented in this sample as compared to table 2.2.
The geographical distribution of the sample is presented in (1).

(1) Geographical distribution of the sample



2.2 Evaluating the sample using a Python script

I created a script in Python that automatically detects the relative order of affixes and potential instances of variable affix order in a given language. Thus, the script assists in the evaluation of the data collected to answer the research questions of this dissertation. Note that the script does not evaluate or interpret the results. Thus, a manual interpretation of the data is necessary. The working title of the script is Luise's language linearizer (LLL).
The input for the script comes from a list of glosses that originate from descriptive grammars or fieldwork collections. As shown in (2), the input to the script is a list of glossed, verbal forms where grammatical affixes are typed in capital letters whereas roots are typed in small letters.

(2) Examplary input for Python script

```
make-PST-1SG
die-CAUS-2SG
do-CAUS-PST
```

The script is then able to discriminate affixes from stems by their capitalization. In case of forms that contain both upper case and lower case letters that might occur in proper names or due to typos, the user is asked to determine the status of the given form. The script operates with the morphemes given in the glosses and does not group them into more abstract categories, such as tense or aspect. The only exception to this are markers that indicate ϕ-features which are categorized as `AGR`. The elements that will be substituted by `AGR` are listed in Table 2.4.

person	number	gender
1	SG	NEUT
2	PL	MASC
3	DU	FEM
1/2		N
		F
		M
		MIX
		CL

Table 2.4: List of agreement morphemes recognized by the script

The main reason for not categorizing other markers is that categorization requires theoretical consensus on how a given morpheme should be categorized. There are numerous cases of morphemes for which this condition is not fulfilled, e.g. future markers which exhibit properties of both tense and aspect (see Błaszczak 2018 and references therein for an overview). Moreover, highly agglutinating languages exhibit affixes that correspond to adverbs in other languages and most of these adverbial affixes do not neatly fall into larger categories. Since the categorization of affixes is in principle highly desirable in order to contribute to discussions on crosslinguistic tendencies of the ordering of certain categories, the long-term goal would be to use an online interface that allows the users to categorize the affixes according to their needs and theories.
By means of this input, the script is able to evaluate the data and automatically creates several outputs: if the input contains an instance of variable affix order, such that an affix A precedes an affix B in one example but follows B in a different example, the script will detect the pair of the variable affix A and B and extract them as variable affixes. Concretely, the input in (3):

(3) Examplary input for Python script

```
make-PST-1SG
die-1SG-PST
```

creates the output displayed in (4):

(4) Extracting variable affixes

```
For Test, LLL detected the following variable prefixes:
[]
and the following variable suffixes:
[(PST, AGR)]
```

The script is also trained to discover affixes that may appear on both sides of the root in order to detect potential cases of affix mobility. Concretely, the script marks each gloss that appears in a prefixal and a suffixal position. It should be noted, however, that most of these cases turn out to be either entirely independent affixes (e.g. subject and object agreement markers) or connected affixes, such as circumfixes. For illustration, the input in (5) creates the minimal working example in (6):

(5) Examplary input for Python script

```
make-PST-1SG
PST-do-CAUS-2SG
```

(6) Extracting mobile affixes

```
These elements occur both as prefixes and as suffixes:
[PST]
```

The script is created to provide a template-similar output in order to allow a comparision to descriptive templates provided in the literature. More specifically, it provides a list of affixes that share a slot. This output can be used to check whether the set of elements that share a slot form a natural class syntactically, semantically or phonologically. For the calculation of the slots, the script regards only those affixes that occur exclusively on one side of the root and do not participate in variable affix order. A necessary condition for a set of affixes to be detected as competing for a slot is that the elements do not cooccur and stand in the same relationship to surrounding affixes, thus abiding by the definition of Stump (1993: 138). In other words, it can be the case that some elements are assigned to the same slot only because the data point that would separate them is missing. Therefore, it is crucial to note that the quality of this output depends directly on the size of the data set, as discussed in more detail in Chapter 2.3. If the hypothetical input in (7) consisted only of the following two sentences, the script would conclude that the two affixes in the rightmost position compete for the same slot since they do not cooccur and are in the same relationship to the stem and the preceding suffix:

(7) Examplary input for Python script

```
make-PST-NEG
do-PST-PFV
```

This simple set of sentences in the output would create the output in (8):

(8) Creating a template

```
These elements share a slot:
1: [PST], 2: [NEG, PFV]
```

The script also provides the maximum number of affixes found in the given source. This output can be compared to the number of slots given in a grammatical description later on, thus contributing to the evaluation of the empirical adequacy of descriptive templates, discussed in chapter 4. The script regards only the example

with the maximum number of affixes, making this output sensitive to outliers.
The hypothetical input in (9):

(9) Examplary input for Python script

```
make-PST-1SG
PST-do-CAUS-2SG
die-3SG
dead-VBLZ-CAUS-PROG-PST-2SG
```

creates the output in (10):

(10) Extracting the maximum number of affixes

```
The longest element contains 5 affixes.
```

Finally, the script provides the absolute numbers of prefixes and suffixes of the investigated languages, thus providing a ratio of prefixes and suffixes found in the input. The script disregards affixes occurring on both sides of the root in this calculation. Consider the input in (11), where only `EMPH` occurs in a prefixal position, while all other affixes are suffixes:

(11) Examplary input for Python script

```
make-PST-1SG
EMPH-do-CAUS-2SG
die-3SG
dead-VBLZ-CAUS-PROG-PST-2SG
```

This input yields the output in (12).

(12) Extracting the prefix-suffix ratio

```
Testlanguage has 1 prefix and 6 suffixes.
```

All results are automatically exported as .csv-files that might serve as an input for bigger databases later on.
While the Python script proves advantageous as it massively improves the scanning of grammars, the architecture of the script leads to a couple of problems most of which could be solved easily when evaluating the results.
First, the script takes every item between two hyphens to be a separate morpheme. In the case of agreement morphology, there are plenty of cases in which agreement forms a portmanteau with a different category (typically tense, mood or aspect). Specifically, 1SG, 1SG.PRES, 1SG.PRES.SUBJ, 1SG.SUBJ count as four different affixes

leading to an increased number of affixes that has an impact on the affixing tendency in table 2.3. This problem occurs in almost every language of the sample. While categorizing at least ϕ-features to AGR is a major step of improvement concerning this problem, the problem needs to tackled if the script should be used for research purposes beyond this dissertation.

Another problem which is caused by the hyphenated separation is that the script counts semantically empty elements, like linkers or thematic vowels as affixes. In these cases, the script adds these elements to the list of affixes although they do not play a role in the semantic composition of the verbal complex. However, this problem occurs only in a couple of languages that exhibit this kind of marker.

A different problem is caused by insufficient and bad glossing habits of the authors of descriptive grammars. The most common problem is that two elements are glossed by the same label even though these elements differ in form and meaning. If these elements occur in different positions, they will cause false positive results of variable affixes. One particularly common example is insufficient glossing of agreement markers. That is, an affix is simply glossed as 1SG without indicating whether it reflects subject or object agreement even though the markers are morphologically distinct, as well. Since the output data of the script are raw and not analyzed yet, the false positive results are not filtered out. For example, the script detected three cases of variable affix order for Nambikwara. A deeper analysis of the results shows that two of these cases result from insufficient glossing, since a) the agreement affixes clearly refer to two different arguments and b) one of the cases involves only covert morphology.

There are three structures which are problematic for the script: First, it is does not detect co-dependencies, i.e. affixes that attach only in the presence of another affix or affixes that attach only in the absence of another affix. Second, the script is not very informative for languages with a large number of morphophonological processes, blurring the boundary between two morphemes. Third, the script disregards multi-verb constructions or constructions that involve more than one stem-like element.

2.3 Methodological preliminaries

When examining phenomena such as variable affix order or nontransitivity in the individual languages in order to investigate the research questions of this dissertation, it is crucial to determine the factors that drive the affix ordering patterns displayed in that particular language. That is, I investigate what rules are needed to explain a particular phenomenon (variability, lack of semantic variability, nontransitivity, etc.), thus disentangling the various factors that have been claimed to affect affix order. This distinction is not always easy to make since morphological explanations of linguistic problems are often adopted only when syntax or phonology fail to account for the problem (for an exhaustive discussion, see Luís & Bermúdez-Otero 2016). The distinction between morphological and phonological rules is particularly hard to draw. I assume that one clue pointing towards a **morphological phenomenon** is if there is no rule which makes reference to the phonological form of the considered elements that explains the phenomenon, and if the affixes under consideration do not form a natural class phonologically, thus following the argumentation by Benz (2017). Moreover, I check if closely related languages exhibit the same phenomenon, since genetic effects have been reported in the literature for the CARP template in Bantu languages (Hyman 1994a, Hyman & Inkelas 1997, Hyman 2003, Alsina 1999, Good 2005, 2007, 2016, McPherson & Paster 2009). Furthermore, investigating closely related languages might help to understand the origin of incompatibilities: if a certain pair of affixes cannot cooccur in a given language while the cognates of this pair in a related language can, this might suggest that the incompatibility is not due to semantic incompatibilites but due to a specific morphological requirement of the language.

At this point, I would like to resolve several notational ambiguities.

When discussing the transparency of combinations of derivational affixes, terms like *counter-scopal* or *anti-scopal* orders are often used in the existing literature. In most of these cases, the term *scope* deviates from the standard definition adopted in formal semantics, where the notion *scope* is used to refer to the semantic object to which a semantic operator, i.e. a quantifier or a negative element, applies (Reinhart 1978, Kratzer & Heim 1998, Szabolcsi 2010). An influential view on the formal modeling of scope is that it is reflected in the syntactic structure somehow. In these terms, the scope-bearing element is assumed to be in a c-commanding position relative to the elements it takes scope over.

In the literature on affix order, the typically adopted definition of scope deviates from this definition in the sense that it does not refer to semantic operators in the strict sense, but rather to the relative order in which semantic elements are composed. For example, the relative order of applicative and causative yields different semantic forms depending on the relative order of application of the two valency operations, as illustrated in (13). Thus, the applicative refers to the complex event of causation, as in (13a). When applicativization applies prior to causativization, it modifies the original subevent, as shown in (13b).

(13) Combination of causative and applicative (Stiebels 2003: 304)

a. [[[V]CAUS]APPL]
   λz λy λx λu λs' ∃s [[ACT(u) & V(x,y)(s)](s') & APPL(s',z)]
b. [[[V]APPL]CAUS]
   λz λy λx λu λs' ∃s [ACT(u) & [V(x,y)(s) & APPL(s,z)]](s')

In these scenarios, the relative order of causative and applicative is often translated as *scope*. In that sense, applicative takes scope over the causative in (13a) and vice versa in (13b). When the relative order yields interpretative effects, the underlying order can be read off the surface. In brief, a somewhat laxer definition of *scope* refers to the history of the semantic composition, or the order in which two elements are combined. Moreover, the term *scope* refers to a purely semantic relationship that is independent of the structural relationship of the elements in the syntax. In this dissertation, I adopt this somewhat laxer definition of scope in accordance with the preceding literature on the phenomenon.

A relatively common ambiguity that occurs when discussing affixes arises from markers glossed as 1SG, 3PL or other ϕ-features. The gloss itself does not reveal whether the person features encode **agreement** or refers to a **phonologically bound pronoun**. The main diagnostics I used to disambiguate the two phenomena is that agreement cooccurs with nominal constituents where it is mostly obligatory. Bound pronouns, however, are in complementary distribution with nominal constituents. In a small number of cases, the grammatical description does not allow any statement about that decision. In these cases, I use the abstract term *person marker* in order to remain agnostic about this ambiguity.[3]

Another descriptive peculiarity arises from the distinction between affixes and clitics. The core assumption is that some elements – clitics – have a syntactic distribution like independent words but are phonologically deficient. Consequently, clitics are typically promiscuous with respect to their host. That is, they may attach to more than one grammatical category. Moreover, clitics tend to be phonologically less integrated than true affixes, in the sense that they are typically affected by other or less phonological processes than true affixes (Spencer 1991). However, these empirical generalizations are only tendencies. The most prominent diagnostics to differentiate affixes from clitics have been suggested by Zwicky & Pullum (1983).

(14) Properties of clitichood (Zwicky & Pullum 1983)

a. Clitics can exhibit a low degree of selection with respect to their hosts, while affixes exhibit a high degree of selection with respect to their stems.
b. Arbitrary gaps in the set of combinations are more characteristic of affixed words than of clitic groups.
c. Morphophonological idiosyncrasies are more characteristic of affixed words than of clitic groups.
d. Semantic idiosyncrasies are more characteristic of affixes than of clitics.
e. Syntactic rules can affect affixed words, but cannot affect clitic groups.

[3] In the literature, a three-way distinction has been suggested by Joppen & Wunderlich (1995). More specifically, the term **incorporated pronoun** has been used to refer to bound person markers that are in complementary distribution with all types of nominal constituent. The term **strong agreement**, in contrast, refers to obligatory person marking that cooccurs with weak pronouns and other types of nominal constituents. Moreover, the term **weak agreement** is used to make reference to person markers that are in complementary distribution with nominal constituents, but may be used in combination with emphatic pronouns. In this dissertation, I adopt a dichotomy instead of a trichotomy since the descriptive grammars do not always reveals whether a pronoun is emphatic or not. Thus, it cannot always be resolved whether agreement morphology is of the strong type or the weak type.

f. Clitics can attach to material already containing clitics, but affixes cannot.

In the grammatical descriptions of the languages considered in this dissertation, the term clitic is often used to refer to bound elements that are lexically less restricted than other affixes. However, most of the languages do not allow to define a dichotomy between affixes and clitics, since the defining properties overlap or show gradient differences. This problem with existing diagnostic tests of clitichood is also discussed by Haspelmath (2015), who shows by the example of Makassarese that there are also some bound elements matching defining criteria of affixhood and clitichood simultaneously. In this dissertation, I adopt the terminology provided by these authors. For the evaluation of the patterns, I take the actual phonological properties into account while disregarding the author's terminology, since the language-individual definition does not allow for a crosslinguistic comparison.
Another difficulty refers to the definition of wordhood. Haspelmath (2017) shows that common criteria typically used to define wordhood, such as free occurrence, mobility or uninterruptibility, do not serve as sufficient, crosslinguistic criteria for defining words. Haspelmath (2017) further argues that wordhood can be defined for each language separately, which is also the approach I adopt in this dissertation. Typically, grammatical descriptions provide a language-specific definition of wordhood, taking the above criteria and phonological processes into account.
I would also like to introduce different notations that I use throughout this dissertation to differentiate among different descriptive levels when discussing affix order: I will use:

[ ] refers to the underlying semantic structure, such that [[[V]A]B] indicates that B takes scope over A.

\- refers to surface orders which are adjacent.

<,> refers to the relative distance from the verb without making reference to adjacency.

< refers to the relative distance to the verb without making reference to the affixal status.

To clarify the exact usage of these symbols, consider the examples in table 2.5. Hypothetically, there is a glossed verb form EVID-1SG-CAUS-V-APPL-PST-2SG. This verb form contains three prefixes and three suffixes, thus yielding four different pairs of adjacent affixes - EVID-1SG, 1SG-CAUS, APPL-PST, PST-2SG. The symbols <,> refer to the relative distance to the verb without making reference to adjacency. This relation between two affixes is important when testing empirical predictions of syntactic and semantic approaches, since these approaches make exact statements about the relative distance of the affixes to the root. Table 2.5 shows that six relations matching this definition can be derived from the provided: the evidentiality marker is further away than the 1SG marker and the causative. The 1SG marker itself is also external to the causative, thus yielding the hierarchical pairs EVID>1SG, EVID>CAUS and 1SG>CAUS. With respect to the suffixes, the 2SG is external to the past marker and the applicative, which itself is realized inside the past marker. Consequently, the examples within the suffixal domain are symbolized in the three pairs: APPL<PST, APPL<2SG, PST<2SG. The notation symbol < is similar in the sense that it makes reference to the relative distance of a certain affix from the verb root. It differs from the symbols <,>, however, as it abstracts away from the affixal status of the respective morphemes. This will prove helpful when comparing hierarchical tendencies of certain affix combinations across languages, as in chapter 5.1. Furthermore, this notation will prove also helpful when evaluating the predictions by semantic/syntactic approaches to affix order. As an example, these approaches predict that the underlying semantic representation [[[V]CAUS]REC] should map onto the morphological form V<CAUS<REC, which is expected to be realized as REC>CAUS>V in prefixing languages, but as V<CAUS<REC in suffixing languages.

Symbol	Descriptive level	EVID-1SG-CAUS-V-APPL-PST-2SG
[]	underlying representation	not applicable
-	adjacency	EVID-1SG, 1SG-CAUS, APPL-PST, PST-2SG
<,>	hierarchy	EVID>1SG, EVID>CAUS, 1SG>CAUS, APPL<PST, APPL<2SG, PST<2SG
<	hierarchy	V<CAUS<1SG<EVID V<APPL<PST<2SG

Table 2.5: Usage of notation symbols

Chapter 3

Expectations from the literature

Previous research on affix order shows that crosslinguistic tendencies of the relative order of verbal affixes within a complex morphological word is relatively robust, thus suggesting that affix order not arbitrary but follows from general principles of grammar. More specifically, the leading hypotheses within the research on affix order are that affix order matches the syntactic structure (Baker 1985, 1988) or the semantic composition (Bybee 1985, Muysken 1986, Rice 2000, Stiebels 2003). In this chapter, I review the core assumptions made by syntactic approaches in chapter 3.1 and semantic approaches in chapter 3.2 and summarize the empirical predictions made in the existing literature in chapter 3.3.

3.1 Syntactic approaches

The main claim in the syntactic approaches (Baker 1985, 1988, Pesetsky 1985, Speas 1991a,b, Alsina 1999, Zukoff 2022) is that the order of affixes reflects the syntactic derivation. The most influential syntactic account is Baker's 1985 *Mirror Principle*, presented here in (1). This principle was also formulated as the *Satellite Principle* (Gerdts 1981) couched within Relational Grammar.

(1) *The Mirror Principle* (Baker 1985)
Morphological derivations must directly reflect syntactic derivations (and vice versa).

Baker (1985) presents numerous examples from Chamorro (Austronesian) which exemplify that different orderings of affixes correspond to different underlying syntactic structures, as can be inferred from the interpretation of the sentences. Baker (1985) takes examples like these to be evidence that syntax and morphology are tightly connected. Compare the examples (2a) and (2b), where the plural morpheme *fan-* refers to different arguments.

(2) Chamorro (Baker 1985: 374, data originally from Gibson 1980)

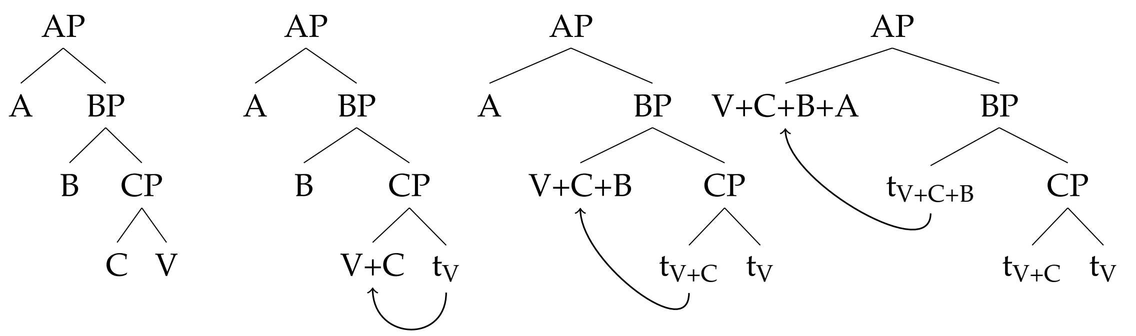
a. Para-u-fan-s-in-aolak i famagu'un gi as tata-n-niha.
IRLS-3PL.SUBJ-PL-PASS-spank the children by their father
'The children are going to be spanked by their father.'

b. Hu-na'-fan-otchu siha.
1SG.SUBJ-CAUS-PL-eat them
'I made them eat.'

In (2a), the plural marker *fan-* refers to the sole argument of a passivized, hence intransitive, predicate. In (2b), however, it refers to the object of a causativized predicate. Baker (1985) captures the natural class of the arguments targeted by *fan-* by making reference to the difference in the underlying syntactic structure of the sentences. Specifically, the most important generalization is that **the relative position of a morpheme to the root reveals its position in the syntactic derivation**. Concretely, the plural morpheme *fan-* is closer to the root than the causative morpheme in (2b), suggesting that it is lower in the syntactic derivation than causativization. Thus, the plural morpheme can only make reference to the object of the causativized verb in (2b) since it was the sole argument of the verb before causativization. In (2a), however, the passive morpheme is closer to the root than the plural morpheme which indicates that agreement is higher in the syntactic derivation than the respective passive head. Since passivizations renders the predicate intransitive, the plural morpheme necessarily targets the sole argument of the passivized verb. Hence, the order of syntactic heads that is reflected in the order of morphemes captures the class of arguments targeted by the plural morpheme *fan-*. According to Baker (1985), this observation necessitates a connection between morphology and syntax, however, he remains vague on how this link is actually implemented in the theory. In Baker (1988), this connection is formalized by cyclic head-to-head movement in the syntax, such that affix order is constrained by the relative order of heads in the syntax, as well as global and language-specific constraints on head movement. More specifically, Baker (1988) suggests that there is a morphological operation of concatenation applying to nodes that are in sisterhood relation in the syntactic derivation. To illustrate this in closer detail, let us assume the hypothetical syntactic structure in (3). Crucially, heads that are in a sisterhood relationship concatenate by forming a complex head. This complex head moves up cyclically, thus attracting all heads on its way. At the end of the derivation, heads low in the derivation, like C in (3), end up in a position close to the verbal head in the resulting complex head, while heads higher up in the derivation are the more external heads, e.g. A in (3).

(3) Hypothetical derivation of syntax-obeying surface order

Step 1: Step 2: Step 3: Step 4:



In short, the *Mirror Principle* predicts that syntactic elements low in the syntactic derivation are reflected by a morpheme close to the root while elements high in the syntactic derivation are expressed by a morpheme further away from the root. While the main empirical evidence for this claim comes from grammatical function-changing morphology like diathesis markers, the *Mirror Principle* is intended to account for the order of inflectional morphology, as well, since the mechanism translating the syntactic hierarchy into ordered affixes makes reference to heads, without differentiating between derivational and inflectional morphology.

Previous work supporting the hypothesis that the *Mirror Principle* holds in the area of inflectional morphology, as well, is presented for various, mainly European languages, like French (Pollock 1989), English (Chomsky 1989), Finnish (Mitchell 1991), Basque (Laka 1988) or Modern Greek (Rivero 1990). The findings on the relative order of inflectional categories of those languages are summarized in table 3.1. At this point, I would like to emphasize that most accounts implementing the *Mirror Principle* do not provide independent, phrase-structural evidence for the relative sequence of functional heads. In simpler terms, the argument that the relative order of affixes matches the relative order of functional heads in the syntax is only conclusive if the hierarchy of heads in the syntax were supported by additional evidence which is independent of affix order.

Language	**Reference**	**Scopal order**
English & French	Chomsky (1989)	SUBJ.AGR > TNS > OBJ.AGR > V
Modern Greek	Rivero (1990)	agent > TNS > ASP > voice > V
Finnish	Mitchell (1991)	agent > TNS > ASP > voice > V
Basque	Laka (1988)	ERG > TNS > mood > ABS > V

Table 3.1: Case studies on affix order implementing the *Mirror Principle*

These findings are summarized and extended by Speas (1991a,b) yielding the empirical generalization in (4) that reflects the predictions of the *Mirror Principle*.

(4) Speas' generalization (Speas 1991b)
subject agreement > tense > aspect > object agreement > voice > V

3.2 Semantic approaches

Semantic approaches (Bybee 1985, Muysken 1986, Rice 2000, Stiebels 2003) presume that the order of affixes has some type of semantic correlate. More specifically, Bybee (1985) assumes that the core trigger for affix order is *semantic relevance* is the core trigger for affix order. In contrast, Muysken (1986), Stiebels (2003) and Rice (2000) take *semantic scope* to be the relevant semantic correlate of affix order with Muysken (1986) and Stiebels (2003) referring to *scope* as a reflex of the semantic composition, while Rice (2000) refers to a semantic subset relation with a structural correlate in the syntax.
The influential crosslinguistic contribution to affix order by Bybee (1985) investigates the relative order of verbal categories by means of a sample of 50 languages with a special focus on the order of tense, aspect and mood. She concludes that there is a strong tendency for affixes to be ordered along the hierarchy in (5).

(5) Bybee's generalization (Bybee 1985)
agreement > mood > tense > aspect > voice > valence

In fact, this hypothesis appears to be strikingly robust since there is only one counter-example from Ojibwa. Bybee (1985) further argues that the crucial factor underlying this generalization is *relevance*:

> *'A category is relevant to the verb to the extent that the meaning of the category directly affects the lexical content of the verb stem.'* (Bybee 1985: 15)

In those terms, the linguistic concept of *relevance* refers to the idea that the semantic content of one element directly affects the semantic content of another element. Consider the examples of speech verbs. The type of manner of the speech verb (*whispering*, *screaming*, *stumming*) is *relevant* to the meaning of the basic verb, while the number of the argument executing the action of speaking has less impact on the meaning of the basic verb. As a consequence, the manner of speech verbs is often incorporated yielding separate lexical items for each manner. With respect to affix order, the core idea is that those elements strongly affecting the semantic content of the verb should be realized closer to the verb than those exhibiting less relevance. While the idea behind this is intuitive, it remains unclear how the concept of *relevance* is implemented in the theory and how this can be tested empirically.
Muysken (1986) presents data from Quechua that reveal variable affix order of the causative *chi-* and the reciprocal *na-*. Depending on the relative order of the two affixes, the sentences yield a different interpretation, as illustrated in (6). He concludes that the difference in the interpretation of the sentences arises from a different order of operations in the semantic composition: while the reciprocal applies **before** causativization in (6a), it applies **after** causativization in (6b). Thus, the reciprocal in (6a) necessarily marks coindexation of the patient and the agent

since the causer has not been introduced by the causative yet. In (6b), in contrast, two different readings a possible: a reading in which the causer binds the agent and also the reading expressed by (6a), in which the causer is coindexed with the theme argument. In Quechua, (6b) only allows for the former reading. Muysken (1986) takes this to be evidence that affixes are added successively.

(6) Quechua, simplified (Muysken 1986: 636)

a. riku-na-chi-ku-n-ku
see-REC-CAUS-REF-3-PL
'They caused them$_i$ to see each other$_i$.'

b. riku-chi-na-ku-n-ku
see-CAUS-REC-REF-3-PL
'They$_i$ caused each other$_i$ to see them.'

The most influential semantic approach to affix order comes from Rice (2000), who investigates the deeply puzzling picture of affix order within the Athapaskan language family. She concludes that the order of affixes in Athapaskan languages matches scope in the sense that an element which affects the interpretation of a different element in its domain is further away from the stem than the affected item. Rice (2000) defines the scopal relationship between two elements as an asymmetrical subset relation. This asymmetry is assumed to be reflected in the syntactic structure by means of a c-command relation, such that a scope-bearing element is taken to asymmetrically c-command all elements it scopes over. In that sense, the notion of scope adopted by Rice (2000) differs from the notion adopted by Muysken (1986), since her definition draws a link to syntactic structure. Rice (2000) concretizes the definition of scope by providing a number of general principles about scope that are thought to hold in other language families, as well. Only to mention one out of numerous examples, Rice (2000) concludes that general and specific items instantiate a subset relation in the sense that specific elements are subsets of more general items. Consequently, Rice (2000) states that the superset – the more general markers – take scope over more specific items, thus predicting that more general items should occur in a position external to more specific items. This is illustrated in (7): the first preverb *te(h)* provides the general location of an event, whereas the second preverbs *ká* and *k'e* encode more specific concepts of location such as position, direction or source. In those terms, the relative order of the two preverbs is ordered along their subset relations – the more general item is external to the more specific item.

(7) Order of general and specific locations in Slave (Rice 2000: 86)

a. Te-ká-yį̨-ya
water-out.of-ASP-go.SG

b. teh-k'e-ts'e-ne-tah
water-around-HUMAN.SUBJ-qualifier-look
'look around in the water'

This idea is extended to other principles like the generalizations of entailing elements having scope over entailed elements, and quantifying elements have scope over quantified elements. With these principles, Rice (2000) makes very precise predictions about the relative order of two morphemes **across languages**, as well: if the scopal relationship of two elements is fixed across languages, the order of the affixes reflecting those elements should be fixed, as well. If the scopal relationship of two elements is invertible like in the case of certain combinations of diathesis markers, Rice (2000) predicts that the order of affixes is expected to be flexible as long as the order corresponds to the scopal relationships between the two elements. This contrasts with elements that are not in a scopal relationship. For these pairs of elements, Rice (2000) predicts that the order of elements should be flexible across languages or even within one language. Moreover, variation between languages and variability within one language arises when the aforementioned principles lead to conflicting results.

As already mentioned above, Rice (2000) assumes that scope corresponds to syntactic *c-command*. However, this syntactified definition of scope has led to extensive sharp criticism. Crysmann & Bonami (2016: 22), for instance, sharply criticise that the syntactic definition of scope deviates from established and testable notions of scope in the semantics. Concretely, they argue that couching scope in the syntax predicts scopal relationships between elements that do not seem to interact semantically. Furthermore, the scopal relationships Rice (2000) establishes make wrong predictions for multiple exponence. As shown by Caballero & Harris (2012), a common pattern of muliple exponence are cases in which the multiple exponence is partially superfluous. In these cases, a certain marker realizes features that have been realized before, but adds new features that have not been realized yet. An well-known examples comes from German *Kind-er-n*, illustrated here in (8).

(8) Multiple exponence of PL in German

a. Die Kind-er sing-en.
the kid-PL sing-3PL
'The kids are singing.'

b. Dem Kind gefäll-t das Lied.
the.DAT kid like-3SG the song
'The kid likes the song.'

c. Den Kind-er-n gefäll-t das Lied.
the.DAT.PL kid-PL-DAT.PL like-3SG the song
'The kids like the song.'

In German, plural is marked by the suffix *-er*, as shown in (8a), where *Kinder* is the nominative subject of the sentence. The sentence in (8b) shows an example with the predicate *gefallen*, which takes a dative subject. The dative singular subject *dem Kind* in (8b) does not carry an overt dative exponent. In (8c), however, where the dative subject is plural, and carries both the regular plural exponent *-er* and *-n*, which is a dative marker that occurs in plural contexts only. In that sense, *-n* is a more specific plural marker than *-er*. In those terms, the latter marker is more specific than the first exponent. Rice (2000), however, predicts that the more specific exponents should always be internal to the more general ones.

Let me also elaborate on the similarities and differences between semantic and syntactic approaches to affix order. Both theories base on the core assumption that there is an independent, underlying grammatical component that is mapped onto the morphological structure of the verb: the semantic composition in semantic approaches and the syntactic derivation in syntactic approaches. Thus, the approaches overlap in their predictions about affixes that are semantically meaningful/syntactically relevant. In both theories, the empirical evidence for their assumptions comes mainly from affixes reflecting diathesis operations, which have a clear semantic and syntactic effect. However, semantic approaches seem to make different predictions than syntactic approaches in the field of inflectional morphology even though this is not explicitly mentioned in either of the theories. Since the *Mirror Principle* is intended to hold in the area of inflectional morphology, as well, it predicts that there should be a fixed order of, e.g, subject agreement and object agreement with object agreement expected to be closer to the root than subject agreement. In contrast, Rice (2000) makes the precise empirical prediction that elements not in a scopal relationship do not exhibit a fixed order across languages. Moreover, Rice (2000) narrows the empirical scope of her proposal by saying affix order is partially idiosyncratic, especially in the area of inflectional morphology, thus motivating the existence of morphotactic and phonotactic rules alongside semantic factors (see also Muysken 1986 for similar arguments and Crysmann & Bonami 2016, who take this to be evidence that affix order is computed entirely in the morphology). However, it needs to be highlighted that this intuition and thus the differences between syntax and semantics are heavily blurred by the syntactified notion of scope adopted by Rice (2000).

Evidence against both syntactic and semantic approaches comes from a cross-linguistic investigation of different combinations of diathesis markers in Stiebels (2003). Stiebels (2003) shows that certain combinations of diathesis marker are *opaque*, since they do not fully match the semantic interpretation. This is exemplified in (9) for Quechua, which exhibits a fixed order of causative and applicative yielding three different interpretations. However, only the reading in (9a) is semantically transparent, since the applicative argument is related to the event of causation while the readings in (9b) and (9c) are opaque as the applicative arguments refer to subevent of the sentence.

(9) CAUS and APPL in Quechua (Stiebels 2003: 23, citing van de Kerke 1996)

Mama-y	Ana-wan	chompa-ta	ruwa-chi-pu-wa-n.
mother-1SG.POSS	Ana-COM	sweater-ACC	make-CAUS-APPL-1-3.

a. 'In my place my mother made Ana make a sweater.'
b. 'My mother made Ana make a sweater in my place.'
c. 'My mother made Ana make me a sweater.'

This clearly contradicts the predictions by syntactic and semantic approaches, which claim that the order of the semantically meaningful/syntactically relevant elements like causative and reciprocal should be flexible to match the different interpretations (see also Hyman 1994a, 2003, Good 2005, 2007, Paster 2006, McFarland 2009, Caballero 2010, Marquardt 2014 for more examples).

3.3 Empirical predictions from the literature

Syntactic and semantic approaches to affix order share the underlying assumption that the relative order of semantically vacuous/syntactically relevant affixes is expected to match the underlying semantic order/syntactic hierarchy of these categories. However, the two approaches make considerably different assumptions with respect to inflectional morphology and variable affix order. Let me summarize the empirical predictions discussed so far:

- Both syntactic and semantic approaches predict interpretative effects coming from different underlying semantic compositions/syntactic derivations should be reflected in the relative order of affixes.
- Both syntactic and semantic approaches predict that the affixal status as prefix or suffix is orthogonally determined, e.g. by orthogonal morphological or phonological rules.
- Presuming that the relative order of affixes matches the syntactic hierarchy of heads, syntactic approaches predict a fixed, invariable order of affixes in the area of inflectional morphology. Deviations from those fixed hierarchical relations are typically approached by phrasal movement prior to spell-out (Buell 2005, Buell et al. 2014).
- Since semantic approaches make only statements about affixes that are in a scopal relation with other elements, they allow for more flexibility with respect to inflectional morphology. Concretely, Rice (2000) notes that two affixes that are not in any scopal relationship are expected to occur in either order across languages and allowed to exhibit variable affix order within a language. Moreover, Rice (2000) notes that arbitrary, morphological rules of the individual language are assumed to participate in the linearization of those affixes.

Thus, variable affix order is an important phenomenon for evaluating the empirical adequacy of the two approaches: if variable affix order occurs without interpretative effects, syntactic approaches have very little instruments to account for this variability. If the relative order of two affixes is fixed although the semantic order of application is relevant for their interpretation, both accounts make wrong predictions or need to make additional statements about these cases.

Let me now elaborate more closely on the relative order of verbal categories predicted by the various approaches. The predictions by semantic approaches on the relative order of categories are captured in the generalization made by Bybee (1985), repeated here in (10).

(10) Bybee's generalization (Bybee 1985)
agreement > mood > tense > aspect > voice > valence

The relative order of categories as predicted by syntactic approaches are summarized in the findings by Speas (1991a,b). The generalization is demonstrated again in (11).

(11) Speas' generalization (Speas 1991b)
subject agreement > tense > aspect > object agreement > voice > V

Both Bybee (1985) and Speas (1991b) make reference to the position of agreement morphology without differentiating ϕ-agreement any further. Shlonsky (1989) suggests the following internal structure of agreement morphology based on evidence from Hebrew:

(12) Shlonsky's generalization (Shlonsky 1989)
person > number > gender > V

Wunderlich (1993) combines these generalizations and derives a hierarchy of functional categories in the morphology, presented here in (13).

(13) Wunderlich's generalization (Wunderlich 1993)
case > person > number > gender > tense > aspect > diathesis > V

Tense, mood and aspect have received further attention in the work by Cinque (1999), who examines the relative order of adverbs in more than 500 languages. Cinque (1999) reaches the conclusion that the relative order of the categories encoded by adverbs is extremely robust crosslinguistically and can be extended to bound markers, as well. More specifically, Cinque (1999) differentiates the categories tense, mood, aspect and modality even further and illustrates that the order of those categories matches the hierarchy in (14). While Cinque (1999) focuses on the relative position of AdvPs in the syntax, Ernst (2001) shows that ordering principles of adverbs can be analyzed by taking their semantic composition into account.

(14) Hierarchy of suffixes (Cinque 1999)
$\text{Mood}_{\text{Speech Act}}$ » $\text{Mood}_{\text{Evaluative}}$ » $\text{Mood}_{\text{Evidential}}$ » $\text{Mod}_{\text{Epistemic}}$ » T_{Pst} » T_{Future} » $\text{Mood}_{\text{Irrealis}}$ » Mod_{root} / $\text{Aspect}_{\text{Habitual}}$ / $\text{T}_{\text{Anterior}}$ » $\text{Aspect}_{\text{Perfect}}$ » $\text{Aspect}_{\text{Progressive}}$ / $\text{Aspect}_{\text{Completive}}$ » Voice » V

This summary of the empirical predictions of the relative order of linguistic categories serves as a starting point for the next chapter. In the next chapter, I will compare the relative order of affixes to the predictions summarized in this chapter to investigate if the relative order of inflectional categories is as robust as predicted by Bybee (1985) or Speas (1991a,b). The empirical adequacy of these empirical generalization is crucial to investigate the empirical scope of **morphological rules on affix order**, since a high adequacy suggests that affix order can be derived from independent principles of grammar to a large extent. In this case, morphology takes over only a complementary role in deriving affix ordering patterns. Morever, this chapter has revealed the importance of investigating variable affix order, in order to evaluate the empirical adequacy of semantic approaches on the other hand and syntactic approaches on the other hand. Furthermore, a lack of variability in semantically meaningful/syntactically relevant affix combinations suggest that morphological rules do not only complement, but overwrite the patterns provided by syntax or semantics.

Chapter 4

Evaluating the predictions

In the previous chapter, I summarized the predictions in the literature on the **relative order of affixes**. In chapter 4.2, I will evaluate the predictions made by these approaches by means of the sample of this dissertation. To evaluate this question, I will make use of the descriptive templates provided in the literature. This allows also a critical discussion of descriptive templates as means of illustrating affix order. Thus, I will briefly introduce and discuss descriptive templates in chapter 4.1. Moreover, I discuss the crosslinguistic distribution of variable affix order in chapter 4.3, which reveals that variable affix order is less common than predicted by Rice (2000). A preliminary conclusion that can be drawn from the previous chapter is that syntax and semantics need to complemented by additional rules, at least in the determination of the affixal status of each affix. That is, there need to be additional rules that decide whether an affix is attached as a prefix or a suffix. Consequently, the question arises whether this determination is entirely arbitrary, or follows systematic patterns. In chapters 4.5 and 4.6, I will argue that there are biases in the distribution of the affixal status of certain grammatical categories, thus providing evidence for the existence of independent morphological rules on the linearization of affixes.

4.1 A short discussion of descriptive templates

In the descriptive literature, the relative order of affixes is most commonly illustrated by *templates*, such that all possible affixes are presented according to their relative position to other affixes and the verb root. If two affixes are in the same linear and hierarchical relationship to other affixes, and if those affixes are in complementary distribution, they are associated with the same relative position to the verb. These properties are laid out by Stump (1993), summarized here in (1).

(1) Assumptions about members of the same position class (Stump 1993: 138)

- They are in complementary distribution (so that the appearance of one in a given form excludes the appearance of the others in that same form).
- They stand in the same hierarchical relationship to other affixes in the same word.
- They appear in the same linear order with respect to other affixes in the same word

Crucially, these models of illustrating affix order rely heavily on the assumption that affix order is transitive and invariable. Concretely, if affix A precedes affix B which itself precedes affix C, a template necessarily predicts that affix A should also precede affix C. In this chapter, I discuss the advantages and disadvantages of templates or position class models, which remain the most commonly used model for visualizing affix order despite persistent criticism (Simpson & Withgott 1986, Rice 2006, Chelliah & de Reuse 2011), and compare them to cooccurrence tables which instantiate an alternative visualization of affix order.

There are three major points of critique I would like to present. First, many templatic models do not achieve their purpose in their current form. Concretely, Rice (2006: 253) roughly describes the purpose of a template as providing an overview of the affix ordering patterns of the described language to serve as a point of comparison with other languages or with general tendencies of affix order, e.g. the generalizations presented in chapter 3.3. However, not all templatic models in descriptive work exhibit a format which allows for direct comparison between language-individual patterns and typological tendencies. One example is illustrated by the templates provided by Facundes (2000: 327, 334), demonstrated here in (2) and (3), for Apurinã (Arawakan, Brazil). See also the original visualization in (4).

(2) Template of inner suffixes as suggested by Facundes (2000: 327)

0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13
verb	DISTR	CAUS	INTR	AUG	TR.CAUS	EVID	COLL	PROG	almost	random	INTSF	DESID	QUOT

(3) Template of outer suffixes as suggested by Facundes (2000: 334)

+14	+15	+16	+17	+18	+19
VBLZ	COND	INCH	CAUS	HAB	REC

(4) Apurinã templates in in Facundes (2000: 327, 334)

Table 3: Suffixes of $Class_1$ and their Position Classes[8]

POSITION CLASS	1	2	3	4	5	6	7	8	9	10	11	12	13
MEANING/ FUNCTION:	DISTR	CAUS	INTR	AUGM	T.CAUS	INFER	COLTV	PROG	ALMOST	RANDOM	INTENS	DESID	RS
FORMS	*-poko*	*-ka₂*	*-rewa*	*-powa*	*-kũtaka*	*-ã₂*	*-pirĩka*	*-nanu*	*-wari*	*-ãpo*	*-ka₁*	*-ene*	*-pira*
TRANSIT.	+	+	#	+	+	+	+	+	+	+	+	+	+
INTRANS.	#	+	+	+	+	+	+	*	+	+	+	+	+

Table 4: Suffixes of $Class_2$ and their Position Classes

POSITION CLASS	14	15	16	17	18	19
MEANING/FUNCTION:	VBLZ	HYPOTH	IMMIN	CAUS	HAB	RECIPR
FORM	*-ta*	*-ã₃*	*-napano*	*-ka₃*	*-pi*	*-kaka*
TRANSITIVE	+	+	+	+	+	-
INTRANSITIVE	+	+	+	+	+	+

First, these templates do not provide information about the semantic categories of the verbal affixes. Thus, a direct comparison to comparative hierarchies like the ones presented in chapter 3.3 is not possible. Even if readers might automatically classify frequent markers like CAUS as a valency marker or PROG as an aspect marker, it is impossible to classify other affixes without further reading. For example, a reader who is not familiar with grammar of Apurinã does neither know the semantics nor the category of a marker abbreviated as DISTR.[4] Thus, a reader cannot deduce simple generalizations like the relative order of tense and aspect from the template. It is worth noting that Apurinã is only one out of many languages where the descriptive grammar provides unclassified templates. Similar cases arise in templates on Kuna (Smith 2014), Mixtec (Macaulay 1996), Mawng (Singer 2006), Tukang Besi (Donohue 2011) or Chukchi (Dunn 1994). Moreover, not only the relative order of verbal categories, but also possible instances of variable affix order are important for a comparison with crosslinguistic tendencies, as discussed in chapter 3. Templates in its current form do not allow to test these predictions.

A second point of criticism I would like to rise is that templatic models do not have enough predictive power. Given the underlying definition that elements belonging to the same position class must not cooccur, while elements belonging to different position classes may cooccur, a position class model predicts more forms than actually attested. While elements belonging to the same position do in fact not cooccur, position classes do not provide information about which combinations of affixes or position classes are in fact attested. I see two main reasons for this problem of massive overgeneration. First, templates presume transitivity of affixes, as already mentioned above. This presumption is not only disproved by nontransitivity, described in more detail in chapter 5.2.1 but also by non-attested cooccurrences of affixes. This is crucial

[4]Note that the abbreviations used in the templates differ from the original templates in (4) and the templates provided in (2) and (3). These differences result from changes I made to improve the comparability of the template.

since non-attested coccurrences are far more common than nontransitivity. How misleading the presumption of transitivity might be is exemplified by the position of the reciprocal marker *-kaka* in the template in (3) and (4). The reciprocal marker is a valency marker indicating a mutual relationship between plural subjects and objects, thus intransitivizing the predicate it attaches to. In the templates in (3) and (4), it is associated with the outermost suffix slot in position +18. From a first glance at the template, this seems unusual in comparison with the general tendency of valency affixes to occur in proximity of the verb root. However, in the entire grammar by Facundes (2000), there is **at most** one affix between the verb root and the reciprocal, as shown in (5).

(5) Distribution of REC *-kaka* in Apurinã (Facundes 2000: 515)

a. Ata atama-ta-kaka.
1PL see-*ta*-REC
'We saw each other.'

b. A-atama-pi-kaka.
1PL-see-HAB-REC
'We always see each other.'

The position of the reciprocal marker in the templates goes back to the observation by Facundes (2000) that inner suffixes strictly precede *-ta-* while outer affixes like the reciprocal follow it. Given that the reciprocal follows *ta*, as shown in in (5a), Facundes (2000) associates the reciprocal with the outermost slot presuming that it necessarily follows all inner affixes, as well. However, there is not a single example in the grammar in which the reciprocal cooccurs with the inner affixes.

Third, in many cases, the suggested templates might simply be incorrect. Again, there is one example coming from Apurinã. The relevant examples are presented in (6). Concretely, the progressive and the causative occur in variable affix order in the presence of the verbalizer *-ta*. Recall from the templates that the causative is associated with two slots, slot +2 preceding the progressive and the verbalizer and slot +17 following the progressive and the verbalizer. However, none of the positions explains the relative order of affixes observed in (6a), where the causative follows the progressive but precedes the verbalizer.

(6) Variable ordering of PROG, CAUS and *ta* (Facundes 2000: p. 310, 507)

a. Nhi-nhika-nanu-ka-ta-ru yapa.
1SG-eat-PROG-CAUS-*ta*-3MASC.OBJ capibara
'I am making him eat capibara.'

b. Amarunu n-umaka-ka-nanu-ta
boy 1SG-sleep-CAUS-PROG-*ta*
'I am making the kid sleep

Another instance of incorrect templates comes from Bukiyip (Nuclear Torricelli, Papua New Guinea). The template suggested in the descriptive grammar by Conrad & Kepas (1991) is illustrated in (7).

(7) Template as provided by Conrad & Kepas (1991: 14)

-3	-2	-1	0	+1	+2	+3
SUBJ.AGR	mood	OBJ.AGR_1	verb	OBJ.AGR_2	BEN	DIR

The template predicts that object agreement suffixes precede the benefactive. The examples in (8) illustrate why this generalization is incorrect. In (8a), the predicate is trivalent and has two structural object arguments. Both object agreement markers are suffixes. The theme argument is indexed by the first agreement marker *-as*. As predicted by the template, it precedes the benefactive marker *-um*. However, the beneficiary argument introduced by the benefactive marker is also indexed by an agreement suffix **following** the benefactive. The example in (8b), in contrast, illustrates a different type of trivalent predicate in which the theme argument is indexed by agreement prefixes. In that case, the benefactive is attached directly to the verb root and followed by the object suffixes indexing the beneficiary argument. In other words, in cases where there is one agreement suffix and a benefactive marker, like in (8b), the order is in opposition to the one presented in the template in (7).

(8) Two patterns of trivalent predicates (Conrad & Kepas 1991: 28f)

a. Ali doumun ch-a-núk-as-um-ech-i.
and.now today 3PL.SUBJ-RLS-pull-CL9.PL-BEN-3PL.OBJ-DIR
'And today, they pulled the drums for the others.'

b. I-chu-sah-um-oné-gu.
1SG.SUBJ.IRLS-CL8.OBJ-carry.on.shoulders-BEN-3.MASC.OBJ-DIR
'I will carry the things on my shoulder for him to a different place.'

So far, I have shown that templates should be easy to understand, useful for cross-linguistic comparison, empirically adequate and correct. As a consequence, the following points should be considered by fieldworkers in the future to improve the predictive power and empirical adequacy of descriptive templates: to prevent extensive prediction of unattested patterns, affix ordering patterns should be simplified more generously. Concretely, I suggest that template should focus on the most frequent affixes. Infrequent affixes that are typically subject to semantic incompatibilities should not be considered in the template unless it falls into a group with other affixes exhibiting the same ordering patterns. Given the rare occurrence of these markers, the presumption of transitivity with respect to other affixes leads to a massive overgeneration of templatic models.

Following the suggestions by Rice (2006: 253), templates should allow the reader to see where the affix ordering patterns of the described language follow or violate general tendencies of affix order. Since the generalizations refer to linguistic categories

rather than concrete morphemes, templates need to be categorized. For affixes with adverbial meanings that are often hard to classify, the fieldworker might consider to ignore it when setting up the template or to categorize it as an adverbial affix.
Moreover, Rice (2006: 253) suggests that variable affix order is equally important as the relative order of categories. Even though variable affix order cannot be directly captured within a templatic model, I suggest that templates should be directly followed by a short list of affixes showing variable affix order. One possibility to include variable affix positions in the template is using indices as exemplified above in (7) where the position of the object agreement marker reflecting the theme argument depends on the verb. However, indices might be misleading since they are sometimes used to mark circumfixes.
A last suggestion to improve the predictive power of templatic models is to visually distinguish obligatory markers from non-obligatory markers. This is extremely helpful for predicting how a potential verbal form looks like. Moreover, it weakens the presumption of transitivity since two optional markers are not necessarily predicted to cooccur.
Although the improved version of descriptive templates reduces problems like overgeneration or incorrectness, it still faces one major problem: The only prediction a templatic model reliably makes is the ungrammaticality of combinations between two affixes from one and the same position class. As for combinations between two affixes from different position classes, however, a template does not necessarily allow for inferences as to whether this combination is in fact an attested, grammatical form.
Muysken (1988) provides an alternative way to visualize affix order, which I will refer to as **cooccurrence tables**, presented here in (9). This table should be understood as follows: Each cell represents the information on whether a combination of the row affix preceding the column affix is grammatical (✓) or ungrammatical (✗). The question mark indicates that the information regarding this affix combination were contradictory, which is why no reliable conclusion could be drawn. Cooccurrence tables have a major advantage over templatic models: they provide exact information about each single pair of affixes since grammatical, ungrammatical and non-attested combinations are reliably distinguished from each other. Furthermore, cooccurrence tables provide information about the relative order of morphemes, the degree of transitivity and the affixes that tend to violate transitivity assumptions. Concretely, a cooccurrence table without checkmarks below the diagonal grey line indicates that there is no variable affix order. Checkmarks occurring both above and beneath the grey cell in one and the same column, like in the case of *raya* in (9), indicate that this affix seems to violate transitivity assumptions and should be discussed in more detail. However, a disadvantage of cooccurrence tables to templatic visualizations is that cooccurrence tables do not allow statements about the adjacency of the grammatical pairs. More specifically, if a certain affix combination is marked to be grammatical by ✓, it is not unambiguously clear if this combination requires adjacency or not.

(9) Cooccurrence of affixes in Chumbivilcas Quechua (Muysken 1988: 263)

	lli	ya	na	cha	naqa	raya	pa	paku	puna	na	ri	ykacha	rpari	paya	naya	schi	chi	yu	ru	ku	mu	pu
lli		✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ya	✗		✗	✗	✗	✗	✗	✗	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
na	✗	✗		✗	?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
cha	✗	✗	✗		✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
naqa	✗	✗	✗	✗		✗	✗	✗	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
raya	✗	✗	✗	✗	✗		✗	✓	✓	✓	?	?	?	✓	?	?	✓	✓	✓	✓	✓	✓
pa	✗	✗	✗	✗	✗	✗		✗	✓	✗	✗	✓	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓
paku	✗	✗	✗	✗	✗	✓	✗		✗	?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
puna	✗	✗	✗	✗	✗	✗	✗	✓		✗	✓	✓	✓	✓	✗	✗	✓	✓	✓	✓	✓	✓
na	✗	✗	✗	✗	✗	✗	✗	✓	✗		✓	✓	✓	✓	✗	✗	✓	✓	✓	✓	✓	✓
ri	✗	✗	✗	✗	✗	?	✗	✓	✗	✓		✓	✓	?	✓	✓	✓	?	✓	✓	✓	✓
ykacha	✗	✗	✗	✗	?	?	✗	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
rpari	✗	✗	✗	✗	?	✓	✗	✓	✗	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
paya	✗	✗	✗	✗	✗	?	✗	✓	?	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
naya	✗	✗	✗	✗	✗	✗	✗	✗	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
schi	✗	✗	✗	✗	✗	✗	✗	✓	✓	✓	✗	✗	✓	✓	✓		✗	✗	✗	✓	✓	✓
chi	✗	✗	✗	✗	?	✗	✗	✓	✗	✓	✗	✓	✓	✓	✓	✓		✗	✗	✓	✓	✓
yu	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✓	✓		✓	✓	✓	✓
ru	✗	✗	✗	✗	✗	✗	✗	✗	✗	?	✗	✗	✗	✗	✗	✓	✓	✗		✓	✓	✓
ku	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗		✓	✓
mu	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗		✓
pu	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	

Neither templatic visualisations nor cooccurrence tables allow predictions about possible words containing more than two affixes without presuming transitivity. In that respect, both models seem to overgenerate to a certain extent. Another major deficiency of both types of models is that none of the visualizations allows implications about the semantic transparency of the affix combinations that the models predict to be grammatical. In contrast to templatic visualisations, however, coccurrence tables do not provide information about the side of affixation. Rather, a language which has both prefixes and suffixes would require two separate cooccurrence tables. As a consequence, phenomena like mobile affixation cannot be captured. However, given the rarity of the phenomenon, it seems like a bearable disadvantage. It is also worth noting that cooccurrence tables are much harder to create than templatic models since they require information and elicitation of each pair of affixes. Nonetheless, I have shown that cooccurrence tables are clearly advantageous because of their informativity.

4.2 Testing predictions

At this point, I want to evaluate the empirical predictions on the relative order of verbal affixes, thus referring to the generalizations established at the end of chapter 3. To investigate the hierarchical relationships of the affixes, i.e. their relative distance to the root, prefixes and suffixes are investigated separately. In most of the grammatical descriptions, the relative order of affixes is illustrated by means of descriptive templates, as described in the previous section. In the previous section, I already presented two cases where the template presented in the descriptive template is simply wrong. In Apurinã, the reciprocal was associated with the outermost position class although there is maximally one affix between the verbal root and the reciprocal. In Bukiyip, object agreement was associated with a position class internal to the benefactive marker. In both cases, these mistakes cause empirical predictions to fail. More specifically, the empirical hierarchies of categories by Bybee (1985), Speas (1991a) and Wunderlich (1993) predict that valency markers like the reciprocal in Apurinã or the benefactive marker in Bukiyip should be closer to the root than agreement, tense and aspect. This observation again weakens the descriptive adequacy of templates. Table 4.1 summarizes the correctness of the empirical predictions by Bybee (1985), Speas (1991a), Wunderlich (1993) and Cinque (1999). The table provides information about the relative order of verbal categories in the given language and evaluates each empirical hierarchy with regard to the correctness of its predictions. Furthermore, the table reveals that most attested patterns violate the empirical predictions at some point. In addition, the following generalizations can be drawn from table 4.1: first, most violations of the empirical predictions arise from the relative position of the person marking. The hierarchies by Bybee (1985), Speas (1991a) and Wunderlich (1993) predict that person marking should be the most external marker. In most languages, however, the position of person marking is rather unpredictable and is interspersed between other inflectional categories. In that sense, the relative order of person and other inflectional categories seems to be entirely arbitrary. The empirical predictions by Cinque (1999), in contrast, make precise predictions about the relative order of various types of tense, mood, aspect and modality markers but do not make reference to agreement or person marker. That being said, the empirical predictions by Cinque (1999) turn out to be a better fit precisely for this reason.

Language	Order	Reference	Bybee (1985)	Wunderlich (1993)	Speas (1991b)	Cinque (1999)
Mixtec	Tense > Asp$_{Complet}$ > number > repetitive > valency > voice > V	Macaulay (1996)	✗	✗	✓	✓
Otomí	T$_{Anterior}$ > T$_{Pst}$ > SUBJ.AGR > Aktionsart > valency > verb < valency < OBJ.AGR	Hernández Green (2015)	✗	✗	✗	✗
Apurinã	SUBJ > verb < Asp$_{prog}$ < DESID < voice < Asp$_{hab}$ < valency < OBJ.AGR	Facundes (2000)	✗	✗	✗	✗
Kuna	valency > verb < valency, Asp$_{prog}$ < Asp$_{pfv}$, Asp$_{Prospective}$ < Number, NEG, Asp$_{rep}$	Smith (2014)	✓	✓	✓	✗
Wanano	verb < valency, Asp$_{Cont}$, Asp$_{Desid}$ < SUBJ.AGR < T$_{Fut}$ < Asp$_{Prog}$ < Mood$_{Evid}$	Stenzel (2004)	✗	✗	✗	✗
Bukiyip	SUBJ.AGR > mood > OBJ.AGR > verb < OBJ.AGR < BEN < DIR	Conrad & Kepas (1991)	✗	✗	✓	✓
Mawng	T$_{pres}$, NEG > AGR > verb < Asp$_{complet}$ < DIR	Singer (2006)	✗	✗	✗	✗
Zulu	NEG, TMA, sentence mood> SUBJ.AGR - TMA > OBJ.AGR > verb < valency < polarity, TMA	Buell et al. (2014)	✗	✗	✗	✓
Adyghe	OBJ.AGR> valency > SUBJ.AGR > valency > verb < TMA < number	Arkadiev (2020)	✗	✗	✗	✓
Udihe	verb < valency < Asp$_{dur}$ < Asp$_{impfv}$ < DIR < valency < TMA < AGR	Nikolaeva & Tolskaya (2001)	✗	✗	✗	✗
Chukchi	DESID > valency > verb < valency < DESID < Asp$_{iter}$ < COLL < Asp$_{dur}$ < voice	Dunn (1994)	✗	✗	✗	✓
Southern Pomo	manner > number > verb < number < DIR < valency < TMA	Walker (2013)	✗	✗	✗	✓
Choctaw	AGR > valency > AGR > verb < AGR < valency < tense	Broadwell (2006)	✗	✗	✗	✓
Tukang Besi	SUBJ.AGR > valency > verb < valency < OBJ.AGR - Aspect	Donohue (2011)	✗	✗	✗	✓
Nambikwara	valency > verb < valency < SUBJ.AGR < NEG < mood < SUBJ.AGR < Mood$_{Evid}$ < TMA	Kroeker (2001)	✗	✗	✗	✗
Tiwi	SUBJ > TNS > LOC > mood > OBJ > Aktionsart > FUT.IMP > verb < diathesis < Asp$_{rep}$	Osborne (1974)	✗	✗	✗	✗
Alamblak	sentence mood > tense > verb < manner < tense < aspect < mood$_{epistemic}$ < mood	Bruce (1984)	✗	✗	✗	✗
Caddo	verb < valency < Asp$_{iter}$ < Mod$_{Intent}$ < AGR	Melnar (1998)	✓	✓	✓	✓
Misantla Totonac	Mood$_{irls}$ > AGR > T$_{pst}$ > AGR > verb < valency < Aspect < AGR	MacKay (1999)	✗	✗	✗	✗
Yagua	SUBJ.AGR > verb < valency, Mood$_{debit}$, NEG < T$_{pst}$ < Asp$_{iter}$ < Asp, T$_{pst}$ < Asp$_{hab}$, Asp$_{perf}$ < AGR, Asp$_{rep}$	LLL	✗	✗	✗	✗
Huallaga Quechua	V < derivational < TMA, AGR < Mood$_{evid}$	Weber (1983)	✗	✓	✓	✓

Table 4.1: Empirical adequacy of established hierarchies of categories

4.3 Variable affix order

In the previous chapter, I have illustrated that there are many contributions (Baker 1985, 1988, Bybee 1985, Shlonsky 1989, Speas 1991a,b, Wunderlich 1993, Cinque 1999, Ernst 2001) that make predictions about the relative order of grammatical categories on the verb. Out of those works, only Rice (2000) formulates sharp empirical predictions about those affix combinations which are expected to exhibit variable affix order, that is, the affixes may be expressed in either relative order to each other. Since Rice (2000) explains the relative order of verbal affixes taking their scopal relationships into account, the following three predictions about (in-)variable affix order arise:

- Affixes in a fixed scopal relationship occur in a fixed, invariable order with respect to each other.
- Affixes which are in a reversable scopal relationship occur in variable order with the surface order matching the underlying scopal relationship.
- Affixes that are not in a scopal relationship with each other may occur in either order, both within a language and across languages.

In short, Rice (2000) predicts two different instances of variable affix order: semantically meaningful/syntactically relevant variable affix order, where the order varies along the underlying semantic form, and semantically vacuous or syntactically irrelevant variable affix order, where neither syntax nor semantics necessitate a certain order such that the order may be flexible. In the former case, variable affix order within a language is obligatory, while it is optional in the latter case. The predictions by Rice (2000) have immediate consequences for the expectations about variable affix order in a crosslinguistic perspective. More specifically, semantically comparable affixes are expected to behave consistently across languages along the predictions formulated by Rice (2000). As for combinations of affixes with reversable scope, the expectations across languages would be that their relative order should vary long their underlying scope. If, contrary to the expectations by Rice (2000), the relative order of those affixes is **invariable**, this suggests that there are independent rules that do not only complement, but **overwrite** the scopal requirements on affix order. In the latter scenario, where affixes are not in a scopal relationship with each other, Rice (2000) concludes that the relative order is expected to be flexible across languages and possibly also within a language. If a pair of semantically vacuous affixes is fixed within a language, Rice (2000) suggests that language-specific rules condition the relative order of affixes in exactly these cases. In simpler terms, additional, morphotactic rules **complement** semantics in scenarios where scope alone does not provide a conclusive linear order.

Semantically vacuous variable affix order

Let me first discuss semantically vacuous variable affix order. In chapter 4.2, I have shown that the relative position of agreement with respect to other inflectional categories, such as tense or negation, is flexible **across languages**. This is predicted by Rice (2000), since tense and negation do not modify the argument structure of the verb, which agreement relates to. Consequently, these combinations are in principle predicted to exhibit variable affix order within a language, as well. Table 4.2 summarizes exactly those instances of variable affix order found in the languages discussed in this dissertation, where the affixes are not in scopal relationship. Table 4.2 is to be read as follows: the first column lists the language in which variable affix order occurs. The second column contains the affixes involved in variable affix order. The third column lists exactly those languages in the sample that have semantically comparable affixes in their affix inventory but lack an analogous affix variability.
As a general remark about this discussion, it is worth noting that the semantics of some affixes presented here is extremely hard to determine, since its meaning varies with the predicate it attaches to, and the descriptive grammars do not always provide a satisfying answer, which is why I have to rely entirely on the description in the literature and on the translation of the sentence. Moreover, some combinations of roots and affixes may yield lexicalised meanings.

Language	**Affixes involved**	**Similar cases lacking variability**
Choktaw	PST, *indeed*	
Choktaw	PST, NEG	Otomí, Nambikwara, Huallaga Quechua
Yagua	CAUS, CONT	Udihe
Huallaga Quechua	CAUS, PUNCT	
Yagua	CONT, COMPLET	Otomí
Udihe	REP, IMPFV	Apurinã
Udihe	REP, DISTR	Kuna, Mixtec

Table 4.2: Semantically vacuous variable affix order

In Huallaga Quechua (Quechuan, Peru & Bolivia), the suffix *-ri* denotes punctual aspect. The grammatical description by Weber (1983) discusses the punctual aspect marker as some kind of *Aktionsart* or lexical aspect marker, since it is in complementary distribution with other aspectual markers like the durative. In (10a), the punctual aspect marker follows the causative. In (10b), in contrast, it is closer to the verb than the causative.

(10) Order of CAUS and PUNCT in Huallaga Quechua (Weber 1983: 81)

a. Allqu-nchi miku-na-n-paq wañu-chi-pa-ri-shun
dog-1INCL.POSS eat-SUB-3PL-PURP die-CAUS-BEN-PUNCT-1INCL.IMP
'Let's kill it for our dogs to eat.'

b. Chay-chaw wañu-rI-chi-mu-nki
that-LOC die-PUNCT-CAUS-there-2.IMP
'Kill it over there'

In Udihe (Tungusic, Russia), there is an instance of semantically vacuous variable affix order between the marker *si*, which is labeled 'imperfective' in Nikolaeva & Tolskaya (2001), but covers a variety of meanings, such as continuous aspect, event pluractionality or argument pluractionality. In (11a), the imperfective marker is internal to the repetitive, but follows the repetitive in (11b). Nikolaeva & Tolskaya (2001) note that the variability of the two affixes is entirely free and does not yield an interpretative effect.

(11) Order of REP and IMPFV in Udihe (Nikolaeva & Tolskaya 2001: 319)

a. uli-si-gi
sew-IMPFV-REP
'sew many times again and again'

b. tagdi-gi-si
wake.up-REP-IMPFV
'wake up again many times'

The same generalization holds for the REP and DISTR in Udihe. The distributive is an argument-related suffix encoding argument pluractionality. It may either precede or follow the repetitive, compare (12a) and (12b). Again, Nikolaeva & Tolskaya (2001) argue that the variability of the two affixes is not conditioned by semantic effects.

(12) Order of REP and DISTR in Udihe (Nikolaeva & Tolskaya 2001: 319)

a. eme-kte-gi
come-DISTR-REP

b. eme-gi-kte
come-REP-DISTR
'come back again of several people'

Another case of semantically vacuous variable affix order is found in the relative order of completive and continuative in Yagua (Peba-Yagua, Peru), as shown in (13). The continuative marks continuous, uninterrupted action, whereas the exact semantics of the completive is not described in the descriptive work on Yagua. Payne (1985) translates completive aspect as 'to finish'. The two markers may be ordered freely without any change in meaning, as shown in (13), where the completive marker precedes the continuative in (13a), but follows the completive in (13b). Both orders result in an interpretation in which the continuative takes scope over the subevent of crying rather than over the event of finishing. One potential explanation for that opacity is that the completive denotes an *achievement*-predicate that cannot be marked for duration.

(13) Order of CONT and COMPLET in Yagua (Payne 1985: 266)

a. Sa-junaay-muuy-jancha-jay.
3SG.SUBJ-cry-COMPLET-CONT-PST

b. Sa-junaay-janumucha-muuy-jay.
3SG.SUBJ-cry-CONT-COMPLET-PST
''She finished crying yesterday (and had been crying for a long time).

Furthermore, the continuative marker *jancha* and the causative marker *taniy* in Yagua exhibit variable ordering, as well. This is shown in (14), where the interpretation remains constant although the causative is closer to the verb than the continuative in (14a), but external to the continuative in (14b). Since continuative marker denotes extended duration of an event, one would expect the orders to reflect a change in the interpretation, since the continuative could refer either to the event of causation or to the causativized subevent. However, Payne (1985) reports that both orders reflect the interpretation in which causative takes scope over continuative aspect.

(14) Order of CONT and CAUS in Yagua (Payne 1985: 281)

a. Ra-jasiriivay-taniy-jancha-ray.
INANIM.SUBJ-sneeze-CAUS-CONT-1SG.OBJ

b. Ra-jasiriivay-jancha-taniy-ray.
INANIM.SUBJ-sneeze-CONT-CAUS-1SG.OBJ
'This is making me sneeze for a considerable time.'

Furthermore, Choctaw (Muskogean, USA) exhibits two instances of semantically vacuous variable suffix order, all of which occur in the area of inflectional morphology. The examples in (15) constitute a minimal pair illustrating variable affix order between the past marker *-tok* and the negation *kiiyo*. In (15a), the negation precedes the past marker, whereas it follows the past marker in (15b). The variation in the surface form does not yield a change in the interpretation.

(15) Variable order of PST and NEG in Choctaw (Broadwell 2006: 322)

a. John-at shókha' abi-kiiyo-tok.
John-NOM hog kill-NEG-PST

b. John-at shókha' abi-tok-kiiyo.
John-NOM hog kill-PST-NEG
'John did not kill the dog.'

Moreover, the past marker in Choctaw appears variably with the marker *-akilih*, which Broadwell (2006) translates as 'indeed'. This is illustrated in (16), where the past marker precedes *-akilih* - 'indeed' in (16a), but follows the very same marker in (16b). Again, changing the surface order does not affect the interpretation.

(16) Variable order of PST and *-akilih* 'indeed' in Choctaw (Broadwell 2006: 326)

a. Oba-tok-akilih.
rain-PST-indeed

b. Ob-akilih-tok
rain-indeed-PST
'It also rained.'

Semantically meaningful variable affix order

Let me now discuss semantically meaningful variable affix order. For affixes which are in a scopal relationship, Rice (2000) predicts that the surface order should always correspond to their underlying scopal relationship. In other words, variable affix order is expected when scope is reversible. Recall that the notion of scope adopted in this dissertation refers to the derivational order of the semantic composition. Note also that this phenomenon comprises certain combinations of diathesis markers, which are also discussed in further detail in chapter 5.1.

In the 21 languages of the sample, there were several cases of semantically meaningful/syntactically relevant variable affix order, which are summarized in table 4.3. Again, the first two columns list the language which exhibits this phenomenon and the concrete affixes involved, while the rightmost column lists exactly those languages of the sample that have semantically similar affixes, but do not exhibit variable affix order.

Language	**Affixes involved**	**Similar cases lacking variability**
Zulu	CAUS,REC	Tukang Besi
Huallaga Quechua	CAUS, REC	Udihe
Huallaga Quechua	CAUS, REFL	
Zulu	REC, APPL	
Yagua	DESID, COMPLET	
Huallaga Quechua	CAUS, there	
Huallaga Quechua	CAUS, INTSF	
Yagua	CAUS, COMPLET	Mixtec
Yagua	CAUS, DESID	Huallaga Quechua
Udihe	CAUS, INCH	Mixtec
Huallaga Quechua	CAUS, ASSIST	Tukang Besi
Misantla Totonac	CAUS, INCH	
Udihe	INCH, REP	Mixtec, Udihe

Table 4.3: Semantically meaningful variable affix order

In Zulu (Bantoid, South Africa), there are two instances of scope-driven affix variability. The examples in (18) illustrate the relative order of reciprocal *-an* and applicative *-el*. Verbal reciprocals allow for a variety of semantic meanings (see Dalrymple et al. 1998), a simplified semantic representation of reciprocals is provided by Stiebels (2003) and illustrated here in (17).

(17) Combinations of REC and APPL following Stiebels (2003: 306)

a. [[[V]APPL]REC] λz λx λs [V(x,x)(s) & APPL(s,z)]

λy λx λs [V(x,y)(s) & APPL(s,x)]

b. [[[V]REC]APPL] λz λx λs [V(x,x)(s) & APPL(s,z)]

Crucially, the underlying form [[[V]REC]APPL], where reciprocalization applies before applicativization, allows only for the interpretation that the agent and the theme argument of the underlying predicate are in a mutual relationship. This is the case in (18a), where the relative order matches this interpretation since the applicative marker is external to the reciprocal. As shown in (17), two different interpretations are possible when applicativization applies before reciprocalization: it could either be the applied beneficiary argument **or** the theme argument that is coindexed with the agent argument. In that sense, the underlying order [[[V]APPL]REC] subsumes the interpretation of [[[V]REC]APPL]. In Zulu, the underlying order [[[V]APPL]REC] yields only the interpretation in which the applied beneficiary and the agent are in mutual relationship. This is shown in (18b), where the applicative is closer to the verb than the reciprocal. Crucially, both surface forms can only be interpreted transparently.

(18) Order of REC and APPL in Zulu (Buell 2005: 26)

a. I-zigebengu zi-fihl-an-el-a a-bangani ba-zo.
CL10-thieves CL10.SUBJ-hide-REC-APPL-TV CL2-friends CL2-CL10
'The thieves hide each other for their friends.'
NOT: 'The thieves hide their friends from each other.'

b. I-zigebengu zi-fihl-el-an-a a-bangani ba-zo.
CL10-thieves CL10.SUBJ-hide-APPL-REC-TV CL2-friends CL2-CL10
'The thieves hide their friends from each other.'
NOT: 'The thieves hide each other for their friends.'

As for the combination of causative markers and reciprocals, Stiebels (2003) notes that the underlying order [[[V]CAUS]REC] is potentially ambiguous: the causer introduced by the causative can either bind the causee **or** the underlying theme/stimulus object.

(19) Combinations of REC and CAUS following Stiebels (2003: 303)

a. [[[V]CAUS]REC] $\lambda y\ \lambda u\ \lambda s'\ \exists s[\text{ACT}(u)\ \&\ V(u,y)(s)](s')$
$\lambda x\ \lambda u\ \lambda s'\ \exists s[\text{ACT}(u)\ \&\ V(x,u)(s)](s')$

b. [[[V]REC]CAUS] $\lambda x\ \lambda u\ \lambda s'\ \exists s[\text{ACT}(u)\ \&\ V(x,x)(s)](s')$

(20) Order of REC and CAUS in Zulu (Buell 2005: 26)

a. A-bafana ba-bon-is-an-a a-mantombazane.
CL2-boys CL2.SUBJ-see-CAUS-REC-TV CL2-girls
'The boys are showing each other the girls.'

b. A-bafana ba-bon-an-is-a a-mantombazane.
CL2-boys CL2.SUBJ-see-REC-CAUS-TV CL2-girls
'The boys are showing the girls to each other.'

In Zulu, only the former option is attested. This is illustrated in (20a), where the causer argument enters a mutual relationship with the causee, which is also the experiencer of the causativized subevent. In that case, the relative order of the causative and the reciprocal is transparent, since the causative is closer to the verb than the reciprocal. In contrast, the underlying semantic form [[[V]REC]CAUS] yields only the interpretation in which the underlying subject and the underlying object are coindexed. This is shown in (20b), where the experiencer enters a mutual relationship with the stimulus. The relative order of the reciprocal and the causative is also transparent, since the causative is external to the reciprocal.

Similarly, the examples in (21) demonstrate variable affix order between the causative and the reciprocal *-naku* in Huallaga Quechua. Again, the surface order of the affixes correlates with the order of the semantic composition. Concretely, the intransitive predicate 'to laugh' is first transitivized by means of a benefactive in (21a), yielding a predicate denoting 'to laugh at somebody'. The reciprocal applies to this transitive predicate coindexing the agent and the applied argument. The causative applies last so that the verbal complex is interpreted as 'X makes Y laugh at Y.'. In (21b), in contrast, the reciprocal cannot apply first since the predicate is intransitive. In that sense, causativization is syntactically relevant since it introduces the causer argument which then binds the base argument. It is unclear what happens when the causative applies to a transitive predicate, which is then further reciprocalized. In that particular case, the causer may bind either the causee or the theme of the causativized predicate. However, a sentence exemplifying this scenario is not provided by Weber (1983).

(21) Order of CAUS and REC in Huallaga Quechua (Weber 1983: 80)

a. Asi-pa:-nakU-chi-ma-nchi
laugh-BEN-REC-CAUS-1.OBJ-1.INCL
'He makes us laugh at each other.'

b. Asi-chi-naku-nchi
laugh-CAUS-REC-1INCL
'We make each other laugh.'

The relative order of CAUS and the reflexive in Huallaga Quechua follows the interpretation, as well, as shown in (22). In (22a), the reflexive binds the theme argument and the causee, suggesting that reflexivization applies before causativization. In (22b), on the other hand, causativization feeds reflexivization in the sense that the intransitive predicate 'to die' needs to be transitive to allow for reflexivization.

(22) Order of CAUS and REFL in Huallaga Quechua (Weber 1983: 81)

a. Huchalli-kU-chi-shu-nki
incur.guilt-REFL-CAUS-2.OBJ-2
'He makes you incur guilt to yourself.'

b. wañu-chi-ku-sha
die-CAUS-REFL-3.PFV
'He killed himself.'

In contrast, the relative order between the causative and the reciprocal in Tukang Besi (Austronesian, Indonesia) is restricted to CAUS>REC>V, as illustrated in (23a). As predicted by (19), the interpretation is transparent in the sense that the theme argument and the causee are coindexed. The opposite order of affixes leads to ungrammaticality, as shown in (23b). This particular example shows that the predictions by Rice (2000) overgenerate: since the scope between reciprocal and causative is reversable, Rice (2000) predicts affix variability between these affixes. Thus, the ungrammatical example in (23b) instantiates a case of lack of semantic variability, which suggests that morphological rules on linearization overwrite semantic conditions on affix order.

(23) Order of CAUS and REC (Donohue 2011: 293)

a. No-pa-po-tandu-tandu-'e na wembe.
3.RLS-CAUS-REC-RED-horn-3.OBJ NOM goat
'He$_i$ incited the goats$_k$ to butt each other$_k$.'

b. *No-po-pa-manga-manga.
3.RLS-REC-CAUS-RED-eat
'They$_i$ made each other$_i$ eat.'

In Udihe, there are several instances of variable affix order which are semantically meaningful. The examples in (24) illustrate the relative order of the repetitive marker *-gi* and the inchoative marker *-li*. The repetitive marker *-gi* expresses meanings like 'again', 'one more time' or 'back home'. When it interacts with the inchoative marker *-li*, the order matches the semantic composition. In (24a), the repetitive modifies the event of coming, where it adds the meaning of coming back. The inchoative marker encodes the inception of the event of coming back. Hence, the interpretation suggests that the inchoative takes scope over the repetitive. Thus, the relative order of inchoative and repetitive is fully transparent. The sentence in (24b), on the other hand, suggests that the repetitive takes scope over the entire event.

(24) Order of REP and INCH in Udihe (Nikolaeva & Tolskaya 2001: 310)

a. eme-gi-li
come-REP-INCH
'start coming back'

b. ise-pte-li-gi-wen
see-PASS-INCH-REP-CAUS
'again make it start being seen'

Similarly, Mixtec (Otomanguean, Mexico) has a repetitive and an inchoative, which also allows for a causative meaning, yet the relative order of those affixes is fixed to the order where the inchoative is closer to the verb than the repetitive. Again, there are two potential interpretations, depending on the relative order of application. If the causative/inchoative marker is realized in a position internal to the repetitive marker, as in (25a), the causative/inchoative marker denotes the beginning of the state of being 'scrawny', thus transitivizing the predicate. In this case, the order of repetitive and inchoative/causative in transparent, since the repetitive scopes over this event. In (25b), the realtive order of the inchoative/causative and the repetitive is the same, yet the interpretation suggests a restitutive reading of the repetitive. First, the causative/inchoative marker has a transitivizing function in (25b), thus clearly acting like a causative. The translation suggests that the causative refers to the retrieval of the truck. Following the generalization by Rice (2000), this interpretation predicts the opposite order. Thus, the relative order of repetitive and causative in (25b) is semantically opaque.

(25) Order of repetitive and causative in Mixtec (Macaulay 1996: 59)

a. Ná-sá-leku=∅
REP-CAUS/INCH-scrawny=3
'He is getting scrawny again.'

b. Ká-na-sá-baʔa=∅ carrú
PL-REP-CAUS/INCH-good=3 car
'They are fixing my truck.'

As for combinations between the causative and the repetitive, Udihe exhibits a rather intricate pattern. As for the relative order of REP and CAUS, Nikolaeva & Tolskaya (2001) note that the order fixed to the repetitive preceding the causative. The examples in (26a) and (26b) support this claim since REP is internal to CAUS in both examples. The underlying semantic order between the two sentences, however, is different. In (26b), the translation suggests that the underlying order is [[[V]REP]CAUS], since the repetitive modifies the causativized subevent. The translation of (26a), in contrast, implies repetition of the event of causation, thus suggesting the underlying order [[[V]CAUS]REP]. In that sense, the order of the affixes is invariable despite reversible scope. The example in (26c), however, shows that the causative may in fact precede the repetitive marker, hence disproving the generalization by Nikolaeva & Tolskaya (2001). In this example, the repetitive modifies the event of causation. It is important to note that the example in (26c) contains a different causative suffix *-u*, which differs from *-wen* not only in its relative position to the verb but also in its syntactic behaviour as it assigns lative instead of accusative case to the causee with a number of verbs. Moreover, the *u*-causative seems to be more productive in Northern varieties of Udihe (Schneider 1937), while Nikolaeva & Tolskaya (2001) focus on Southern varieties.

(26) Order of CAUS and REP in Udihe (Nikolaeva & Tolskaya 2001: 303, 318)

a. ikteme-le-gi-wen
bite-once-REP-CAUS
'again cause somebody to bite once'

b. bu-gi-wen
give-REP-CAUS
'cause to give back'

c. sa-u-ne-gi
know-CAUS-DIR-REP
'go to inform again'

The productive causative suffix *-wen* in Udihe exhibits semantically meaningful variable affix order with the inchoative marker *-li*, illustrated in (27). The surface order matches interpretation, compare (27a) and (27b). In (27a), the translation suggests the interpretation that the event of causation is started, whereas the interpretation of (27b) implies that the act of starting a fire was caused. Thus, the variability in the relative order of the affixes yields a change in the interpretation.

(27) Order of INCH and CAUS in Udihe (Nikolaeva & Tolskaya 2001: 310)

a. eme-wen-e-li
come-CAUS-EV-INCH
'start causing to come'

b. zegde-li-wen
burn-INCH-CAUS
'cause to start burning'

Just as in Udihe, Huallaga Quechua has two different causativizing markers, both of which introduce an additional argument which is then realized as the highest argument. Apart from the general causative, Huallaga Quechua allows for a specific type of causative, sometimes referred to as *assistive*. The assistive introduces an argument that helps the agent of an action. The examples in (28) illustrate that the relative surface order of CAUS and ASSIST matches the interpretation. Concretely, the assistive in (28a) modifies the causativized subevent, whereas it refers to the action of causation itself in (28b). This is in line with the observation by Stiebels (2003) that combinations of affixes which introduce agentive arguments are always transparent.

(28) Order of CAUS and ASSIST in Huallaga Quechua (Weber 1983: 144)

a. Aru-:shi-chi-shu-nki
work-ASSIST-CAUS-2.OBJ-2
'He makes you help (someone else) work.'

b. Aru-chi-:shi-shu-nki
work-CAUS-ASSIST-2.OBJ-2
'You help somebody to work by making someone else work.'

Similarly, Tukang Besi has several different causatives. The example in (29) illustrates the relative order of the general causative *pa-* and the requestative causative *hepe-*. The order is fixed to the requestative preceding the causative. The interpretation is transparent, since the requestative takes scope over the general causative.

(29) Order of REQ and CAUS in Tukang Besi (Donohue 2011: 219)
No-hepe-pa-wila te ana i 'one
3RLS-REQ-CAUS-go CORE child OBL beach
'She asked him to send the child to the beach.'

In Misantla Totonac (Totonacan, Mexico), there is also variable affix order between two transitivizing markers, the inchoative marker and the causative. The examples in (30a) and (30b) illustrate that the two affixes can appear in both orders, which correspond to the semantic interpretation. Note that the causative form *maqa-* in (30b) is a less productive and more lexicalised form of the causative which forms a complex root with the original predicate *stuq* - 'to join'.

(30) Order of INCH and CAUS in Misantla Totonac (MacKay 1999: 84, 311)

a. Ut maa-ta-nuu.
3SG CAUS-INCH-inside
'He/She makes him/her enter.'

b. Kin̰an ta-maqa-stuq-yaa-wa.
1.PL INCH-CAUS-join-IMPFV-1PL.SUBJ
'We get married.'

Another case of semantically meaningful variable affix order from Huallaga Quechua is presented in (31), where the causative occurs with *mu* 'there'. According to Weber (1983), the suffix *-mu* has two main purposes: with motion verbs, it acts as a cislocative indicating motion towards the deictic center. With all other predicates, however, it means something like 'over there'. This difference is reflected in the sentence in (31a). In (31a), it attaches directly to the causativized motion verb, where it denotes a direction toward the speaker. Weber (1983) notes that *sha* 'to come' and *-mu* form a lexicalised unit meaning 'come here', similarly observed in other Quechuan languages like Huaraz oder Ancash Quechua. In (31b), in contrast, it follows the causative and denotes the location of the event of causation. In that sense, the position of the causative allows to differentiate between the two functions of the marker. It is worth noting that Cole (1982) discusses the interaction of cognates of these markers in Imbabura Quechua concluding that the relative order is driven by scope.

(31) Order of CAUS and 'there' in Huallaga Quechua (Weber 1983: 81f)

a. Sha-mu-chi-ma-sha.
come-there-CAUS-1.OBJ-3.PFV
'He made me come here.'

b. Chay-chaw wañu-rI-chi-mu-nki
that-LOC die-PUNCT-CAUS-there-2.IMP
'Kill it over there'

In Huallaga Quechua, the causative also exhibits variable affix order with *-ykU*. The exact meaning of the suffix *-ykU* is hard to determine, as it depends largely on the main verb. Its most frequent use is as an intensifier or emphatic marker. With causatives, its meaning depends on its position with respect to the causative. If the causative outscopes the intensifier, it implies that the causee is not the agent of the causativized predicate, as in (32a). In (32b), where the intensifier takes scope of the causative, it encodes direct causation.

(32) Order of CAUS and INTSF in Huallaga Quechua (Weber 1983: 126)

a. wañu-ykU-chi-pa:-ma-y
die-INTSF-CAUS-BEN-1.OBJ-2.IMP
'Have it killed for me.'

b. wañu-chi-pa:-ykU-ma-y
die-CAUS-BEN-INTSF-1.OBJ-2.IMP
'Kill it for me.'

Yagua exhibits several instances of semantically meaningful variable affix order, as well. Concretely, the causative *taniy* cooccurs in variable order with other derivational affixes. The examples in (33) illustrate variable affix order of the causative *taniy* and the desiderative marker *ruuy*. The surface orders of the affixes reflect the interpretation of the sentence. Concretely, the desiderative is closer to the stem than the causative in (33a) corresponding to the interpretation that the desiderative modifies the causativized subevent rather than the event of causation as such. The sentence in (33b), on the other hand, illustrates the opposite affix order suggesting an interpretation in which the desiderative modifies the event of causation rather than the event of crying.

(33) Order of DESID and CAUS in Yagua (Payne 1985: 280)

a. Sa-junaay-ruuy-taniy-nii.
3SG.SUBJ-cry-DESID-CAUS-3SG.OBJ
'She made him want to cry.'

b. Sa-junaay-taniy-ruuy-nii.
3SG.SUBJ-cry-CAUS-DESID-3SG.OBJ
'She wants to make him cry.'

The combination of causative with the completive marker *muuy* in Yagua behaves similarly in the sense that the order of the marker varies with respect to the interpretation, as shown in (34). The completive marker refers to the completion of an action. In the context of a causative, the completive may either refer to finishing the causativized subevent, as in (34b), or to finishing the event of causation itself, as in (34a). As predicted by Rice (2000), the relative order of the affixes varies along these interpretational differences, so that the completive is external to the causative in (34a) but internal to the causative in (34b).

(34) Order of COMPLET and CAUS in Yagua (Payne 1985: 283)

a. Sa-jimyiy-taniy-muuy-ruuy-nii.
3SG.SUBJ-eat-CAUS-COMPLET-DESID-3SG.OBJ
'He wants to finish making him eat.'

b. Sa-nicyee-muuy-ruuy-taniy-nii.
3SG.SUBJ-talk-COMPLET-DESID-CAUS-3SG.OBJ
'He makes him want to finish talking.'

Similarly, the completive and the desiderative marker in Yagua occur in variable affix order, as well. More specifically, the completive may either modify the event of wanting or the event modified by the desiderative, whenever it combines with the desiderative marker. The relative order of completive and desiderative then matches the interpretation, as shown in (35). In (35a), the completive modifies the desiderative, thus yielding an interpretation where the entire event of wanting is stopped. In (35b), on the other hand, stopping the subevent of washing is what is desidered. Thus, the relative order of completive and desiderative is entirely transparent.

(35) Order of COMPLET and DESID in Yagua (Payne 1985: 290)

a. Sa-quiivuuy-su-ruuy-muuy-ma.
3SG.SUBJ-deceive-TRANS-DESID-COMPLET-PFV
'He has stopped wanting to deceive.'

b. Ray-suuta-muuy-ruuy-ra.
1SG.SUBJ-wash-COMPLET-DESID-INANIM.OBJ
'I want to stop washing it.'

The results from this section show that variable affix order is much rarer than predicted. As for semantically vacuous combinations of affixes, the relative rarity of affix variability simply implies a general dispreference against variable affix order, so that languages tend to complement semantic/syntactic correlates with additional rules of linearization. As for semantically meaningful combinations, lack of variability, as discussed in detail for combinations of transitivizing markers and repetitives, suggests that semantic/syntactic requirements on affix order may in fact be overwritten by additional rules on linearization. It is important to emphasize that the lack of variable affix order in a grammatical description does not necessarily imply that the opposite order is in fact ungrammatical. Thus, this section also aims to serve as a starting point for linguists doing descriptive fieldwork to stress the importance of describing affix variability in languages with complex morphology.

4.4 Unexpected variable affix order

In this section, I discuss several instances of variable affix order, which cannot be analysed as easily as the examples illustrated in the previous section.

Weber (1983) describes a case of variable affix order between the imperfective marker *-yka:* and the object agreement marker *-ma* in Huallaga Quechua. Weber (1983) notes that difference in the surface order results in a difference in the interpretation, which is unexpected from a semantic perspective. It is worth noting that the two surface forms do not vary freely. Rather, the surface order in (36a), in which imperfective aspect precedes agreement, is the standard form while the order (36b) is only attested once as a result from elicitation. That said, it requires more data to see if the order in (36b) is actually produced in spontaneous speech or if it is only a side effect of elicitations in the field.

(36) Order of IMPFV and OBJ.AGR in Huallaga Quechua (Weber 1983: 136)

a. Maqa-yka:-ma-n
hit-IMPFV-1.OBJ-3
'He is hitting me (right now).'

b. Maqa-ma:-yka:-n
hit-1.OBJ-IMPFV-3
'He hits me a lot.'

In Huallaga Quechua, there is variable affix order between the causative and the benefactive marker, as well. As for (37a), the surface order matches the order of application since the benefactive must transitivize the predicate before the reciprocal can apply. As for the example in (37b), the translation does not allow conclusions about whether the benefactive refers to the causativized subevent or the event of causation given that the interpretational differences between these readings are far from self-evident. This ambiguity is discussed in more detail in 5.1.

(37) Order of CAUS and BEN in Huallaga Quechua (Weber 1983: 80, 143)

a. Asi-pa:-nakU-chi-ma-nchi
laugh-BEN-REC-CAUS-1.OBJ-1INCL
'He makes us laugh at each other.'

b. Oam-ta aru-chi-pa:-ma-n.
2SG-OBJ work-CAUS-BEN-1.OBJ-3.PFV
'He makes you work for me.'

In Misantla Totonac, the relative order of the causative and the locative applicative is variable, yet the interpretation remains constant. The descriptive grammar by MacKay (1999) does not discuss if the causative encodes direct causation, indirect causation or both. If the marker reflects indirect causation, the underlying semantic representation between a causative and a locative yields an interpretational difference, since the locative may either refer to the event of causation or the causativized subevent. The sentences in (38) illustrate that either order of the locative and the causative is possible, yet the interpretation remains constant. Specifically, the locative introduces the location of sweeping such that the example in (38b) contains the transparent order while the example in (38a) contains the opaque order.

(38) Order of CAUS and LOC in Misantla Totonac (MacKay 1999: 286)

a. Ut kin-puu-maa-paɬ-ni hun-čik
s/he 1.OBJ-LOC-CAUS-sweep-CAUS the-house

b. Ut kin-maa-puu-paɬ-ni hun-čik
s/he 1.OBJ-CAUS-LOC-sweep-CAUS the-house
'She makes me sweep the house.'

Buell (2005) reports an intricate instance of variable affix order between the reciprocal marker *an* and the passive marker *w* in Zulu. The examples in (39) show that the predicate 'to compete' is composed of a root *khuph* with the original meaning 'to take out', a causative and a reciprocal. In (39b), an applicative is added to this complex structure. If a passive is added to this applicativized structure, the argument introduced by the applicative becomes the subject of the passive sentence. The order of the passive is variable. It may be added in a position external to the applicative, as in (39c), or after the causative, thus being internal to the applicative, as in (39d). This is unexpected from a syntactic perspective, since only the transparent in (39c) would be predicted.

(39) Order of REC and PASS in Zulu (Buell 2005: 38f)

a. khuph-is-an-a
take.out-CAUS-REC-TV
'compete'

b. khuph-is-an-el-a
take.out-CAUS-REC-APPL-TV
'compete for'

c. khutsh-is-an-el-w-a
take.out-CAUS-REC-APPL-PASS-TV
'to be competed for'

d. khutsh-is-w-el-an-a
take.out-CAUS-PASS-APPL-REC-TV
'to be competed for'

4.5 Biases in inflectional affixes

In previous crosslinguistic studies, it has been shown that certain inflectional verbal categories are not distributed arbitrarily across languages, but are rather subject to ordering biases. The most insightful contributions in this area come from Trommer (2001) and Julien (2000, 2002). Trommer (2001) uncovers two patterns in the linearization of person and number affixes. Concretely, Trommer (2001) examines a set of languages in which person and number are expressed by two separate affixes, yielding 80 different patterns in total. The findings by Trommer (2001) are rearranged in Table 4.4, so that the table contains only information about the affixal status of person and number affixes. The total division of the affixes into prefixes and suffixes shows that there are more suffixes in total, thus supporting the general suffixing preference. Table 4.4 contains not only the observed values by Trommer (2001), but also the expected values, that is, the values that would have been expected if the distribution among person and number were arbitrary. The patterns in the distribution of person and number categories are remarkable: despite a general preference for suffixation, person features tend to be realized as prefixes. Number features on the other hand, are realized as suffixes by a majority of patterns. I performed a χ^2 test on the contigency table revealing that this bias in the distribution is statistically significant (p<0.01).

Position / Category	Prefix		Suffix		total
Person	49	(30)	31	(50)	80
Number	11	(30)	69	(50)	80
total	60		100		160

Table 4.4: Distribution of person and number affixes, p-value<0.01

Trommer (2001) further reveals another linearization bias with respect to person and number: person tends to be to the left of number in the majority of cases, independent of their affixal status. This generalization is different then predictions from scopal requirements on surface orders since scopal requirements make reference to **hierarchy**, that is, the relative distance to verb on the surface, independent of the affixal status, whereas Trommer (2001) clearly refers to **linearity**. Concretely, the most precise empirical generalization is that **person is to the left of number**.

(40) Linear order of person and number (Trommer 2001)

a. Person < Number: 70 languages

b. Number < Person: 10 languages

In a crosslinguistic investigation of the relative order of tense and aspect based on a sample of 530 languages, Julien (2000, 2002) reaches the conclusion that aspect is closer to the stem than tense in a majority of cases, independent of their affixal status. This generalization again makes reference to the relative distance to the verb and supports the predictions made by Bybee (1985), Speas (1991b) and Wunderlich (1993). Furthermore, Julien (2000, 2002) reveals a linearity bias between tense and aspect in languages in which one category is a prefix while the other one is a suffix. In these mixed systems, only tense can be prefix. The findings by Julien (2002) are summarized in Table 4.5.

Linear order of TNS & ASP	both prefixes	mixed	both suffixes
TNS-ASP	TNS-ASP-V	TNS-V-ASP	*V-TNS-ASP
ASP-TNS	*ASP-TNS-V	*ASP-V-TNS	V-ASP-TNS

Table 4.5: Attested orders of TNS & ASP in Julien (2002)

Both Julien (2000, 2002) and Trommer (2001) discuss the observation that the affixal status of subject agreement and tense seem to be dependent on each other. For a sample of 169 language, Julien (2000) examines whether subject agreement and tense is realized at the same side of the verb root, reaching the conclusion that both categories are likely to be expressed on the same side of the root. The findings are summarized in Table 4.6 showing that 103 out of 169 languages follow this generalization, while only 87 languages would have been expected to follow the pattern, if the distribution had been arbitrary. The χ^2 test I performed supports this generalization, showing that the bias is statistically significant ($p<0.01$).

TNS / SUBJ.AGR	Prefix		Suffix		total
Prefix	23	(15.15)	57	(64.85)	80
Suffix	9	(16.85)	80	(72.14)	89
total	32		137		169

Table 4.6: Distribution of SUBJ.AGR and TNS (Julien 2000: 360), p-value<0.01

Trommer (2001) replicated the examination of the distribution of subject agreement and tense, reaching similar results. Concretely, the expected values suggest that subject agreement and tense are realized at the same side of the root in 51 cases while the observed number is actually 67. Again, the X^2-test reveals statistical significance with a p-value of 0.00017.

TNS / SUBJ.AGR	Prefix		Suffix		total
Prefix	19	(10.91)	19	(27.09)	38
Suffix	8	(16.09)	48	(39.91)	56
total	27		67		94

Table 4.7: Distribution of SUBJ.AGR and TNS (Trommer 2001: 356), p-value=0.00017

Note that neither Trommer (2001) nor Julien (2002) provide a functional explanation for these biases, but draw their generalization entirely from the crosslinguistic distribution of the patterns. Nonetheless, the statistical significance in the distribution of these patterns clearly shows that linearization is not arbitrary. Rather, the patterns suggest that there are additional, systematic rules specific to the morphological module responsible for the biases in the data.

4.6 The prefixation tendency of causatives

As noted earlier in chapter 3, semantic and syntactic approaches to affix order make precise predictions about the relative order of derivational affixes, while the affixal status remains an orthogonal issue. In other words, additional rules are needed to specify where an affix will be attached as a prefix or a suffix. In the language sample

I examined in this dissertation, there is a set of data pointing towards a prefixation tendency of causative affixes.

In present-day Kuna (Chibchan, Panama), the causative is the only productive prefix in the otherwise strongly suffixing language. The usage of the causative is illustrated in (41).

(41) Position and form of the causative (Smith 2014: 164f.)

An Olo mergi-gaya o-durdak-sa.
1SG Olo American-mouth CAUS-learn-PFV
'I taught Olo English.'

An older stage of the language is described in Holmer (1946). Crucially, the Kuna language of the 1940s had a much larger prefix inventory than present-day Kuna, expressing a variety of meanings. A subset of those prefixes is presented in table 4.8 revealing that the meanings covered by those prefixes vary from categories expressing spatial relations, such as position or direction, to meanings of mood and modality.

Prefix	**Meaning**	**Example**
an-	REFL	*an-nukka* - 'to wash oneself'
an-	NEG	*an-nira* - 'to untie'
ai-	motion through space	*ai-tika* - 'to descend'
ap-	against	*ap-soka* - 'to converse, to answer'
ar-	down	*ar-kwana* - 'to fall'
mak-	ABIL	*mak-ittoa* - 'to be able to hear'
nai-	vicinity	*nai-sikka* - 'to put near'
wis	DESID	*wis-takke* - 'wish to see a little'

Table 4.8: Prefixes in Kuna (Holmer 1946: 191f.)

Moreover, there were two different causative markers in the older stage of Kuna. As shown in (42), there was the prefixal causative *o-*, which is still existing in the current stage of the language, and a suffixal causative *-wa*, expressing inchoativity and causativity, shown here in (42a).

(42) Causatives in Kuna (Holmer 1946: 191f.)

a. /tumma-wa/ [tummoa]
grow-INCH/CAUS
'grow big'

b. ani-o-nukke
1SG-CAUS-wash
'I make someone wash'

These observations are interesting in two respects. First, out of the two causative affixes that existed in the Kuna language of the 1940s, only the prefix is still productive in present-day Kuna. Second, apart from the causative, all other prefixes were lost. A potential explanation for this development could be that most prefixes got lost due to the well-attested suffixing preference (see Himmelmann 2014) while the causative prefix survived due to an independent prefixation preference for causatives.

Another interesting case that points towards such a preference is the grammaticalization of *hay* 'to give' to a causative marker in Alamblak (Sepik, Papua-New Guinea). The relevant examples are repeated in (43). Importantly, the causative prefix results from a grammaticalization of a serial verb construction of the verb *hay* - 'to give' and the causatived verb, as shown in (43a). Crucially, the same marker can be used as a suffix to express applicatives, as shown in (43b).

(43) *hay* as a causative and applicative (Bruce 1984: 249ff.)

a. Ha-fkne-më-r-m.
CAUS/BEN-enter-DIST.PST-3SG.MASC-3PL
'He caused them to enter (by entering with them).'

b. Këfrat tu-hay-më-r-r.
spear throw-CAUS/BEN-DIST.PST-3SG.MASC-3SG.MASC
'He threw a spear at him for his benefit.'

In short, the position of the affix is crucial to determine the meaning of the affix. The data in (43) underline the importance of the verbal origin in this pattern. Crucially, the causative and the applicative result from serial verb constructions involving the verb 'to give'. Given the well-known fact that the relative order of verbs in serial verb constructions matches the temporal sequence of events (see Tai 1985 for Chinese, Downing & Stiebels 2012 and Baah 2015 for Akan, among many others), the data provides a potential explanation for the prefixation preference.

When discussing the most frequent sources of grammatical affixes, Heine & Kuteva (2002) list the verbs 'do', 'give' and 'take' as the three most frequent sources in the grammaticalization of causatives. Thus, it seems to a be a natural hypothesis to assume that the temporal iconicity that is observed in serial verb constructions may lead to a prefixation tendency of causatives, since the event of causation necessarily takes place before or at the same time like the causativized subevent. Crucially, I do not claim that all causatives result from the grammaticalization of serial verb constructions. Rather, I suggest that the temporal iconicity that is well-documented for serial verb constructions extends to causatives, predicting and explaining the prefixation preference of causative. So far, I have presented two case studies in which causatives are attached as prefixes suggesting a bias in the positioning of the causative towards the left edge of the word. If this generalization were true, this bias for causatives in a prefixing position should be reflected in a quantative, typological investigation on the position of causative affixes. Therefore, I conducted a large-scale crosslinguistic study that connects the WALS features 26A (Dryer 2013b) and 111A (Song 2013). Concretely, I checked all available sources of the languages contained in the language sample of WALS feature 111A with a value 'Morphological but no compound' for the position of the causative. In a second step, I grouped the languages according to their value of WALS feature 26A. It should be noted that the categorization of the languages in WALS feature 26A is based only on the distribution of certain inflectional categories, but not on the distribution of derivational categories.

In that sense, the two variables are independent of each other since the position of the causative was not used to determine the feature of a language for WALS 26A. A couple of languages listed in WALS 111A were not listed in WALS 26A. In these cases, I took over the feature value of closely related languages since the feature values of WALS 26A are quite robust within a language family. A full list of all values is in (1) in the appendix.

Position / WALS 26A	Prefix		Suffix		total
equal prefixing and suffixing	8	(7.06)	10	(10.94)	18
little affixation	22	(9.02)	1	(13.98)	23
weakly prefixing	7	(5.1)	6	(7.9)	13
strongly prefixing	5	(3.92)	5	(6.08)	10
weakly suffixing	3	(4.32)	8	(8.68)	11
strongly suffixing	6	(21.58)	49	(33.42)	55
total	51		79		130

Table 4.9: Distribution of causative affixes, p-value<0.01

A first glance at the table reveals that there are far more causative prefixes than prefixing languages in the sample. Concretely, weakly and strongly prefixing languages make up 17,7% (23 languages) of the sample, whereas weakly and strongly suffixing languages make up 50,7% (66 languages) of the sample. However, 39,2% of all causatives are prefixes. In other words, the suffixation preference is much weaker in causatives than in the overall picture of the languages. A χ^2 test reveals that there is statistically significant (p-value=6.11927E-10) difference between the observed values and the expected values in brackets suggesting that there is in fact a bias in the distribution of the data.

Let me elaborate more deeply on the two cells in the table in which the position of the causative violates the general affixing tendency of the language: strongly prefixing languages with a causative suffix and strongly suffixing languages with a causative prefix. These languages should be especially informative since the position of the causative falls out of the general affixation tendency of the language and might therefore be driven by a more general, language-independent tendency.

There are 5 prefixing languages with a causative suffix, summarized in table 4.10. The table reveals that out of these five languages, four languages are Bantu languages. Crucially, Bantu verbs carry other suffixes apart from causatives, like passives, applicatives, reciprocals or the word-final theme vowel. That is, Bantu has a prefixing tendency across all categories including nouns and adjectives, while Bantu verbs show both prefixes and suffixes.

The table in 4.11, on the other hand, reveals that there is no genetic bias in suffixing languages with a causative prefix. In other words, there are only two languages families in which prefixing languages might have a causative suffix but 6 language families in which a suffixing languages might have a causative prefix. Thus, the differences between the two tables underline the general tendency illustrated in table

Family	Genus	Language	Value
Niger-Congo	Bantoid	Zulu	strongly prefixing & suffix
Niger-Congo	Bantoid	Kinyarwanda	strongly prefixing & suffix
Niger-Congo	Bantoid	Kongo	strongly prefixing & suffix
Niger-Congo	Bantoid	Luvale	strongly prefixing & suffix
Tiwi	Tiwian	Tiwi	strongly prefixing & suffix

Table 4.10: Genetic distribution of prefixing languages with causative suffixes

4.9 suggesting that the suffixing preference does not have to but may be overwritten by a more general prefixation preference for causatives.

Family	Genus	Language	Value
Chibchan	Kuna	Kuna	strongly suffixing & prefix
Sepik	Sepik-Hill	Alamblak	strongly suffixing & prefix
Austronesian	Northwest Sumatra-Barrier Islands	Batak (Karo)	strongly suffixing & prefix
Saharan	Western Saharan	Kanuri	strongly suffixing & prefix
Trans-New Guinea	Engan	Kewa	strongly suffixing & prefix
Austro-Asiatic	Nicobarese	Nicobarese	strongly suffixing & prefix

Table 4.11: Genetic distribution of suffixing languages with causative prefixes

The languages counted in table 4.9 are not genetically balanced. I used the method for controlled genealogical control suggested by Bickel (2008) to create a more balanced sample, illustrated in 4.12. Crucially, the observed number of causative prefixes is larger than the expected number of causative prefixes in 5 out of 6 language types with strongly suffixing languages being the exception. Again, the distribution shows a slight bias towards causative prefixes. Specifically, 20 out of 63 languages (31.7%) realize the causative as a prefix. However, only 13 out of 63 languages (20.6%) are classified as prefixing languages. This bias in the distribution is statistically significant in a χ^2-test with p=0.022. A full list of the controlled sample is found in the appendix in (2).

WALS 26A \ Position	Prefix		Suffix		total
equal prefixing and suffixing	4	(3.17)	6	(6.83)	10
little affixation	2	(0.63)	0	(1.37)	2
weakly prefixing	3	(2.22)	4	(4.78)	7
strongly prefixing	4	(1.9)	2	(4.1)	6
weakly suffixing	3	(2.54)	5	(5.46)	8
strongly suffixing	4	(9.52)	26	(20.58)	30
total	20		43		63

Table 4.12: Distribution of CAUS affixes in controlled genealogical sample, *p*-value<0.05

In sum, I have shown both language-individual and cross-linguistic evidence for a prefixation tendency of causative affixes. I claim that the temporal iconicity might serve as a functional explanation for this preference. Given that determining the affixal status is considered to be a duty of morphology, systematic generalizations like these allow for a better understanding of this module, thus reducing the problem of massive overgeneration that morphotactics in affix order face.

Chapter 5

Unpredicted cases of morphotactics

5.1 The limited transparency of valency markers

In chapter 3, I illustrated that the general assumption made by semantic and syntactic approaches to affix is that affix order should vary with the underlying semantic composition/syntactic derivation, with evidence for this claim coming from the area of valency morphology. With regard to the relative order of valency markers, semantic and syntactic approaches share the prediction that an underlying semantic form [[[V] A] B] should map onto a surface form V<A<B. These patterns are then considered to be *semantically transparent* or *compositional*. However, previous language-individual reports on affix ordering patterns have revealed that the relative order of valency markers may be *semantically opaque* or *non-compositional* (see Hyman 1994a, 2003, Stiebels 2003, Good 2005, 2007, Paster 2006, McFarland 2009, Caballero 2010, Marquardt 2014 for examples). For example, a certain combination of affixes may be fixed on a surface but structurally ambiguous. The example from Bolivian Quechua, presented here in (1), illustrates the relative order of the applicative and the causative. The surface order of causative and applicative is restricted to the causative preceding the applicative but yields three different interpretations. The interpretation in (1a) is semantically transparent, since the location introduced by the applicative refers to the event of causation, rather than to the causativized subevent. That is, the applicative is semantically ordered after causativization. This underlying order of operations maps transparently onto the surface order V<CAUS<APPL, thus fulfilling the predictions by semantic/syntactic approaches to affix order. The interpretation in (1b), in contrast, is semantically opaque. Concretely, the location introduced by the applicative refers to the causativized subevent. Thus, it is assumed to apply prior to causativization. This particular example shows that the predictions made by syntactic and semantic approaches overgenerate: since the scope between applicative and causative is reversable, the opposite surface order of CAUS and APPL would be predicted for the translation in (1b). Thus, the ungrammatical example in (23b) instantiates a case of lack of semantic variability, which suggests that morphological rules on linearization overwrite semantic conditions on affix order.

(1) CAUS and APPL in Quechua (Stiebels 2003: 23, citing van de Kerke 1996)
Mama-y Ana-wan chompa-ta ruwa-chi-pu-wa-n.
mother-1SG.POSS Ana-COM sweater-ACC make-CAUS-APPL-1-3.
a. 'In my place my mother made Ana make a sweater.'
b. 'My mother made Ana make a sweater in my place.'
c. 'My mother made Ana make me a sweater.'

Moreover, there are cases in which a certain affix combination appears in both possible surface orders, yet one of them allows is semantically ambiguous. This phenomenon is called *asymmetric compositionality* by Hyman (2003) and Zukoff (2022). Asymmetric compositionality is attested in various languages and exemplified in (2) for Choguita Rarámuri. In this language, the desiderative and the causative may show up in both surface orders, such that the desiderative precedes the causative in (2a), but follows it in (2b). For both surface orders, the transparent interpretation is available. More specifically, the causative in (2) takes scope over the desiderative, while the reverse scope is encoded in (2b). However, the order in which the causative is closer to the verb allows also for the non-compositional interpretation where the desiderative takes scope below the causative, as in (2c). Thus, the relative order of causative and desiderative is asymmetrically compositional since the order DESID-CAUS is necessarily transparent whereas the order CAUS-DESID may yield the compositional or the non-compositional reading.

(2) Order of CAUS and DESID in Choguita Rarámuri (Caballero 2008: 330, 353)
a. awi-nár-ti
dance-DESID-CAUS
'X makes Y wanna dance'
b. awí-r-nare
dance-CAUS-DESID
'X wants to cause Y to dance'
c. mísa tamí riná-t-ni-k-o
mass 1SG.ACC yawn-CAUS-DESID-PST-EV
'The mass made me wanna yawn.'

These cases of non-compositionality within the field of valency markers are particularly important for investigating the role of morphotactic rules on affix order, since these patterns show that semantic requirements on affix order are not only complemented but overwritten by independent factors.
In this chapter, I discuss the ordering patterns of valency markers exhibited in the 21 languages of the sample, as well as cases from the literature. I present only the examples that are important for reasons of illustration and argumentation, while the remaining examples considered in this chapter can be found in chapter A.2 in the appendix. Note also that some of the examples are also discussed in chapter 4.3.

(3) Schema of transparency patterns between valency markers

a. Transparent (Stiebels 2003)

B>A>V	A>B>V	surface order
[B[A[V]]]	[A[B[V]]]	underlying scope

b. Restricted (Stiebels 2003)

B>A>V	~~A>B>V~~	surface order
[B[A[V]]]	~~[A[B[V]]]~~	underlying scope

c. Restricted-on-the-surface

B>A>V	~~A>B>V~~	surface order
[B[A[V]]]	[A[B[V]]]	underlying scope

d. Restricted-on-the-base

B>A>V	~~A>B>V~~	surface order
[B[A[V]]]	~~[A[B[V]]]~~	underlying scope

e. Opaque$_1$ (Stiebels 2003)

B>A>V	~~A>B>V~~	surface order
[B[A[V]]]	[A[B[V]]]	underlying scope

f. Opaque$_2$ (Stiebels 2003)

B>A>V	~~A>B>V~~	surface order
~~[B[A[V]]]~~	[A[B[V]]]	underlying scope

g. Asymmetric compositionality (Hyman 2003, Zukoff 2022)

B>A>V	A>B>V	surface order
[B[A[V]]]	[A[B[V]]]	underlying scope

h. Symmetric acompositionality (Ryan 2010, Myler 2021)

B>A>V	A>B>V	surface order
[B[A[V]]]	[A[B[V]]]	underlying scope

To investigate the predictions of semantic and syntactic approaches with regard to valency markers, I examine the combinations of valency markers more closely by classifying them according to the transparency patterns described in the classification by Stiebels (2003), who shows that combinations of valency markers can be grouped into several patterns, which are schematized in (3). In the schemata in (3), a straight line indicates a transparent realization of a combination of valency markers, whereas a diagonal line indicates a non-compositional realization.
In transparent patterns, shown in (3a), semantic/syntactic requirements are entirely obeyed, such that the underlying semantic composition/syntactic structure maps transparently onto the surface order of the markers. Thus, the underlying scopal relationships between two affixes can be read off from the surface order. An example of a transparent pattern of valency markers is presented in (4) for the combination of causative and reciprocal in Zulu (Bantoid, South Africa). In (4a), the interpretation suggests that the reciprocal coindexes the causer and the agent (or: the causee) implying that the reciprocal scopes over the causative. As predicted by semantic requirements on affix order, the reciprocal is realized in a more distant position to the verb than the causative, as in (4a). The interpretation of the example in (4b), in contrast, implies that the reciprocal yields coindexation of the causee and the patient. Consequently, it can be implied that reciprocalization takes place before causativization. As predicted by semantic and syntactic approaches to affix order, this interpretational difference is reflected in the surface order of the affixes, since the reciprocal is now closer to the verb than the causative.

(4) Order of REC and CAUS in Zulu (Buell 2005: 26)

a. A-bafana ba-bon-is-an-a a-mantombazane.
CL2-boys CL2.SUBJ-see-CAUS-REC-TV CL2-girls
'They boys are showing each other the girls.'

b. A-bafana ba-bon-an-is-a a-mantombazane.
CL2-boys CL2.SUBJ-see-REC-CAUS-TV CL2-girls
'They boys are showing the girls to each other.'

Stiebels (2003) introduces the term *restricted patterns*, illustrated here in (3b), which are similar to transparent patterns in the sense that semantic/syntactic requirements are not violated. However, one of the possible combinations between underlying order and surface form cannot be expressed. A priori, it is not clear if the unavailability of this combination results from indepedendent reasons blocking the underlying order, e.g. semantic incompatibilities, or if the respective surface form is morphologically blocked. Thus, restricted interactions is a surface symptome shared by two underlying phenomena that I will refer to as *restricted-on-the-surface* and *restricted-on-the-base*. *Restricted-on-the-base* patterns are patterns in which one of the underlying semantic forms is ruled out due to language-specific constraints, such as semantic incompatibilities or language-specific constraints on argument linking. Restricted-on-the-base patterns are illustrated in (3d). Since the underlying form [A[B[V]]] is ruled out, the transparent surface form is automatically blocked, as well. Moreover, the ✗ symbol indicates that the reverse underlying form [B[A[V]]] cannot be realized by the non-compositional surface form, either. Examples for restricted-on-the-base patterns can be found in Fuuta Tooro Pulaar or Tukang Besi.

In Fuuta Tooro Pulaar (West-Atlantic, Senegal), there is a derivational affix which is labeled *separative* by Paster (2005). The separative is very restricted in its distribution, since it combines only with predicates that share the broad meaning of putting various items together where the separative yields the meaning of undoing this action. The combination of separative and causative yields a restricted configuration in the sense that the separative has to precede to causative with a transparent meaning, illustrated here in (5). Paster (2005) argues that the order of the two markers is restricted due to a semantic incompatibility. Since the separative typically combines with predicates referring to meanings where items are put together, the entire causativized complex would need to have a corresponding meaning in order to create a scenario in which the separative could possible take scope over the causative. Thus, the pattern is restricted-on-the-base, since the underlying semantic form [[[V]CAUS]SEP] is ruled out by a semantic incompatibility of those affixes. This example further shows why restricted-on-the-base phenomena should be considered to result from semantic factors: the opposite surface order is not ruled out due to morphotactic factors, but from constraints on the compatibility of the affixes.

(5) Order of SEP and CAUS in Fuuta Tooro Pulaar (Paster 2005: 175)

o	udd-it-in-ii	kam	baafal	ŋgal
3SG	close-SEP-CAUS-PST	1SG	door	DET

'he made me open the door'

In Tukang Besi (Austronesian, Indonesia), there is an independent requirement on argument structure that applicatives can only apply in the presence of a structurally higher argument. Hence, applicatives and passives can only appear in a restricted fashion: since passivization yields a demotion of the structurally higher argument, having passivization apply **prior to** applicativization destroys the context for applicatives to apply. This is shown in the examples in (6). Since applicatives require the presence of a structurally higher argument, passivization neccessarily applies after applicativization, thus explaining the ungrammaticality of (6c). As a consequence, only the beneficiary argument becomes the subject of the passivized clause, as shown in (6). In Tukang Besi, the passive *to-* is a prefix while the benefactive applicative *-ako* is a suffix. Thus, the relative order of the affixes cannot be read off directly from the surface. However, the fact that the beneficiary argument can be the subject of the passive sentences in (6a) and (6b) shows that the applicative applied before passivization since the benefactive needs to introduce the argument in order to make it accessible to passivization. The ungrammaticality of the intended interpretation of the sentence in (6c) indicates that the theme argument cannot be the subject of the passive sentence, as would have been expected if passivization had applied before applicativization. This examples shows that language-specific rules on argument linking can block certain combination of valency markers.

(6) Order of PASS and BEN in Tukang Besi (Donohue 2011: 233f.)

a. No-to-wila-ako-mo na ina-no i daoa.
3.RLS-PASS-go-BEN-PFV NOM mother-3.POSS OBL marked
''Her mother was gone for to the market.'

b. No-to-helo'a-ako-mo na ana-no te kaujawa.
3.RLS-PASS-cook-BEN-PFV NOM child-3.POSS CORE cassava
'Her children were cooked cassava for.'

c. *No-to-helo'a-ako-mo na kaujawa te ana-no.
3.RLS-PASS-cook-BEN-PFV CORE NOM cassava child-3.POSS
intended: 'The cassava was cooked for the children.'

Restricted-on-the-surface phenomona, on the other hand, result from morphotactic restrictions in combination with requirements on the semantic transparency of affix order. As shown in the schema in (3c), one of the possible surface forms is blocked (due to morphotactics). As a consequence, the transparent interpretation cannot be realized by means of a transparent surface order. Constraints on semantic transparency, however, block the alternative realization of the underlying form by the non-compositional form, as indicated by the ✗ symbol. A potential example of a restricted-on-the-surface pattern is found in Kipsigis (Nilotic, Kenya), as pointed out to me by Maria Kouneli (p.c.). The example in (7b), where the applicative combines with an intransitive predicate, shows that the applicative in Kipsigis does not face the same restriction as applicatives in Tukang Besi. Nonetheless, when the applicative combines with the causative, they can only occur in the surface order CAUS<APPL, as shown in (7a). This example can only have a transparent interpretation in which the applicative refers to the event of causation rather than the causativized subevent. Specifically, the speakers note that the causer acts instead of the argument introduced by the applicative. Since there is no independent reason that would rule out the combination [[[V]APPL]CAUS], the phenomenon should be considered to be a restricted-on-the-surface-pattern.

(7) Order of CAUS and PASS in Kipsigis data provided by Maria Kouneli

a. Kíː-lɑ̀ːŋ-sìː-tʃí Kíbêːt lɑ̀ɑgóːk kêːtít Kìplàŋgàt
PST3-climb-CAUS-APPL Kibeet.NOM children tree Kiplangat
'Kibeet made the children climb the tree for/on behalf of Kiplangat.'
not: 'Kibeet made the children [climb the tree for Kiplangat]'

b. Ríːr-tʃìː-n-kɛ́ː/-tóːs
cry-APPL-IMPFV-REFL/PL
'They are crying for each other (i.e., to be together).'

In $opaque_1$ and $opaque_2$ scenarios, semantic/syntactic requirements on affix order are violated. In $opaque_1$ scenarios in (3e), one surface order yields both the compositional and the non-compositional interpretation. In $opaque_2$ scenarios in (3f), a given surface form may only yield the non-compositional interpretation since the transparent interpretation is blocked. In that sense, transparent and $opaque_2$ scenarios are mutually exclusive. Especially $opaque_1$ patterns are relatively frequent in the data I gathered.
One example of an $opaque_1$ pattern comes from the combination of directive and repetitive in Udihe (Tungusic, Russia), previously discussed in chapter 4.3, where the repetitive adds the notion of a repeated action or event. In the example in (8), the two markers occur in the order DIR<REP such that the repetitive is further away from the verb than the directive. The example has two possible interpretations: the transparent interpretation, in which the repetive takes scope over the directive, as predicted by the surface order **and** the non-compositional interpretation in which the repetitive scopes below the directive marker despite its position external to the directive. In that sense, the sentence in (8) is $opaque_1$.

(8) Order of DIR and REP in Udihe (Nikolaeva & Tolskaya 2001: 318, 586)
egbesi-ne-gi
swim-DIR-REP
'go again to swim' *or* 'go to swim again'

Examples exhibiting asymmetric compositionality, as exemplified above for the relative order between causative and desiderative in Choguita Rarámuri, are then combinations of $opaque_1$ surface orders and transparent surface forms. This is schematized in (3g). Concretely, both surface forms and both interpretation are available. However, one of the surface forms is $opaque_1$ in that it allows both the transparent and the non-compositional interpretation.
Another attested pattern occurs when both possible surface forms are $opaque_1$, which is schematized in (3h). I refer to this phenomenon to *symmetric acompositionality*.[5] In the literature, only one case of symmetric acompositionality has been described by Paster (2005) for the interaction of causative and applicative in Fuuta Tooro Pulaar. The relevant examples are presented in (9). Crucially, the applicative introduces an instrument which can refer either to the event of causation, as in (9c) and (9d), or the causativized subevent, as in (9a) and (9b). In both cases, both surface orders are possible. In other words, the underlying form [[[V]CAUS]APPL] is realized compositionally in (9d) by the order V<CAUS<APPL and non-compositionally in (9c) by the surface form V<APPL<CAUS. The other interpretation [[[V]APPL]CAUS] is expressed compositionally in (9a) and non-compositionally in (9b). As a consequence, a given surface form does not allow any predictions about its interpretation since both forms can have either interpretations and vice versa. When I replicated the examples with

[5] Ryan (2010), Myler (2021) use the term *scopal metathesis* for this phenomenon.

a native speaker of Fuuta Tooro Pulaar, the pattern could not be replicated. In fact, the native speaker accepted only the transparent surface forms in (9a) and (9d).

(9) Order of CAUS and APPL in Fuuta Tooro Pulaar (Paster 2005: 182f)

a. O irt-ir-in-ii kam supu o kuddu.
3SG stir-APPL-CAUS-PST 1SG soup DET spoon

b. O irt-in-ir-ii kam supu o kuddu.
3SG stir-CAUS-APPL-PST 1SG soup DET spoon
'He made me stir the soup with a spoon (I used a spoon)'

c. O irt-ir-in-ii kam supu o laɓi.
3SG stir-APPL-CAUS-PST 1SG soup DET knife

d. O irt-in-ir-ii kam supu o laɓi.
3SG stir-CAUS-APPL-PST 1SG soup DET knife
'He made me stir the soup with a knife (he used the knife)'

It is conceivable that there are languages in which both possible surface forms are opaque$_2$ such that both orders yield only the non-compositional interpretation. To the best of my knowledge, a pattern like this is not attested.

I evaluate the transparency of valency markers by means of three separate tables. First, I discuss combinations of causatives and applicatives in table 5.1 and 5.2. Afterwards, I discuss all remaining patterns in 5.3. The tables provide a value according to the classification in (3) **per surface form** rather than per combination. For example, the case of asymmetric compositionality in Choguita Rarámuri in (2) describes only one combination but two different surface forms: the surface form APPL-CAUS, which is transparent, and the surface CAUS-APPL, which is opaque$_1$. The value provided in the table is the value that results from all available information of a given language. Specifically, the value *restricted (t)(o$_1$)* indicates that the sources contained only examples in which the surface order matches the scopal requirement without providing further information about possible alternative interpretations that would rule out opaque$_1$ patterns, or possible alternative surface forms that would rule out fully transparent patterns. In simpler terms, the value *restricted (t)(o$_1$)* can be understood in the sense that the patterns seems restricted but might also turn out to be transparent or opaque$_1$. This vagueness of the exact transparency value is a side effect of literature-based methods like grammar mining.

Table 5.1 and table 5.2 illustrate the transparency patterns of combinations between causatives and applicatives. Concerning this combination, Stiebels (2003) expresses the observation that languages tend to realize the combination of CAUS and APPL by means of an opaque surface order V<CAUS<APPL. Myler (2021) takes a similar stand on this, predicting that all non-compositional realizations of causatives and applicatives should be realized on the surface as V<CAUS<APPL. The results of this dissertation strongly support this observation, which is formulated in (10). Nonetheless, the picture is more complex in a cross-linguistic comparison.

(10) The CAUS-APPL constraint following Stiebels (2003), Myler (2021)
Causative markers are closer to the verb root than applicative markers.

First, it is crucial to differentiate the different semantic roles that an applicative marker introduces. Instrumental, locative or comitative applicatives allow to refer to the event of causation and the causativized subevent indepedently. As a consequence, the interpretation of the sentence provides the underlying order of application between the operations. If the applicative introduces a beneficiary argument, on the other hand, it is much harder to tell apart the underlying order of application. Concretely, if a participant benefits somehow from an action, it is implied that the participant will also indirectly benefit from the causation of this action. Conversely, a participant that benefits from the act of causing an event will almost always benefit from the act itself, as well. The only conceivable scenario where a participant benefits only from the event of causation but not necessarily from the caused subevent could be scenarios in which the causer takes over responsibilities of the designated agent thus allowing the agent to benefit from the causation. As an example, it could be the case that person A was ordered to cause person B to die but it is reluctant to obey that order. In this scenario, person C could cause person B to die for person A in the sense that the person A does not benefit from the event of dying but the immediate causation. Nevertheless, the semantic differences between a benefactive applicative with scope over the causative and a causative with scope over a benefactive applicative is far more subtle than with other applicatives.

Language	**Surface order**	**Underlying order**	**Pattern**
Misantla Totonac	V<CAUS<LOC	[[[V]LOC]CAUS]	opaque$_2$ (o$_1$)
Misantla Totonac	V<LOC<CAUS	[[[V]LOC]CAUS]	transparent
Misantla Totonac	V<CAUS<INST	[[[V]INST]CAUS]	opaque$_2$ (o$_1$)
Misantla Totonac	V<INST<CAUS	[[[V]INST]CAUS]	transparent
Adyghe	V<CAUS<COM	[[[V]CAUS]COM] [[[V]COM]CAUS]	opaque$_1$
Fuuta Tooro Pulaar	V<CAUS<INST	[[[V]CAUS]INST] [[[V]INST]CAUS]	opaque$_1$
Fuuta Tooro Pulaar	V<INST<CAUS	[[[V]CAUS]INST] [[[V]INST]CAUS]	opaque$_1$

Table 5.1: Transparency patterns of LOC, INST and COM applicatives

Combinations of causatives with instrumentals, locatives or comitatives are attested in Adyghe, Misantla Totonac and Fuuta Tooro Pulaar. In all of these languages, the semantic requirements may be overwritten resulting in opaque surface orders, as shown above for Fuuta Tooro Pulaar. A straightforward generalization that can be drawn from table 5.1 is that each surface form in which the causative is closer to the verb than the applicative is opaque.

The examples in (11) illustrate the ordering patterns of the comitative applicative and the causative in Adyghe (North West Caucasian, Russia & Turkey). In Adyghe, affix order is entirely invariable. Concretely, the relative order of comitative and causative is fixed to COM<CAUS, which yields an opaque$_1$ pattern. The sentence in (11a) is interpreted with the comitative introducing a second causer. Thus, the interpretation of (11a) suggests that the comitative takes scope over the causative, as suggested by the surface order. The example in (11b), in contrast, yields the opaque interpretation where the comitative takes scope below causative, since the comitative introduces a secondary agent (or: causee) rather than a secondary causer suggesting that application of the comitative takes place prior to causativization.

(11) Fixed order of COM and CAUS in Adyghe

a. Se tʃale-r wo qʷə-p-de-sə-ʁə-tŝəyə
I child-ABS you CIS-2SG-COM-1SG-CAUS-sleep
'I (and you) make the child sleep.'
Context: My baby is crying a lot, so me and you sing a song to make him sleep.

b. Se a-r wo qʷə-p-de-ə-ʁə-ʃʼə-ʁ
I 3-ABS 2SG CIS-2SG-COM-1SG-CAUS-dance-PST
'I made him dance with you.'
Context: My friend is secretly in love with you but she is really shy and does not dare to dance with you. In the end, I convince her to dance with you.

The grammar by MacKay (1999) on Misantla Totonac describes two different combinations of causative and applicative. The examples in (12) illustrate variable affix order between the causative and the locative applicatives.

(12) Order of CAUS and LOC in Misantla Totonac (MacKay 1999: 286)

a. Ut kin-puu-maa-paɬ-nii hun-čik
s/he 1.OBJ-LOC-CAUS-sweep-CAUS the-house

b. Ut kin-maa-puu-paɬ-nii hun-čik
s/he 1.OBJ-CAUS-LOC-sweep-CAUS the-house
'She makes me sweep the house.'

Crucially, both surface forms yield the same interpretation in which the applicatives scope below the causative, since the object introduced by the locative applicative refers to the event of sweeping rather than to the event of causation. Thus, the surface form CAUS-APPL is transparent whereas the form APPL-CAUS is opaque. However, it is important to note that MacKay (1999) does not discuss if the opaque example in (12a) allows for the alternative, transparent interpretation. Moreover, MacKay (1999) does not discuss if the causative encodes direct causation, indirect causation or both. If the marker reflects indirect causation, the underlying semantic representation between a causative and a locative yields an interpretational difference, since the locative may either refer to the event of causation or the causativized subevent. Thus, it cannot be resolved if the pattern is opaque$_1$ or opaque$_2$.

The interaction of the causative with the instrumental shows a similar pattern. Both (13a) and (13b) are interpreted with the causative taking scope over the instrumental applicative. As for the example in (13a), MacKay (1999) does not explicitly discuss the interpretation of the sentence, yet it seems more like that the spoon refers to the event of feeding than to the event of causation. The underlying order [[[V]INST]CAUS] may be realized using the transparent surface form, as in (13b), or the opaque surface form, as in (13a). MacKay (1999) sets up the generalization that the causative is always closer to the verb than the applicative. This generalization is clearly disproved in (13b). Nonetheless, it indicates that the opaque surface order is more frequent than the transparent one.[6]

(13) Variable order of INST and CAUS in Misantla Totonac (MacKay 1999: 312)

a. Juan kin-lii-maa-kutu-nii hun-kučara hun-kḭinčun.
Juan 1.OBJ-INST-CAUS-feed-CAUS DET-spoon DET-child
'Juan makes me feed the child with a spoon.'

b. lii-min → maa-lii-min-nii
INST-take CAUS-INST-take-CAUS
'bring, cause to bring

The examples Fuuta Tooro Pulaar and Misantla Totonac suggest that there is a morphological restriction on the relative order of causative and applicative, such that the causative is closer to the verb root than the applicative, which complements the semantic/syntactic requirements. Thus, there is optionality between surface forms matching the semantic requirements and surface forms matching morphotactic requirements. In that sense, the patterns Fuuta Tooro Pulaar and Misantla Totonac are similar to Bantu languages where a surface form may violate semantic requirements or morphotactic requirements in form of the CARP template but never both. In Adyghe, the same morphotactic requirement seems to overwrite semantics, thus yielding entirely rigid affix orders. Furthermore, the results from these three languages show that the nature of the morphological requirement is hierarchical rather than linear. In other words, the requirement occurs in the prefixal domain in Misantla Totonac and Adyghe and in the suffixal domain in Fuuta Tooro Pulaar. In both cases, the causative is expressed closer to the root than the applicative yielding a APPL>CAUS requirement in prefixes but a CAUS<APPL requirement in suffixes. If the requirement were of a linear nature, one would expect the same pattern on both sides of the root.

The generalizations drawn from the interaction of causatives and instrumentals, comitatives and locatives seem to account for most combinations of causatives and benefactive applicatives, as well, summarized in table 5.2.

[6] The exact role of the suffixal part *-nii* of the causative is unclear: it may act as a valency-increasing applicative withouth the causative prefix *maa-*. Furthermore, there are contexts in which the causative prefix *maa-* occurs without the suffixal part *-nii*. However, descriptive grammars of related languages like McFarland (2009) for Filomeno Totonac or Esteban Juarez (2020) for Tuxtla Totonac treat the causative as being composed of a prefixal part *maa-* and a suffixal part *-nii*, since the valency is only increased by one argument if both affixes occur together.

Language	Surface order	Underlying order	Pattern
Caddo	CAUS<APPL	[[[V]CAUS]APPL]	restricted (t)(o$_1$)
Huallaga Quechua	V<APPL<CAUS	[[[V]APPL]CAUS]	transparent
Huallaga Quechua	V<CAUS<APPL	unclear	unclear
Choguita Rarámuri	V<CAUS<APPL	[[[V]APPL]CAUS]	opaque$_2$ (o$_1$)
Choguita Rarámuri	V<APPL<CAUS	[[[V]APPL]CAUS]	transparent (o$_1$)
Bemba	V<APPL<CAUS	[[[V]CAUS]APPL]	opaque$_2$
Xhosa	V<CAUS<APPL	[[[V]APPL]CAUS]	opaque$_1$
Xhosa	V<APPL<CAUS	[[[V]APPL]CAUS]	transparent

Table 5.2: Transparency patterns of BEN applicatives

In Huallaga Quechua, there is variable affix order between CAUS<APPL and APPL<CAUS, as shown in (14). It is worth noting that (14a) is the only example in which the applicative is closer to the verb than the causative. In this example, the applicative needs to apply first to transitivize the predicate, thus creating the environment for the reciprocal to apply. In all examples where the reciprocal is absent, the causative precedes the applicative, as in (14b).

(14) Order of CAUS and BEN in Huallaga Quechua (Weber 1983: 80, 143)

a. Asi-pa:-nakU-chi-ma-nchi
laugh-BEN-REC-CAUS-1.OBJ-1INCL
'He makes us laugh at each other.'

b. Oam-ta aru-chi-pa:-ma-n.
2SG-OBJ work-CAUS-BEN-1.OBJ-3.PFV
'He makes you work for me.'

In Xhosa (Bantoid, South Africa), the applicative and the causative display variable affix order, as well, compare (15b), where the applicative is closer to the root than the causative, and (15c), where causative is internal to the applicative.

(15) Position of APPL and CAUS in Xhosa (Myler 2021)

a. u-Themba u-ceng-el-e u-Dallas uku-theng-a i-sonka.
CL1-Themba CL1-beg-APPL-PFV CL1-Dallas INF-buy-TV CL7-bread
'Themba begged Dallas to buy bread.'

b. u-Zoli u-ceng-el-is-e u-Themba u-Dallas
CL1-Zoli CL1-beg-APPL-CAUS-PFV CL1-Themba CL1-Dallas
uku-theng-a i-sonka.
INF-buy-TV CL7-bread

c. u-Zoli u-ceng-is-el-e u-Themba u-Dallas
CL1-Zoli CL1-beg-CAUS-APPL-PFV CL1-Themba CL1-Dallas
uku-theng-a i-sonka.
INF-buy-TV CL7-bread
'Zoli made Themba beg Dallas to buy bread.'

In Xhosa, there is independent evidence that applicativization comes before causativization. The example in (15a) illustrates that the applicatives introduces the object controlling the infinitival complement. In (15b) and (15c), the entire sentence is causativized. Consequently, the applicative should be closer to the verb than the causative, as in (15b). However, the opposite order with the causative preceding the applicative is also grammatical without any change in meaning or function, as demonstrated in (15c).

Another case of variable affix order between causative and applicative is found in Choguita Rarámuri, shown here in (16). According to Caballero (2008), the speakers of Choguita Rarámuri stated that the benefactive takes scope below the causative. It is not clear to me how reliable this judgment is, given that the scopal relationship between causatives and benefactives is hard to dermine, as described above.

(16) Order of CAUS and APPL in Choguita Rarámuri (Caballero 2008: 351f)

a. To, Jéni dúlse íw-ki-ti-ri Jadíra
go Jeni candy bring-APPL-CAUS-IMP.SG Yadira
'Go! Make Jeni bring candy for Yadira'

b. Tamí ko=mi o'pés-ti-ki-ma ré ba
1SG.ACC EMPH=2SG.NOM vomit-CAUS-APPL-FUT DUB FC
'You'll make him throw up on me.'

There are two counterexamples to the empirical generalization in (10) stating that causative markers tend to be closer to the root in semantically opaque affix combinations. First, consider the example of non-compositional APPL<CAUS orders in Bemba, presented here in (17).

(17) Stem + CAUS + APPL in Bemba (Hyman 1994b, 2002: 3f)

V			**V < CAUS**			**V < CAUS < APPL**	
-leep-	'be long'	→	-leef-i̧	'lengthen'	→	-leef-es-i̧	'lengthen for'
-lub-	'be lost'	→	-luf-i̧	'lose'	→	-luf-is-i̧	'lose for'

In combinations of causatives and applicatives, the causative applies first and forms a transitive predicate out of an intransitive base. The affixation of the causative suffix *-i̧* has an impact on the phonological quality of the stem-final consonant. Concretely, the causative suffix causes the labial stops to become fricatives, as shown in (17). When the applicative with the underlying forms *-il* and *-el* is attached, it surfaces between the verb root and the causative. The causative suffix then triggers a phonological process on the applicative, in which the affix-final /l/ becomes [s]. Nonetheless, the final consonant of the stem remains as a fricative even though the stem and the causative are no longer adjacent. In other words, frication of the stem-final consonant and affixation of the applicative are in a counter-bleeding relationship: if affixation of the applicative had applied first, the environment for frication of the stem-final consonant had never been created. Hyman (1994b, 2002) claims that the causative is closer to the verb underlyingly, while the applicative is infixed in a later step. Polak-Bynon (1975) observes a similar process which is labeled *transfer of causative* and indicates 'outward movement' of the causative in the closely related language Shi. In fact, Müller (2020) connects these facts by claiming that the phonological effects in fact resemble morphological movement of the causative to the right. However, all of these analyses seem to assume an independent rule that seems to be contradictory to the The CAUS-APPL constraint in that there has to be an additional, morphological rule that derives the pattern in (17), which forces the causative to a more external position. In fact, a closer look at the phonotactics of Bemba reveals that this movement step seems to be phonologically conditioned. More concretely, having the compositional order surface would yield the surface order *luf-į-is*, which is phonologically suboptimal as it contains a clash of two adjacent vowels. In fact, Kasonde (2009) and Hamann & Kula (2015) show that there are no roots containing two adjacent non-identical vowels in Bemba. In cases where two vowels become adjacent through affixation, phonological processes apply to fix that clash, as shown in (18). In these examples, two vowels become adjacent through affixation. As a result, the first vowels becomes a glide. However, resolving vowel hiatus by gliding in the examples in (17) would yield the consonant cluster *fy*. Hamann & Kula (2015) observe a general ban on consonant clusters in Bemba with the exception of combinations of obstruents preceded by homorganic nasal consonants. In simpler terms, resolving vowel hiatus by turning the first vowel into a glide yields a problematic and marked consonant cluster.

(18) Repairing vowel clashes in Bemba (Kasonde 2009: 59)

a. /ú-kù-kí-à/ → /úkùkyá/ → [úkùcá]

b. /ú-kù-témú-à/ → /úkùtémwa/ → [úkùtémwá]

Thus, the fact that the causative appears in a more external position than the applicative can be explained under the assumption that repositioning the causative is the only alternative strategy the language has to repair the vowel hiatus since gliding would result in a consonant cluster. A more detailed analysis of the pattern is provided later in chapter 8.5. That being said, (17) does not constitute a counter-example to the (10), since it is a **phonological** rule rather than a **morphological** rule that enforces that surface order.

The second counterexample to the (10) is the case of symmetrical noncompositionality in Fuuta Tooro Pulaar. More specifically, the availability of the non-compositional interpretation of the APPL<CAUS order in (19a) seems to violate the Causatives-Close-Constraint (CCC): the order of the affixes is opaque with the applicative suffix being realized inside causative morphology.

(19) Order of CAUS and APPL in Fuuta Tooro Pulaar (Paster 2005: 182f)

a. O irt-ir-in-ii kam supu o laɓi.
3SG stir-APPL-CAUS-PST 1SG soup DET knife

b. O irt-in-ir-ii kam supu o laɓi.
3SG stir-CAUS-APPL-PST 1SG soup DET knife
'He made me stir the soup with a spoon (he used the knife)'

Given the overwhelming tendency of causatives being realized closer to the verb than the applicative, the question is whether this generalization results from a restriction on causatives enforcing their realization in adjacency to the verb, a restriction on applicatives that enforces morphological realization further away from the verb, or from a restriction specific to the combination of causatives and applicatives. The empirical picture that emerges from a narrow investigation of the language sample allows for the unequivocal answer that this generalization follows from a more general restriction that **causatives should be realized close to the verb**. Specifically, there are numerous examples of non-compositonal combinations between causatives and other derivational affixes in which the causative is always closer to the verb.
As a consequence, the CAUS-APPL constraint in (10) needs to be reformulated in order to become empirically adequate. More specifically, opacity arises in affix combinations in which the causative is close to the verb. In these combinations, there seems to be a tension between the underlying semantic representation and a morphological restriction that requires causatives to be realized as close to the verb root as possible. This observation gives rise to the CAUS-CLOSE constraint in (20).

(20) The CAUS-CLOSE constraint
Causative markers should be realized in proximity of the verb root.

One example showing the tendency of causatives to occur in adjacency to the verb is the asymmetric compositionality between the causative and *s(i)* - 'go' in Choguita Rarámuri. The example in (21a) illustrates that the order in which *s(i)* - 'go' precedes the causative is necessarily transparent. The opposite order with the causative being realized closer to the verb is opaque yielding the compositional interpretation in (21b) and the non-compositional interpretation in (21c).

(21) Order of CAUS and and *s(i)* - 'go' in Choguita Rarámuri (Caballero 2008: 341)

a. ma=ni mi wikára-s-ti-ma
already=1SG.NOM 2SG.ACC sing-go-CAUS-FUT
'I will make you go along singing.'

b. Ne mi bené-r-si-ma
1SG.NOM 2SG.ACC learn-CAUS-go-FUT
'I will go along teaching you.'

c. Rosária ko tamí awí-r-si-niri
Rosaria EMPH 1SG.ACC sing-CAUS-go-DESID
'Rosaria wants to make you go along singing.'

Another example exhibiting the tendency of causatives to be realized in proximity of the verb is the case of variable affix order between the continuative aspect marker and the causative in Yagua, repeated here in (22). Crucially, both surface orders yield the interpretation in which the causative takes scope over the continuative. Thus, the variability between the two surface forms seems to arise from a tension between the surface order matching the semantic/syntactic requirements in (22b) and the surface order matching the morphological restriction that forces the causative closer to the verb in (22a).

(22) Order of CONT and CAUS in Yagua (Payne 1985: 281)

a. Ra-jasiriivay-taniy-jancha-ray.
INANIM.SUBJ-sneeze-CAUS-CONT-1SG.OBJ

b. Ra-jasiriivay-jancha-taniy-ray.
INANIM.SUBJ-sneeze-CONT-CAUS-1SG.OBJ
'This is making me sneeze for a considerable time.'

A morphological restriction on the position of the causative could also explain the restricted order between causative and passive in Tukang Besi, where the causative has to appear closer to the verb than the passive allowing only for the transparent interpretation where the passive scopes over the causative, as shown in (23). Regarding the interaction of causatives and passives in general, Baker (1988) notes that the order V<PASS<CAUS is generally excluded by languages which exhibit a type 1 causative, where the causee becomes oblique, whereas the theme argument receives structural case. However, the causative in Tukang Besi is a type 2 causative since only the causee argument is eligible for structural nominative case. Thus, the generalization by Baker (1988) is not applicable to Tukang Besi leaving the restricted order of causative and passive unexplained. An alternative explanation for the absence of the V<PASS<CAUS could in fact be a morphological restriction on the position of the causative. In simpler terms, the combination V<PASS<CAUS cannot be expressed since its realization would violate rules on morphological wellformedness.

(23) Order of CAUS and PASS in Tukang Besi (Donohue 2011: 214)

a. No-to-pa-ala-mo na mia iso te wemba.
3RLS-PASS-CAUS-fetch-PFV NOM person yon CORE bamboo
'That person was made to fetch bamboo.'

b. *No-to-pa-ala-mo na wemba iso te mia.
3RLS-PASS-CAUS-fetch-PFV NOM bamboo yon CORE person
intended: 'That bamboo was made to be fetched by the person.'

The CCC has immediate theoretical consequences, since it is a striking argument against proposals linking the CAUS-APPL constraint to the syntactic nature of the applicative (Myler & Mali 2021, Myler 2021) or to combinations of causative and applicative specifically (Ryan 2010). At this point, I want to review and discuss the recent proposal by Myler (2021). I will argue that Myler's (2021) approach makes wrong empirical predictions and is not able to derive the CCC in its current form. The examples in (24) were presented by Myler (2021) to illustrate a mismatch between the surface order of causative and applicative in Xhosa, as already presented earlier in this chapter in (15). Concretely, the applicative in (24a) introduces the object argument which controls the infinitival complement. This entire sentence is causativized in (24b) suggesting that the causative is syntactically higher than the applicative as it enters the structure later. However, the example in (24c) shows that causativization of (24a) may also be expressed with a causative being realized closer to the verb than the applicative. Thus, the order in (24b) matches the syntactic structure, thus fulfilling the predictions by the Mirror Principle, while (24c) violates this presumption.

(24) Position of APPL and CAUS in Xhosa (Myler 2021)

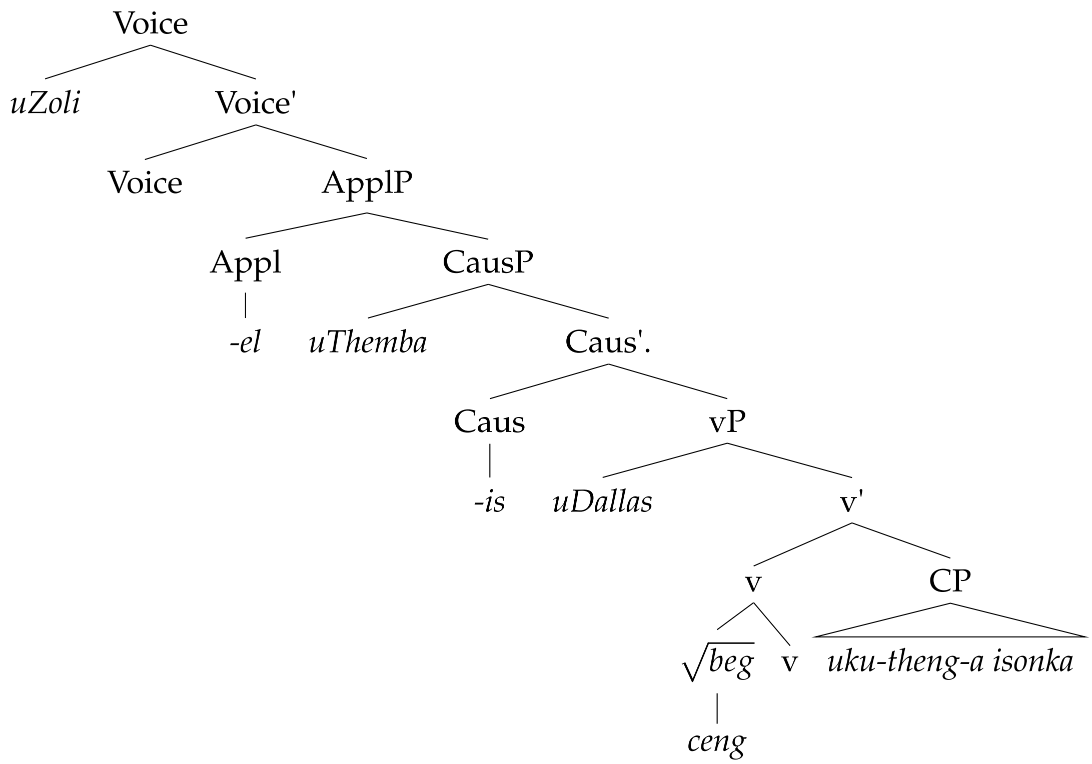
a. u-Themba u-ceng-el-e u-Dallas uku-theng-a i-sonka.
CL1-Themba CL1-beg-APPL-PFV CL1-Dallas INF-buy-TV CL7-bread
'Themba begged Dallas to buy bread.'

b. u-Zoli u-ceng-el-is-e u-Themba u-Dallas
CL1-Zoli CL1-beg-APPL-CAUS-PFV CL1-Themba CL1-Dallas
uku-theng-a i-sonka.
INF-buy-TV CL7-bread

c. u-Zoli u-ceng-is-el-e u-Themba u-Dallas
CL1-Zoli CL1-beg-CAUS-APPL-PFV CL1-Themba CL1-Dallas
uku-theng-a i-sonka.
INF-buy-TV CL7-bread
'Zoli made Themba beg Dallas to buy bread.'

Myler & Mali (2021) explain the variation by linking the problem to a recent discussion about the division of applicatives into licensing and introducing applicatives (see also Paul & Whitman 2010, Georgala 2012, Nie 2019, Tyler 2020, Myler & Mali 2021. Concretely, Myler (2021) assumes that introducing applicatives provide the semantic role of the introduced argument and the applicative head. Syntactically, introducing applicatives are phrases in which the introduced argument is merged in specifier of ApplP. Licensing applicatives, however, do not provide the semantic role for the argument. As a consequence, the argument is introduced lower in the syntax and gets licensed by a higher applicative head in a later step. Since the applicative head and the applicative argument are not merged in the same phrase, it is possible that other heads like the causative intervene between the argument and the head. Therefore, an argument may be interpreted lower than the position of the applicative head suggests. Thus, the mismatch between the surface position and the interpretation in (24c) arises from the fact that the semantic role is introduced in a different position in the syntax than the applicative head that is spelled out as *-el* thus explaining the Mirror Principle violation in (24c). The underlying structure proposed by Myler (2021) is shown in (25). Concretely, the argument *uDallas* is introduced in the specifier of v but licensed by the applicative head *-el* which is merged in a syntactically higher position. Since the causative head *-is* is syntactically higher than the introduced argument but lower than the applicative, the causative marker is closer to the verb than the applicative marker, but realized as having scope over the applicative.

(25) Suggested structure for (24c) (Myler 2021)



The analysis by Myler (2021) makes several empirical predictions.
First, the CAUS-APPL generalization is explained by a mismatch between the position where the applied argument is introduced and the position where it is licensed. This predicts that non-compositionality between CAUS and APPL should be unidirectional. Specifically, non-compositionaly might only arise in the form that the applicative head shows up too far away from the verb thus deriving the CAUS-APPL generalization. This prediction is borne out at least as an overwhelming tendency. However, it explains only combinations of CAUS and APPL but not the CCC as such, since the mismatch is linked to the nature of licensing applicatives.
Second, Myler (2021) links the CAUS-APPL generalization to the division of licensing and introducing applicatives stating that non-compositionality should only arise with licensing applicatives. As for introducing applicatives, the argument and the head enter the syntactic structure in the same syntactic phrase. Consequently, there cannot be a mismatch between the underlying structure and the surface form in licensing applicatives, since the causative head cannot appear between the two positions. Myler (2021) suggests a diagnostic to distinguish introducing from licensing applicatives: if the form of the applicative head covaries with its meaning, it is an introducing (also: thematic) applicative. If the form of the applicative head does not vary with the semantic role of the applied argument, it is a licensing (also: gen-

eral) applicative. This is the case in most Bantu languages, which have only one applicative head that might introduce different arguments, like instruments, goals or locations. In simpler terms: non-compositionality between causatives and applicatives are predicted only with general applicatives but not with thematic applicatives. The results presented in this chapter clearly show that this prediction is not borne out. In Adyghe, non-compositionality arises between the causative and the comitative prefix, which is a thematic applicative (see Chirikba 2003 for a similar case in the closely related language Abkhaz). Furthermore, non-compositionality arises with instrumental applicatives and locative applicatives in Misantla Totonac, which are also thematic applicatives.

Moreover, the heuristic for distinguishing introducing applicatives from licensing applicatives is clearly too simple. If licensing applicatives are identified by a one-to-many relationship in the sense that one head introduces many different semantic roles and introducing applicatives are identified by many one-to-one relationships in the sense that there are several applicative heads introducing different types of arguments, it remains unclear how one-to-one relationships are diagnosed in which an applicative heads introduces only, e.g. goal argument. In sum, the approach by Myler (2021) focuses too much on the applicatives involved in non-compositional combinations of causatives and applicatives. However, I have shown that there are non-compositional combinations of causatives and other affixes, as well, which is why the non-compositionality is clearly tied to the position of the causative.

Table 5.3 provides an overview on the transparency patterns of all combinations of valency markers apart from causatives and applicatives. It reveals that other combinations of valency markers are either transparent or restricted, apart from the opacity between passive, reciprocal and applicative in Zulu, demonstrated in (26). The examples in (26) originate from Xhosa, a closely related language treated as a dialect by Buell (2005). Concretely, the root *khuph* carries a meaning 'to take out'.[7] In combination with a causative and a reciprocal, it results in a predicate meaning 'to compete', as shown on (26a). In (26b), an applicative was added, resulting transparently in a meaning like 'to compete for'. If this complex is passivized, with an intended meaning like 'to be competed for', two surface orders are possible: first, the transparent order in (26d) and the opaque order in (26c) in which the passive morpheme precedes the applicative and the reciprocal. Note that (26d) violates both scopal requirements **and** the CARP template (Hyman 2003).

(26) Order of REC and PASS (Buell 2005: 38f)

a. khuph-is-an-a
take.out-CAUS-REC-TV
'compete'

[7] It should be noted that my informant does not use the predicate *khuphisana* to express the meaning 'to compete'. Instead, he preferred the predicate *ncintisana* which shows the same affix ordering patterns like *khuphisana*. In addition, he noted that *khuphisana* is old-fashioned and no longer used in spoken language.

Language	Hierarchical order	Linear order	Pattern
Zulu	CAUS<REC	[[[V]CAUS]REC]	transparent
Zulu	REC<CAUS	[[[V]REC]CAUS]	transparent
Zulu	APPL<REC	[[[V]APPL]REC]	transparent
Zulu	REC<APPL	[[[V]REC]APPL]	transparent
Zulu	REC<PASS	[[[V]REC]PASS]	transparent
Zulu	PASS<REC	[[[V]REC]PASS]	opaque$_2$ (o$_1$)
Zulu	APPL<PASS	[[[V]APPL]PASS]	transparent
Zulu	PASS<APPL	[[[V]APPL]PASS]	opaque$_2$
Zulu	CAUS<PASS	[[[V]CAUS]PASS]	restricted
Choctaw	APPL<REFL	[[[V]APPL]REFL]	restricted (t)(o$_1$)
Choctaw	APPL<REC	[[[V]APPL]REC]	restricted (t)(o$_1$)
Tukang Besi	CAUS<CAUS$_{req}$	[[[V]CAUS]CAUS$_{req}$]	restricted (t)(o$_1$)
Tukang Besi	CAUS<PASS	[[[V]CAUS]PASS]	restricted (t)
Tukang Besi	REC<CAUS	[[[V]REC]CAUS]	restricted (o$_1$)
Tukang Besi	REC<PASS	[[[V]REC]PASS]	restricted (t)(o)
Nambikwara	APPL<REC	[[[V]APPL]REC]	restricted (t)(o$_1$)
Udihe	CAUS<PASS	[[[V]CAUS]PASS]	transparent (o$_1$)
Udihe	PASS<CAUS	[[[V]PASS]CAUS]	transparent $_1$
Huallaga Quechua	CAUS<REC	[[[V]CAUS]REC]	transparent (o$_1$)
Huallaga Quechua	REC<CAUS	[[[V]REC]CAUS]	transparent (o$_1$)
Huallaga Quechua	CAUS<REFL	[[[V]CAUS]REFL]	transparent (o$_1$)
Huallaga Quechua	REFL<CAUS	[[[V]REFL]CAUS]	transparent (o$_1$)
Huallaga Quechua	CAUS<CAUS$_{assist}$	[[[V]CAUS]CAUS$_{assist}$]	transparent (o$_1$)
Huallaga Quechua	CAUS$_{assist}$<CAUS	[[[V]CAUS$_{assist}$]CAUS]	transparent (o$_1$)
Huallaga Quechua	PASS<CAUS	[[[V]PASS]CAUS]	restricted (t)(o$_1$)

Table 5.3: Transparency patterns of valency markers

b. khuph-is-an-el-a
take.out-CAUS-REC-APPL-TV
'compete for'

c. khutsh-is-an-el-w-a
take.out-CAUS-REC-APPL-PASS-TV
'to be competed for'

d. khutsh-is-w-el-an-a
take.out-CAUS-PASS-APPL-REC-TV
'to be competed for'

At this point, I want to argue that the different transparency patterns of valency markers result from tensions between semantic requirements enforcing transparency and independent **morphotactic** rules that make requirements on the surface forms. In the following, I demonstrate that all patterns arise from tensions between semantic requirements and additional morphological rules.

1. Transparent patterns, like the interaction of causative and reciprocal in Zulu, arise when semantic requirement are always obeyed while morphological rules like the CCC are disregarded.

2. Restricted-on-the-surface phenomena arise if the underlying order of valency markers is in principle available in the given language, yet its transparent combination is blocked by morphological rules on the surface. I argued that this might be the case for the unattested order *V-PASS-CAUS in Tukang Besi, which does not violate the rules on argument structure in Tukang Besi but the CCC. Moreover, rules on transparency disallow the opposite surface form to express that underlying form. Thus, restricted-on-the-surface phenomena arise from a combination of morphological rules and restrictions on transparency.

3. Restricted-on-the-base phenomena refer to cases in which a certain combination of affixes is ruled out since the categories cannot interact in that order to begin with. Examples for these phenomena result from semantic incompatibilities, as in Fuuta Tooro Pulaar, or language-specific rules on argument structure, as in Tukang Besi. In addition, requirements on semantic transparency ensure that the remaining underlying order can only be expressed by the transparent order. As a consequence, morphological rules might be disregarded.

4. Opaque$_1$ orders constitute scenarios in which morphological requirements are obeyed while semantic requirements are disregarded. Cases of asymmetric compositionality arise when opaque$_1$ patterns and transparent cooccur. This is predicted under the assumption that morphological requirements like the CCC are uni-directional, i.e. refer only to one of the respective categories, thus explaining the asymmetry. More specifically, I have shown that the only pattern of non-compositional patterns that seems robust across language is that causatives seem to be subject to a morphological rule that enforce their realization in proximity of the verb root. Other cases of non-compositionality, like the opacity in the relative order passive, reciprocal and applicative in Zulu does not belong to a more general, coherent pattern. Since morphological rules like the CCC exist only for the causative and not for other categories (at least crosslinguistically), it is expected that asymmetric compositionality is quite frequent, since only one of the relevant categories is subject to a morphological rule, while the other one is not.

5. Opaque$_2$ orders are similar in the sense that morphological requirements are obeyed while semantic requirements are violated. In addition, opaque$_2$ scenarios require the compositional reading to be blocked for independent reasons. Hence, opaque$_2$ orders are predicted to arise only under very specific conditions, thus explaining its rarity.

This section captures empirical generalizations on the transparency of valency markers. An important empirical generalization that can be drawn from this chapter is that there seems to be a crosslinguistically stable morphological rule that requires causatives to be realized in proximity of the verb root, while other opaque patterns do not follow a systematic pattern. A theoretical modeling of these findings is suggested in chapter 8.7.

5.2 Nontransitivity and noncumulativity

This section deals with the phenomena of non-transitivity and non-cumulativity, in which morphotactic rules seem to overwrite the general assumption that affix order is transitive.

5.2.1 Non-transitivity

The notion **non-transitivity** was introduced by Ryan (2010) to describe affix ordering patterns in which an affix A precedes an affix B which itself precedes affix C. Affix C, however, precedes affix A. By definition, non-transitivity is considered to occur only without optionality, as summarized in (27).

(27) *Nontransitivity* (roughly following Ryan 2010)
Three affixes (A, B and C) are in a nontransitive configuration if:
→A and B occur only in the order A-B,
→B and C occur only in the order B-C and
→A and C occur only in the order C-A.

In the literature, at least four different cases of non-transitivity are described.
Ryan (2010) quotes an example from nontransitivity in Tucano (Tucanoan, Brazil), originally put forth by Grimes (1983). The relevant example is provided in (28). In Tucano, the desiderative marker precedes the negative marker, as in (28a). The negative marker, on the other hand, precedes *cã'*, the marker of emphasis, illustrated here in (28b). The marker of emphasis, however, precedes the desiderative, as in (28c) and (28d). The description of the pattern in Grimes (1983) is fatally poor. Concretely, the author provides rather abstract examples without any translation. Without a translation, an evaluation of the examples with respect to their semantics is not possible. The fact that the emphatic marker *cã'* is involved suggests that the nontransitivity might arise from semantic conditions on affix order. Specifically, it could easily be assumed that the emphatic marker takes scope over the negation in (28b) but over the stem in (28c) and (28d). Moreover, Grimes (1983) does not provide examples illustrating that the opposite orders are in fact ungrammatical. Thus, it cannot be excluded that the relative order stem<EMPH<NEG is actually grammatical in a context where the emphatic marker takes scope over the verb stem. In fact, the grammar by West (1980) on Tucano confirms the relative order of the markers in (28b), (28c) and (28d), but not (28a). Moreover, a desiderative marker is not described

in further detail.[8] Furthermore, the pattern is entirely absent in the related Tucanoan language Wanano (Stenzel 2004), which was examined as part of the sample. In all, I conclude that there is no compelling evidence that this case of nontransitivity actually arises from **morphotactic** requirements of language, unless semantic correlates can be excluded as an explanatory factor.

(28) Nontransitivity in Tucano (Grimes 1983: 7)

a. stem-sĩr'ĩ-ti-TNS
stem-DESID-NEG-TNS

b. stem-ti-cã'-TNS
stem-NEG-EMPH-TNS

c. stem-cã'-sĩr'ĩ-mi-TNS
stem-EMPH-DESID-3.MASC-TNS

d. stem-nu'-cã'-sĩr'ĩ-TNS
stem-always-EMPH-DESID-TNS

Buell et al. (2014) discuss a transitivity violation in the relative order of three valency markers in Wolof (Atlantic-Congo, Senegal), the causative, the instrumental and the benefactive applicative. As shown in (29), the instrumental has to precede the causative, as shown in (29a). The benefactive, on the other hand, precedes the instrumental, illustrated in (29c). The causative, however, has to precede the benefactive. The opposite surface forms are ungrammatical, see (29b), (29d) and (29f).

(29) Non-transitivity of valency markers in Wolof (Buell et al. 2014: 79f)

a. Gàllaay dóór-e-lo-naa Faatu xeer bi (ag) bant
Gallaay hit-INST-CAUS-FIN Faatu stone with a stick

b. *Gàllaay dóór-lo-e-naa Faatu xeer bi (ag) bant
Gallaay hit-CAUS-INST-FIN Faatu stone with a stick
'Gallaay made Faatu hit the stone with a stick.'

c. Gàllaay togg-al-e-na Faatu yàpp diwtiir.
Gallaay cook-BEN-INST-FIN Faatu meat palm.oil

d. *Gàllaay togg-e-al-na Faatu yàpp diwtiir.
Gallaay cook-INST-BEN-FIN Faatu meat palm.oil
'Gallaay cooked Faatu some meat with palm oil.'

e. Gàllaay bin-loo-al-na gan gi xale yi taalif.
Gallaay wrote-CAUS-BEN-FIN guest the child the poem

f. *Gàllaay bin-al-loo-na gan gi xale yi taalif.
Gallaay wrote-BEN-CAUS-FIN guest the child the poem
'Gallaay made the children write the visitor a poem.'

[8] It is worth noting that the description by West (1980) lists a couple of independent verbal auxiliaries with a similar shape like *sĩr'ĩ*. Concretely, all verbal suffixes are monosyllabic, whereas auxiliaries are bisyllabic since the second syllable can be analysed as a marker of inflection.

Buell et al. (2014) note that this instance of nontransitivity cannot be derived under the assumption that the affix order corresponds to a strict hierarchy of syntactic heads. However, Buell et al. (2014) do not consider the semantic interpretation of the examples. Especially for the interaction of instrumental and causative, it could be the case that the instrument refers to the causativized subevent or to the event of causation. In the former case, it would be expected that the instrumental is closer to the root than the causative, although it would be expected to be external to the causative in the latter case. The example in (29a) is badly chosen by Buell et al. (2014) since the interpretation does not imply which event the instrument refers to. In other words, the grammatical surface form in (29a) is fully transparent with the interpretation that the instrument refers to the subevent of hitting. This might also explain the ungrammaticality of the reverse surface form in (29b). Given that the instrument refers to the subevent, the order in (29b) is unexpected to begin with. In other words, an ungrammatical example of a sentence in which the instrument can only make reference to the event of causation would be clearly more convincing to illustrate the ungrammaticality of the form. As for the relative order between the benefactive and the instrumental in (29c) and (29d), the underlying semantic structure is hard to determine. The same holds for the interaction between the causative and the benefactive in (29e) and (29f), as I discussed in chapter 5.1. I see two analytical options for the examples in (29): first, it is entirely conceivable that all grammatical examples are semantically transparent while the ungrammatical examples arise from requirements on semantic transparency. In these terms, this case of non-transitivity does not necessarily arise from morphotactic constraints on the relative order of the affixes, since semantic/syntactic factors seem to play a role.

Another instance of nontransitivity is described by Jacobsen (1964, 1973) and Benz (2017) for Washo (isolate, USA). In Washo, the affixes involved in nontransitivity include the inclusive suffixes DU.INCL and PL.INCL, which precede the near future marker, as shown in (30a). The NEAR.FUT marker *á̌šaʔ* precedes negation, see (30b). Negation, however, precedes the inclusive suffixes, compare (30d) and (30c).

(30) Nontransitivity in Washo (Jacobsen 1964, 1973)

a. le-ímeʔ-ši-ášaʔ-i
   1-drink-DU.INCL-NEAR.FUT-IND
   'Both of us are going to drink.'

b. le-ímeʔ-ášaʔ-éːs-i
   1-drink-NEAR.FUT-NEG-IND
   'I will not drink'

c. *le-ímeʔ-ši-éːs-leg-i
   1-drink-DU.INCL-NEG-REC.PST-IND
   'Both of us did not drink.'

d. le-ímeʔ-éːs-ši-leg-i
   1-drink-NEG-DU.INCL-REC.PST-IND
   'Both of us did not drink.'

If negation, NEAR.FUT and the inclusive suffixes cooccur, there is only one possible ordering, as shown in (31).

(31) 3-affix-clusters (Jacobsen 1964, 1973)

a. lé-íme?-áša?-éːs-hu-i
   1-drink-NEAR.FUT-NEG-PL.INCL-IND
   'We (incl.) are not going to drink.'

b. *lé-íme?-hu-áša?-éːs-i
   1-drink-PL.INCL-NEAR.FUT-NEG-IND

c. *lé-íme?-éːs-hu-áša?-i
   1-drink-NEG-PL.INCL-NEAR.FUT-IND

Jacobsen (1964) observes that some of the affixes involved in nontransitivity like NEAR.FUT, NEG and Q are inherently stressed and suspects that the phenomenon arises due to prosodic restrictions of the language. Concretely, he notes:

> *'The effect of this shifting around is to insure an even distribution of stressed and unstressed syllables and to draw most sequences of unstressed suffixes to the end of the word.'* (Jacobsen 1964)

This is formalized by Benz (2017), who implements exactly these observations by Jacobsen (1964), and argues that nontransitivity in Washo instantiates a case of phonologically conditioned affix order. A more detailed summary of the formal implementation by Benz (2017) in Stratal OT (Kiparsky 2000, Bermúdez-Otero 2011) is provided in chapter 8.5. Roughly, the empirical generalization by Benz (2017) is that stressed and unstressed syllables should alternate. Since some affixes are inherently stressed, they are shifted to the position which is optimal with respects to the phonotactic requirements of the language. Benz (2017) argues that a phonological analysis should be preferred to a morphotactic one since reference to the phonological structure of the affixes explains the natural class of affixes involved in nontransitivity: while the causative and the inclusive suffixes do not form a natural class in terms of syntax or semantics, they share a phonological structure as their markers are unstressed CV syllables. The question marker *héːs* and the negation *éːs* also form a natural phonological class as they are both inherently stressed, monosyllabic affixes. Moreover, the phonological analysis of nontransitivity by Benz (2017) explains an example of an opaque ordering of NEG and CAUS. Specifically, the sentence in (32) is interpreted as a prohibition against killing such that the negation takes scope over the causative. However, Washo allows only for the order of NEG preceding CAUS which should lead to a different interpretation according to the Mirror Principle (Baker 1985). The order of CAUS preceding NEG is ungrammatical, as shown in (32b). The ungrammaticality of (32b) is predicted by the analysis by Benz (2017), since this surface order involves a sequence of two unstressed syllables (*li-ha*), thus violating the generalization that stressed and unstressed syllables should alternate.

(32) Opaque ordering of CAUS and NEG (Jacobsen 1964, 1973)

a. Ge-yúli-éːs-ha.
IMP-die-NEG-CAUS
'Don't kill it!'

b. *Ge-yúli-ha-éːs.
IMP-die-CAUS-NEG
intended: 'Don't kill it.'

A final example of nontransitivity is by Newbold (2013) for Kuna (Chibchan, Panama) and confirmed by Newbold (2013). The relevant data is illustrated in (33). Concretely, the future marker *-o(e)* precedes the negation in (33a) which itself precedes the plural marker in (33b). The plural marker, however, precedes the future marker, as shown in (33c). When all three markers coccur, there is optionality between (33d) and (33e) although Newbold (2013) notes that (33d) appears more frequently. It is worth mentioning that the plural marker is actually representative of a small group of affixes that exhibit exactly the same behaviour. Concretely, the plural marker shows the same ordering patterns like *-moga* 'also' and *-bali* 'again'.

(33) Nontransitivity of FUT, NEG and PL (Newbold 2013)

a. Nu-gu-o-sur-iye.
good-COP-FUT-NEG-QUOT
'It was said that he wouldn't get better.'

b. dak-sur-mala.
see-NEG-PL
'to not see (pl.)'

c. Oyo-na-mal-oe.
show-go-PL-FUT
'They will go show (the place to you).'

d. dak-o-sur-mar-ye
see-FUT-NEG-PL-QUOT
'(He said) You (pl.) won't see him anymore'

e. na-mal-o-suli
go-PL-FUT-NEG
'They won't go.'

f. *STEM-suli-mala-oe.
stem-NEG-PL-FUT

Newbold (2013) does not provide an explanation for the pattern, nor are semantic or phonological correlates discussed. Smith (2014) shows that not all suffixes in Kuna behave similary with respect to stress assignment. The generalization is that stress generally falls on the penultimate syllable of the word, illustrated for a simple word in (34a), where word stress is indicated by an acute accent. Some affixes are counted when stress is assigned and can therefore be assumed to be part of the stress domain, as shown for the diminutive in (34b). Some verbal affixes, however, are outside the stress domain. This is shown in (34c), where the inchoative suffix is relevant for stress assigment, while the plural marker is not. Unfortunately, Smith (2014) does not provide an exhaustive description of all affixes as to whether they belong to the stress domain or not. Given the underdescription of the phonological properties of the markers involved in nontranstivity in Kuna, it cannot ultimately be excluded that phonology conditions the phenomenon.

(34) Inner vs. outer affixes in stress assignment (Smith 2014)

a. dú.le
person

b. o.mé-gwa
woman-DIM
'a little woman'

c. ób-de-mar
bathe-INCH-PL
'start bathing (PL)'

To conclude, it seems that the cases of nontransitivity in Tucano and Wolof can partially be explained when the semantic structure of the verbal form is taken into consideration. The case of nontransitivity in Washo is argued to be driven by phonotactic requirements on the prosodic structure of the word. The case of nontransivity in Kuna, on the other hand, lacks a semantic or phonological explanation. However, the last case is clearly underdescribed with respect to the semantic and phonological correlates of the affixes. Consequently, a morphotactic explanation for the pattern in (33) is rather a result from underdescription and can possible be resolved when more factors are taken into consideration. **At this point, I hypothesize that there is no case of entirely morphologically driven nontransitivity, such that there are no morphological rules that require the surface forms A-B, B-C and C-A.**

5.2.2 Non-cumulativity

The term **noncumulativity** was introduced by Newbold (2013) to describe affix ordering patterns in which a morpheme A precedes morpheme B which itself precedes morpheme C. If all three morphemes are combined, however, the order is not A-B-C. In contrast to patterns of nontransitivity in (27), which do not make any predictions about combinations of three morphemes, noncumulativity (see (35)) is a special case of variable ordering that occurs only when a third morpheme is involved.

(35) *Noncumulativity* (roughly following Newbold 2013)
Three affixes (A, B and C) are in a noncumulative configuration if:

→A and B occur only in the order A-B,

→B and C occur only in the order B-C and

→A, B and C do not occur in the order A-B-C.

One example of noncumulativity comes from Kavalan (Austronesian, Taiwan). In negative sentences in Kavalan, a small number of bound marker occurs on the negative morpheme instead of the verb: the absolutive agreement markers and five different TMA markers: the future marker *pa*, the change-of-state marker *ti*, the imperative marker *ka*, the hedge marker *ma* and a marker that restricts temporal alternatives *pama* (Yen & Billings 2012). Out of the five TMA markers, only four combinations are attested, as shown in (36). Crucially, the order of these four affix pairs is fixed.

(36) Fixed order of two TMA markers (Yen & Billings 2012)

a. Mai=pa=ti (*=ti=pa) qainəp ti aßas anuqaχaßi.
NEG=FUT=COS sleep PROPER Abas tonight
'Abas won't sleep tonight.'

b. Assi=ka=ti (*=ti=ka) q<m>an.
NEG=IMP=COS <AV>drink
'Don't keep drinking!'

c. Mai=ti=ma (*ma=ti) m-issi ti aßas.
NEG=COS=HEDGE AV-fat PROPER Abas
'Abas is no longer very fat.'

d. Assi=ka=pama (*=pama=ka) q<m>an tu χaq.
NEG=IMP=YET <AV>drink OBL alcohol
'Don't keep drinking alcohol!'

When one of the five TMA markers occurs with an absolutive agreement marker, the TMA marker strictly precedes the ABS marker, as shown in (37). This generalization holds for all five different TMA markers and all absolutive markers.

(37) Fixed orders of TMA and ABS (Yen & Billings 2012)

a. Mai=pa=isu (*=isu=pa) qainəp χaßi zau.
NEG=FUT=ABS.2SG sleep night DET
'Won't you sleep tonight?'

b. Assi=ka=imi (*=imi=ka) pukun-an.
NEG=IMP=ABS.1PL beat-PV
'Don't beat us!'

c. Mai=ti=iku (*=iku=ti) q<m>an tu χaq.
NEG=COS=1SG.ABS <AV>drink OBL alcohol
'I don't drink alcohol any longer.'

d. Mai=ma=iku (*=iku=ma) m-issi.
NEG=HEDGE=ABS.1SG AV-fat
'I am not very fat.'

When the four pairs of TMA markers in (36) occur together with absolutive markers, there is consistent optionality between TMA-TMA-ABS in (38a), (38c) and (38e), and TMA-ABS-TMA, see (38b), (38d) and (38f). Crucially, the order in which the absolutive clitic intervenes between the two TMA clitics is **non-cumulative**, since the combination of examples in (36) and (37) suggests that only the order TMA-TMA-ABS should surface. Thus, Kavalan exhibits optional noncumulativity in verbal forms that contain two TMA markers and an absolutive marker.

(38) Variable orders of two TMA markers and ABS (Yen & Billings 2012)

a. Qainəp=pa=ti=iku.
   sleep=FUT=COS=ABS.1SG
   'I'm going to bed.'

b. Qatiw=pa=iku=ti.
   go=FUT=ABS.1SG=COS
   'I'm going fishing.'

c. Assi=ka=ti=imi pukun-an.
   NEG=IMP=COS=ABS.1PL beat-PV

d. Assi=ka=imi=ti pukun-an.
   NEG=IMP=ABS.1PL=COS beat-PV
   'Don't beat us!'

e. Assi=ka=pama=imi pukun-an.
   NEG=IMP=YET=ABS.1PL beat-PV

f. Assi=ka=imi=pama pukun-an.
   NEG=IMP=ABS.1PL=YET beat-PV
   'Don't keep beat us!'

From the description provided by Yen & Billings (2012), it is unclear what triggers the noncumulativity in Kavalan as absolutive agreement is not expected to interact semantically with tense, mood or aspect. It is important to note that the language-specific restrictions that trigger the patterns in (38) cannot simply be assumed to arise from a tension between language-specific requirements on the morphological wellformedness of the word and some type of default affix order provided by syntax or semantics, as commonly assumed for asymmetric compositionality in Bantu languages. Concretely, it would be inappropriate to assume the order in (38a) is the default order provided by syntax or semantics while the order in (38b) is provided by templatic restrictions of Kavalan, since this assumption would predict optionality in (37), as well. It is important to note that the description in Yen & Billings (2012) is insufficient since it does not discuss potential semantic or phonological correlates, nor does it provide information about the distribution of the optionality. Thus, it cannot fully be concluded that the patterns arises from **morphotactic requirements.** A second case of non-cumulativity is found in Apurinã, between the progressive marker, the causative and the suffix *-ta*, an affix that Facundes (2000) considers to be transitivizing marker. Although *-ta* might have functioned as a transitivizer in the past, the linguistic examples in Facundes (2000) illustrate that the marker does not take over this function anymore. Rather, *-ta* acts as verbalizing affix: it is required non-verbal roots in order to host verbal affixes, as shown in (39), where it combines with nominal roots, which can then carry verbal agreement.

(39) *-ta* as a verbalizing suffix in Apurinã (Facundes 2000: 279f)

a. Karuwa-ta-no.
non.Indian-*ta*-1SG.OBJ
'I am acting like a non-Indian.'

b. Nhi-nhipoko-ta.
1SG-food-VBLZ
'I eat.'

With verbal roots, however, the appearance of the verbalizer depends on the presence of other suffixes. With these roots, the grammatical function of this affix is unclear. This is shown in (40). Crucially, the root *atama* can host 1SG agreement in (40a) with *ta* being optional. However, when the same root combines with other verbal suffixes, such as the desiderative or the distributive, it is obligatory, as shown in (40b) and (40c). These examples show that *ta* deviates from canonical properties assigned to verbalizing suffixes, since its appearance is not exclusively depending on the root, but rather on the presence of affixes. Moreover, its position within the word is peculiar: if it were a verbalizer required by certain non-verbal roots to host certain categories, it would be expected that a root needs to be verbalizer prior to being attached with verbal affixes. This would predict that the verbalizer should be closer to the root than the verbal affixes. However, *ta* is external to the distributive and the desiderative in (40b) and (40c).

(40) Distribution of *-ta* in Apurinã (Facundes 2000: 322f)

a. N-atama-(ta).
1SG-see-*ta*
'I saw.'

b. N-atama-poko-*(ta).
1SG-see-DISTR-*ta*
'I saw around.'

c. N-atama-ene-*(ta).
1SG-see-DESID-*ta*
'I wanted to see.'

Crucially, not all suffixes require the presence of *ta*. Among the suffixes that are in a dependency relation with *ta* are not only the distributive in (40b) and the desiderative in (40c), but also an intransitivizer, the augmentative, a marker of emphasis, the collective marker and the progressive. Other verbal suffixes, like the habitual or the reciprocal, do not require the presence of *ta*. It is important to note that the group of markers requiring *ta* does not form a natural semantic or phonological class to the exclusion of affixes that do not require *ta*.
When the verbalizer occurs with the progressive marker *nanu*, it strictly follows it, as shown in (41). Crucially, *ta* seems to be obligatory in the context of a progressive.

(41) Strict ordering of PROG and *ta* (Facundes 2000: p.314)

a. O-nhika-nanu-ta-ru.
3FEM-eat-PROG-VBLZ-3SG.OBJ
'She is eating it.'

b. P-irika-nanu-ta.
2-fall-PROG-VBLZ
'You are falling down.'

As for the causative, the description by Facundes (2000) suggests that the causative is a suffix that does not require the presence of *ta*, since it is optional in (42a). As shown in (42b), the reverse order with causative being internal to the verbalizer is ungrammatical.

(42) Strict ordering of CAUS and *ta* (Facundes 2000: p. 328f.)

a. Nhi-nhika-(ta)-ka.
1SG-eat-VBLZ-CAUS
'I made eat.'

b. *Nhi-nhika-ka-ta.
1SG-eat-CAUS-VBLZ

When the causative and the progressive combine, *ta* has to be present, probably due to the morphological dependency relation between the progressive and *ta*. In this situation, the causative suddenly precedes *ta*, while the relative order between the causative and the progressive is flexible, compare (43a) and (43b). The examples in (43) are instances of non-cumulativity: the combination of the examples in (41) and (42) would imply the surface order PROG-VBLZ-CAUS. However, exactly this surface order is not attested, though not explicitly excluded by Facundes (2000). Instead, the causative **precedes** *ta* only in this particular context. This scenario further shows that the dependency between the progressive and *ta* is seemingly non-local.

(43) Order of PROG, CAUS and VBLZ in Apurinã (Facundes 2000: p. 310, 507)

a. Nhi-nhika-nanu-ka-ta-ru yapa.
1SG-eat-PROG-CAUS-VBLZ-3MASC.OBJ capibara
'I am making him eat capibara.'

b. Amarunu n-umaka-ka-nanu-ta
boy 1SG-sleep-CAUS-PROG-VBLZ
'I am making the kid sleep.'

Chapter 6

Phonologically conditioned affix order

In the previous chapter, I discussed the example of causative shifts in Bemba, where reordering of the causative is the only possibility to avoid a phonologically marked structure. Moreover, I have illustrated that the pattern of nontransitivity in Washo and the natural class of affixes involved can be explained if the prosodic structure of the word is taken into account, as argued by Jacobsen (1964, 1973). The core generalization is that stressed and unstressed syllables alternate. Since some affixes are inherently stressed, they are shifted to the position which is optimal with respect to the prosodic structure of Washo. In these two cases, the resulting order of the affixes is sensitive to the phonological form of the affixes: if the affixes had a different shape, reordering would not be expected. In that sense, affix order in Bemba and Washo is **phonologically conditioned**.

Patterns of phonologically condtioned affix order (PCAO) are particularly revelant for linguistic theory since they provide considerable insights into the exact structure of the morphology-phonology interface. Along these lines, two different models of the morphology-phonology interface are conceivable: first, there are models in which the phonology has global access and the power to affect morphological structure, which is why they are called P(honology) » M(orphology) models. These models predict the existence of **true** PCAO, in the sense that affix order is conditioned by independently motivated phonological rules. Thus, reordering of entire affixes is predicted to apply for reasons of phonological optimization. The empirical predictions of those approaches are summarized in (1), following Paster (2009).

(1) Predictions of P » M for PCAO (Paster 2009: 23)

a. Phonology can produce morpheme orderings that disobey other principles (i.e., PCAO exists).
b. Entire morphemes, not just segments, may be phonologically ordered.
c. A sequence of multiple affixes may be re-ordered for reasons of phonological optimization.
d. PCAO results from externally motivated phonological constraints.

P » M models are discussed critically in the literature, since the global access of phonology to morphological structure makes this model extremely powerful (Paster 2006, 2009, Embick 2010). Subcategorization models of PCAO (Yu 2003, 2007), on the other hand, are a more restricted than P » M models of the morphology-phonology interface. In these models, affixes are equipped with selectional restrictions, which may but do not have to make reference to phonological structure. As an example, an affix might be subcategorized for being ordered to the right of a stressed syllable, after a consonant cluster etc. In these models, the phonological component of the grammar is not actively affecting the morphological structure of the affixes. Rather, phonological structure has been fossilized in rules of morphology. The empirical predictions by subcategorization approaches have been summarized by Paster (2009) and are presented here in (2).

(2) Predictions of subcategorization approach to PCAO (Paster 2009: 24)

a. True PCAO does not exist.
b. Segments belonging to affixes may undergo phonological metathesis, but entire affixes cannot.
c. No case exists in which multiple affixes are phonologically ordered with respect to each other.
d. Phonological conditions on the placement of affixes may or may not be phonologically optimizing.

In short, subcategorization approaches allow morphological rules to make reference to phonological structure to explain affix ordering patterns of a given language, while true phonologically-conditioned affix order really makes reference to phonological rules.

In this chapter, I will review previously described cases of phonologically conditioned affix order and evaluate whether they can be analysed by means of subcategorization or whether they require a P » M model of the morphology-phonology interface.

In Choguita Rarámuri (Uto-Aztecan, Mexico), the relative order of desiderative and evidentiality marker is driven by phonological factors. The generalization by Caballero (2008, 2010) is that the desiderative precedes the evidentiality marker when stress falls on the ultimate syllable of the stem, as in (3b) whereas the evidentiality marker precedes the desiderative when stress, indicated by an acute accent in (3), falls on the penultimate syllable of the stem, as in (3a). Semantically, the evidentiality marker always modifies the entire proposition independent of the presence of a desiderative marker. In other words, the surface order in (3b) matches the semantic composition of the two markers while (3a) violates it. The case of phonologically-conditioned suffix placement in Choguita Rarámuri can be analysed in terms of subcategorization: first, the ordering of the suffixes is not phonologically optimizing, since the alternative, semantically compositional surface order *kéči-nale-ča* does not violate phonotactic principles of the language. Rather, it seems that the affix have independent positioning preferences that make reference to phonological features. Concretely, Caballero (2008) shows that the patterns can be explained under the assumption that the evidentialy marker subcategorizes for a foot to its left.

(3) Order of DESID and EVID (Caballero 2008: 348f)

a. Á birá čikle kéči-ča-nale.
AFFIRM really gum chew-EVID-DESID
'It sounds like the kids want to chew gum.'

b. wikará-n-čane
sing-DESID-EVID
'It sounds like they want to sing.'

Kim (2010) discusses the phenomenon of mobile affixation in Huave. In this language, a closed group of affixes is mobile. That is, their relative position with respect to the verb depends on phonological properties, yet their distance to the verb and their relative order with respect to other affixes does not change. Concretely, the 1st person subordinate marker *-n-* is a suffix in (4a) but a prefix in (4b). The completive *-t-* is a prefix in (4c) but a suffix in (4d). The 1st person marker *-(iu)s-* is a suffix in (4c) and (4d) but a prefix in (4a), where it is palatalized to *x-*.

(4) Mobile affix placement in Huave (Kim 2010: 134)

a. x-i-n-a-jch
1-FUT-1SUB-TV-give
'I will give'

b. pajk-a-n
face.up-EV-1SUB
'(that) I lie face up'

c. t-a-jch-ius
COMPLET-TV-give-1
'I gave'

d. pajk-a-t-u-s
face.up-EV-COMPLET-ITER-1
'I laid face up.'

Kim (2010) argues that these affixes are suffixes by default. In the context of vowel-initial stems like *a-jch* in (4a) and (4c), however, mobile affixes surface as prefixes. Kim (2010) further argues that the prefix position optimizes the phonological profile of the word. Concretely, consonant clusters in Huave are typically resolved by epenthesis, as shown in (4b) where the epenthetic vowel *a* surfaces between the stem and the 1st person subordinate marker. If the mobile affix is realized in a prefixal position with vowel-initial stems, however, vowel epenthesis becomes unnecessary. Thus, mobile affixation is an alternative strategy to optimize the phonological structure. Interestingly, the relative distance between the mobile affixes and the stem and the relative distance to other affixes does not change. Specifically, the 1st person subordinate marker *-n-* is always the innermost affix attached inside other categories like future or reflexive. The 1st person marker *-(iu)s-* always attaches outside categories like future or reflexive independent of its relative position to the verb. Kim (2008, 2010) thoroughly discusses whether mobile affixation can be analysed in terms of subcategorization frames and reaches the conclusion that a P » M analysis is highly desirable since mobile affixation in Huave would require two separate subcategorization frames – one for the prefixal allomorph and one for the suffixal allomorph.

In the Cushitic language Afar, spoken in Ethiopia, there is phonologically conditioned mobile affixation of several affixes, including the 2SG affix *t*. This is illustrated in (5). In (5b), the 2SG marker *t* is realized as a suffix. The resulting structure *dunuq-t* involves a consonant cluster at the end. Due to a phonotactic requirement of Afar, vowel epenthesis applies such that the resulting structure *dunuq-t-e* does not include a complex coda anymore. In (5a), in contrast, the root starts in a vowel but ends in a consonant. Realizing the 2SG marker *t* as a suffix would yield the structure *uktubt*. This structure is phonologically suboptimal, since there is no consonantal onset in the first syllable. According to Rucart (2006), the phonotactics of Afar require strict sequences of CV(C) syllables. Having *t* realized as a prefix resolves this issue, since the resulting structure *tuktub* produces the required CVC.CVC structure. In that sense, mobile affixation in Afar is in fact phonologically optimizing and results from the general principle of onset maximization (and coda minimization) (Pulgram 1970, Vennemann 1988, Kahn 1976). According to Rucart (2006), these principles yield a verbal template of CV(C) sequences. Even though Rucart (2006) does not provide full-fledged analyses of entire words, the assumptions made about Afar may potentially derive entire words, rather than the position of single affixes. In that sense, Afar is an example where phonological structure explains the order of affixes of entire words.

(5) Mobile affixation in Afar (Rucart 2006: 213f)

a. t-uktub-e
   2SG-write-EV
   'you wrote'

b. dunuq-t-e
   push-2SG-EV
   'you pushed'

In Western Armenian, there is mobile affixation of the indicative affix *g(V)*, as described by Bezrukov & Dolatian (2020) The conditions influencing the affixal status of the affix are subject to dialectal variation. In the Hamshen dialect of Western Armenian, *g(V)* is a prefix in the context of vowel-initial verbs but a suffix with consonant-initial verbs, as shown in (6). In that sense, the phonological condition on mobile affixation is somewhat similar to mobile affixation in Huave and Afar since the mobile affix is a prefix with vowel-initial verbs, as in (6a).

(6) Mobile affixation in Hamshen Armenian (Bezrukov & Dolatian 2020: 1)

a. g-arnes
IND-take.2SG
'you take'

b. xosis-gu
speak.2SG-IND
'you speak'

In the dialect of Gyumri of Western Armenian, the phonological condition may be overwritten in certain syntactic contexts, as argued by Bezrukov & Dolatian (2020). Consider the examples in (7). The example in (7a) includes a transitive, consonant-initial verb where the object is covert. In that sentence, the indicative is realized as a suffix, as predicted by the rules of phonology. If the object is overt and unstressed, indicating that the object does not comprise new information, as in (7b), the indicative is also realized in a suffixal position. In (7c), however, the object argument is stressed, as indicated by the underlining, suggesting that the object encodes new information. In that context, the indicative is realized as a prefix although the phonological context for prefixation is not given. To account for the distribution of the affix, Bezrukov & Dolatian (2020) conclude that syntactic structure is relevant: the authors set up the generalization that the affix is in a prefixal position whenever the VP consists of more than a verb, that is, if the preverbal position is occupied. **In that sense, Gyumri Armenian is the only example in which syntactic structure seems to be crucial to account for the distribution of affixes.** However, there is an alternative solution that has not been discussed thoroughly enough by Bezrukov & Dolatian (2020): an alternative generalization is that the indicative affix is realized to the right of the stressed constituent. In that sense, the pattern could be analysed by means of a subcategorization frame. Concretely, the indicative is a prefix only when the object is stressed due to information-structural reasons, as in (7c). If it is unstressed, stress is on the verb and the indicative occurs to the right of the word, as in (7a) and (7b).

(7) Unexpected mobile affixation in Gyumri Armenian (Bezrukov & Dolatian 2020: 4)

a. Ara-n t͡saxe-gə
Ara-DEF sell-IND
'Ara is selling.'

b. Ara-n girkʰ-ə t͡saxe-gə
Ara-DEF book-DEF sell-IND
'Ara is selling the book.'

c. Ara-n girkʰ-ə kə-t͡saxe
Ara-DEF book-DEF IND-sell
'It is the book that Ara is selling.'

Another case of mobile affixation has been described by Jenks & Rose (2015) for Moro (Heibanic, Sudan). In Moro, incorporated object markers can occur either as prefixes or as suffixes. At first sight, the affixal status of the object markers seems to be depending on aspectual and spatial distinctions between the contexts. In (8a), the object marker is realized in a preverbal position. The relevant context is labeled *proximal imperfective* by Jenks & Rose (2015). In (8b), on the other hand, the same object marker occurs as a suffix in a context called *distal imperfective*.

(8) Mobile affixation in Moro (Jenks & Rose 2015: 270f)

a. g-a-ŋgá-vəleđ-a
3SG.SUBJ-IND-2SG-pull-IMPFV
'she is about to pull you'

b. g-á-vəleđ-á-ŋgá.
3SG.SUBJ-DIST.IMPFV-pull-DIST.IMPFV-2SG
'she is about to pull you there to here'

Jenks & Rose (2015) show that the distribution of the object markers can fully be explained by the tonal properties of the verbal form it attaches to. Specifically, the different morphosyntactic contexts require different tonal patterns. In contexts requiring either a tonal pattern with high tones only or without any high tones, object markers are realized as suffixes on the verb. This is the case in (8b). Specifically, the distal imperfective requires a pattern without any high tones. Consequently, high tones on the verb are forbidden. However, if the verb form adopts the default pattern, as in the context of proximal imperfectives in (8a), it requires a high tone at its left edge. Instead of inserting a high tone, the object marker already carrying a high tone is incorporated before the verb, thus providing the required high tone. In that sense, mobile affixation is phonologically optiming, since shifting the object marker to a prefixal position prevents tone epenthesis. A crucial assumption here is that the object marker carrying an inherent high tone is incorporated into the verbal domain in (8a). Thus, realizing the object marker equipped with a high tone in a preverbal position in (8b) would violate the ban against high tones. A considerable advantage of the phonology-based explanation of the distribution is that the contexts in which the object marker occurs as a prefix do not form a coherent morpho-syntactic class, but exhibit the same tonal properties.

Table 6.1 summarizes the properties of the different patterns of phonologically conditioned affix order. Apart from the the example from Choguita Rarámuri, phonologically conditioned affix order is always optimizing. In all of the examples apart from Washo and Afar, reordering the affixes is preferred to other repair operations, such as epenthesis (Huave, Moro, Western Armenian). That being said, it seems that these languages prefer affix metathesis to epenthesis, suggesting that epenthesis is more restricted or more marked than other phonological process. This generalization seems to be in line with epenthesis being more restricted than other processes. Specifically, epenthesis is more common in loan words than in native words (see Hall 2011 and references therein). Furthermore, it occurs less often than predicted by factorial typologies (see Moore-Cantwell 2016 and references therein).

Language	Subcat.?	Optimizing?	Several morphs?	Motivated?
Bemba	(✓)	✓	✗	✓
Choguita Rarámuri	✓	✗	✗	✗
Huave	✗	✓	✗	✓
Washo	✗	✓	✓	✓
Moro	✗	✓	✗	✓
Western Armenian	✓?	✓	✗	✓
Afar	✓	✓	✓	✓

Table 6.1: Properties of PCAO

Altogether, this summary of examples of phonologically conditioned affix order has revealed that phonological conditioned affix metathesis is almost always optimizing (with the exception of Choguita Rarámuri). Moreover, all predictions made by P » M models to the morphology-phonology interface, as listed in (1), are actually attested:

- In Washo, the causative is shifted to a position external to the negative marker for reasons of phonotactic optimization although this surface order disobeys principles of semantic compositionality. Thus, phonology can in fact produce morpheme orderings that violate other principles of affix order.

- In Moro, Choguita Rarámuri and Washo, the affixes reordered for phonological reasons consist of more than one segment, thus contradicting the prediction by subcategorization approaches that phonology can metathesize only segments, but not entire affixes. This observation shows that phonology needs to have access to morphological structure. In the remaining cases, it is always an affix consisting only of a single segment, which is metathesized. Thus, it is not clear if the phenomenon instantiates phonologically conditioned affix order, or phonologically conditioned segment metathesis. In chapter 8.5.2, I will show that causative shift in Bemba in fact instantiates phonological metathesis of a single segment, but still requires a P » M model, in which phonological constraints make reference to morpheme boundaries.

- P » M models predict that there should be languages in which all affixes or at least a large portion of affixes is ordered by phonological principles. Although a language in which all affixes are affected by phonology is not attested, phonological rules influence the position of all affixes within a stratum in Washo. Moreover, the poor description of affix ordering patterns in Afar suggests that words in Afar have to obey a prosodic template in the sense that the resulting word should be construed of sequences of CV(C) syllables. If this assumption turns out to be true, it would be predicted that all affixes should be affected by phonotactic requirements on words in Afar.

- The prediction that phonologically conditioned affix order results from externally motivated P constraints is tightly connected to the observation that PCAO is phonologically optimizing. In all of the optimizing cases of PCAO, the resulting affix order prevents a marked structure from surfacing: in Huave, Afar and Western Armenian, affix mobility is a strategy to avoid consonant clusters. In Moro, affix mobility provides a required high tone thus preventing tone epenthesis. In Washo, the affixes are ordered to obey general prosodic principles such as bans against sequences of stressed syllables. In Bemba, reordering the causative prevents vowel hiatus and consonant clusters.

Chapter 7

Previous approaches on morphotactics in affix order

Let me briefly summarize the empirical findings presented in this dissertation so far. In chapter 4, I have shown that the affixal status of certain verbal categories is not arbitrary but subject to strong cross-linguistic tendencies. Moreover, semantically meaningful combinations of affixes exhibit less variability than expected.
In chapter 5, I have demonstrated that there are idiosyncrasies in affix order that cannot be explained by semantic, syntactic and phonological rules: first, opaque combinations of derivational affixes are subject to a rule which forces the causative to be realized in proximity of the verbal base. Second, there are examples exhibiting nontransitivity and noncumulativity of affixes that lack a semantic, syntactic or phonological explanation. It is unclear whether this lack of explanation results from mere underdescription or points towards a morphology-internal explanation.
In sum, affix order is clearly conditioned by rules independent of semantics, syntax and phonology. This generalization necessitates an independent component in the grammar responsible for the implementation of these morphotactic rules. In the literature, there are several distributions postulating morphotactic rules. In this chapter, I will review the contributions by Ryan (2010), Crysmann & Bonami (2016) and Müller (2020).

7.1 Affix order in Information-based morphology

A large group of morphological approaches to affix order comprises **templatic approaches** that make use of **position classes**. While templates used in descriptive grammars serve as a purely descriptive device to visualise affix ordering patterns of languages with complex morphology, templatic approaches implement position classes as a concept in linguistic theory (Simpson & Withgott 1986, Kari 1989, Stump 1993, Nordlinger 2010, Crysmann & Bonami 2016). The idea behind templatic approaches is that affixes are associated with **position classes** in relative order to the stem. These position classes seem to lack any syntactic, semantic or phonological motivation (Inkelas 1993, Stiebels 2003). Good (2016), who investigates different types of templates from a crosslinguistic perspective by means of a several case studies, provides the following definition for a **template**:

> *'An analytical device used to characterize the linear realization of a linguistic constituent whose linear stipulations are unexpected from the point of view of a given linguist's approach to linguistic analysis'* (Good 2016: 7)

To reformulate this definition, the general principles on affix order, like semantic transparency, yield expectations about attested affix ordering patterns in the world's languages. However, these principles seem to be overwritten by languages exhibiting a large number of idiosyncrasies in affix order, such as the cases of nontransitivity and noncumulativity presented in chapter 5. As a consequence, additional rules need to be formulated to account for these patterns. Templatic approaches assume that position classes allow to account for exactly these idiosyncrasies in affix order. In this dissertation, I classify all approaches implementing *the relative position to the stem* as a primitive entity of the grammar as templatic approaches. These approaches differ as to whether they assume a fixed order of the position classes and the affixes therein, and if the morphological structure they assume is flat (Simpson & Withgott 1986, Kari 1989, Stump 1993, Nordlinger 2010, Crysmann & Bonami 2016) or cyclic (Inkelas 2016). In this chapter, I review the recent approach by Crysmann & Bonami (2016) as a representative analysis of templatic approaches.

An early approach forwarding position classes comes from Stump (1993) and is couched in Paradigm Function Morphology. Crysmann & Bonami (2016) take up this idea and suggest a model called **Information-based Morphology**, which combines an incremental-realisational model to morphology with Head-driven Phrase Structure Grammar (HPSG). Crysmann & Bonami (2016) take over the idea by earlier templatic approaches that affixes are associated with a specific position classes, resulting in a broad definition of templatic morphology in (1).

(1) Definition of a template (Crysmann & Bonami 2016: 314)

a. Classes of morphemes are associated with a rigid sequence of positions for the realisations of morphs.
b. Each position may be filled by at most one morph.
c. For each paradigm cell of each lexeme, the grammar specified a) which morphs it consists of, and b) which position(s) these morphs occur in.

A central idea is that the number of the position class(es) associated with a certain affix is stored in the featural specification of the vocabulary item along with other information like morphosyntactic information or the phonological form of the affix. The major advancement by Crysmann & Bonami (2016) as opposed to previous templatic approaches is that they can account for cases of variable affix order or conditioned placement of morphemes. One example of conditioned placement is the position of relativizing markers in Swahili (Bantoid, Tanzania), as shown in (2). The markers appear as prefixes in progressive present tense (and also in future, past and negative tenses), see (2a) and (2b), but as suffixes in positive present tense, demonstrated in (2c) and (2d), independent of the phonological form of the marker. That is, the phonological form depends only on the noun class of the relativized element but not on the position, such that the relativizer *ye* refers to arguments from noun class 1 (*m-/wa-*) while *cho* refers to objects from noun class 7 (*ki-vi*).

(2) Placement of relativizers in Swahili (Crysmann & Bonami 2016: 7-8)

a. a-na-ye-soma
   CL1-PROG-CL1.REL-read
   '(person) who is reading'

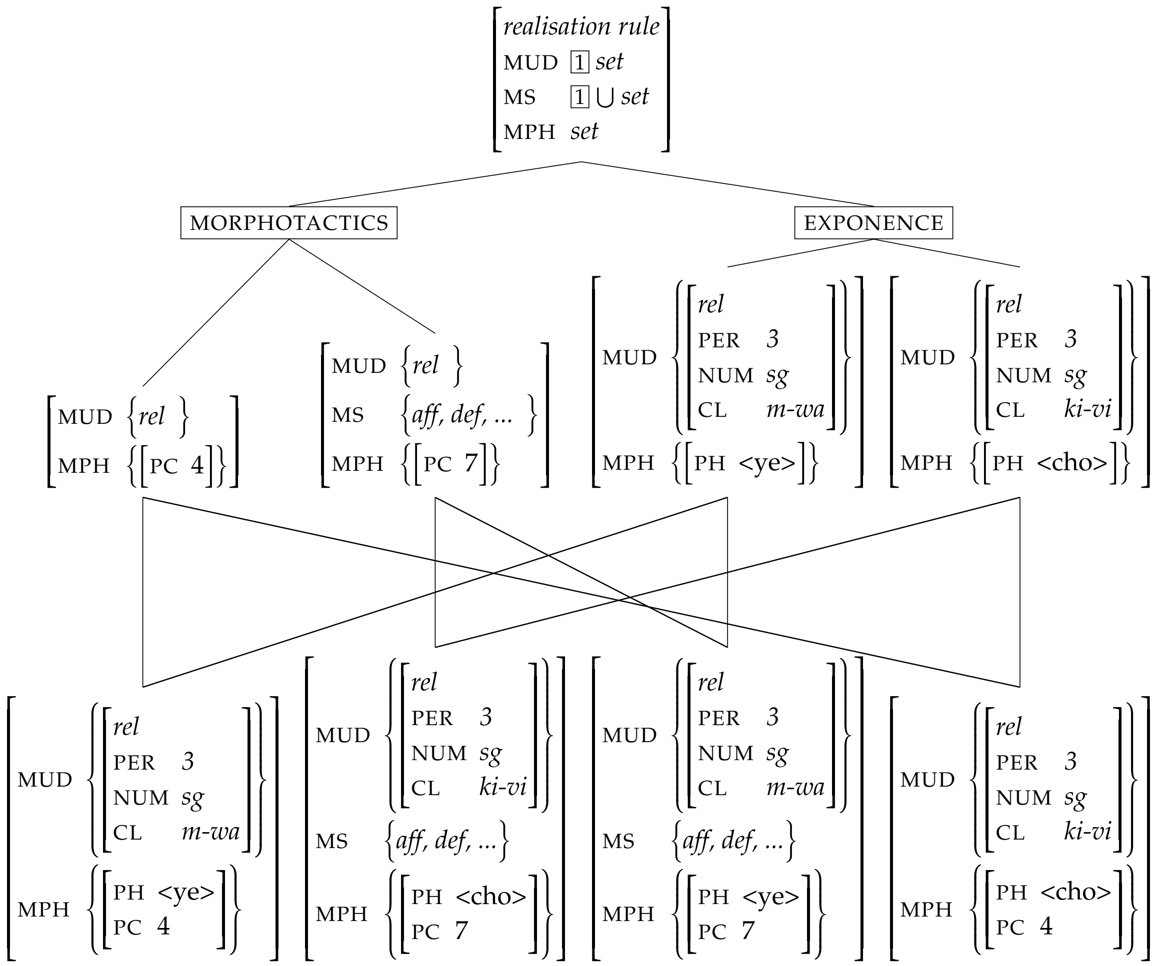
b. a-na-cho-ki-soma
   CL1-PROG-CL7.REL-CL7-read
   '(book) which he is reading'

c. a-soma-ye
   CL1-read-CL1.REL
   '(person) who reads'

d. a-ki-soma-cho
   CL1-CL7-read-CL7.REL
   '(book) which he reads'

The concrete analysis by Crysmann & Bonami (2016) explaining the conditioned placement of the relativizers in (2) is illustrated in (3). The feature sets on the bottom line of the schema illustrate full feature matrices of the relativizers from (2). Each matrix contains information about the morphosyntactic properties of the marker, which are listed as MUD (morphology under discussion). The MUD set contains the information that the marker in hand is a relativizer (*rel*) and features of the relativized argument. The set entitled MPH contains information about the morph realizing these features, including the phonological form PH and crucially, **the position class PC**, in which the marker is realized. In the examples in (2), each relativizer, or rather, each phonological form of a relativizer, can occur in two different positions. As shown in (3), there are two different feature sets for each phonological form, *cho* and *ye*. Crucially, these two feature matrices do not differ with respect to the MUD feature set since both sets realize the same information. However, they differ with respect to the PC value such that the affix will be realized either in position 4 or 7. Moreover, one of these two matrices, carries information about the context in which it is chosen, stored in MS. Concretely, the affix specified for position class 7 is chosen in the context of affirmative sentences, as indicated by the value MS {*aff, def, ...*}. Thus, Crysmann & Bonami (2016) analyse the case of conditioned placement of relativizers in Swahili as a result from a competition between two different affixes which have the same phonological form but differ with respect to their position. Crucially, one of these affixes is specified for context. Since this featural specification is then more specific than the other one, general principles of morphological blocking, such as Pāṇini's Principle or the Elsewhere condition (Kiparsky 1985), will always prefer the more specific marker to the more general one when the context for its application is given.

(3) Partial hierarchy of Swahili relative markers in (2)



In short, the position class of each affix is stored as a primitive entity of the lexical entry of each affix. These affixes are then concatenated by an abstract concatenation rule that makes reference to these position classes: an affix can only be concatenated to the right of an affix with a lower position class number and so on. Crysmann & Bonami (2016) further show that each individual feature structure does not emerge from scratch but results from language-specific rules of exponence and morphotactics. Let us now consider the feature structures in the middle line of the schema in (3). There are two feature blocks implementing rules of exponence in that they combine morphosyntactic information in MUD with the phonological structure in PH, such that each affix of the form *ye* refers to arguments of 3SG from noun class 1. In simpler terms, these rules encode the information about form and meaning. Rules on morphotactics make statements about the position class in a certain context of affixes with a certain MUD property. In the example in (3), morphotactic rules make statements about all relativizers such that a relativizer is realized in position class 4 by default or in position class 7 in the context of affirmative sentence with this particular context, provided in MS. These rules on morphotactics and exponence are then combined to create the four different feature structures in the bottom line with the PC values coming from rules of morphotactics while all other values come from rules of exponence.

Since the position class itself and a morphosyntactic environment of an affix can be implemented in the feature structures of the affixes, the analysis by Crysmann & Bonami (2016) has the power to derive a couple of anomalies in affix order. Consequently, it has been implemented to account for phenomena typically associated with templatic morphology. Diaz et al. (2019) use the approach by Crysmann & Bonami (2016) to account for morphological blocking in Oneida (Iroquoian, USA). Concretely, Diaz et al. (2019) show that certain affix combinations, like the partitive and the negative marker in Oneida, never cooccur, although the markers are likely to be semantically compatible. As shown in (4), the negative marker *té* and the partitive *ni* never cooccur. The examples in (4) differ only minimally, since the sentence in (4b) is the negated version of (4a). However, the partitive marker, which is present in (4a), is not realised in (4b). As argued by Diaz et al. (2019), the root *ot* 'to be so' cannot occur without the partitive. However, in the context of a negative, the partitive is blocked.

(4) NEG suppressing PART in Oneida (Diaz et al. 2019: 433)

a. tho ni-y-ót
that.is PART-NEUT-be.so(STAT)
'the way it is'

b. yah tho té-y-ot
not that NEG-NEUT-be.so(STAT)
'it's not the way'

Diaz et al. (2019) argue that this incompatibility arises from a competition between these affixes for one and the same slot. This morphologically conditioned incompatibility is taken to be evidence for slots or templates being a primitive part of the grammar. Consequently, this case of morphological blocking requires the grammar to make reference to the **relative position** to the verbal base and requires a framework like Crysmann & Bonami (2016) which is equipped with exactly these possibilities.

Although the framework by Crysmann & Bonami (2016) is very explicit and powerful enough to derive the various types of anomalies described in the realm of affix order, I want to bring up a major conceptual point of critique: in the previous chapters of this dissertation, I have shown that there are morphotactic rules that hold across languages. Moreover, requirements on semantic transparency are active, as well. It is unclear to me, how the crosslinguistically stable morphological or semantic rules could be integrated in the theory. It seems that these universal rules could possibly yield the morphotactic rules linking position classes and morphosyntactic informations. In chapter 5.1, I have shown that languages exhibit different patterns which result from the competition between rules on semantic transparency and universal morphotactic rules. It could be assumed that this competition takes place when the language-specific rules on morphotactics are generated. This assumption, however, would require some sort of grammar component during the generation of these rules. In simpler terms, I have shown in the previous chapters that the empirical challenge each account of affix order has to face is that there are strong crosslinguistic tendencies and all sorts of language-specific anomalies. The account by Crysmann & Bonami (2016) is clearly powerful enough to account for all these anomalies. However, it is unclear how the framework by Crysmann & Bonami (2016) derives morphological tendencies of affix placement, like the category-specific positioning preferences described in chapter 4.5, 4.6 and 5.1. Rather, it seems that their framework actually predicts unattested patterns, such as semantically opaque combinations of causative and applicative affixes, in which the applicative morpheme is closer to the root (APPL-CLOSE). Thus, allowing general tendencies on affix order to participate in the generation of the feature structures would actually strengthen the predictive adequacy of the proposal.

7.2 Bigram constraints

Ryan (2010) discusses patterns of unexpected cases of morphotactics, such as unexpected variable affix order or nontransitivity and concludes that affix order is regulated by a specific type of markedness constraint called *bigram constraint* which operates in the framework of Optimality Theory (OT). In chapter 5, I already discussed phenomena exhibiting exactly this type of unexpected morphotactic behaviour which is relevant for the discussion by Ryan (2010). Recall the case of nontransitivity between the desiderative, the negative marker and the marker of emphasis in Tucano, which was already discussed in chapter 5.2.1. The relevant examples are repeated in (5). Crucially, the desiderative precedes the negative marker in (5a), which itself precedes the marker of emphasis in (5b). The marker of emphasis, however, precedes the desiderative in (5c). Thus, the relative order between the three markers is not transitive. Instances of nontransitivity, as discussed in more detail in chapter 5.2.1, require an additional rule which regulates the pairwise ordering between the three categories. Ryan (2010) takes exactly these type of phenomena to be evidence for a rule that implements pairwise ordering in Optimality Theory (OT).

(5) Nontransitivity in Tucano (Grimes 1983: 7)

a. stem-sĩr'ĩ-ti-TNS
   stem-DESID-NEG-TNS

b. stem-ti-cã'-TNS
   stem-NEG-EMPH-TNS

c. stem-cã'-sĩr'ĩ-mi-TNS
   stem-EMPH-DESID-3.MASC-TNS

d. stem-nu'-cã'-sĩr'ĩ-TNS
stem-always-EMPH-DESID-TNS

Optimality Theory (OT) is a framework within Generative Grammar, and was first introduced by Prince & Smolensky (1993). The core idea is that the grammar of Human language consists of a set of **violable, rankable and universal rules**, which are referred to as *constraints* in OT. The grammars of each individual language results from an individual ranking of these constraints. A hypothetical morphological module operating in OT has the following components:

1. The *input*, which is taken from the lexicon in a pre-syntactic model and from the syntax in a post-syntactic model, is shifted to the independent morphological module, where the generator GEN produces manipulated instances of the input. Manipulations in affix order could be attaching an affix, deleting an affix, inserting an affix or repositioning an affix. Since GEN in Standard Parallel Optimality Theory (SPOT) will in principle generate an infinite set of manipulated copies of the input, it is common practice to present only the forms which are most likely to become a surface form.

2. This set of manipulated clones of the input is then shifted to the Evaluation component (EVAL), which is the core of the framework. In this particular step, the manipulated copies of the input, which are called *candidates*, are evaluated with respect to the ranking of constraints. The core idea is that the candidate with the best constraint profile becomes the optimal output candidate. This candidate will then surface in the language. Starting with the top-ranked constraints, all candidates are compared with each other. Those candidates violating this constraint receive a violation mark, typically illustrated by the asterisk *. At this point, candidates with one or more violation mark can no longer become optimal as long as there are candidates that do not violate the constraint. This principle is called *Strict Domination* meaning that a single violation of a high-ranked constraint is worse than multiple violations of constraints lower ranked.

3. The candidate with the best constraint profile is *optimal*. Again, the optimal candidate is not necessarily the one with the least violations overall but with the least violation in top-ranked constraints. This candidate, that is, the optimized morphological word, is then shifted to the next module for further optimization.

In the existing literature deriving affix order in SPOT, the lineariziation of affixes is often approached using general **alignment constraints** (Hargus & Tuttle 1997, Trommer 2001, 2003, 2008, Müller 2020, Zukoff 2022, 2021). A general definition of ALIGN-constraints, which are often abbreviated in the form CAT ⇒ R or L ⇐ CAT, is provided in (6).

(6) ALIGN-CAT-R (short CAT ⇒ R):
Assign a * for each exponent between an exponent of category CAT and the right edge of the word.

The core idea behind alignment constraints is that each affix is oriented towards a certain edge of the word: the left edge for prefixes, and the right edge for suffixes. Specifically, the EVAL component will take the constraint to be violated when another exponent is realized between the category that is aligned and the edge it orientates to. If several affixes need to be aligned, there will be alignment constraints for each separate affix. As for the examples in (5), there are three different alignment constraints for the negative, the desiderative and the emphatic marker, all of which are oriented towards the right edge of the word. In the tableau in (7), the constraints are labeled DESID ⇒ R, EMPH ⇒ R and NEG ⇒ R. In order to derive the relative order between the desiderative and the negation, two possible surface realizations are possible: NEG-EMPH and EMPH-NEG with the former pattern being the attested one in (5b). To derive the relative order, the constraints EMPH ⇒ R and NEG ⇒ R compete: EMPH ⇒ R enforces the emphatic marker to be realized as the rightmost affix, whereas NEG ⇒ R ensures the same fo the negative marker. Since only one affix can be the rightmost affix, one of the constraints is necessarily violated. The relative ranking of the two constraints, where EMPH ⇒ R and NEG ⇒ R, predicts the correct surface form. Following the logic of OT, the candidate EMPH-NEG violates EMPH ⇒ R, since the negative marker intervenes between the emphatic marker and the right edge, as indicated by the $*$ in candidate (b) in (7). The surface form NEG-EMPH, in contrast, violates NEG ⇒ R, but obeys the higher ranked constraint EMPH ⇒ R. Thus, NEG-EMPH will become the optimal candidate, indicated by ☞, since the violation of a lower ranked is preferable. The same logic can be applied to the relative order of the desiderative and the emphatic marker. Since the desiderative is to right of the emphatic marker in (5c), it follows that DESID ⇒ R has to be ranked above EMPH ⇒ R. This ranking, however, predicts the wrong result for the relative order of desiderative and negation. More specifically, it predicts that NEG-DESID should become optimal, although the opposite order is observed in (5a). This situation is called a **ranking paradox**, since all possible rankings produce wrong output forms. I use the ❄ symbol to illustrate that an observed output is not predicted and the ✈ symbol to indicate that a predicted output is not observed.

(7) Nontransitivity modelled in OT using alignment constraints

			DESID ⇒ R	EMPH ⇒ R	NEG ⇒ R
a.	☞	NEG-EMPH			*
b.		EMPH-NEG		*!	
c.		DESID-EMPH	*!		
d.	☞	EMPH-DESID		*	
e.	✈	NEG-DESID			*!
f.	❄	DESID-NEG	*!		

Since alignment constraints fail to derive the pattern in (5), Ryan (2010) introduces a different type of morphotactic constraint – a *bigram*. Crucially, a bigram constraint X-Y enforces a local, selectional restriction by penalizing each instance of X not immediately preceding Y, as defined in (8)

(8) X-Y: (Ryan 2010: 767)
Assign a * for each instance of X not immediately followed by Y.

Crucially, bigram constraints operate under strict adjacency in order to avoid overgeneration problems. The local nature of bigram constraints is justified by two reasons: first, Ryan (2010) assumes that bigrams arise from the course of learning. Thus, non-local bigrams would be harder to detect for the learner and should therefore be avoided (see also Gouskova & Gallagher 2018 for a discussion on the learnability of trigrams). Second, Ryan (2010) claims that non-local affix dependencies are not attested. Hence, non-local bigrams would overgenerate. In short, bigram constraints make reference to adjacency between to affixes and to the linear order of affixes simultaneously. However, bigram constraints do not make reference to the relative distance of an affix to the root. The tableau in (9) illustrates how bigram constraints derive nontransitivity. Crucially, each pair of affixes in (5) is translated into a bigram constraint. Ryan (2010) does not put limitation on the substance of a bigram, since the focus lies on the theoretical make-up and nature of the constraint. Since there is no requirement of transitivity between the bigrams, bigram constraints provide a possibility to implement morphotactic requirements that give rise to non-transitivity.[9]

[9]Note also that the each evaluated pair of candidates in (9) exhibits violations of a bigram constraints involving a category which is not concatenated at all. Thus, both candidates EMPH-NEG and NEG-EMPH cause a violation of NEG-DESID. This result goes back to the initial definition of bigram constraints where a bigram X-Y is violated if an affix X is not immediately followed by category Y. Consequently, the constraint is also violated each time that Y is not realized at all. However, since all candidates violate this constraint, it will never become decisive.

(9) Nontransitivity modelled in OT using bigrams

	EMPH-NEG	NEG-DESID	DESID-EMPH
☞ EMPH-NEG		*	
NEG-EMPH	*!	*	
☞ NEG-DESID			*
DESID-NEG		*!	*
☞ DESID-EMPH	*		
EMPH-DESID	*		*!

The fact that bigrams address the linear order between two affixes and adjacency at the same time creates a couple of problems, out of which some have already been brought up by previous scholars, like Caballero & Inkelas (2013) or Crysmann & Bonami (2016). As I have shown in chapter 4 and chapter 5, morphological rules can make reference to the linear order, or the relative distance to the root.

First, bigram constraints are unable to capture categorical edge-asymmetries, such as the generalizations set up by Julien (2002) and Trommer (2001, 2003) or the tendency for causatives to be realized as prefixes, established in chapter 4.6, since there is simply no possibility to address the side of the verb that the affix attaches to. For example, setting up an independent requirement that the causative should always be the first and therefore leftmost affix within a bigram constraint does not help, since this constraint could then be satisfied in a suffixal position, as well. Alternatively, one could think of implementing the prefixing tendency of causatives by setting up a bigram CAUS-V which enforces the causative to be realized in the innermost prefix position. However, the adjacency requirement of bigrams would initiate a violation as soon as another affix appears between the causative and the verb root. While the causative is typically the innermost prefix, it does not have to be the innermost one. In Tukang Besi, for example, the reciprocal is closer to the verb than the causative, yet the causative is a prefix, as illustrated again in (10).

(10) Order of CAUS and REC in Tukang Besi (Donohue 2011: 293)

a. No-pa-po-tandu-tandu-'e na wembe.
3.RLS-CAUS-REC-RED-horn-3.OBJ NOM goat
'He$_i$ incited the goats$_k$ to butt each other$_k$.'

b. *No-po-pa-manga-manga.
3.RLS-REC-CAUS-RED-eat
'They$_i$ made each other$_i$ eat.'

Moreover, bigrams cannot easily derive the generalizations by Trommer (2001, 2003) about the positioning preferences of person and number exponents: Trommer (2001, 2003) observes that there is a linear dependency between person and number that is valid under non-adjacency of the categories as well. Concretely, person features tend to be realized to the left of number features by a vast majority and also in cases where person is realized by a prefix while number is realized as a suffix. In order to derive that generalization, it would be necessary to assume a universal constraint Pers-Num that operates under non-adjacency.

A related, second problem that comes up with the nature of the bigram constraints is the fact that bigrams do not make reference to the relative distance to the verb root. As I have shown in detail in chapter 5.1, there is exactly this type of morphological effect, in the sense that causatives are typically closer to the verb than applicatives both in the prefixal (e.g. Adyghe and Misantla Totonac) and in the suffixal domain (e.g. Bantu languages, Choguita Rarámuri), summarized as the CCC. In order to capture the effects of the CCC, it would be required to have a bigram appl-caus in prefixing languages and a bigram caus-appl in suffixing languages. Given that all constraints in OT are **universal**, a grammar would always have both bigram constraints appl-caus and caus-appl. In combination with the fact that constraints are freely rankable, having both constraints would predict basically any order. Concretely, it would predict unattested patterns of asymmetric compositionality where the applicative is closer to the verb than the causative and symmetric non-compositionality, which is attested in Fuuta Tooro Pulaar, but is nonetheless a rare phenomenon.

Crysmann & Bonami (2016) reveal an additional problem of bigram constraints. Since bigrams make only reference to linear order between two affixes, bigrams predict that two affixes should occur on both sides of the root in the same order. In fact, this seems to be borne out in the case of clitic clusters, as shown in (11) for Italian. In the imperative, the clitic combination *me-lo* follows the verb while it precedes the verb in indicative sentences in , see (11a). Crysmann & Bonami (2016) argue that the data in (11) is nonetheless problematic for Ryan (2010) since the bigrams express different content in (11a) vs. (11b). Concretely, it would be necessary to complement the bigram constraint with an additional requirement that links the environment to the side of realization such that the bigram is realized before the verb in the indicative but after the verb in imperatives.

(11) Position of Italian clitic combinations (Crysmann & Bonami 2016: 19)

a. me-lo-da-te
1sg.dat-3sg.acc-give-2pl
'You give it to me.'

b. Da-te-me-lo!
give-2pl-1sg.dat-3sg.acc
'Give it to me!'

7.3 Inflectional morphology in Harmonic Serialism

In contrast to the two accounts discussed so far in this chapter, Müller (2020) does not only seek to provide an appropriate analysis of affix order, but introduces an entirely new model of the morphological component of the grammar. Concretely, Müller (2020) suggests that a morphological component built in the framework of *Harmonic Serialism (HS)* is capable of deriving persistent problem of inflectional morphology beyond affix order, such as disjunctive blocking, extended exponence or suppletion. In contrast to SPOT, HS adds a derivational component to constraint-based optimization (Heck & Müller 2007, McCarthy 2008). In the case of morphology, SPOT models assume that entire words are generated and evaluated in parallel. HS, however, makes explicit statements about possible output candidates by limiting the number of manipulations of the input to maximally **one step**. Specifically, when a given input enters the GEN component of the grammar, it is not the case that GEN provides a possible infinite set of output candidates. Rather, it generates only candidates which have undergone exactly one step of manipulation. The output from the first cycle of optimization is then taken to the next step of optimization, where again only one single manipulation is possible. This procedure continues until further optimizing manipulation is no longer possible. This status yields *convergence*. In that sense, HS is a modified version of SPOT which imposes restrictions on the operation of GEN. Conceivable manipulations in the area of affix order could be adding, deleting, changing or moving an affix. That being said, a major contribution by Müller (2020) is that there is **movement in morphology**. The proposal by Müller (2020) suggests a model to morphology, which is presyntactic, lexical, realizational and Merge-based. In simpler terms, Müller (2020) assumes that morphology operates before syntax and is therefore independent of syntactic structure. The core idea with respect to affix order is that affixes are morphological exponents realizing morphosyntactic features that are independently available. These morphological exponents are stored as indepent lexical items in the lexicon. The concatenation of these affixes is Merge-based. That is, the derivation starts with a verb root that is taken from the lexicon along with inherent, structure building features [•F•]. In addition to the verb root, the input comprises non-inherent features yielding a fully specified context. Specifically, a German verb root comes with the inherent structure-building features [•T•] and [•Agr•] since German verbs need to be marked for tense and subject agreement. The non-inherent features specify the morpho-syntactic context, e.g. [PST, 2SG]. In the morphology, the exponents which are the best match for the features [T] and [Agr] are then concatenated. The constraint MERGE CONDITION$_F$ is the core part of the analysis. MERGE CONDITION$_F$ constraints are inherently ranked above other morphotactic constraints and ensure that all structure-building features of the input are deleted by Merging a matching exponent. In addition, there are general alignment constraints, which are inevitable for linearization. Concretely, they model the affixal status of each affix and may trigger morphological movement in later steps of the derivation. I will illustrate the approach by the example of German verb inflection in the tableaux (13) through (15). The relevant constraints are listed in (12).

(12) Constraints in Müller (2020), Gleim et al. (2022)

a. MERGE CONDITION$_F$ (MC$_F$):
A structure building feature [•F•] on a stem participates in (and is deleted by) a Merge operation with an inflectional exponent bearing [F].

b. F ⇒ R
Assign a * for each item separating an exponent of [F] from the right edge of the word.

c. L ⇐ V
Assign a * for each item separating the verb stem from the left edge of the word.

As mentioned above, German verb roots are taken from the lexicon with the inherent structure-building features [•T•] and [•Agr•]. For this derivation, let the context be [PST, 2SG] where *te* is the matching marker for [T] and *st* is the matching marker for [Agr]. The tableau in (13) shows that the two MC constraints ensuring that exponents realizing tense and subject agreement are concatened are top-ranked. The relative ranking of the two MC constraints is assumed to correspond to *f-seq* such that an MC constraint related to a functional head low in f-seq is ranked above an MC constraint referring to a functional head high in f-seq. Since GEN produces only outputs where the input, in this case the verb root, is manipulated by one single step, only one exponent can be added in the first step of the derivation. Since MC$_T$ is the top-ranked constraint, the tense marker *te* is concatenated first. Consequently, only the two candidates (b) and (d) in (13) remain, since they are the only candidates in which the relevant marker is realized. The alignment constraint L ⇐ V, which ensures that all affixes are suffixes, becomes decisive and yields candidate (b) as the optimal candidate. This candidate is then shifted as the input to the next cycle of optimization.

(13) German verb inflection, step 1 - Merging T (Gleim et al. 2022: 13)

I: [$_V$ kauf]: [•T•], [•Agr•]	MC$_T$	MC$_{AGR}$	L ⇐ V	AGR ⇒ R	T ⇒ R
a. [$_V$ kauf]: [•T•], [•Agr•]	*!	*			
b. ☞ [$_V$ kauf-te]: [•Agr•]		*			
c. [$_V$ kauf-st]: [•T•]	*!				
d. [$_V$ te-kauf]: [•Agr•]		*	*!		*
e. [$_V$ st-kauf]: [•T•]	*!		*	*	

The output of the previous step, [$_V$ kauf-te]: [•Agr•], serves as the input for the next step of the morphological derivation. Crucially, it has a remaining structure-building feature [•Agr•]. Due to the high ranking of MC_{AGR}, concatenation of the matching exponent *st* will be the next step of the derivation. As in the previous step, the general alignment constraint L ⇐ V ensures that the marker will be realized in a suffixal position. At this point of the derivation, another crucial assumption by Müller (2020) becomes relevant: similarly to syntactic derivations triggered by MERGE, the morphological derivation is subject to the *Strict Cycle Condition*. In simpler terms, the output of the first cycle is a cyclic domain on its own. Therefore, it cannot be affected in a later step of the derivation, unless the superdomain is involved in the step, as well. Consequently, new markers are always concatenated (or moved to) the most external position. Outputs violating the *Strict Cycle Condition* are entirely excluded (and probably not even produced by GEN). Hence, the candidate [$_V$ kauf-st-te], which fulfils both MC constraints and L ⇐ V cannot be generated at that point, since concatenating *st* within the previous cyclic domain would violate the *Strict Cycle Condition*. However, the candidate could be generated in a later step of the derivation, as a result of morphological movement.

(14) German verb inflection, step 2 - Merging AGR (Gleim et al. 2022: 14)

[$_V$ kauf-te]: [•Agr•]	MC_T	MC_{AGR}	L ⇐ V	AGR ⇒ R	T ⇒ R
a. [$_V$ kauf-te]: [•Agr•]		*!			
b. ☞ [$_V$ kauf-te-st]					*
c. [$_V$ st-kauf-te]			*!	**	

The output of the previous derivation, [$_V$ kauf-te-st], is taken to another cycle of optimization. As illustrated in tableau (15), the input candidate violates the lowest ranked alignment constraint T ⇒ R. However, any manipulation of the input, such as moving *te* around *st* to the most external position, as in candidate (d) yields a violation of a higher ranked constraint. Consequently, the input becomes also the optimal output candidate and convergence takes place.

(15) German verb inflection, step 3 - convergence (Gleim et al. 2022: 14)

[$_V$ kauf-te-st]	MC_T	MC_{AGR}	L ⇐ V	AGR ⇒ R	T ⇒ R
a. ☞ [$_V$ kauf-te-st]					*
b. [$_V$ st-kauf-te]			*!	**	
c. [$_V$ te-kauf-st]			*!		**
d. [$_V$ kauf-st-te]				*!	

As I mentioned above, a major assumption is that there is movement in morphology. Müller (2020) and Gleim et al. (2022) provide additional evidence for movement in morphology by showing that there are phonological reflexes triggered by the affixes before movement. Connecting the assumption of movement in morphology and phonological reflexives yields the advantage that seemingly non-local phonological can in fact be analysed as local phonological processes before morphological movement. Hence, Gleim et al. (2022) suggest a concrete plan of the interaction between morphology and phonology: when all MC constraints are satisfied, the word is potentially complete for the first time. At this point of the derivation, the first cycle of phonological optimization applies. Afterwards, lower ranked morphotactic constraints are evaluated and the input is potentially further manipulated, i.e. by movement of affixes. When convergence takes place, phonological rules apply again. Recall the case cyclic spirantization in Bemba, previously discussed in chapter 5.1.

(16) Stem + CAUS + APPL in Bemba (Hyman 1994b, 2002: 3f)

	V		V < CAUS			V < CAUS < APPL	
-leep-	'be long'	→	-leef-i̧	'lengthen'	→	-leef-es-i̧	'lengthen for'
-lub-	'be lost'	→	-luf-i̧	'lose'	→	-luf-is-i̧	'lose for'

In Bemba, the causative suffix *-i̧* triggers spirantization twice: it causes the stem-final consonant /p/ or /b/ to surface as [f]. In addition, it causes the final consonant of the applicative marker /-el/ or /-il/ to surface as [-es] or [-is]. One the surface, however, the applicative is closer to the verb root than the causative. That is, the causative is not in a local relationship with the stem-final consonant. In that sense, it seems that the spirantization of the stem-final consonant was caused by non-local phonological process. The account by Müller (2020) and Gleim et al. (2022) provides a neat way to avoid this assumption: it is assumed that the causative was closer to the root than the applicative at the point of the derivation where the two MC constraints had been satisfied. This is illustrated in the tableaux in (17) and (18). In the first step of the derivation in tableau (17), the causative is concatenated, since MC_{Caus} is ranked above MC_{Appl}. In the second step of derivation, the applicative marker is concatenated, as shown in tableau (18). At this point of the derivation, the linearization of the markers has only been regulated by L ⇐ V constraint, which ensures that all markers are suffixes, and the relative ranking of the MC constraints. Concretely, the marker that is concatenated first, will end up in the innermost position while the latter ones will be realized to the right of previously concatenated markers.

(17) Bemba, step 1 - Merging [Caus] (Müller 2020: 88)

	[$_V$ leep]: [•Caus•], [•Appl•]	MC$_{CAUS}$	MC$_{APPL}$	L ⇐ V	CAUS ⇒ R	APPL ⇒ R
a.	[$_V$ leep]: [•Caus•], [•Appl•]	*!				
b.	☞ [$_V$ leep-]-[$_{Caus}$ i̧]: [•Appl•]		*			
c.	[$_V$ leep]-[$_{Appl}$ -el]: [•Caus•]	*!				
d.	[$_{Caus}$ -i̧]-[$_V$ leep]: [•Appl•]		*	*	*!	
e.	[$_{Appl}$ -el][$_V$ leep]: [•Caus•]	*!		*		*

(18) Bemba, step 2 - Merging [Appl] (Müller 2020: 88)

	[$_V$ leep-]-[$_{Caus}$ i̧]: [•Appl•]	MC$_{CAUS}$	MC$_{APPL}$	L ⇐ V	CAUS ⇒ R	APPL ⇒ R
a.	[$_V$ leep-]-[$_{Caus}$ i̧]: [•Appl•]		*!			
b.	☞ [$_V$ leep-]-[$_{Caus}$ i̧]-[$_{Appl}$ -el]				*	
c.	[$_{Appl}$ el]-[$_V$ leep]-[$_{Caus}$ i̧]			*!		*

Since the word is complete at this point of the derivation, phonology applies and triggers spirantization of the stem-final consonant in a local configuration with the causative, such that the stem-final /p/ becomes [f]. In a later step of the derivation, illustrated here in tableau (19), the causative is moved to the right of the applicative. The constraint that triggers this movement is CAUS ⇒ R, which is ranked above APPL ⇒ R. Thus, alignment constraints that make explicit statements about the order of causative and applicative become decisive. In that configuration, spirantization applies again yielding the predicted output form.

(19) Bemba, step 3 - Move [CAUS] (Müller 2020: 89)

	[$_V$ leef-]-[$_{Caus}$ i̧]-[$_{Appl}$ -el]	MC$_{CAUS}$	MC$_{APPL}$	L ⇐ V	CAUS ⇒ R	APPL ⇒ R
a.	[$_V$ leef-]-[$_{Caus}$ i̧]-[$_{Appl}$ el]				*!	
b.	☞ [$_V$ leef-]-[$_{Appl}$ el]-[$_{Caus}$ i̧]					*
c.	[$_{Appl}$ el]-[$_V$ leef-]-[$_{Caus}$ i̧]			*!		**
d.	[$_{Caus}$ i̧]-[$_V$ leef-]-[$_{Appl}$ el]			*!	**	

The advantage of the model by Müller (2020) is that the account provides an elegant way to derive general, crosslinguistically stable patterns of affix order by assuming a fixed ranking of MC constraints, which follows the *f-seq*. However, the system is also capable of deriving unexpected cases of morphotactics by enriching the constraint set with different types of morphotactic constraints. That being said, the analysis is powerful enough to derive the intricate variation in affix order but als restrictive enough to prevent massive overgeneration. Moreover, Gleim et al. (2022) provide an explicit connection between morphology and phonology, which seems crucial to derive the full array of phonologically conditioned affix order, see chapter 6.

There are two issues in the analysis whose empirical predictions are not entirely clear: first, it remains unclear if the morphotactic constraints that are ranked below the MC constraints are limited to alignment constraints or if other types of morphotactic constraints are allowed, as well. In the derivation above, I have shown that the alignment constraints referring to the individual categories become crucial for the successful derivation of the surface forms: movement of the causative is triggered by CAUS ⇒ R outranking APPL ⇒ R. As argued in narrow detail in chapter 5.1, morphological rules generally enforce the causative to be realized in proximity of the verb. In simpler terms, the morphological rule adopted by Müller (2020) seems to contradict the generalization set up as the CCC. In chapter 5.1, I further demonstrate that the movement of the causative to the rightmost position is phonologically optimizing, since it is a strategy to avoid vowel hiatus and consonant clusters. Given that the phonological generalizations base on compelling crosslinguistic evidence, while the morphological rule adopted by Müller (2020) contradicts a crosslinguistically stable pattern, the phonological analysis I suggest in 5.1 should be preferred.
Furthermore, Müller (2020) also exploits reflexive local conjunction to derive certain patterns without restricting the mechanism any further. Since local conjunction is claimed to be extremely powerful (Kirchner 1996, Popp 2019), it seems that the unrestricted application of local conjunction derives potentially unattested patterns.

Chapter 8

Towards an analysis of morphotactics in affix order

8.1 Preceding considerations

In the previous chapters, I presented evidence that it is reasonable and also inevitable to assume that there are rules on affix order that exist independently of semantic, syntactic, phonological or extra-grammatical triggers on affix order, thus suggesting the existence of independent, morphological requirements on affix order. Let me summarize the empirical findings from this dissertation:

- The minimum work load of morphology in affix order is determining the status of each affix. That is, morphology determines whether an affix will end up in a prefixal or a suffixal position, as suggested by Rice (2000), who ascribes a complementary responsibility to morphology when scopal principles are irrelevant. If there were no independent morphotactic rules responsible for this decision, it would have to be assumed that the affixal status is either completely arbitrary or determined by the head-parameter of the language. We have seen in chapter 4.5 and chapter 4.6 that the affixal status is not entirely arbitrary. Rather, some categories are subject to direction biases. Concretely, it has been said that person features and causatives are subject to prefixation tendencies while number features tend to occur towards the right edge of the word.

- Chapter 5.1 has confirmed previous observations by Stiebels (2003) that scopal requirements are not inviolable. Rather, it seems to be the case that scopal requirements compete with – potentially contradictory – rules on morphological wellformedness. I have also shown that the morphological rules in this area of affixes are not arbitrary. Instead, there is an overwhelming tendency across languages to realize the causative exponent in proximity to the verb root.

- In chapter 6, I have demonstrated that phonologically conditioned affix order is almost always phonologically optimizing, thus necessitating a tight interaction of morphology and phonology. Moreover, the examples from Huave, Washo and Moro cannot be analyzed using subcategorization frames. Following the argumentation by Paster (2009), exactly this type of data requires a P » M module of the morphology-phonology interface. Concretely, true phonologically conditioned affix order requires access to morphology structure by phonological rules, at least temporarily.

- As for the role of syntactic structure, Gyumri Armenian instantiates the only example where syntactic influence which is independent of semantic considerations (e.g. phasehood, phrase-structural evidence) is crucial to explain the observed patterns. Moreover, I argued in chapter 5.1 that recent work by Myler & Mali (2021) and Myler (2021), which relate the CAUS-APPL constraint to purely syntactic structure, could be disproved, since it makes several empirically wrong predictions.

As a consequence of the observations above, I infer that an appropriate theoretical model of morphotactics in affix order has the following characteristics:

- There is an independent morphological module which is responsible for the morphological wellformedness of a word.
- The tight interaction between morphology and phonology requires a model, in which phonological rules have access to morpheme boundaries. It is argued most prominently by Embick (2010) that a global interaction of phonology and morphology should be banned. One reason for this scepticism comes from Paster (2006, 2009), who argues that a model where phonology has unlimited access to morphological structure would overgenerate by predicting unrestricted non-local phonological requirements on morphology. In cyclic models, however, the interaction of phonology and morphology is temporarily limited to cyclic domains and therefore less powerful, as demonstrated by Orgun & Inkelas (2002), Deal & Wolf (2017) or Benz (2017), among others. As argued by Bermúdez-Otero (2011), a cyclic interaction of phonology and morphology makes powerful lexically-indexed constraints unnecessary. Thus, I conclude that the empirical facts and generalizations established in this dissertation require **a cyclic model to the interaction of phonology and morphology.**
- As for the interaction between morphological rules and rules of semantic/syntactic transparency, the violability of the rules and the simultaneous interaction thereof calls for an analysis couched in Optimality Theory (OT), as also argued by Trommer (2001, 2008), Hyman (2003), Clem et al. (2020), Müller (2020), Zukoff (2022), Gleim et al. (2022).

I believe that the empirical facts presented in this dissertation do not allow a decision between a presyntactic (or: lexical) or post-syntactic model of morphology.

Rather, I believe that the competition between rules on semantic transparency and morphological wellformedness, which is at the core of the analysis, are in principle compatible with either model. Rather, the theoretical contribution of this analysis lies in other areas, such as the nature of morphotactic constraints, the interaction of rules on transparency and morphology, and the interaction between morphology and phonology.
As I have shown in chapter 3, the main evidence for the Mirror Principle by Baker (1985, 1988) comes from affixation patterns of valency markers. In a post-syntactic model, one would assume that the valency is formed by different heads, e.g. Caus and Appl, which enter the syntactic derivation according to their interpretation. This order is then translated into morphology, e.g. via cyclic head-movement (Baker 1988) or a translation from syntactic hierarchy into a fixed ranking of ALIGN-constraints (Zukoff 2022). In a presyntactic model, it would have to be assumed that valency operations take place in the lexicon, which provides information about the underlying semantic order of operations. In this dissertation, I adopt a pre-syntactic model to morphology for two reasons: first, I have shown in chapter chapter 4.2 that variation across languages occurs mainly in the area of inflectional morphology with the position of agreement morphology being highly flexible. This is predicted by Rice (2000), who discusses the possibility that affixes without scopal requirements are ordered by independent morphological rules. Syntactic approaches, however, typically assume a fixed sequence of functional heads responsible for inflection, such as T, Asp or Agr (Buell 2005, Buell et al. 2014). To model the observed variation in affix order, post-syntactic models need to assume either unmotivated word-internal phrasal movement in the syntax (Buell 2005, Buell et al. 2014, Koopman 2005, 2015, Muriungi 2008, Myler 2017) or morphotactic constraints overwriting the order provided by f-seq, as assumed by Zukoff (2022). A second reason to adopt a pre-syntactic model is that the evidence that purely syntactic structure, i.e. phasehood, phrase-structure has an effect on morpheme order is rather scant. The only example which makes reference to phrase-structure is Gyumri Armenian. As discussed in chapter 6, Bezrukov & Dolatian (2020) do not exclude an alternative, phonologically-driven generalization of the pattern.

8.2 Assumptions

Within this analytic space, the following models have been suggested: the presyntactic approach to inflectional morphology couched in Harmonic Serialism, recently put forth by Müller (2020) and Gleim et al. (2022), the presyntactic approach in Optimal Construction Morphology by Inkelas (2016) and the analysis of nontransitivity in Washo in Stratal OT by Benz (2017), which is compatible with both presyntactic and postsyntactic morphological modules. I believe that any of these models is in principle capable of deriving the morphotactic effects observed in affix ordering.

In this dissertation, I use a pre-syntactic analysis couched in Stratal OT to capture the interface between morphology and phonology, but sketch how a post-syntactic model in the sense of Zukoff (2022) would work in chapter 8.6.
Stratal Optimality Theory (StratOT) (Kiparsky 2000, Bermúdez-Otero 2011, 2016) is a derivational version of SPOT, which is based on assumptions similar to the ones posited by Lexical Phonology and Morphology (Kiparsky 1982a). The initial idea that led to emergence of StratOT was to account for cases of cyclic reapplication or opaque rule interactions, where SPOT fails to derive the patterns (Kiparsky 2015). A core component of StratOT is the division of labour into several different cyclic domains. A concrete suggestion with respect to the number of domains comes from Bermúdez-Otero (2011), who assumes three different levels:

1. the **stem-level** comprises the root and some derivational affixes
2. the **word-level** comprises the stem and inflectional affixes
3. the **phrase-level** comprises entire utterances and potentially more external clitic-like affixes

The classification by Bermúdez-Otero (2011) is thought to serve only as a very rough categorization of affixes. Reports and analyses from individual languages suggest that there are languages with more than three cyclic domains (see Hargus (2018) on Sekani, Rice 1989 on Slave, Odden 1996 for Kimatuumbi, Caballero 2008 for Choguita Rarámuri, Eberhard 2009 for Mamaindê, Jones 2014 for Kinande or Jaker & Kiparsky 2020 for Tetsǫ̓t'ıné). Moreover, post-lexical cyclic domains containing clitics or phrases are described by Kaisse (1985, 1990), Clark (1990), McHugh (1990), Rubach (2011, 2016), Jones (2014) or Gjersøe (2016). A priori, it is not clear, how many groups of affixes can be established within a language or across languages. Moreover, Booij (1996) demonstrates that inflection should be differentiated further, therefore suggesting to distinguish between contextual inflection (e.g. agreement) and inherent inflection (e.g. tense, mood, aspect).
An important assumption by StratOT is that morphological derivations are accompanied by cycles of phonological optimization such that the morphological component of the grammar and the phonological component of the grammar are interleaved. After each stratum, bracket erasure takes place, which renders morphological structure inaccessible to further cycles. Bracket erasure is a mechanism introduced by Kiparsky (1982a,b) and refers to the process of making morphological boundaries invisible to phonological or morphological rules. More specifically, morphological boundaries become invisible at the end of a cycle. Consequently, neither phonological nor morphological rules can make reference to these boundaries. In this work, I assume that only the morpheme boundaries are deleted, while the grammar still has access to the morphosyntactic information realized in a previous stratum. In other words, a morphologically complex word, e.g. a root plus its affixes, is treated as a morphologically

simplex word after bracket erasure. Thus, access to morphological boundaries is only possible within a cycle. In other terms, StratOT answers the non-trivial question of morphological sensitivity in phonology by restricting this access to morphological structure by phonology to smaller subdomains. The exact architecture of the cyclic model of the morpho-phonology interface I adopt is illustrated in table 8.1

morphological optimization phonological optimization	stem-level
bracket erasure	
morphological optimization phonological optimization	word-level
bracket erasure	
morphological optimization phonological optimization	phrase-level
bracket erasure	

Table 8.1: Assumed architecture of the morpho-phonology interface

A recurrent question in StratOT is how it is determined at which stratum an affix enters the morphological structure. While it would be highly desirable if the strata could be entirely motivated by morphosyntactic correlates, e.g. a stratum corresponds to a phase, the current state of the art in StratOT is rather that strata should correspond to morphosyntactic components in the broadest sense and it is also commonly assumed that it is specified in the lexical entry of each affix at which stratum it enters the optimizing derivation (Bermúdez-Otero 2011, 2016, 2019).

Another crucial component of StratOT is re-ranking. This assumption is based on the observation that certain phonological rules apply only to certain subdomains, suggesting that the ranking of the constraints may differ from one stratum to the other. In this dissertation, I assume that the constraints in morphological strata comprise linearity constraints, such as ALIGN constraints, constraints implementing scopal requirements and constraints on morphological adjacency but crucially **no rules making reference to position classes.**

I believe that a stratal or cyclic model to the morphology-phonology interface is advantageous to parallel models not only since it restricts the access to morphological structure by phonology to a narrow subdomain. Without further ado, stratal models give rise to cyclic effects such as re-ranking, or phenomena making reference to edges of the stratum.

8.3 Case study: Adyghe

Let me illustrate the procedure of this model by the example of Adyghe. I assume that the word in Adyghe comprises four domains, as illustrated in (1): **the root-**

level, which does not instantiate a cyclic domain on its own, **the stem-level**, which contains the root and inner prefixes, like causatives and ergative morphology, **the word-level** which contains the stem-level and outer prefixes and **the phrase-level**, which contains the word-level and all suffixes. The schema in (1) also illustrates a core idea of StratOT: a stratum does not only contain the affixes added at this point of the derivation but also material added in previous strata. With respect to phonological rules in Adyghe, this implies that the word-level phonological process assimilation may in principle affect stem-level affixes, as long as the context for the rule is given.

(1) Suggested cyclic structure for Adyghe based on Arkadiev (2020: 85)

-10	-9	-8	-7	-6	-5	-4	-3	- 2	- 1	0	1	2	3	4
ABS	CIS	SUB	APPL	DAT	ERG	JUSS	DYN	NEG	CAUS	root	DIR TRANS	event operators	PL	SUB
										root				
					stem-level *e.g., epenthesis*									
word-level *e.g. assimilation*														
phrase-level *e.g. final vowel deletion*														

The division of the word into these levels corresponds to different phonological grammars on these levels. Concretely, the affixes on the stem-level are subject to other phonological processes than word-level affixes. Suffixes – or phrase-level affixes, have a more elaborated phonological structure to begin with. Most of them come with a *CV-* shape, which has the consequence that consonant clusters to not even arise. Let me elaborate more on the different phonological processes between stem-level affixes and word-level affixes. Specifically, Smeets (1984) assumes that all agreement prefixes, independent of the semantic role they index, start out with the same underlying forms, but end up in different shapes, since they undergo different phonological processes depending on their relative distance to the verb. These phonological processes behave consistently across the entire paradigm, and are illustrated the 1SG agreement marker, which comes with the underlying form */s/*, in (2). The example in (2a) shows the underlying form of a word in which the 1SG agreement marker */s/* indexing the agent argument precedes a root starting with */n/*, thus resulting in a consonant cluster */sn/*. In (2b), this consonant cluster is resolved by epenthesis of an epenthetic vowel ə. In (2c), the 1SG agreement marker */s/* indexes an applicative argument and attaches to the left of a locative applicative */ne-/*, resulting in the very same consonant cluster */sn/*. In (2d), the consonant cluster is not resolved, but the agreement marker undergoes voicing assimilation with the nasal. In sum, there is the same marked underlying phonological structure of a voiceless obstruent followed by a nasal in (2a) and (2c), which is resolved differently in (2b) and (2d).

According to Smeets (1984), this is not an idisyncrasy of these particular examples but a general pattern in which inner agreement prefixes indexing agents undergo other phonological processes than outer agreement prefixes indexing indirect and direct objects.[10,11]

(2) Two different repairs for /s-n/ in Adyghe (Smeets 1984: 193f.)

a. /x̂e-**s-ne**-št/

b. [x̂e-**sə-ne**-št]
LOC-1SG-leave-FUT
'I will leave it in it.'

c. /qə-**s-ne**-sə-ğ/

d. [qə-**z-ne**-sə-ğ]
INV-1SG-LOC-arrive-PST
'He arrived at my place.'

To illustrate how the cyclic model I assume derives these patterns, let me assume that the verb root comes with a list of contextual features that need to be spelled out somehow. This list is then checked against the available affixes at each stratum. To derive the patterns in (2), let us assume the input features of the verb for (2a) in (3a) and (2c) in (3b). I follow the notation introduced by Müller (2020) in using the • symbol to mark features that should be expressed in a morphological word.[12]

(3) Input feature sets

a. V, [•AGR_{ERG}•], [•TMA•], [•APPL•]

b. V, [•AGR_{DAT}•], [•TMA•], [•APPL•], [•INV•]

As for the agreement affixes, I assume that there are two sets of person markers with overlapping forms, which are stored separately as stem-level affixes and as word-level affixes, in contrast to the assumption by Smeets (1984). In fact, there are certain contexts in which the sets differ. As shown in (4), 3rd person is generally zero-marked if it is realized in the two word-level positions. Crucially, the 3rd person argument 'Ali' is not coindexed by an agreement marker, neither as a beneficiary in (4a) nor as an agent in (4b).

[10] In fact, the generalizations by Smeets (1984) indicate that different repair strategies occur between the two prefix sets for other consonant clusters, as well. Data from joint work with Imke Driemel and Ahmet Bilal Özdemir supports these generalization. However, there are some contradictory data in Smeets (1984) (probably due to orthogonal phonological processes), which is why I decided to not this intricate data set for reasons of readibility.

[11] Adyghe has a variety of applicative morphemes including several different locative morphemes, a benefactive applicative and a comitative applicative. In this chapter, I treat all of these applicatives as instances of a more abstract category [APPL], since the applicatives do not vary with respect to affix order.

[12] The [•INV•] is probably not a category as such. Rather, its emergence is computed from different combinations of person markers on the word-level, as recently argued by Driemel et al. (2020b). I take it as separate feature in this analysis since it does not interact with the other features in this example.

(4) Zero 3rd person prefix (Driemel et al. 2020b: 13)

a. se Ali-jəm sə-∅-fə-laʒə
I Ali-OBL 1SG-**3SG**-BEN-study
'I study for Ali.'

b. Ali-jər se ∅-qʷə-s-fə-laʒə
Ali-ABS I **3SG**-CIS-1SG-BEN-study
'Ali studies for me.'

As a stem-level affix, 3rd person may be expressed by *r(ə)-*, see (5). Thus, the markers of certain cells in the paradigm differ morphologically from stem-level to word-level.

(5) 3rd person subject prefix in ditransitives/benefactives (Driemel et al. 2020b: 13)

Hasan-əm wo se wə-qʷə-sə-**r**ə-tə.
Hasan-OBL 2SG 1SG 2SG-CIS-1SG-**3SG**-give
'Hasan gives you to me.'

At each stratum, it is then checked which feature can be filled with a respective marker from Adyghe. A crucial assumption I make is that the stratal specification of each affix, that is, at which stratum it enters the word, is specified in the lexicon. Let me assume the following specifications for affixes in Adyghe:

Stratum	Feature	Meaning	Form	Phonological processes
Stem	[CAUS]	CAUS	ʁe	epenthesis
	[AGR_{ERG}]	1SG	s	
	[AGR_{ERG}]	2SG	p	
Word	[APPL]	LOC	x̂e	assimilation
		LOC	ne	
		COM	de	
	[INV]	INV	qə	
	[AGR_{DAT}]	1SG	s	
	[AGR_{DAT}]	2SG	p	
Phrase	[TMA]	FUT	št	final vowel deletion
		PST	ğ	

Table 8.2: Adyghe affixes divided into strata

In the morphological component of the first stratum - the stem level, all stem-level affixes will be concatenated with the root. The input to the morphological component of this stem-level is the verbal root with **all** features and all stem-level affixes. At the morphological level, I make use of L ⇐ PERS(ON) (Trommer 2001, 2003, 2008), as well as MAX-constraints. Crucially, L ⇐ PERS(ON) constraints are needed to determine the status of the affix while MAX-constraints ensure that a certain feature is actually integrated into the morphological word. In short, MAX-constraints tell the root that a certain feature should be realized, while L ⇐ PERS(ON) specify where a certain feature is realized.

(6) Morphological constraints

a. L ⇐ PERS(ON): (Trommer 2001, 2003, 2008)
Assign a * for each exponent between an exponent of the feature PERSON and the left edge of the word.

b. MAX(F): (Trommer 2008, Müller 2020)
Assign a * for each feature [F] of the input if it is not realized on an exponent in the output.

The tableau in (7) illustrates the computation of the morphological component at the stem-level for the example in (2b). The input to the derivation is the verb root *ne* with all features that need to be concatenated. Crucially, the verb root in (7) is supposed to concatenate three different categories: [•AGR•], [•TMA•], [•APPL•]. At the stem-level, no matching affixes of TMA and APPL are available. As a consequence, no candidate fulfilling MAX(APPL) or MAX(TMA) can be generated at this stratum. In contrast, MAX(AGR) can be satisfied by attaching the 1SG exponent *s* with the root. The linearity constraint L ⇐ PERS ensures that the exponent attaches as a prefix, yielding the optimal candidate /s-ne/, which will serve as the input to the phonological optimization at stem-level.

(7) Morphological optimization at stem-level for (2b)

ne: V
s: [AGR_{ERG}], 1SG, stem-level
x̂e: [LOC, word-level
št: [TMA], FUT, phrase-level

V, [•AGR_{ERG}•], [•TMA•], [•APPL•]	L ⇐ PERS	MAX(AGR)	MAX(APPL)	MAX(TMA)
a. ☞ s-ne			*	*
b. ne-s	*!		*	*
c. ne		*!	*	*

In the phonological component of the stem stratum, the consonant cluster of a voiceless obstruent and a nasal is optimized by vowel epenthesis. To model this process, I adopt the constraints in (8). Note that all of these constraints are well-established constraints in OT-based phonology (see e.g. Lombardi 1999).

(8) Phonological constraints

a. $AGREE_{CC}$(VOICED)
Assign * for each pair of adjacent consonants that differ in their specification for [voiced].

b. $AGREE_{CC}$(NASAL)
Assign * for each pair of adjacent consonants that differ in their specification for [nasal].

c. ID:
   Assign * for each feature that in the output that was changed from the input.
d. Dep:
   Assign * for each segment in the output that was not present in the input.
e. *[-son,+nas]:
   Assign * for each nasal obstruent.
f. *[-voiced, +nas]:
   Assign * for each voiceless nasal.

The tableau in (9) illustrates how the relative ranking of these widely established constraints derive consonant cluster resolution by epenthesis in Adyghe. The optimal candidate of the morphological computation /s-ne/ serves as the input to phonological optimization. Agree$_{CC}$(voiced) and Agree$_{CC}$(nasal) are markedness constraints that require adjacent consonants to match in the features [±voiced] and [±nasal]. There are two faithfulness constraints trying to preserve properties of the input in the output. Specifically, ID prevents assimilation by penalizing each feature change, while Dep prevents epenthesis. Moreover, there are two markedness constraints building on a strong phonological basis, *[-son,+nas] and *[-voiced, +nas], which prevent the emergence of phonetically marked segments, i.e. nasal obstruents and voiceless nasals. Crucially, candidate (b) in (9) is ruled out since the two adjacent consonants have contradictory features of [±nasal] leading to a fatal violation of Agree$_{CC}$(nasal). However, nasalization of /z/, as in candidate (c), creates a violation for *[-son,+nas] since nasalized obstruents do not exist in the phonological grammar of Adyghe. Candidate (d) faces a similar problem: changing /s/ to a nasal obstruent and /n/ to a voiceless nasal creates violation for *[-son,+nas] and *[-voiced, +nas]. As a consequence, candidate (e) in (9), in which the consonant cluster was resolved by epenthesis, becomes optimal due to the relatively low ranking of Dep.

(9) Phonological optimization at stem-level for (2b)

/s-ne/	Agree$_{CC}$(voiced)	Agree$_{CC}$(nasal)	*[–son,+nas]	*[–voiced, +nas]	Dep	ID
a. sne	*!	*				
b. zne		*!				*
c. z̃ne			*!			**
d. s̃n̥e			*!	*		**
e. ☞ səne					*	

After this phonological optimization, bracket erasure takes place and *səne* enters the word-level stratum as a unit. In the morphological component of the word-level stratum, the grammar has now access to *səne* as the input stem and all word-level affixes. For this derivation, only the locative applicative is added to the word. However, Adyghe has numerous different applicatives with varying semantics and it is possible that all these applicatives and their respective agreement affixes enter the derivation at this level. Since all affixes at this level are prefixes, I assume a relatively high-ranked constraint V ⇒ R that ensures that the input stem is to the right of all affixes:[13]

(10) Alignment constraints controlling the affixal status

a. L ⇐ V :
Assign * for each exponent between the base and the left edge of the word.

b. V ⇒ R:
Assign * for each exponent between the base and the right edge of the word.

As shown in the tableau in (11), the optimal candidate is candidate (b), in which the applicative attaches to the left of the input.

(11) Morphological optimization at word-level for (2b)

ne: V
s: [AGR]$_{ERG}$, 1SG, stem-level
x̂e: [LOC], word-level
št: [TMA], FUT, phrase-level

səne, [•TMA•], [•APPL•]	MAX(AGR)	MAX(APPL)	MAX(TMA)	L ⇐ PERS	V ⇒ R
a. səne		*!	*		
b. ☞ x̂e-səne			*		
c. səne-x̂e			*		*!

Again, the optimal candidate from the derivation in (11) is shifted to the phonological component for further optimization. At this step of the derivation, re-ranking takes place. Crucially, AGREE$_{CC}$(NASAL) is lower ranked than in the phonological computation at the stem-level, and crucially, lower ranked than DEP. StratOT assumes cyclic application of phonological rules. More specifically, phonological processes triggered at a later cycle, in this case the word-level, may in principle overwrite the output of previous phonological cycles, in this case the stem-level. The tableau in (12) illustrates that the ranking of the phonological constraints at word-level in Adyghe does not affect the input coming from the previous stratum since the input does not violate any of the markedness constraints. Thus, candidate (b) in (12) cannot become optimal, since the context for assimilation is no longer given. However, this constraint ranking will become crucial to derive the surface form found in (2d).

[13] The observant reader will notice that the information that *ne* was the root is actually inavailable after bracket erasure. Thus, the title of the constraint is somewhat misleading. Hence, the definition of the constraint refers to the position of the *base*, that is, the input to the current stratum. In this sense, the definition follows the argumentation by Kiparsky (2015), who claims that constraints operating at a later cycle can make reference to the input, but not to the internal structure of the input.

(12) Phonological optimization at word-level for (2b) .

x̂esəne	AGREE$_{CC}$(VOICED)	*[–son,+nas]	*[–voiced, +nas]	DEP	AGREE$_{CC}$(NASAL)	ID
a. ☞ x̂esəne						
b. x̂ezne					*!	*

After this step, computation at word-level is complete, bracket erasure applies again, and the resulting output *x̂esəne* is transferred to the phrase-level. At phrase-level, the grammar takes *x̂esəne* as the input and has access to all phrase-level affixes. Since all phrase-level affixes are suffixes, I assume that there is re-ranking in the sense that V ⇒ R is replaced by L ⇐ V to ensure that the input is to the left of all affixes attached at this level. At this level, the last remaining MAX constraint is satisfied by concatenating a TMA-affix. The winning candidate from tableau (13) is the output form observed in (2b). Smeets (1984) discusses that final vowel deletion is restricted to the phrasal level of the word. However, it is not clear whether the process is phonologically or morphologically conditioned. Since the rules triggering the process are unclear, I will not provide a tableau for the phonological computation at phrase-level, although it nonetheless takes place.

(13) Morphological optimization at phrase-level for (2b)
ne: V
s: [AGR$_{ERG}$], 1SG, stem-level
x̂e: [LOC], word-level
št: [TMA], FUT, phrase-level

x̂esəne, [•TMA•]	MAX(AGR)	MAX(APPL)	MAX(TMA)	L ⇐ PERS	L ⇐ V
a. x̂esəne			*!		
b. ☞ x̂esəne-št					
c. št-x̂esəne					*!

In order to derive the correct surface form of (2d), recall that only agent arguments of transitive verbs and causative markers introducing new agent arguments are marked by stem-level affixes. Since the agent in (2d) is 3rd person marked and therefore zero-marked, the example contains only word-level and phrase-level affixes. At word-level, the locative applicative, the 1st person agreement marker of the indirect object and the inverse marker enter the derivation. At word-level, all available affixes, that is, applicative, agreement and inverse marker, are concatenated in order to satisfy the high-ranked MAX constraints. MAX(TMA) cannot be satisfied, since no affix is available at that point of the derivation. The candidates (b), (c), (d) in (14) remain since all available markers have been attached to the verb. Among these candidates, morphotactic linearity constraints determine the optimal candidate. Since all word-level affixes are prefixes, V ⇒ R rules out candidate (c) and L ⇐ INV rules out candidate (e), such that candidate (b) becomes optimal in (14).

(14) Morphological optimization at word-level for (2d)

sə V
ne [LOC], word-level
s [AGR$_{\text{DAT}}$], 1SG, word-level
qe [INV], word-level
ǧ [PST], phrase-level

sə, [•AGR$_{\text{DAT}}$•], [•TMA•], [•APPL•], [•INV•]	M(AGR)	M(APPL)	M(TMA)	M(INV)	L ⇐ INV	L ⇐ PERS	V ⇒ R
a. sə	*!	*	*	*			
b. ☞ qə-s-ne-sə			*			*	
c. qə-s-sə-ne			*			*	*!
d. s-ne-sə			*	*!			
e. s-qə-ne-sə			*		*!		

The winning candidate of the morphological computation in (14) is shifted to the phonological component of the word-level stratum. Importantly, the input to this computation *qə-s-ne-sə* contains a similar marked consonant cluster as the structure in (9), namely /sn/. However, since the structure enters computation at a later level, it faces a different constraint ranking, which will result in a different repair of the marked structure. Crucially, AGREE$_{\text{CC}}$(NASAL) is lower ranked than at stem-level, as shown in (15). As a consequence, the phonological grammar will only trigger voicing assimilation of the fricative, such that candidate (b) becomes optimal in (15). Candidate (c), in which the consonant cluster was resolved by vowel epenthesis does not surface as the optimal candidate, since AGREE$_{\text{CC}}$(NASAL) is lower ranked than DEP at word-level. Moreover, candidate (d), in which the second consonant of the cluster assimilates, is ruled out due to a high-ranked constraint on voiceless nasals.

(15) Phonological optimization at word-level for (2d)

qə-s-ne-sə	AGREE$_{\text{CC}}$(VOICED)	*[–son,+nas]	*[–voiced, +nas]	DEP	AGREE$_{\text{CC}}$(NASAL)	ID
a. qəsnesə	*!					
b. ☞ qəznesə					*	*
c. qəsənesə				*!		
d. qəsn̥esə			*!		*	*

After the phonological computation, bracket erasure takes place and the output is shifted to phrase-level. As in (13), the remaining MAX(TMA) is satisfied by concatenating the tense marker in (16). Recall that there is re-ranking from word-level to phrase-level in the morphological component of the grammar since all affixes now attach to the right of the word. As a consequence, candidate (b) becomes optimal since the tense-marker is attached as a suffix.

(16) Morphological optimization at phrase-level for (2d)

sə V
ne [LOC], word-level
s [AGR$_{DAT}$], 1SG, word-level
qe [INV], word-level
ǧ [PST], phrase-level

qəznesə, [•TMA•]	MAX(AGR)	MAX(APPL)	MAX(TMA)	MAX(INV)	L ⇐ INV	L ⇐ PERS	L ⇐ V
a. qəznesə			*!				
b. ☞ qəznesə-ǧ							
c. ǧ-qəznesə							*!

These two sample derivations illustrate how the stratal interaction of morphology and phonology derive the different repairs of the consonant cluster /sn/ in (2b) vs. (2d). In the following, I will show that the stratal architecture of the Adyghe verb explains the non-compositionality of the combination of applicatives and causatives in Adyghe without further assumptions.

In chapter 5.1, I already showed that the relative order of the comitative and the causative is fixed to the order COM>CAUS. The relevant examples are repeated here in (17). In (17a), the comitative applicative introduces an argument accompanying the causer. Consequently, it can be assumed that causative applies **before** comitative applicative. Assuming that the relative order of affixes matches the compositional history of the two operations, it is predicted that the causative marker is closer to the verb than the comitative. This prediction is borne out in (17a). In (17b), however, the comitative applicative introduces a second agent or causee rather than a second causer, as indicated by the context. Thus, it has to be assumed that the causative applies **after** the comitative applicative. As a consequence, it is predicted that the comitative is actually closer to the verb than the causative marker in order to allow the morphological structure of the verb to match the semantic requirements of the underlying structure. However, this prediction is not borne out since the causative is still closer to the verb, independent of the interpretation, as shown in (17b).

(17) Fixed order of COM and CAUS

a. Se tʃale-r wo qʷə-p-de-sə-ʁə-tŝəyə
I child-ABS you CIS-2SG-COM-1SG-CAUS-sleep
'I (and you) make the child sleep.'
Context: My baby is crying a lot, so me and you sing a song to make him sleep.

b. Se a-r wo qʷə-p-de-sə-ʁə-ʃʼə-ʁ
I 3-ABS 2SG CIS-2SG-COM-1SG-CAUS-dance-PST
'I made him dance with you.'
Context: My friend is secretly in love with you but she is really shy and does not dare to dance with you. In the end, I convince her to dance with you.

In chapter 8.7, I illustrate how semantic transparency is implemented in the analysis I suggest in this dissertation. In Adyghe, however, the noncompositionality of (17b) arises directly from the stratal architecture of the word: since the causative belongs to the stem-level while the applicative enters the derivation only at word-level, the affixes cannot interact. Concretely, bracket erasure has applied when the applicative comes into play, such that constraints on semantic transparency cannot become active. Thus, the stratal architecture provides an explanation to the counter-feeding opacity. Let me illustrate how the complex sentence in (17b) is derived. I assume that the verb in (17b) comes with the following contextual features:

(18) Input for (17)
V, [•CAUS•], [•APPL•], [•AGR_{ERG}•], [•AGR_{DAT}•], [•TMA•], [•CIS•]

At this point, I want to elaborate how the argument structure of the predicate is implemented by the contextual features [•AGR_{ERG}•] and [•AGR_{DAT}•]. A lexical model of model of argument structure and argument linking is suggested by Joppen & Wunderlich (1995), Wunderlich (1997b) or Stiebels (2002). In Adyghe, there are three positions, in which agreement morphology may show up: first, the 1SG marker /s/ in (17b) attaches at stem-level. Arguments indexed in this position are typically the structurally highest arguments, e.g. agents and causers. The descriptive literature about Adyghe calls agreement morphology in this position *ergative morphology*. I adopt this terminology in this analysis. Second, the 2SG marker /p/ in (17b) is a word-level affix and indexes arguments which are introduced by applicatives. This set of agreement affixes is typically called *dative agreement*. The terminology in the descriptive literature is misleading, since the agreement markers differ only marginally between the different position. Rather, the case-related terminology refers to the group of arguments which are indexed by these markers. The third possible position for agreement morphology in Adyghe is the leftmost word-level prefix. This position is empty in all examples considered in this chapter, since these sentences involve a zero-marked 3SG argument. Nonetheless, this position usually encodes the structurally lowest argument, and is also called the *absolutive agreement* slot.
In the sentence in (17b), three markers attach at word-level: the comitative, the 2SG dative marker and the cislocative. The relative order between these markers is regulated by alignment constraints that make reference to these markers. Consequently, the relative ranking of these alignment constraints provides the relative surface order of affixes within a stratum. The question arises where the ranking between these constraints comes from. In this dissertation, I have no conclusive answer to this question. As a starting point, I assume that the relative ranking roughly corresponds to the *Relevance principle* by Bybee (1985). In short, the semantically most relevant category, e.g. voice, is expected to be realized in proximity of the verb root. Semantically less relevant categories, like agreement, are expected to occur in a more external position. Since both valency markers and agreement markers are prefixes in Adyghe,

I assume that the two constraints L ⇐ PERS and L ⇐ VOICE regulate the relative order between the two categories, and that L ⇐ PERS is higher ranked than L ⇐ VOICE. Consequently, agreement will appear in a more external position than voice and valency morphology. This mechanism is suggested by Zukoff (2022) and is discussed in further detail in chapter 8.6. This assumption allows to produce some kind of default order, which then corresponds to the hierarchy established by the *Relevance principle* by Bybee (1985). In chapter 4, I have shown that the position of agreement morphology is less predictable than other categories. To derive the anomalies related to agreement, it is conceivable that there are additional, morphological constraints on the position of agreement morphology, e.g. COHERENCE (Trommer 2008), which will be discussed in chapter 8.4. I would like to emphasize that this assumption is only a tentative hypothesis. In fact, I believe that future research on the relative order of grammatical categories has to uncover which of the categories exhibit some type of default ordering. The tableaux in (19) and (20) illustrate how the complex sentence in (17b) is derived in the analysis adopted in this dissertation. At stem-level, the root combines with the causative and the ergative agreement marker, which indexes the causer argument. Candidates (e) and (f) in (19) are ruled out due to violations of the highly ranked MAX constraints. The alignment constraints L ⇐ PERS and L ⇐ VOICE regulate the relative order of the causative morpheme and the person marker within the stem-level. As a result, candidate (a) becomes optimal, where agreement is further away from the stem than causative morphology. That is, the relative order of the verbal categories obeys the *Relevance Principle* by Bybee (1985) **within a stratum**.

(19) Morphological optimization at stem-level for (17b)

ʃ'ə V
ʁə [CAUS], voice, stem-level
s [AGR_{ERG}], 1SG, stem-level
de [APPL], COM, word-level
p [AGR_{DAT}], 2SG, word-level
q^wə [INV], word-level

V, [•CAUS•], [•APPL•], [•AGR_{ERG}•], [•AGR_{DAT}•], [•TMA•], [•CIS•]	M(CAUS)	M(APPL)	M(TMA)	M(CIS)	M(AGR_{ERG})	M(AGR_{DAT})	L ⇐ CIS	L ⇐ PERS	L ⇐ VOICE
a. ☞ s-ʁə-ʃ'ə		*	*	*		*			*
b. ʁə-s-ʃ'ə		*	*	*		*		*!	
c. ʃ'ə-s-ʁə		*	*	*		*		*!	**
d. s-ʃ'ə-ʁə		*	*	*		*			**!
e. s-ʃ'ə	*!	*	*	*		*			
f. ʁə-ʃ'ə		*	*	*	*!	*			

The output from the derivation in (19) is taken to the phonological component of the stem-level for phonological optimization. Afterwards, bracket erasure takes place and the word enters the morphological component of the word-level, which is illustrated in (20). At this point of the derivation, the applicative, the dative agreement marker and the inverse marker are concatenated. Again, the relative order of the three markers is regulated by the alignment constraints. As a result, candidate (a) in (20) becomes the optimal surface candidate. Again, the relative order of agreement and the applicative morphology obeys the *Relevance Hierarchy* within the word-level stratum.

(20) Morphological optimization at word-level for (17b)

ʃ'ə	V
ʁə	[CAUS], voice, stem-level
s	[AGR$_{ERG}$], 1SG, stem-level
de	[APPL], COM, word-level
p	[AGR$_{DAT}$], 2SG, word-level
qʷə	[INV], word-level

V, [•APPL•], [•AGR$_{DAT}$•], [•TMA•], [•CIS•]	M(APPL)	M(TMA)	M(CIS)	M(AGR$_{DAT}$)	L ⇐ CIS	L ⇐ PERS	L ⇐ VOICE
a. ☞ qʷə-p-de-s-ʁə-ʃ'ə		*				*	**
b. qʷə-de-p-s-ʁə-ʃ'ə		*				**!	*
c. de-p-qʷə-s-ʁə-ʃ'ə		*			*!*	*	
d. qʷə-s-ʁə-ʃ'ə	*!	*		*			
e. p-s-ʁə-ʃ'ə	*!	*	*				
f. de-s-ʁə-ʃ'ə		*	*!	*			
g. s-ʁə-ʃ'ə	*!	*	*	*			

8.4 Case study: Murrinh-Patha

In this chapter, I will present and analyze the intricate pattern of the placement of the dual non-sibling marker *ngintha* in Murrinh-Patha. I will show that the prosodic correlates of the placement of *ngintha* provide further evidence for a stratal modeling of the morpho-phonology interface. Moreover, it has been argued by Nordlinger & Mansfield (2021) that *ngintha* is part of a phenomenon involving morphological blocking and position-sensitive allomorphy, two phenomena that require reference to position classes in the grammar. I will argue that a stratal architecture provides a straight-forward explanation to these patterns under the assumption that *ngintha* is underspecified for the stratum at which it attaches (Kiparsky 2015).
Mansfield (2017) shows that the prosodic word in Murrinhpatha is subject to a phonotactic constraint on bimoraicity. That is, phonological constituents need to consist

of at least two moras with stress falling on the penultimate syllable, as indicated by an acute accent in (21). In (21a), the word consists only of an monosyllabic, finite verb stem. Since a short vowel would violate the minimum quantity requirement, the vowel of the syllable undergoes compensatory lengthening in order to fulfil the condition on bimoraicity. In (21b), the word contains a monosyllabic finite stem and an object suffix. Stress falls on the penultimate syllable, whose vowel is not lengthened. Mansfield (2017) concludes that the lack of compensatory lengthening indicates that the affix and the stem are part of the same prosodic constituent since the mora of the affix is taken into account when stress is assigned. However, this generalization does not hold for all affixes. As shown in (21c), the vowel of the finite verb stem is lengthened even though there is an affix attached to it. Mansfield (2017) assumes that this affix attaches at a later phonological level, that is, after lengthening has applied. In simpler terms, the contrast in the vowel length between (21b) and (21c) indicates that phonology is layered and that the requirement on bimoraicity refers to the inner layer. The example in (21d) illustrates that the dual marker *ngintha* is part of the inner layer, since stress falls on the penultimate syllable of the entire complex. In (21e), however, stress falls on the penultimate syllable of the coverb *páta* indicating that inner phonological layer comprises the finite verb stem, the object marker and the coverb, but crucially not *ngintha* and the imperfective marker *pibim*. In this sense, *ngintha* is part of the inner layer in (21d), but part of the outer layer in (21e).

(21) Minimum quantity and phonological levels (Mansfield 2017: 362, 366, 368)

a. kéː
'nerite shell'

b. ná-nge
say.2SG.IRLS-3SG.FEM.OBJ
'tell her'

c. tíː-nu
sit.2SG.IRLS-FUT
'you will sit'

d. piɾim-ngíntha
stand.3SG.NONFUT-DU
'the two of them are standing'

e. pumam-nga-páta-ngintha-pibim
use.hands.3PL-1SG.OBL-make-DU-IMPFV
'the two of them are making it for me'

Mansfield (2017) takes this data set to be evidence for layered phonology and exploits this observation to predict the structure of verbal compounds in Murrinhpatha. Concretely, Murrinhpatha exhibits the unusual property that the predicate consists of an inflected verb stem, which also carries features of the subject argument, called the *finite stem*, and an uninflected coverb, which is to the right of internal affixes but to the left of external affixes, e.g. *páta* in (21e). Mansfield (2017) assumes a stratal phonological structure to provide an anchor for the placement of the coverb. More specifically, Mansfield (2017) suggests that the coverb attaches to the word-level and that stratafication is recursive such that the coverb initiates another stem-level stratum.

Another peculiarity found in Murrinhpatha is the resolution of number features. Since the finite stem encodes certain features of the subject argument, the realization of number is distributed across the finite stem, and additional number affixes. The resulting number value depends on the combination of both markers, as illustrated in table 8.3.

Finite verb stem	**Number**	**Value**
SG	∅	SG
SG	DU.NONSIB	DU.NONSIB
DU/PC	∅	DU.SIB
DU/PC	PC.NONSIB	PC.NONSIB
PL	∅	PC.SIB/PL

Table 8.3: Number resolution in Murrinh-Patha

A combination which is not listed in table 8.3 is the combinaton of a DU/PC finite stem and a dual non-sibling number marker. However, exactly this combination arises in certain constellations, as shown by Nordlinger & Mansfield (2021), who argue that the form of the finite verb stem changes if the dual non-sibling marker *ngintha* is not adjacent. In both examples in (22), *ngintha* refers to the subject argument. In (22a), it is adjacent to the finite stem which carries the person features of the subject argument. In that case, the form of the finite stem is *ba*, which is typically used for singular non-sibling subjects, i.e. it is a SG finite stem. If the object argument is overtly marked, as in the case of 1st or 2nd person objects, the object marker appears to the right of the finite stem, as illustrated in (22b). In that scenario, the form of the finite stem changes to *nguba*, which is otherwise used for dual subjects, i.e. it is the DU/PC finite stem of 'to see'. Moreover, the dual non-sibling marker *ngintha* is shifted to the right edge of the verb. In that position, it follows the coverb *ngkardu* 'to see'. Nordlinger & Mansfield (2021) take the varying placement of *ngintha* to be evidence for position classes, assuming that the object marker and *ngintha* compete for the same position class, yielding to a suppression of *ngintha* in (22b).

(22) Allomorphy of the classifier stem (Nordlinger & Mansfield 2021: 8)

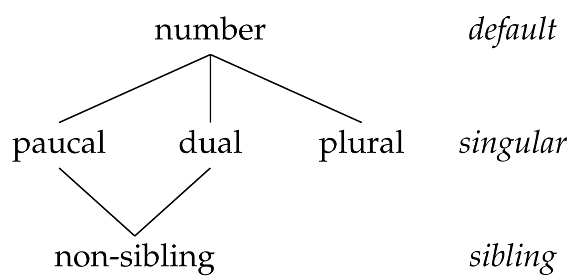
a. ba-ngintha-ngkardu-nu
   see.1SG.SUBJ-DU-see-FUT
   'We (dual non-sibling) will see him / her.'

b. nguba-nhi-ngkardu-nu-ngintha
   see.1DU.SUBJ-2SG.OBJ-see-FUT–DU
   'We (dual non-sibling) will see you'

Taking all these observations into account, I will show that featural specifications of the markers, a number of morphotactic constraints basing on strong crosslinguistic evidence and the stratal architecture of the morpho-phonology interface will provide a neat explanation to the placement of *ngintha* and its phonological and semantic correlates without assuming position classes as a primitive entity of the theoretical model.

Let me first discuss the featural specifications of the relevant markers, including the finite stems. From the complex number resolution patterns in 8.3, I infer the following feature geometry of number in Murrinhpatha:

(23) Number specification in Murrinh-Patha



This feature geometry is to be understood as follows: I assume that number is represented by a set of privative features, which are in a dependency relation with each other. Concretely, the feature [non-sibling] entails that either [paucal] or [dual] is present. In simpler terms, [non-sibling] can only be realized in the presence of [paucal] or [dual]. In the absence of those privative feature, the default interpretation of number is active, which is singular in the absence of paucal, dual or plural, and sibling in the absence of non-sibling. Following Harley & Ritter (2002), I further assume that 1st and 2nd person argument are realized using privative person features, while realization of 3rd person does not involve features and is inferred through default interpretation. I further assume that the 3rd person object in (22a) is realized by a covert object marker which has the feature [object].

Just as Mansfield (2017), I assume that the word is internally divided into several strata, but deviate from his analysis in assuming that the coverb does not attach **to** the level of the inflectional, but **at** the same level as the inflectional affixes. In that sense, the coverb behaves like a regular affix. In short, I assume that inner inflectional affixes and the coverb attach at stem-level, while external affixes attach at word-level. *ngintha* is different than other affixes in that it is underspecified as to the stratum it attaches to, an analytical option previously made by Kiparsky (2015). These assumptions give rise to the following featural specifications of the markers in Murrinhpatha:

As already said, there are no uninflected verb stems in Murrinhpatha. Rather, all verb stems are already inflected, which is why their featural specification include argument-related features. We have also seen that the features belonging to the subject argument are realized by an array of different markers, which are distributed

Stratum	Category	Specification	Form
Stem	[finite stem]	[1, subject]	ba
		[1, dual, subject]	nguba
	[coverb]	'to see'	ngkardu
	[OBJ]	[2, object]	nhi
		[object]	∅
Word	[TMA]	FUT	nu
unspecified	[SUBJ]	[non-sibling, dual]	ngintha

Table 8.4: Murrinh-Patha affixes divided into strata

across the word. Concretely, the number features are realized by the finite verb stem, which is always the left-most element of the word, and several number markers. In the morphological component of the grammar, it has to be ensured that the different exponents cover the featural specifications of the subject in the most optimal way. That is, all features should ideally be realized exactly once, thus avoiding overexponence and underexponence. Let me assume that the input to the morphological component of the grammar is two-fold: it contains a set of features belonging to the subject argument (and other arguments), which I will refer to as SUBJ or OBJ, and a set of selectional [•F•] features that concatenate the root with exponents. In contrast to other languages, the grammar selects an already inflected verb stem from an array of markers. Thus, the verb stem itself is already specified for certain features. In the morphological grammar, constraints ensure that these exponents – the finite stem and independent number markers – realize the features of the argument. To model this matching, I adopt the following constraints:

(24) a. L ⇐ PERS(ON): (Trommer 2003)
Assign * for each exponent between exponents of [Person] and the left edge of the word.

b. M(AX)(F): (Trommer 2008, Müller 2020)
Assign * for each feature [F] of the input if it is not realized on an exponent in the output.

c. *M(ULTIPLE) E(XPONENCE)$_F$:
Assign * for each feature F which is realised by more than one exponent.

d. COH(ERENCE): adapted from Trommer (2008)
Assign * for each exponent that intervenes between the first exponents realizing features from one and the same feature set in the input.

Crucially, the MAX(F) constraints trigger the realization of features from the input by different types of exponents, that is, a finite verb stem, a number marker or a TMA marker. The other constraints refer to the exact features that these markers encode. Crucially, L ⇐ PERS(ON) ensures that exponents encoding person are left-aligned. It could, however, be the case that exponents (including finite verb stems) are underspecified with respect to [Person] and would therefore not be aligned by that constraint.

This is what happens in (22a) when a 3rd person object marker is concatenated: since 3rd person is not realized by a private person feature, L ⇐ PERS(ON) is not violated. The constraint COH(ERENCE) is an adjacency constraint that ensures that features belonging to the same feature set are realized in adjacency to each other. Crucially, COH(ERENCE) refers to the feature set belonging to the subject or the object argument. It is irrelevant if the features of the shared feature set are expressed by one and the same exponent or by two different, adjacent exponents. It will only be violated if another exponent which is not part of the shared features intervenes. MAX(SUBJ) and *M(ULTIPLE) E(XPONENCE)$_F$ ensure that the exponents realize the input feature set of the verbal arguments in the most optimal way. Concretely, MAX(SUBJ) will be violated if a feature from the input feature set of the subject is not realized, while *M(ULTIPLE) E(XPONENCE)$_F$ is violated if it is realized more than once.
Since there is no overt root that all inflectional and derivational affixes attach to, but a finite verb stem which is already inflected, I assume that the root is an abstract pointer $\sqrt{see}$, which already selects a paradigm, that is, a set of inflected forms of one and the same stem, but does not choose a specific form of the root. This assumption does not cause a problem for StratOT since the root is not a cyclic domain and does not undergo phonological optimization.
I assume that the words in (22) have the following selectional features:

(25) Selectional features of the Murrinhpatha words [14]
$\sqrt{see}$, [•finite stem•], [•coverb•], [•TMA•], [•SUBJ•], [•OBJ•]

I assume that the ranking of constraints at the morphological component at stem-level is: M(FIN STEM), M(COVERB), M(OBJ) » L⇐PERS » COH » M(SUBJ), *ME
Crucially, constraints on placement of the markers (L⇐PERS and COH) are higher ranked than constraints on optimal matching (MAX(SUBJ) and *ME). **As a result, a feature will remain unrealized or realized twice if it cannot be realized in its optimal position.** The tableau in (26) illustrates the derivation of the morphological component of the stem-level for the surface form in (22a). The input to this derivation is the abstract pointer $\sqrt{see}$, the selectional features [•finite stem•], [•coverb•], [•TMA•], [•SUBJ•] and [•OBJ•]. The feature set that MAX(SUBJ) makes reference to is [Subject, 1, Dual, Non-Sibling].

[14] In this dissertation, I assume that it is the finite stem that selects the coverb and not vice versa. This assumption is far from uncontroversial since there are numerous codependencies between the finite verb stem and the coverb. Moreover, reciprocal selection is generally problematic, as previously argued by Popp & Tebay (2019). I leave the question of the directionality of selection open for further research.

(26) Morphological optimization at stem-level, (22a)

ba	[finite stem], [1, subject], stem-level
nguba	[finite stem], [1, dual, subject], stem-level
ngkardu	[coverb], 'to see', stem-level
∅	[OBJ], [Object], stem-level
nu	[TMA], [FUT], word-level
ngintha	[SUBJ], [non-sibling, dual], unspecified

$\sqrt{see}$, [•fin stem•], [•coverb•], [•TMA•] SUBJ: [Subject, 1, Dual, Non-Sibling]		M(FIN STEM)	M(COVERB)	M(OBJ)	L⇐PERS	COH	M(SUBJ)	*ME
a. ☞	ba-ngintha-∅-ngkardu							
b.	ba-ngintha-∅		*!					
c.	ba-∅-ngkardu						*!*	
d.	nguba-∅-ngkardu						*!	
e.	nguba-ngintha-∅-ngkardu							*!
f.	ba-∅-ngkardu-ngintha					*!		

Candidate (a) in (26) is the optimal candidate, since all constraints are satisfied: all affix types have been concatenated such that none of the MAX constraints is violated. Moreover, each feature of the input feature set is realized exactly once, since *ba* realizes [1] and [Subject] while *ngintha* realizes [Dual] and [Non-Sibling]. Moreover, both exponents are in their preferred position. Since the covert person marker does not involve a private person feature, L⇐PERS is not violated by candidate (a) and becomes optimal. The finite stem carrying the person features is maximally left aligned and *ngintha* is immediately adjacent, such that neither L⇐PERS nor COH is violated. The optimal candidate *ba-ngintha-ngkardu* is then taken to the phonological component of the stem-level for further phonological optimization. Note that the optimal candidate contains exactly those affixes that are taken into consideration when the minimum quantity requirement is evaluated. Concretely, it contains inner affixes and the coverb, but crucially, no external affixes. **In short, checking of the bimoraicity condition takes place at the phonological optimization of stem-level.** Within the phonological component, stress assignment and compensatory lengthening apply. After this computation, bracket erasure applies. The next step of the derivation takes place in the morphological component at word-level. At this step of the derivation, the grammar has access to the output of the stem-level **with stress already assigned**, *banginthangkardu*, remaining selectional features, as well as word-level and underspecified affixes. This step of the derivation is illustrated in (27). All selectional features have already been satisfied at the previous stratum, except for [•TMA•], which can only be satisfied at word-level, since all TMA affixes are word-level affixes. The high-ranked L⇐V ensures that all affixes attached at word-level will end up in a suffixal position. Note that NUM⇒R is not violated, since *ngintha* was already concatenated and bracket erasure has taken place. As a consequence, the grammar does not have access to the morphological boundaries of *ngintha* anymore and can therefore not evaluate its position. After this step of morphological optimization, the optimal candidate *banginthangkardu-nu* enters the phonological component of the word-level for further optimization.

(27) Morphological optimization at word-level, (22a)

ba	[finite stem], [1, subject], stem-level
nguba	[finite stem], [1, dual, subject], stem-level
ngkardu	[coverb], 'to see', stem-level
nu	[TMA], [FUT], word-level
ngintha	[SUBJ], [non-sibling, dual], unspecified

banginthangkardu, [•TMA•] SUBJ: [~~Subject~~, ~~1~~, ~~Dual~~, ~~Non-Sibling~~]		M(TMA)	L⇐V	M(SUBJ)	NUM⇒R	*ME
a.	banginthangkardu	*!				
b. ☞	banginthangkardu-nu					
c.	nu-banginthangkardu		*!			

Recall that Nordlinger & Mansfield (2021) argue that the data set in (22) suggests that Murrinhpatha exhibits *templatic morphology*: since *ngintha* is blocked in the position after the finite stem in (22b), the authors argue that both markers compete for the same position class. Moreover, the appearance of a different finite stem in (22b) is taken to be evidence for position-conditioned allomorphy where a different allomorph of the stem is chosen in the presence of an object marker or rather - in the absence of *ngintha*. In short, Nordlinger & Mansfield (2021) suggest that position classes need to be assumed as abstract entities in the morphological grammar so that certain morphological rules can make reference to it. However, the model presented in this chapter allows the derivation of the example in (22b) **without assuming position classes**. Rather, morphological blocking of *ngintha* arises from morphotactic constraints on placement of person features, as previously suggested by Trommer (2001, 2003, 2008) and constraints on adjacency, as illustrated in (28). Recall the constraint ranking of the morphological component at stem-level from (26), so that M(FIN STEM), M(COVERB), M(OBJ) » L⇐PERS » COH » M(SUBJ), *ME. In contrast to the derivation of (22a) in (26), the example in (22b) concatenates an object marker with a privative person feature [2], which cause the relatively high-ranked L⇐PERS becomes active, thus shifting the marker to the right of the finite stem. This constraint actually causes a competition between the object marker and *ngintha* for the position to the right of the finite stem. However, the competition arises from morphotactic constraints on positioning preferences rather than from position classes.[15] Consequently, the fact that L⇐PERS outranks COH yields structures in which the object marker is realized in this position, thus excluding candidates (b) and (f) in (28). Concatenating *ngintha* as the next affix to the right of the object marker creates a violation of COH, thus rendering candidates (a) and (d) suboptimal. There is an independent reason why COH should be ranked that high: since *ngintha* can refer to either subjects or objects, adjacency to the object would yield a wrong interpretation. Since *ngintha* cannot be realizes in its preferred position, the grammar chooses to not concatenate the marker. Since *ngintha* realized the input features [Dual, Non-Sibling], non-realization of the markers yields two violations of the constraint M(SUBJ), thus ruling out candidate (c). However, the grammar still has the option to choose a more specific finite stem - *nguba* - which is specified for [Dual], in contrast to *ba*. In (26), the choice of *nguba* was blocked since simultaneous realization of *nguba* and *ngintha* creates a violation of *ME. In the derivation in (28), choosing *nguba* becomes now the preferred option since non-realization of *ngintha* prevents a violation of *ME and creates only one violation of M(SUBJ). Thus, candidate (e), which includes *nguba*, but excludes *ngintha*, becomes optimal.

(28) Morphological optimization at stem-level, (22b)

ba	[finite stem], [1, subject], stem-level
nguba	[finite stem], [1, dual, subject], stem-level
ngkardu	[coverb], 'to see', stem-level
nhi	[OBJ], [2, object], stem-level
nu	[TMA], [FUT], word-level
ngintha	[SUBJ], [non-sibling, dual], unspecified

[15] Since both the finite stem and the object marker carry person features, an additional constraint would be needed to determine which affix will end up in the left-most position. This could be achieved with a high-ranked L⇐V, as in (27), which generates structures in which the finite stem is always to the left.

√*see*, [•fin stem•], [•coverb•], [•TMA•], [•OBJ•] SUBJ: [Subject, 1, Dual, Non-Sibling] OBJ: [Object, 2]		M(FIN STEM)	M(COVERB)	M(OBJ)	L⇐PERS	COH	M(SUBJ)	*ME
a.	ba-nhi-ngintha-ngkardu				*	*!		
b.	ba-ngintha-nhi-ngkardu				**!			
c.	ba-nhi-ngkardu				*		**!	
d.	ba-nhi-ngkardu-ngintha				*	*!*		
e. ☞	nguba-nhi-ngkardu				*		*	
f.	nguba-ngintha-nhi-ngkardu				**!			*
g.	ba-ngintha-ngkardu			*!	*		*	
h.	nhi-ngintha-ngkardu	*!			*		**	

Again, the optimal candidate *nguba-nhi-ngkardu* is taken to the phonological component of stem-level, where evaluation of the minimum quantity condition, stress assignment and compensatory lengthening apply. After this step, computation at stem-level is complete, bracket erasure takes place and the output is send to word-level, illustrated in (29). This time, no exponent for the [Non-Sibling] feature of the input has been realized yet, which led to a violation of M(SUBJ). As a consequence, the grammar will try to find a matching exponent and a TMA exponent. Since Murrinhpatha does not only have the underspecified *ngintha* number exponent, but also a word-level only number marker *ngime*, I believe that the grammar at this level still requires access to the input feature structure to find the matching exponent. Thus, the constraints M(SUBJ) and *ME are still active. The high-ranked MAX constraints require that both a number and a TMA exponent are concatenated at this step, thus ruling out candidate (a) in (29). Again, there is a constraint L⇐V ensuring that all affixes added at this level are suffixes, therefore excluding candidate (d). At this point of the derivation, NUM⇒R (Trommer 2001, 2003, 2008) becomes active and regulates the relative ranking of TMA and *ngintha*. Candidate (b), which surfaces in (22b) is therefore successfully predicted to become the optimal candidate.

(29) Morphological optimization at word-level, (22b)

ba	[finite stem], [1, subject], stem-level
nguba	[finite stem], [1, dual, subject], stem-level
ngkardu	[coverb], 'to see', stem-level
nhi	[OBJ], [2, object], stem-level
nu	[TMA], [FUT], word-level
ngintha	[SUBJ], [non-sibling, dual], unspecified

ngubanhingkardu, [•TMA•] Subj: [~~Subject~~, ~~1~~, ~~Dual~~, Non-Sibling] Obj: [~~Object~~, ~~2~~]		M(TMA)	L⇐V	M(Subj)	Num⇒R	*ME
a.	ngubanhingkardu	*!	*	*		
b. ☞	ngubanhingkardu-nu-ngintha					*
c.	ngubanhingkardu-ngintha-nu				*!	
d.	nu-ngubanhingkardu-ngintha		*!			

In short, the difference in the prosodic behaviour of *ngintha* between (21d), where *ngintha* belongs to the stress domain, and (21e), where *ngintha* is outside the stress domain, arise from the fact that *ngintha* attaches at different phonological strata.

A crucial factor in the analysis of the data in (22) is the low ranking of Max(Subj) and the underspecification of *ngintha* with respect to the strata it is affiliated with, thus creating a scenario in which realization of an exponent can be delayed. A probing question is whether the grammar somehow knows that *ngintha* has the chance to enter the structure later, thus creating some sort of *lookahead* problem? I argue that these two properties are completely independent of each other. With the low ranking of Max(Subj), the grammar builds in the option that a marker cannot be concatenated if it cannot be concatenated at the best fit **without** taking into account if the affixes may be attached at a later cycle. Exactly this is what happens to the paucal marker *-ka*, which is a stem-level affix only. In (30a), the paucal marker *-ka* is attached to the finite verb stem under adjacency. The position of the stress indicates that *-ka* is attached in the first cycle, since it is part of the domain stress is assigned to. Another number affix, *-ngime* is attached at word-level to contribute the gender feature. In (30b), *-ka* is faced with the same situation like *ngintha* in (22b): it cannot be placed in adjacency to the finite stem, since this position is blocked by the object marker. As a consequence (due to the low ranking of Max(Subj)), the exponent is entirely blocked. Since *-ka* is not underspecified, it cannot be concatenated at word-level either. This minimal pair shows that the option to not concatenate a marker is entirely independent of the underspecification of the marker.

(30) *-ka* as a stem-level affix only (Mansfield 2017)

a. [[Pumám-ka]$_{stem}$-ngime]$_{word}$.
say.3PL-PC.SUBJ-PC.FEM
'They (paucal) said'

b. dɻáf [[pumám-nga]$_{stem}$-neme]$_{word}$
draft do.3PL-1SG.OBJ-PC.MASC
'They (paucal) drafted me.'

8.5 More stratality in affix ordering

In the previous two sections, I have shown that phonological correlates of affix order uncover the internal, layered structure of the word in Adyghe and Murrinhpatha. These layered structures then allow to account for anomalies in affix order, such as non-compositionality between CAUS and APPL in Adyghe or morphologically conditioned displacement in Murrinhpatha. The stratal architecture of the model predicts a number of cyclic effects, among which are cyclic application of phonological rules, cycle-based opacity and limited application of rules. Crucially, the limited application necessitates constraint re-ranking and is an argument in favor of a stratal model, instead of a more general cyclic model. Cyclic application of phonological rules or cycle-based opacity, on the other hand, are predicted by any cyclic model (see Kushnir 2019 for discussion). I believe that all three types of phenomena are attested in the realm of affix order.

8.5.1 Washo

In chapter 5.2.1, I already the discussed the case of nontransitivity in Washo, which was argued to follow from phonological rules (Jacobsen 1964, 1973, Benz 2017). Recall that Washo (isolate, USA) exhibits nontransitivity of the inclusive markers, the negation and the near future marker, such that the inclusive suffixes *ši* and *hu* precede the near future marker *áša*ʔ in (31a) and the near future marker precedes the negation *éːs* in (31b). Contrary to transivitity presumptions, however, the negation precedes the inclusive suffixes in (31c).

(31) Nontransitivity in Washo (Jacobsen 1964, 1973)

a. le-ímeʔ-ši-ášaʔ-i
1-drink-DU.INCL-NEAR.FUT-IND
'Both of us are going to drink.'

b. le-íme ʔ-ášaʔ-éːs-i
1-drink-NEAR.FUT-NEG-IND
'I will not drink'

c. le-íme ʔ-éːs-ši-leg-i
1-drink-NEG-DU.INCL-REC.PST-IND
'Both of us did not drink.'

If negation, near future and the inclusive suffixes cooccur, there is only one possible surface form, as shown in (32).

(32) 3-affix-clusters (Jacobsen 1964, 1973)

a. lé-íme?-áša?-éːs-hu-i
   1-drink-NEAR.FUT-NEG-PL.INCL-IND
   'We (incl.) are not going to drink.'

b. *lé-íme?-hu-áša?-éːs-i
   1-drink-PL.INCL-NEAR.FUT-NEG-IND

c. *lé-íme?-éːs-hu-áša?-i
   1-drink-NEG-PL.INCL-NEAR.FUT-IND

Jacobsen (1964) discusses two peculiarities about the affixes involved in nontransitivity: first, some of these affixes, like the near future marker *áša?* or the negation *éːs*, are inherently stressed. Jacobsen (1964) further observes that affixes in Washo seem to be rhythmically aligned such that a stressed syllable and an unstressed syllable alternate. Second, Jacobsen (1964) shows that the affixes involved form a natural class to the exclusion of more external suffixes. More specifically, the indicative *-i* in (31) and (32), and other more external suffixes are absent in many infinite verb forms, e.g. nominalizations. Moreover, they are never inherently stressed nor do they participate in non-transitivity. Benz (2017) takes these facts to be evidence that the phonological word in Washo exhibits a layered, cyclic structure and suggests a formal analysis couched in StratOT. Benz (2017) assumes that the affixes involved in nontransitivity belong to the *stem-level*, while more external affixes are *word-level* affixes. In the following, I will present the analysis as suggested by Benz (2017). Therefore, the tableaux differ slightly from the ones I presented earlier in this chapter, since Benz (2017) takes the input to be an unordered set of affixes. Moreover, she assumes that phonology and morphology operate in parallel within a stratum.

(33) Constraints by Benz (2017)

a. NEG-R
   Assign * for every exponent intervening between NEG and the right edge of prosodic word (PrWd).

b. INCL-R
   Assign * for every exponent intervening between INCL and the right edge of PrWd.

c. NEARFUT-R
   Assign * for every exponent intervening between NEAR.FUT and the right edge of PrWd.

d. NONFIN(ALITY)
   Assign * for a stressed syllable that is final in PrWd.

e. MAX
   Assign * for a syllable that is stressed in the input but not in the output.

f. *CLASH
Assign * for a stressed syllable that is immediately followed by another stressed syllable.

To derive phonologically conditioned affix order in Washo, Benz (2017) adopts the constraints listed in (33), where NEG-R, INCL-R and NEARFUT-R are general alignment constraints (McCarthy 1993), while the other constraints are well-established phonological constraints ruling stress assignment. Note that the abbreviation PrWd in the constraint definitions in (33) refers to the prosodic word.
When the near future marker *áša?*, which carries inherent stress on its intial syllable, and the inclusive suffixes enter the derivation, phonological constraints *CLASH, NONFIN(ALITY) and MAX do not become active, as shown in (34). This is because none of the possible orders creates violations of *CLASH, which penalizes two adjacent stressed syllables, or NONFIN(ALITY), which penalizes stressed final syllables. As a consequence, the *default order*, regulated by ALIGN constraints, shows up, as shown in (34).

(34) Derivation for (31a) (Benz 2017: 11)

íme? drink
áša? NEAR.FUT
é:s NEG
hu PL.INCL
ši DU.INCL

/íme?/, /áša?/, /ši/	*CLASH	MAX	NONFIN	NEG-R	NEARFUT-R	INCL-R
a. ☞ íme?-ši-áša?						*
b. íme?-áša?-ši					*!	

As for the combination of the inherently stressed negation *é:s* and the inclusive suffixes, however, the alignment constraints would actually predict the order INCL-NEG. However, the opposite order NEG-INCL surfaces, as shown in (31c). This surface form becomes optimal, since candidate (a) in (35), which implements the order INCL-NEG, violates the higher ranked NONFINALITY constraint. Crucially, this violation arises from the inherent stress on *é:s*, which is the rightmost and therefore final syllable in candidate (a). Removing this stress is illegitimate in Washo, yielding a violation of the higher ranked MÁX constraint for candidate (c), shown in (35). Consequently, the observed order NEG-INCL in candidate (b) becomes optimal in the derivation in (35).

(35) Derivation for (31c) (Benz 2017: 11)

ímeʔ drink
ášaʔ NEAR.FUT
é:s NEG
hu PL.INCL
ši DU.INCL

/ímeʔ/, /é:s/, /ši/	*CLASH	MAX	NONFIN	NEG-R	NEARFUT-R	INCL-R
a. ímeʔ-ši-é:s			*!			*
b. ☞ ímeʔ-é:s-ši				*		
c. ímeʔ-ši-es		*!				*

When the near future marker *ášaʔ* and the negation *é:s* are combined, both markers are inherently stressed. The default order provided by the alignment constraints would be candidate (a) in (36) , which violates NONFINALITY. Since removing the inherent stress is not possible, candidates (b) and (d) in (36) are ruled out. Reordering the affixes to avoid a violation of NONFINALITY yields a violation of the higher ranked constraint *CLASH, which penalizes two adjacent stressed syllables. Thus, candidate (a) becomes optimal despite a violation of NONFINALITY.

(36) Derivation for (31b) (Benz 2017: 14)

ímeʔ drink
ášaʔ NEAR.FUT
é:s NEG
hu PL.INCL
ši DU.INCL

ímeʔ/, /é:s/, /ášaʔ/	*CLASH	MAX	NONFIN	NEG-R	NEARFUT-R	INCL-R
a. ☞ ímeʔ-ášaʔ-é:s			*		*	
b. ímeʔ-ášaʔ-es		*!			*	
c. ímeʔ-é:s-ášaʔ	*!			*		
d. ímeʔ-es-ášaʔ		*!		*		

When all three affixes are combined, the alignment constraints would predict the order in candidate (f) in (37), where INCL-NEAR.FUT-NEG. However, this candidate and candidates (b), (c) and (e) in (37) violate higher ranked constraints on phonotactic well-formedness. As a consequence, the aligment constraints prefer candidate (a) over (d), since this candidate has less violations of NEG-R.

(37) Derivation of (32)[16] (Benz 2017: 15)

íme? drink
áša? NEAR.FUT
é:s NEG
hu PL.INCL
ši DU.INCL

íme?/, /é:s/, /áša?/, /hu/	*CLASH	NONFIN	NEG-R	NEARFUT-R	INCL-R
a. ☞ íme?-áša?-é:s-hu			*	**	
b. íme?-áša?-hu-é:s		*!		**	*
c. íme?-é:s-áša?-hu	*!		**	*	
d. íme?-é:s-hu-áša?			**!		*
e. íme?-hu-é:s-áša?	*!		*		**
f. íme?-hu-áša?-é:s		*!		*	**

In short, Benz (2017) uses independently motivated, well-established constraints to account for nontransitivity in Washo. In those terms, phonology does not only affect single affixes, but all affixes within that stratum. Thus, the analysis by Benz (2017) requires a P » M model of the morphology-phonology interface: the phonology shifts entire affixes for reasons of phonological optimization. Consequently, the phonology needs to have access to the morphological boundaries of these affixes. Paster (2006) has argued that the pattern in Washo can be analyzed using subcategorization under the assumption that inherently stressed suffixes like the negative marker *é:s* subcategorize for a foot to their left. A phonological foot is indicated by $[]_{\text{Ft}}$ in (38). Benz (2017) shows that this is assumption makes wrong predictions. In fact, this assumption correctly predicts the grammaticality of (38a). However, it also predicts (38b) and (38c), which are ungrammatical. In order to derive (38a) but exclude (38b) and (38c), it could be assumed that *áša?* has the same subcategorization frame. If this were true, (38a) would be the only option to fulfil both selectional requirements. However, the sentence in (38d) shows clearly that *áša?* does not subcategorize for a foot to its left, since there is no such structure in (38d). Consequently, subcategorization approaches fail to predict the case of phonologically conditioned affix order in Washo.

(38) 3-affix-clusters (Jacobsen 1964, 1973)

a. lé-[íme?]$_{\text{Ft}}$-[áša?]$_{\text{Ft}}$-é:s-hu-i
1-drink-NEAR.FUT-NEG-PL.INCL-IND
'We (incl.) are not going to drink.'

b. *lé-[íme?]$_{\text{Ft}}$-hu-[áša?]$_{\text{Ft}}$-é:s-i
1-drink-PL.INCL-NEAR.FUT-NEG-IND

[16] I removed the MAX in this tableau for reasons of readability.

c. *lé-[íme?]$_{Ft}$-éːs-hu-áša?-i
1-drink-NEG-PL.INCL-NEAR.FUT-IND

d. le-íme?-ši-áša?-i
1-drink-DU.INCL-NEAR.FUT-IND
'Both of us are going to drink.'

8.5.2 Bemba

A remarkable pattern illustrating the cyclic application of phonological rules has been described in detail for Bemba in chapter 5.1. In Bemba, the causative exponent triggers spirantization twice, as shown in (39). When attached to the verb root, the tense high vowel of the causative suffix triggers spirantization of stem-final stops to fricatives, which is a well-attested phonological process in Bemba. When an applicative is attached to this entire structure, it appears in the unexpected position between the verb root and the causative. When the applicative has been concatenated, the causative triggers spirantization of the applicative-final consonant /l/ to [s].

(39) Stem + CAUS + APPL in Bemba (Hyman 1994b, 2002: 3f)

	V			**V < CAUS**			**V < CAUS < APPL**
-leep-	'be long'	→	-leef-i̧	'lengthen'	→	-leef-es-i̧	'lengthen for'
-lub-	'be lost'	→	-luf-i̧	'lose'	→	-luf-is-i̧	'lose for'

Crucially, the stem-final consonant of the stem remains spirantized although the trigger of the phonological process is not longer in a local configuration with the stem. This instance of opacity has been analysed as infixation of the applicative by Hyman (1994b, 2002), or as movement in morphology by Müller (2020). While both analytical possibilities assume a cyclic structure of the morphology-phonology interface anyway, an analytical alternative would be to assume that the causative is in fact concatenated in the first cycle (e.g., the stem-level), illustrated in (40) where spirantization applies for the first time causing the stem-final consonant to become a fricative. This assumption is fully supported by Kula (2002), who argues that only the causative suffix is part of the same phonological domain as the stem, since it is the only derivational suffix that triggers spirantization of the stem-final consonant.

(40) Morphological optimization at stem-level in Bemba

leep V
i̦ [CAUS], stem-level
es [APPL], word-level

leep, [•Caus•], [•Appl•]	MAX(CAUS)	MAX(APPL)	L⇐V
a. leep	*!	*	
b. ☞ leep-i̦		*	
c. i̦-leep		*	*!

The tableau in (42) demonstrates the phonogical optimization of the form at stem-level. Spirantization is triggered by the constraint $*C_{[\text{-cont}]}$i, which penalizes non-continuant segments before high tense vowel *i*. Since this constraint of phonotactic markedness outranks the faithfulness constraints, the output with a spirantized stem-final consonant becomes the optimal candidate in tableau (42). The relevant phonological constraints needed to derive the pattern in Bemba are illustrated in (41).

(41) Phonological constraints in Bemba

a. $*C_{[\text{-cont}]}$i:
Assign a * for each phonological element with the feature [-cont] before /i/.

b. *VV:
Assign a * for each pair of vowels which is not separated by a consonant.

c. *CC:
Assign a * for each pair of consonant whhich is not separated by a vowel.

d. $ID_{[\text{CONT}]}$:
Assign a * for each feature that in the output that was changed from the input.

e. LINEARITY-IO:
Assign a * for each segment A which precedes segment B in the input, iff A and B have correspondents in the output and the correspondent of A follows the correspondent of B in the output.

f. $\text{LINEARITY-IO}_{\text{Morph}}$:
Assign a * for each segment A which precedes segment B in the input, iff A and B belong to the same morphological element, and have correspondents in the output and the correspondent of A follows the correspondent of B in the output.

(42) Phonological optimization at stem-level in Bemba

leep-i̦	*VV	*CC	$*C_{[\text{-cont}]}$i	$\text{LINEARITY-IO}_{\text{Morph}}$	$ID_{[\text{CONT}]}$	LINEARITY-IO
a. leepi̦			*!			
b. ☞ leefi̦					*	

After computation of the stem-level, bracket erasure takes place. Once bracket erasure has applied, morphological structure becomes inavailable to phonology, thus excluding that morphological operations applying at a later cycle modifies the morphological structure of the stem-level. I assume that the following operations take place in a later cycle (e.g., at word-level): first, the applicative is concatenated in a position following the causative in the morphological component of word-level, thus yielding a form *leefi̯-el*, shown in (43).

(43) Morphological computation at word-level in Bemba
leep V
i̯ [CAUS], stem-level
es [APPL], word-level

leefi̯, [•Appl•]	MAX(CAUS)	MAX(APPL)	L⇐V
a. leefi̯		*!	
b. ☞ leefi̯-el			
c. el-leefi̯			*!

Based on the description by Kasonde (2009) and Hamann & Kula (2015), this structure is phonologically marked, since it contains two adjacent vowels, yielding a violation of the anti-hiatus constraint *VV. In Bemba, vowel hiatus is typically resolved by gliding of the first consonant, which would yield a structure *leefyel*, corresponding to candidate (b) in (44). However, this structure violates a general ban against consonant clusters, which is ensured by the markedness constraint *CC.[17] Therefore, shifting a segment is the only conceivable option to avoid vowel hiatus and consonant clusters in Bemba. In this scenario, the grammar can either shift i̯ to the right, yielding candidate (d), or metathesize within the applicative affix, as shown in candidate (e) in (44). At this point of the derivation, the constraint LINEARITY-IO$_{\text{Morph}}$ becomes relevant. Crucially, LINEARITY-IO$_{\text{Morph}}$ penalizes segment metathesis with a morpheme. Hence, it makes reference to the morphological structure. In the derivation in (44), it rules out candidate (e), where metathesis applies within the applicative affixes. Consequently, candidate (d) becomes optimal, since it does not violate LINEARITY-IO$_{\text{Morph}}$. More specifically, the metathesizing segment i̯ does not skip other segments internal to its morphological element, but two segments belonging to a different morphological elements – the applicative morpheme. Thus, it creates two violations of the general anti-metathesis constraint LINEARITY-IO, but no violation of the more specific LINEARITY-IO$_{\text{Morph}}$.

[17] According to Hamann & Kula (2015), the only type of consonant cluster that arises in Bemba are combinations of consonants preceded by a homorganic nasal consonant.

(44) Phonological computation at word-level in Bemba

leefi̯-el	*VV	*CC	*$C_{[-cont]}$i	LINEARITY-IO_{Morph}	$ID_{[CONT]}$	LINEARITY-IO
a. leefi̯el	*!					
b. leefyel		*!				
c. leefeli̯			*!			**
d. ☞ leefesi̯					*	**
e. leefi̯le				*!		*

In short, causative shift in Bemba instantiates phonological movement of a single segment. Contrary to the generalizations by Paster (2009), the phenomenon needs to make reference to the morphological structure of the word. Thus, this instance of phonologically conditioned affix order requires a P » M model of the phonology-morphology interface, although only a single segment is metathesized.

8.5.3 Huave

A third property predicted by a stratal architecture of the morphology-phonology interface is that rules are limited to a smaller domain of the word, caused by re-ranking. Exactly this type of phenomenon is attested in Huave, where affixes with roughly the same phonological properties behave differently depending on their relative position to the root. Recall from chapter 5.1 that Huave exhibits phonologically conditioned mobile affixation in the sense that an affix with a -C- shape is attached before the root rather than after the root, if cluster-resolving epenthesis can be prevented by doing so (Kim 2008, 2010). This is shown again in (45), where the completive affix *-t* ends up in a prefixal position in (45a), since attaching it after the root would have caused vowel epenthesis to break up the resulting consonant cluster. Hence, the position of the affix is also depending on phonological features of the root: mobile affixation can only takes place if the root starts in a vowel. If the root starts in a consonant, as in (45b), attaching the affix as prefix would also cause epenthesis. Consequently, the completive is concatenated in its default position as a suffix.

(45) Mobile affix placement with COMPLET *-t* in Huave (Kim 2010: 134)

a. t-a-jch-ius (*jch-(i)-t-ius)
COMPLET-TV-give-1
'I gave'

b. pajk-a-t-u-s
face.up-TV-COMPLET-ITER-1
'I laid face up.'

The examples in (46) illustrate the positioning patterns of the plural agreement marker *-n* in Huave. Crucially, the plural agreement marker has a similar -C- shape as the completive marker. However, when the marker is faced with the environment of a vowel-initial stem, mobile affixation does not apply, illustrated here in (46). Instead, vowel epenthesis of *i* is triggered, as shown in (46a) and (46b). In these two examples, the verbal forms to which the affixes attach start with a vowel (*ec* in (46a) and *imetʃ* in (46b)). However, vowel epenthesis is preferred to prefixation of *n*, although the context for prefixation is given. This suggests that the rules for mobile affixation hold only in proximity of the verb root. In more distant positions, vowel epenthesis is the preferred option to resolve a consonant cluster.

(46) No mobile affixation with PL *n* in Huave (Kim 2008, Zukoff 2021)

a. e-c-i-n (*n-e-c)
2-eat-EV-PL
'you (sg.) eat'

b. i-m-e-ʰtʃ-i-n (*n-i-m-ʰtʃ)
FUT-SUB-2-give-EV-PL
'you (pl.) will give'

Thus, the same phonological context yields different surface patterns in (45) vs. (46). Although Zukoff (2021) shows that the pattern can in principle be derived in a parallel model, it suggests that phonology is layered in a stratal manner, so that the phonological grammar of the inner cycle including the completive marker prefers mobile affixation to epenthesis, whereas the phonological grammar of the outer layer including the plural agreement marker prefers epenthesis to mobile affixation.

8.6 A post-syntactic alternative

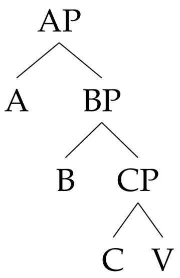
As noted in the beginning of this chapter, I presume a pre-syntactic model to morphology. In this section, I will sketch how the stratal architecture could be implemented in a post-syntactic model to morphology by the example of the analysis recently put forth by Zukoff (2022), which is the most explicit post-syntactic model suggested so far. I will also discuss what additional assumptions would be necessary in order to account for seemingly counter-syntactic patterns like Adyghe.

Recall that Baker (1985, 1988) assumes that the syntactic derivation forms the basis for affix order, an assumption formulated as the Mirror Principle. Concretely, Baker (1988) describes that cyclic head-movement in the syntax is the relevant mechanism that provides syntax-obeying affix ordering patterns. Zukoff (2022) specifies how the syntactic structure is passed into the morphophonological component of the grammar: Zukoff (2022) assumes that the hierarchy of heads in the syntax gives rise to a fixed ranking of ALIGN constraints, a mechanism called *Mirror Alignment Principle*. The definition of ALIGN adopted by Zukoff (2022) is repeated here in (47).

(47) ALIGN-CAT-R (short: CAT ⇒ R)
Assign a * for each exponent between an exponent of category CAT and the right edge of the word.

To illustrate how the Mirror Alignment Principle works, let me assume the hypothetical underlying syntactic structure in (48), where A, B and C are functional heads. Syntactic approaches to affix order would predict the surface form V>C>B>A, since C as the lowest head in the syntactic hiearchy is predicted to occur close to the verb, while A should be the most external affix, since it is the highest head in the syntactic tree.

(48) Underlying syntactic structure



Zukoff (2022) assumes that this hierarchy is mapped onto a fixed ranking of ALIGN constraints, such that the ALIGN constraint referring to the highest head will also be the highest ranked constraint. For the hypothetical structure in (48), the Mirror Alignment Principle would predict the ranking ALIGN-A-R » ALIGN-B-R » ALIGN-C-R. In a post-syntactic morphological component of the grammar, these constraints produce a surface order matching the syntactic hierarchy, but are also allowed to interact with morphotactic constraints, such as bigrams (Ryan 2010). Concretely, the ranking for the structure in (48) results in a tableau in (49), which illustrates how this ranking derives a syntax-obeying output form. Concretely, the fact that ALIGN-A-R is the highest ranked constraint will enforce an output in which A is the most external affix, as in candidates (d) and (f). Among these two candidates, the ranking will favor (f).

(49) Tableau providing the syntax-obeying surface order

A, B, C	ALIGN-A-R	ALIGN-B-R	ALIGN-C-R
a. A-B-C	*!*	*	
b. A-C-B	*!*		*
c. B-A-C	*!	**	
d. B-C-A		**!	*
e. C-A-B	*!		**
f. ☞ C-B-A		*	**

As shown in the previous sections of this chapter, a number of affix ordering patterns suggest a cyclic interaction of morphology and phonology. While Zukoff (2022) shows that Huave can in principle be modeled without a cyclic analysis, it is unclear how a post-syntactic analysis would deal with languages like Adyghe. As I have shown in chapter 8.3, Adyghe requires a cyclic model of the morphophonology interface and violates the predictions by the Mirror Principle, since the relative order of causative and comitative is invariable. Moreover, the relative order of verbal categories is unusual from a syntactic point of view, since the agreement marker indexing the external argument is always closer to the verb root than agreement markers indexing the internal argument. In short, the affix ordering pattern observed in Adyghe require a stratal architecture and violate syntactic hierarchies. Recall the example in (50), which illustrates the interaction of causative and comitative in Adyghe. Crucially, the order of the two markers is fixed and therefore entirely independent of the interpretation. The interpretation of the example in (50a) suggests that the comitative adds a second causer implying that causativization applies before applicativization. The example in (50b), on the other hand, yields the interpretation that the comitative adds a second causee suggesting that the comitative takes scope below causative.

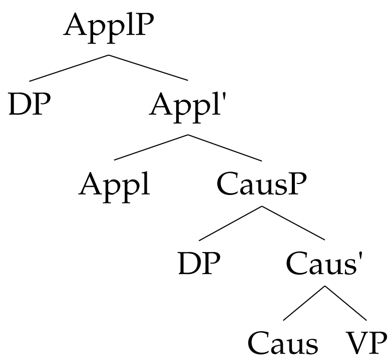
(50) Fixed order of COM and CAUS in Adyghe

a. Se tʃale-r wo qʷə-p-de-sə-ʁə-tŝəyə
I child-ABS you CIS-2SG-COM-1SG-CAUS-sleep
'I (and you) make the child sleep.'
Context: My baby is crying a lot, so me and you sing a song to make him sleep.

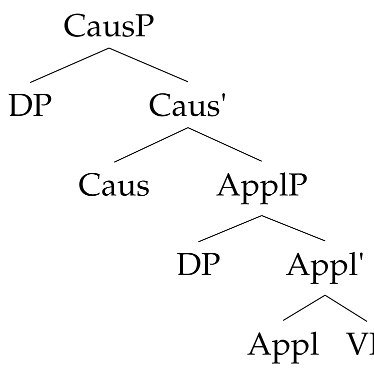
b. Se a-r wo qʷə-p-de-ə-ʁə-ʃ'ə-ʁ
I 3-ABS 2SG CIS-2SG-COM-1SG-CAUS-dance-PST
'I made him dance with you.'
Context: My friend is secretly in love with you but she is really shy and does not dare to dance with you. In the end, I convince her to dance with you.

I have shown in chapter 8.3 that phonological correlates allow to separate the word into several layers. More specifically, the causative and the agreement marker indexing the highest argument belong to the inner layer whereas all other affixes including applicatives and other agreement markers belong to the outer layer. The interpretative differences between (50a) and (50b) suggest that the valency operations are differently ordered, such that causativization precedes applicativization in (50a) but follows applicativization in (50b). Syntactic approaches to affix order, particularly Baker (1985, 1988) and Zukoff (2022), assume that the order of operations results in different syntactic hierarchies. The simplified trees in (51) and (52) illustrate how this difference is modeled in the syntax. In order to produce the interpretative effect that applicatives scopes over causative, it has to be assumed that the Appl head is merged above CausP, as in (51). In contrast, Caus is merged after ApplP when the interpretation suggests that it applies after applicativization, as in (52).

(51) Underlying structure for (50a)

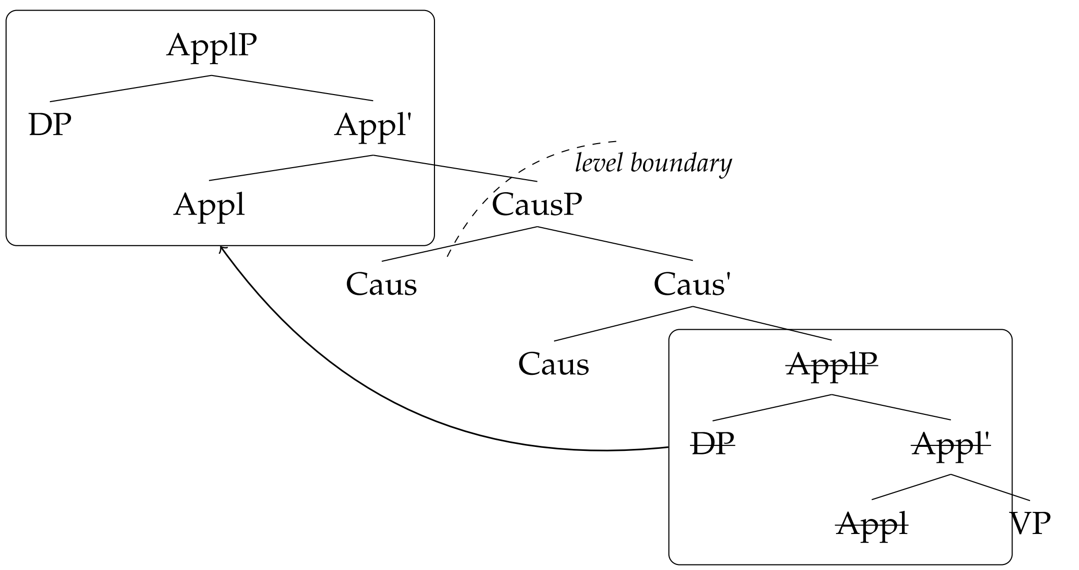


(52) Underlying structure for (50b)



If these syntactic hierarchies are then mapped onto a ranking of ALIGN constraints, the two underlying derivations predict two different surface realizations, contrary to the observed pattern in (50). I see two ways to modify the mapping between syntax and morphology in order to produce the correct output forms: a first option would be phrasal movement of ApplP in the syntax, such that the applicative **always** moves to a position above CausP, as illustrated in (53). This analytical alternative is commonly assumed to account for Mirror Principle violations, as proposed by Buell (2005), Buell et al. (2014), Koopman (2005, 2015), Muriungi (2008) or Myler (2017).

(53) Hypothetical phrasal movement of ApplP



Interpretation of the structure at Logical Form (LF) would then refer to the underlying structure (e.g., the traces), whereas the final hierarchy is mapped onto morphology, leading to a mismatch between semantics and morphology. It could then be assumed that there is some kind of level boundary about CausP, such that anything below that boundary is sent to the first cycle (the stem-level) while anything above would be concatenated at word-level. An advantage of this analysis would be that the division of affixes into stem-level affixes and word-level affixes is not entirely unmotivated, but matches syntactic components. A considerable disadvantage of this analysis would be that the phrasal movement of ApplP is entirely unmotivated and opaque.

That is, it is unclear where the phrase moves and what triggers this movement.
An analytical alternative would be that the syntax does in fact produce two different rankings of ALIGN constraints, which serve as the input to morphological optimization. It could then be assumed that this order produced by the syntax is simply overwritten by morphotactic constraints, such as CARP-inducing constraints or bigram constraints, so that the syntax-obeying order that would be expected in (50b) never has a chance to surface. A problem of an analysis in these terms is that it requires a tight, **simultaneous** interaction between the ALIGN constraints and morphotactic constraints. However, the discussion in chapter 8.3 shows that the relevant affixes belong to two different levels. Consequently, it would have to be assumed that all affixes are concatenated at the same level to allow the interaction between morphotactic constraints and constraints on syntactic transparency. Thus, it would have to be assumed that morphology is flat while phonology would still have to be cyclic.
A final alternative that combines syntax-violating affix order and layered morphology could be that the output of the syntax is filtered such that the morphological cycles receive only subsets of the entire ranking. Concretely, each cycle would only receive the set of ranked ALIGN constraints referring to the affixes specified for this cycle. In other words, causatives would be lexically specified to be stem-level affixes, and only the ALIGN constraints relevant for the causative will be evaluated first. This alternative is very similar to the analysis I assume in the pre-syntactic model I adopt. It is clearly not the purpose of this section to argue entirely against the post-syntactic modelings of affix order. Rather, it is thought to create attention for the issues arising from the assumption that the syntax is the origin for affix order. Concretely, it would be desirable if scholars implementing post-syntactic analyses of affix order would provide independent evidence for the underlying syntactic hierarchies, particularly for the relative order of the heads responsible for inflectional morphology.

8.7 Scope vs. morphotactics

In combinations of affixes with reversible scope, four different realization patterns are possible. For example, causatives and applicatives can be combined in either order, yielding two different semantic forms, presented here in (54). Crucially, the applied argument refers to the event of causation in (54a), but to the causativized subevent in (54b). The underlying semantic function assumed in Stiebels (2003) is presented in (54c). Following Wunderlich (1997a), causative affixes are assumed to combine with a verb P through functional composition. The causative then binds the situational variable of the verbal predicate s. In addition, the causative introduces the causer argument u and the situational variable s' which refers to the (now complex) event. ACT refers to the actual activity undertaken by the causer.

(54) Combination of causative and applicative (Stiebels 2003: 304)

a. [[[V]CAUS]APPL]
   $\lambda z\ \lambda y\ \lambda x\ \lambda u\ \lambda s'\ \exists s$ [[ACT(u) & V(x,y)(s)](s') & APPL(s',z)]
b. [[[V]APPL]CAUS]
   $\lambda z\ \lambda y\ \lambda x\ \lambda u\ \lambda s'\ \exists s$ [ACT(u) & [V(x,y)(s) & APPL(s,z)]](s')
c. $\lambda P \lambda u \lambda s' \exists s$ [ACT(u) & P(s)](s′)

In principle, there are four combinatory options of the underlying semantic order and the surface order: first, both [[[V]APPL]CAUS] and [[[V]CAUS]APPL] are realized transparently, resulting in a **transparent** pattern. Second, both underlying forms are realized by the surface form V<CAUS<APPL, resulting in a CAUS-CLOSE pattern, where the causative is always closer to the root, independent of the semantic form. Third, both underlying forms yield the surface form V<APPL<CAUS, such that the applicative is always internal to the causative, independent of the interpretation. As far as I know, this pattern is not attested. Finally, the underlying form [[[V]CAUS]APPL] is expressed by the surface from V<APPL<CAUS, while the other form [[[V]APPL]CAUS] yields the surface form V<CAUS<APPL, such that both forms are realized intransparently, a pattern I refer to as **symmetric noncompositionality**. This option is attested in Fuuta Tooro Pulaar, where it is in variation with a fully transparent pattern. To the best of my knowledge, Fuuta Toora Pulaar is the only language which exhibits symmetrical noncompositionality. Moreover, this pattern could not be replicated with a native speakers. Thus, the existence of symmetric noncompositionality is empirically doubtful, yet of theoretical relevance: if it turns out that symmetrical noncompostionality does not exist, more restrictive syntactic theories can be built.[18]
In sum, we have seen in Chapter 5.1 for the interaction of causatives and applicatives that only three out of these four patterns are actually attested, as summarized in table 8.5. In some of these languages, there is optionality between two patterns, as in Xhosa or Choguita Rarámuri. In none of these cases, there is information where this optionality comes from, e.g. if it is optionality between speakers or within a speaker of it is is conditioned somehow. For these languages, I assume that there are two competing grammars and add them to both columns.

	transparent	CAUS-CLOSE	symmetrically noncomp.	APPL-CLOSE
[[V CAUS] APPL]	V<CAUS<APPL	V<CAUS<APPL	V<APPL<CAUS	V<APPL<CAUS
[[V APPL] CAUS]	V<APPL<CAUS	V<CAUS<APPL	V<CAUS<APPL	V<APPL<CAUS
Examples	Fuuta Tooro 2	Adyghe	Fuuta Tooro 1	unattested
	Huallaga Quechua?	Misantla Totonac	Bemba?	
	Xhosa	Xhosa		
	Choguita Rarámuri	Choguita Rarámuri		

Table 8.5: Observed patterns of CAUS and APPL

[18] Dabkowski (2022) shows Paraguayan Guaraní exhibits symmetric noncompositionality, as well, arguing that it is prosodically conditioned. Thus, Fuuta Tooro Pulaar is the only case of morphologically conditioned symmetric noncompostionality.

In this chapter, I outline that these three patterns can be analysed as resulting from tensions between morphotactic requirements and requirements on semantic transparency and illustrate how this tension is modeled in the analysis put forth in this dissertation. Crucially, I will show that the system suggested here derives only the three attested pattern to the exclusion of the unattested APPL-CLOSE pattern.
In chapter 5.1, I set up the empirical generalization that opaque combinations of causative and applicative markers occur in the order V<CAUS<APPL, with an overwhelming tendency. I also concluded that this pattern can be captured by a morphological rule that requires causatives to be realized in adjacency to the verb, resulting in the CAUS-CLOSE constraint in (55).

(55) The CAUS-CLOSE constraint
Causative markers should be as close to the verb root, as possible.

In the analysis of this dissertation, the empirical generalization in (55) is implemented as a violable adjacency constraint, as shown in (56).[19]

(56) $\text{ADJ}_{\text{V,CAUS}}$ (CAUS-CLOSE):
Count * for each exponent between the verbal root and an exponent of CAUS.

In chapter 8.3, I suggested that the non-compositionality of CAUS and APPL in Adyghe arises from the fact that the causatives attaches at stem-level, while the applicative attaches at word-level such that the two markers do not have the chance to interact simultaneously. In Adyghe, there is phonological evidence that the markers actually belong to different strata. For the other languages exhibiting non-compositionality between CAUS and APPL, phonological correlated suggesting a layered structure of the morphological word cannot be observed. As a consequence, I model the interaction as a simultaneous interaction within one and the same stratum in this chapter. However, an alternative option would be to assume that the causative attaches at the stem-level in these languages. This assumption, however, makes unusual predictions for languages in which there is optionality between compositional and non-compositional surface forms: in these languages, it would have to be assumed that the causative can attach either at stem-level or at the same level as the

[19] Note that the constraint in (56) is absolute in its formulation, while the empirical generalization in (55) is not. While the causative is the innermost affix in the majority of languages with causatives, this is not an absolute universal. A counterexample comes from Tukang Besi, repeated here in (i), where the reciprocal is closer to the root than the causative.

(i) Order of CAUS and REC (Donohue 2011: 293)
a. No-pa-po-tandu-tandu-'e na wembe.
3.RLS-CAUS-REC-RED-horn-3.OBJ NOM goat
'He$_i$ incited the goats$_k$ to butt each other$_k$.'
b. *No-po-pa-manga-manga.
3.RLS-REC-CAUS-RED-eat
'They$_i$ made each other$_i$ eat.'

However, the violability of the constraint in (56) allows to capture exceptions from this generalization.

applicative. This assumption would then predict that the optionality should correlate with the phonological structure of the word. Since evidence along these lines is not attested in the languages with optional non-compositionality, I abstain from this assumption in the rest of this chapter, although I uphold this analysis for Adyghe. However, I would like to emphasize that this analytical option should nevertheless be taken into consideration when describing and analysing patterns of combinations of valency markers, since this discussion contributes to the recurrent question within StratOT on the rules defining at which stratum certain categories attach to.
The expectation from the existing literature (Bybee 1985, Baker 1985, 1988, Hyman 2003, Aronoff & Xu 2010, Zukoff 2022) about the interaction of exponents in a scopal relationship is that a scopal exponent should be external to the element it takes scope over. A great body of literature has translated these underlying scopal ordering principles [[[V] X] Y] into OT constraints (Hyman 2003, Spencer 2003, Aronoff & Xu 2010, Inkelas 2016), leading to constraints as in (57) and (58).

(57) MIRROR (X,Y) (Hyman 2003, Inkelas 2016)
The morphosyntactic input [[[...] X] Y] is realized *Verb-x-y*, where *x* is the exponent of X and *y* is the exponent of Y.

(58) SCOPE (Spencer 2003, Aronoff & Xu 2010)
Given two scope-bearing features f_1 and f_2, if f_1 scopes over f_2, then I_2, an exponent of f_2, cannot be farther away from the same stem than I_1, an exponent of f_1.

Zukoff (2022) implements this idea by assuming that scope corresponds to different hierarchical relationships in the syntax, which are then mapped onto a fixed ranking of ALIGN constraints. I follow the general idea by Zukoff (2022) that the underlying scopal relationship are translated into morphological constraints in the morphological module of the grammar. **As a consequence, the semantic form will not be evaluated directly in the semantics, but its morphological correlate will be evaluated along other morphological rules**. In contrast to Zukoff (2022), who translates the hierarchical relationship from the syntax into a fixed ranking of ALIGN constraints, I suggest that the respective constraints are not linearity constraints, but adjacency constraints that make reference to the relative distance to the verbal root, rather than to the left or the right edge of the verb. The exact definition of this constraint type is given in (59).

(59) ADJACENCY$_{V,A}$:
Assign * for each exponent between the verbal root and an exponent of category A.

In contrast to Zukoff (2022), the underlying structure that provides the input to the mapping onto ALIGN-constraints is not the syntactic hierarchy of heads, but rather the underlying semantic representation. In (54), causative and applicative are representated by the predicates ACT and APPL. The semantic representation in (54) further implies the layered structure of the form: in (54a), the ACT predicate is internal to APPL, whereas it is external to APPL in (54b). In this dissertation, I assume that the layered semantic structure is not translated into a fixed ranking of the two ADJACENCY-constraints, but results from a very restricted implementation of reflexive local conjunction. Local conjunction (Smolensky 1993) is a mechanism within OT in which two constraints can be conjoined such that the conjoined constraint is only violated if both subparts of it are violated. This mechanism has been exploited to model cumulative effects in OT. Since this mechanism is said to be extremely powerful and unrestrictive (Kirchner 1996, Popp 2019), Kirchner (1996) suggests to restrict it to reflexive local conjunction. That is, a constraint can only be conjoined with itself resulting in a scenario where the conjoined constraint is violated only if the underlying constraint is violated twice. Müller (2020) implements this idea to model affix order: by conjoining an ALIGN constraint, the resulting conjoined constraint will only be violated if ALIGN is violated twice. Concretely, it will only be violated if a certain category is more than two exponents away from the specified edge of the word.

In this dissertation, I use reflexive local conjunction in a even more restricted way: if two categories are in a scopal relationship [[[V]A]B], there are two adjacency constraints for both category A and B and crucially, **only the adjacency constraints referring to B will undergo local conjunction**. Thus, the hypothetical, underlying representation [[[V]A]B] would yield the following three constraints, where local conjunction is indicated by ^{2}:

(60) Implementing SCOPE between [[[V]A]B] in OT:

a. $\text{ADJ}_{\text{V,B}}{}^2$: Assign * if two exponents occur between the verbal root and an exponent CATB.

b. $\text{ADJ}_{\text{V,A}}$: Assign * for each exponent between the verbal root and an exponent CATA.

c. $\text{ADJ}_{\text{V,B}}$: Assign * for each exponent between the verbal root and an exponent CATB.

Following the general logic of local conjunction, the conjoined constraint has to be ranked higher than its simple version. Modeling the interaction between causatives and other derivational markers yields the unusual situation that there are two constraints of the same shape. Specifically, **CAUS-CLOSE and $\text{ADJ}_{\text{V,CAUS}}$ are violated under the same conditions.** However, they are ranked independently of each other and exist independently of each other. That is, in a scenario where a causative is not in a scopal relationship with other exponents, there would still be a CAUS-CLOSE constraint, but no $\text{ADJ}_{\text{V,CAUS}}$. Moreover, $\text{ADJ}_{\text{V,CAUS}}$ is bound in its ranking by the logic of local conjunction. Therefore, $\text{ADJ}_{\text{V,CAUS}}$ will never outrank $\text{ADJ}_{\text{V,CAUS}}{}^2$, while

CAUS-CLOSE can. Exactly this interaction of constraints will provide the flexibility to derive unusual patterns like symmetrical noncompositionality, but the restrictiveness to prohibit the emergence of unattested APPL-CLOSE patterns.
Another assumption I make is that grammars have a specific ranking for these scope-implementing constraints on the one hand and morphotactic constraints on the other hand. In simpler terms, the underlying semantic order [[[V]APPL]CAUS] will yield a constraint ADJ$_{\text{V,CAUS}}^2$ while the underlying semantic order [[[V]CAUS]APPL] will yield a constraint ADJ$_{\text{V,APPL}}^2$ but crucially, both constraints will have to be ranked similarly within one language. For the interaction of causatives and applicatives, these four constraints will be relevant:

(61) a. CAUS-CLOSE:
Assign * for each exponent between the verbal root and an exponent CAUS.
b. ADJ$_{\text{V,CAT1}}^2$: Assign * if two exponents occur between the verbal root and an exponent CAT1.
c. ADJ$_{\text{V,CAT2}}$: Assign * for each exponent between the verbal root and an exponent CAT2.
d. ADJ$_{\text{V,CAT1}}$: Assign * for each exponent between the verbal root and an exponent CAT1.

Given the general rule about constraint conjunction that the conjoined constraints are inherently higher ranked than the simple version, 12 different rankings of these four constraints are logically possible. The table in (62) illustrates the predicted surface forms for each constraint ranking for [[V]APPL] CAUS].

(62) Outcomes of possible rankings for [[[V]APPL]CAUS]

1	ADJ$_{\text{V,CAUS}}^2$ » CAUS-CLOSE » ADJ$_{\text{V,CAUS}}$ » ADJ$_{\text{V,APPL}}$	V<CAUS<APPL	opaque
2	ADJ$_{\text{V,CAUS}}^2$ » CAUS-CLOSE » ADJ$_{\text{V,APPL}}$» ADJ$_{\text{V,CAUS}}$	V<CAUS<APPL	opaque
3	ADJ$_{\text{V,CAUS}}^2$ » ADJ$_{\text{V,APPL}}$ » ADJ$_{\text{V,CAUS}}$ » CAUS-CLOSE	V<APPL<CAUS	transparent
4	ADJ$_{\text{V,CAUS}}^2$ » ADJ$_{\text{V,APPL}}$ » CAUS-CLOSE » ADJ$_{\text{V,CAUS}}$	V<APPL<CAUS	transparent
5	ADJ$_{\text{V,CAUS}}^2$ » ADJ$_{\text{V,CAUS}}$ » CAUS-CLOSE » ADJ$_{\text{V,APPL}}$	V<CAUS<APPL	opaque
6	ADJ$_{\text{V,CAUS}}^2$ » ADJ$_{\text{V,CAUS}}$ » ADJ$_{\text{V,APPL}}$ » CAUS-CLOSE	V<CAUS<APPL	opaque
7	ADJ$_{\text{V,APPL}}$ » ADJ$_{\text{V,CAUS}}^2$ » ADJ$_{\text{V,CAUS}}$ » CAUS-CLOSE	V<APPL<CAUS	transparent
8	ADJ$_{\text{V,APPL}}$ » ADJ$_{\text{V,CAUS}}^2$ » CAUS-CLOSE » ADJ$_{\text{V,CAUS}}$	V<APPL<CAUS	transparent
9	ADJ$_{\text{V,APPL}}$ » CAUS-CLOSE » ADJ$_{\text{V,CAUS}}^2$ » ADJ$_{\text{V,CAUS}}$	V<APPL<CAUS	transparent
10	CAUS-CLOSE » ADJ$_{\text{V,CAUS}}^2$ » ADJ$_{\text{V,CAUS}}$ » ADJ$_{\text{V,APPL}}$	V<CAUS<APPL	opaque
11	CAUS-CLOSE » ADJ$_{\text{V,CAUS}}^2$ » ADJ$_{\text{V,APPL}}$» ADJ$_{\text{V,CAUS}}$	V<CAUS<APPL	opaque
12	CAUS-CLOSE » ADJ$_{\text{V,APPL}}$ » ADJ$_{\text{V,CAUS}}^2$ » ADJ$_{\text{V,CAUS}}$	V<CAUS<APPL	opaque

The table in (63) shows the predictions of these constraints for the underlying form [[[V]CAUS]APPL]. Note that the rankings are exactly the same like in (62) but with reversed scope. In other words, the rankings are produced by the same grammar.

(63) Outcomes of possible rankings for [[[V]CAUS]APPL]

1	ADJ$_{V,APPL}$^{2} » CAUS-CLOSE » ADJ$_{V,APPL}$ » ADJ$_{V,CAUS}$	V<CAUS<APPL	transparent
2	ADJ$_{V,APPL}$^{2} » CAUS-CLOSE » ADJ$_{V,CAUS}$» ADJ$_{V,APPL}$	V<CAUS<APPL	transparent
3	ADJ$_{V,APPL}$^{2} » ADJ$_{V,CAUS}$ » ADJ$_{V,APPL}$» CAUS-CLOSE	V<CAUS<APPL	transparent
4	ADJ$_{V,APPL}$^{2} » ADJ$_{V,CAUS}$» CAUS-CLOSE » ADJ$_{V,APPL}$	V<CAUS<APPL	transparent
5	ADJ$_{V,APPL}$^{2} » ADJ$_{V,APPL}$ » CAUS-CLOSE » ADJ$_{V,CAUS}$	V<APPL<CAUS	opaque
6	ADJ$_{V,APPL}$^{2} » ADJ$_{V,APPL}$» ADJ$_{V,CAUS}$ » CAUS-CLOSE	V<APPL<CAUS	opaque
7	ADJ$_{V,CAUS}$ » ADJ$_{V,APPL}$^{2} » ADJ$_{V,APPL}$» CAUS-CLOSE	V<CAUS<APPL	transparent
8	ADJ$_{V,CAUS}$ » ADJ$_{V,APPL}$^{2} » CAUS-CLOSE » ADJ$_{V,APPL}$	V<CAUS<APPL	transparent
9	ADJ$_{V,CAUS}$ » CAUS-CLOSE » ADJ$_{V,APPL}$^{2} » ADJ$_{V,APPL}$	V<CAUS<APPL	transparent
10	CAUS-CLOSE » ADJ$_{V,APPL}$^{2} » ADJ$_{V,APPL}$ » ADJ$_{V,CAUS}$	V<CAUS<APPL	transparent
11	CAUS-CLOSE » ADJ$_{V,APPL}$^{2} » ADJ$_{V,CAUS}$» ADJ$_{V,APPL}$	V<CAUS<APPL	transparent
12	CAUS-CLOSE » ADJ$_{V,CAUS}$» ADJ$_{V,APPL}$^{2} » ADJ$_{V,APPL}$	V<CAUS<APPL	transparent

In table 8.6, the surface forms of both tables were combined such that it illustrates the patterns predicted by each ranking. In sum, there are 5 different rankings predicting a CAUS-CLOSE pattern and 5 different rankings predicing transparent patterns, but only two rankings giving rise to symmetric noncompositonality. Moreover, there is no pattern that predicts the unattested APPL-CLOSE pattern. Thus, the combination of these constraints does not only exclude the emergence of unattested patterns, but explains also the rarity of symmetric noncompositionality.

	transparent	CAUS-CLOSE	symmetrically noncomp.	APPL-CLOSE
[[V CAUS] APPL]	V<CAUS<APPL	V<CAUS<APPL	V<APPL<CAUS	V<APPL<CAUS
[[V APPL] CAUS]	V<APPL<CAUS	V<CAUS<APPL	V<CAUS<APPL	V<APPL<CAUS
Rankings	3, 4, 7, 8, 9	1 ,2, 10, 11, 12	5, 6	none
Examples	Fuuta Tooro 2	Misantla Totonac	Fuuta Tooro 1	unattested
	Xhosa 1	Xhosa 2	Bemba?	
	Choguita Rarámuri 1	Choguita Rarámuri		
	Huallaga Quechua ?			

Table 8.6: Deriving attested patterns in OT

Let me illustrate how this mechanism works by means of the example of Fuuta Tooro Pulaar, the relevant examples are repeated in (64). When causative and applicative are combined, both underlying forms yield two different surface forms. The underlying form [[[V]APPL]CAUS], where the applied argument refers to the causativized subevent, can either be realized by the V<APPL<CAUS in (64a) or by means of an opaque affix order V<CAUS<APPL in (64b). The opposite underlying form, where the applied instrument modifies the event of causation, also produces two possible surface realizations – the transparent surface form V<CAUS<APPL in (64d) or the opaque form V<APPL<CAUS in (64c). Thus, both underlying form have two different surface forms and both surface forms have two possible interpretations.

(64) Order of CAUS and APPL in Fuuta Tooro Pulaar (Paster 2005: 182f)

a. O irt-ir-in-ii kam supu o kuddu.
3SG stir-APPL-CAUS-PST 1SG soup DET spoon

b. O irt-in-ir-ii kam supu o kuddu.
3SG stir-CAUS-APPL-PST 1SG soup DET spoon
'He made me stir the soup with a spoon (I used a spoon)'

c. O irt-ir-in-ii kam supu o laɓi.
3SG stir-APPL-CAUS-PST 1SG soup DET knife

d. O irt-in-ir-ii kam supu o laɓi.
3SG stir-CAUS-APPL-PST 1SG soup DET knife
'He made me stir the soup with a knife (he used the knife)'

Paster (2005) does not discuss what conditions the optionality between transparent and opaque patterns. I checked the examples above with a speaker of the same dialect, and it turned out that this speaker accepted only the transparent examples in (64a) and (64d). This suggests that there is variation between speakers. To derive the optionality in OT, I assume that optionality arises from two minimally different rankings: the ranking of only two constraints differs. Concretely, the two different Fuuta Tooro grammars make use of the rankings M(CAUS) » M(APPL) » $\text{ADJ}_{\text{V,CAUS}}{}^2$ » $\text{ADJ}_{\text{V,APPL}}$ » $\text{ADJ}_{\text{V,CAUS}}$ » CAUS-CLOSE for the transparent patterns and M(CAUS) » M(APPL) » $\text{ADJ}_{\text{V,CAUS}}{}^2$ » $\text{ADJ}_{\text{V,CAUS}}$ » $\text{ADJ}_{\text{V,APPL}}$ » CAUS-CLOSE for the opaque patterns.

The tableau in (65) illustrates the derivation of the transparent realization of the underlying form [[[V]APPL]CAUS]. Note that this tableau differs from other tableaux presented earlier in this chapter, and does not make reference to strata, since **the simultaneous interaction of the scope-implementing adjacency constraints and the morphotactic constraints takes place within one and the same stratum**.[20] Let me first illustrate how the ranking of the constraints accounts for the observed surface forms of the valency markers.

The underlying form is translated into the two adjacency constraints $\text{ADJ}_{\text{V,APPL}}$ and $\text{ADJ}_{\text{V,CAUS}}$. $\text{ADJ}_{\text{V,CAUS}}$ undergoes reflexive local conjunction, since it is the marker with greater scope. The relative ranking of the constraints yields the optimal candidate *irt-ir-in* 'V-APPL-CAUS', which is the transparent realization of the underlying form.

(65) Derivation for (64a)

irt V, 'to stir'
in [CAUS]
ir [APPL]

[20]By assumption, the past maker and the agreement suffix would be concatenated by aligment constraints.

V, [•Caus•], [•Appl•] [[[V]APPL]CAUS]	M(CAUS)	M(APPL)	$\text{ADJ}_{\text{V,CAUS}}{}^2$	$\text{ADJ}_{\text{V,APPL}}$	$\text{ADJ}_{\text{V,CAUS}}$	CAUS-CLOSE
a. V-CAUS-APPL				*!		
b. ☞ V-APPL-CAUS					*	*
c. V-CAUS		*!				
d. V-APPL	*!					

The tableau in (66), in contrast, assumes a different grammar, thus, a different ranking of the constraints. More specifically, the simple adjacency constraints exhibit the opposite ranking, such that the simple adjacency constraint of the element with greater scope, $\text{ADJ}_{\text{V,APPL}}$, is now ranked below the adjacency constraints of CAUS. Consequently, the opaque surface form V-CAUS-APPL becomes optimal.

(66) Derivation for (64b)
irt V, 'to stir'
in [CAUS]
ir [APPL]

V, [•Caus•], [•Appl•] [[[V]APPL]CAUS]	M(CAUS)	M(APPL)	$\text{ADJ}_{\text{V,CAUS}}{}^2$	$\text{ADJ}_{\text{V,CAUS}}$	$\text{ADJ}_{\text{V,APPL}}$	CAUS-CLOSE
a. ☞ V-CAUS-APPL					*	
b. V-APPL-CAUS				*!		*
c. V-CAUS		*!				
d. V-APPL	*!					

The same picture arises for the underlying semantic form [[[V]CAUS]APPL]. Crucially, a difference in the underlying form corresponds to a different ranking. More specifically, the constraint rankings of (65) and (67) are similar since the higher ranked adjacency constraints always refer to the element with greater scope. Consequently, the transparent candidate (a) becomes optimal in (67), just as in (65).

(67) Derivation for (64c)
irt V, 'to stir'
in [CAUS]
ir [APPL]

V, [•Caus•], [•Appl•] [[[V]CAUS]APPL]	M(CAUS)	M(APPL)	$\text{ADJ}_{\text{V,APPL}}{}^2$	$\text{ADJ}_{\text{V,APPL}}$	$\text{ADJ}_{\text{V,CAUS}}$	CAUS-CLOSE
a. V-CAUS-APPL				*!		
b. ☞ V-APPL-CAUS					*	*
c. V-CAUS		*!				
d. V-APPL	*!					

Similarly, the reverse ranking produces the opaque output in (68), instead of the transparent form in (67).

(68) Derivation for (64d)
irt V, 'to stir'
in [CAUS]
ir [APPL]

V, [•Caus•], [•Appl•] [[[V]CAUS]APPL]	M(CAUS)	M(APPL)	$\text{ADJ}_{\text{V,APPL}}{}^2$	$\text{ADJ}_{\text{V,CAUS}}$	$\text{ADJ}_{\text{V,APPL}}$	CAUS-CLOSE
a. ☞ V-CAUS-APPL					*	
b. V-APPL-CAUS				*!		*
c. V-CAUS		*!				
d. V-APPL	*!					

Modeling scopal relationships via constraint conjunction has an interesting side effect: the element with greater scope allows one single exponent between the root and itself. If, however, more than one element intervenes between the verbal root and the element with greater scope, the rankings above would then predict that the element with greater scope has to be internal to the element it scopes over, since the conjoined constraint is inherently higher ranked than its simple version. In short, the scopal requirement loses its power if it is too far away from the root. The analysis adopted here does in principle predict this effect. However, two cases need to be differentiated. First, if the intervening exponent is in a scopal relationship with the other markers, e.g. another valency marker, local conjunction would take place again. The resulting conjoined constraints would be higher ranked, thus preserving the initial scopal relationships.

A second hypothetical scenario would be a case where the intervening marker is not in a scopal relationship with either of the markers, e.g. some inflectional category. In these cases, the analysis would predict that the surface forms yields the reverse order. In the languages considered in this dissertation, there is not a single example which matches this definition. However, an interesting, related effect is found in Apurinã, previously discussed in chapter 5.2.2. In Apurinã, there is an unusual interaction between the progressive marker *nanu*, the causative marker *ka* and the marker *ta*, which is said to be a verbalizing affix. Unfortunately, the exact meaning and distribution of *ta* remains unclear in the description by Facundes (2000). Thus, it is not possible to determine a clear function. Let me assume for now that *ta* is in fact a verbalizer. Consequently, it would have to be assumed that it is closer to the verb than the causative and the progressive, since these elements require a verbal host. Thus, the underlying scopal relationships are [[[V]*ta*]CAUS] and [[[V]*ta*]PROG]. In the examples in (69a), all three markers cooccur. In these examples, it seems that scopal relationships are violated, since the verbalizing suffix *ta* is external to causative and progressive.

(69) Order of PROG, CAUS and *ta* in Apurinã (Facundes 2000: p. 310, 507)

a. Nhi-nhika-nanu-ka-ta-ru yapa.
1SG-eat-PROG-CAUS-*ta*-3MASC.OBJ capibara
'I am making him eat capibara.'

b. Amarunu n-umaka-ka-nanu-ta
boy 1SG-sleep-CAUS-PROG-*ta*
'I am making the kid sleep.'

Let me illustrate how the mechanism implemented in this chapter may explain this pattern. The two underlying scopal representations yield the following set of constraints: $\text{ADJ}_{\text{V,CAUS}}{}^2$, $\text{ADJ}_{\text{V,CAUS}}$, $\text{ADJ}_{\text{V},ta}$, $\text{ADJ}_{\text{V,PROG}}{}^2$ and $\text{ADJ}_{\text{V,PROG}}$.
Consider the tableau in (70). In this hypothetical derivation, the two conjoined constraints outrank all simple constraints. Hence, all candidates in which the verbalizer *ta* is the innermost suffix are disqualified, since one of the conjoined constraints would always be violated. Consequently, the only remaining options are the candidates (a) and (c) in (70), in which the verbalizer is the rightmost of the three affixes, since these candidates do not cause violations of the conjoined constraints. In fact, 8 out of 24 possible constraint rankings produce either (69a) or (69b). The remaining 16 possible rankings produce outputs, where the innermost affix is the verbalizer. In the tableau in (70), constraint conjunction produces the effect that the two elements with scope over the verbalizer *ta*, the progressive and the causative, compete for the first two positions to the right of the verb. Thus, the system implemented in this chapter allows to produce non-compositional surface forms in a very restricted way. In short, the core idea behind this mechanism is that non-compositionality is always predicted in a few different rankings, but it is always less likely then compositional affix order. This effect arises directly from constraint conjunction, since the adjacency constraint referring to the element with greater scope is harmonically bounded by its conjoined version, while the adjacency constraint of the other elements is free in its rankings. Consequently, there will always be more rankings, in which the element with greater scope is external to the element it scopes over.[21]

(70) Derivation for (69)

nanu	[PROG]
ta	[*ta*], verbalizer
ka	[CAUS]

[21]The tableau in (70) does not include the CAUS-CLOSE constraint, which would render candidate (c) optimal, even if CAUS-CLOSE would be the lowest constraint in a ranking. This is, however, not problematic for the optionality found in the data, since optionality arises from two possible constraint rankings. Thus, the exact ranking of the three equally ranked constraints is decisive for the prediction of the output form, rather than the presence of CAUS-CLOSE.

V, [•PROG•], [•CAUS•], [•*ta*•]			$\text{ADJ}_{\text{V,CAUS}}{}^2$	$\text{ADJ}_{\text{V,PROG}}{}^2$	$\text{ADJ}_{\text{V,PROG}}$	$\text{ADJ}_{\text{V,CAUS}}$	$\text{ADJ}_{\text{V},ta}$
a.	☞	V-PROG-CAUS-*ta*				*!	**
b.		V-PROG-*ta*-CAUS	*!			**	*
c.	☞	V-CAUS-PROG-*ta*			*!		**
d.		V-CAUS-*ta*-PROG		*!	**		*
e.		V-*ta*-CAUS-PROG		*!	**	*	
f.		V-*ta*-PROG-CAUS	*!		*	**	

Chapter 9

Diachrony as a potential source of morphotactics

I have shown in chapters 4 and 5 that there are affix ordering patterns that cannot be explained by syntactic, semantic or phonological factors, particularly in the field of inflectional morphology. In a large number of languages, specifically Otomí, Mixtec, Bukiyip, Choktaw, Nambikwara, Misantla Totonac and Adyghe, agreement morphology seems to be too close to the root. Anderson (2006, 2011) shows that exactly these types of anomalies in the affix ordering patterns of inflectional morphology, like multiple exponcence or inflectional markers appearing in too internal positions, result from the grammaticalization of auxiliary verb constructions, a well-known process sometimes referred to as *univerbation*. Therefore, I argue that it is highly desirable to consider the diachronic origins of affixes in order to gain full insights into affix ordering anomalies across languages. A similar argumentation is found in Bybee (2010: 110):

> '*Understanding how structures arise in grammars provides us with possibilities for explanation not available in purely synchronic descriptions. Because morphosyntactic patterns are the result of long trajectories of change, they may be synchronically arbitrary; thus the only source of explaining their properties may be diachronic.*'

To transfer this statement by Bybee (2010) to the phenomena discussed in this dissertation, it seems that grammaticalised auxiliary verb constructions as the diachronic origins of the affixes are the common core of many different types of ordering anomalies, each of which is considered to be idiosyncratic in the synchronic grammar of the individual languages. In these constructions, syntactic properties of the auxiliary verb construction may be reflected in morphological anomalies of the resulting fused verb form. Anderson (2006) exemplifies this process by means of numerous examples from unrelated languages, two of which are presented in (1) and (2). The examples in (1) from Pero (West-Chadic, Nigeria) illustrate two auxiliaries exhibiting two different stages of grammaticalization. In Pero, subject marking is prefixal on auxiliaries, but suffixal on verbal complements. In the example in (1a), the auxiliary *mén* 'to want' selects a verbal complement with person marking being a prefix on the auxiliary, but a suffix on the complement verb 'to seat'. In (1b), the auxiliary *n* has grammaticalized into a consecutive marker to the main verb 'to settle'. Nonetheless, the person marker that was prefixal to the auxiliary is still present leading to multiple exponence of 1st person marking on the verb where the prefixal part is a remnant of the auxiliary and the suffixal part is a remnant of the complement.

(1) Multiple exponence in Pero (Anderson 2006: 273)

a. nì-mén-ji ɗi-ee-nò
1-want-HAB seat-AUG-1
'I want to sit down.'

b. nì-n- ɗi-ée-nò
1-CONSEC-settle-AUG-1
'and I settled'

The example in (2) illustrates an anomaly in the order of 1st person marking and past marking in the Southern Nilotic language Nandi, spoken in Kenya. In Nandi, past marking results from a fusion of a formerly independent auxiliary *tâ* and the lexical verb. Since tense was encoded on the auxiliary while person marking was restricted to the lexical verb, the resulting fused construction yields a pattern in which past is more external than person, thus contradicting general tendencies on affix order. Based on these observations, Anderson (2006) makes the observation that the fusion of TMA auxiliaries through univerbation will lead to the emergence of portmanteau affixes encoding TMA and person.

(2) Order of 1 and PST in Nandi (Anderson 2006: 281)
ká-tâ-aː-kás-é.
PST-AUX-1-listen-ASP
'I have just listened'

The conclusions by Anderson (2006) relate to the phenomenon of *externalization*, as described by Haspelmath (1993). Concretely, Haspelmath (1993) demonstrates that inflectional affixes can be trapped in a position inside other, typically derivational elements as a result of grammaticalization of these more external elements. In a later step, the inflectional affixes may be *externalized*, meaning that they are shifted to a position outside of the derivational element. This is exemplified in (3) for externalization of person in the Dravidian language Pengo. In the first step, the perfect marker *-na* was external to person. In a second step, there was multiple exponce of person marking in the sense that one of the exponent remained in its original position while the second exponent was realized in a position external to the perfect marker. In the last step, the more internal person marker got lost.

(3) Pengo (Burrow & Bhattacharya 1970, Steever 1984, Haspelmath 1993)

	'see' (PST)	perfect (old)	perfect (hybrid)	perfect (new)
1SG	hurṭa-ŋ	hurṭa-ŋ-na	hurṭa-ŋ-na-ŋ	hurṭa-na-ŋ
2SG	hurṭa-y	hurṭa-y-na	hurṭa-y-na-y	hurṭa-na-y
3SG.MASC	hurṭa-n	hurṭa-n-na	hurṭa-n-na-n	hurṭa-na-n
3SG.FEM	hurṭa-t	hurṭa-t-na	hurṭa-t-na-t	hurṭa-na-t

In simpler terms, the observations by Anderson (2006) describe examples of *incomplete externalization*, in which the inflectional markers that appear in seemingly too internal position have not been shifted to a more external position yet. In this chapter, I want to discuss if the generalizations can be extended to the cases discussed in chapters 4 and 5.

Zulu exhibits bipartite negative marking with a prefixal marker *a-* and a suffixal marker *-i*. Specifically, the negation *-i* normally surfaces as a final vowel, as shown in (4a). If a future marker is present, however, it immediately follows the future tense marker, as shown (4c) and (4d) where the (4c) is the example provided by Buell (2005), which was corrected and adjusted by a native speaker in (4d). Buell (2005) also discusses that the final negative morpheme *-i* in (4c) is optionally deleted, thus explaining its absence in (4d).

(4) Position of NEG (Buell 2005: 73f)

a. a-ka-cul-i
NEG-CL1-sing-NEG
'she does not sing'

b. u-z-o-cul-a
CL1-FUT-TV-INF-sing-TV
'she will sing'

c. a-ka-z-i-y-uku-cul-a
NEG-CL1-FUT-NEG-EV-INF-sing-TV

d. a-ka-z-uku-cul-a
NEG-CL1-FUT-INF-sing-TV
'she will not sing'

In fact, there is evidence that the future marker derives from an independent auxiliary *za* 'to come', as noted by Buell (2005). The examples in (5) show how the analytic construction involving an auxiliary became grammaticalized into a bound future marker. In (5a), there is an auxiliary verb *z(a)* - 'to come', which carries the negation, subject agreement morphology, and selects for an infinitival complement marked by the infinitival marker *uku-*. *Uku-* is composed of the noun class marker *u-* which is specific to action nouns and the actual infinitive marker *ku-*. In (5b), these two words are fused into one word. Since this fusion leads to a vowel hiatus, the epenthetic glide *-y-* (glossed as EG) is inserted. Similary, the sentence in (4c) seems to be on that level of grammaticalization. In the next step, the epenthetic glide is deleted, as in

(4d) and in (5c), where the suffixal part of the negation is deleted in addition. The example in (5d) illustrates the infinitival marker *ku-* may optionally be deleted. Thus, the patterns in (4c) and (4d) seem to violate crosslinguistic tendencies of affix order synchronically, but can easily be explained knowing that the construction originates from a periphrastic future construction.

(5) Grammaticalization of future markers in Zulu (Buell 2005: 120)

a. a-si-z-i uku-cul-a
NEG-1PL.SUBJ-FUT-NEG INF-sing-TV

b. a-si-z-i-y-uku-cul-a
NEG-1PL.SUBJ-FUT-NEG-EG-INF-sing-TV

c. a-si-z-uku-cul-a
NEG-1PL.SUBJ-FUT-INF-sing-TV

d. a-si-z-u-cul-a
NEG-1PL.SUBJ-FUT-CL1-sing-TV
'I will not help.'

That being said, let me reconsider the two cases of nontransitivity I presented in chapter 5.2.1. In Kuna, there is nontransitivity between the future, the plural marker and the negative marker in the sense that future precedes negation, negation precedes plural but future does not precede negation, as illustrated again in (6).[22]

(6) Nontransitivity of FUT, NEG and PL in Kuna (Newbold 2013)

a. Nu-gu-o-sur-iye.
good-COP-FUT-NEG-QUOT
'It was said that he wouldn't get better.'

b. dak-sur-mala.
see-NEG-PL
'to not see (pl.)'

c. Oyo-na-mal-oe.
show-go-PL-FUT
'They will go show (the place to you).'

d. dak-o-sur-mar-ye
see-FUT-NEG-PL-QUOT
'(He said) You (pl.) won't see him anymore'

e. na-mal-o-suli
go-PL-FUT-NEG
'They won't go.'

f. *STEM-suli-mala-oe.
stem-NEG-PL-FUT

Abstractly, the phenomenon in Kuna is somewhat similar to the displacement of the negative marker in Zulu in the sense that negation appears in a different position in the presence of a future marker. Let me hypothesize for now that the future

[22] A similar picture arises in the related language Teribe, where the prospective aspect marker is outside person marking but inside negation (Quesada 2000).

marker in Kuna derives from an auxiliary just as in Zulu. Under this assumption, it is conceivable that it also hosted the negation at a stage of the language where future was still an independent auxiliary. This would then explain the fact that the number marker seems to be stuck inside the future marker in (6c) since agreement is closer to the verb than future aspect.[23] In fact, it can further be stated that the optionality in combinations of all three affixes in (6d) and (6e) shows the ongoing process of externalization. In (6e), the number marker is trapped in its original positon. In (6d), however, displacement of the negation **feeds** externalization of the plural marker.
It is crucial to note that this generalization is of course somewhat hypothetical since there is no synchronic evidence that the future marker originates from a previously independent auxiliary. However, given the observation that inchoatives, causatives and future markers are very likely to derive from independent verbs in general (Heine & Kuteva 2002), it seems like a plausible hypothesis.
Abstractly, nontransitivity in Washo, presented earlier in chapter 5.2.1 takes place among the same verbal categories, namely future aspect (see Bochnak 2016, who argues that it is prospective aspect rather than tense), negation and number, illustrated again in (7). In striking similarity to Kuna, the example in (7b) shows that negation seems to be hosted by the near future marker.

(7) Nontransitivity in Washo (Jacobsen 1964, 1973)

a. le-ímeʔ-ši-ášaʔ-i
1-drink-DU.INCL-NEAR.FUT-IND
'Both of us are going to drink.'

b. le-ímeʔ-ášaʔ-éːs-i
1-drink-NEAR.FUT-NEG-IND
'I will not drink'

c. le-ímeʔ-éːs-ši-leg-i
1-drink-NEG-DU.INCL-REC.PST-IND
'Both of us did not drink.'

Moreover, the example in (8), where all three categories are combined, displays a similar pattern to the examples from Kuna in (6), in the sense that placement of the negation after the future marker feeds externalization of the number marker, shown here in (8). Again, there is no synchronic evidence suggesting that the prospective aspect marker actually originates from a periphrastic future construction apart from the similarities to Kuna and Zulu.

(8) 3-affix-clusters in Washo (Jacobsen 1964, 1973)

lé-íme?-ášaʔ-éːs-hu-i
1-drink-NEAR.FUT-NEG-PL.INCL-IND
'We (incl.) are not going to drink.'

[23] Smith (2014) argues that the future marker *o(e)-* is actually prospective aspect rather than future tense.

As Haspelmath (1993) shows for Pengo in (3), externalization predicts an intermediate step that includes multiple exponence of the affix undergoing externalization. Moreover, multiple exponence is a common result of univerbation of auxiliary verb construction, as already illustrated above for Pero and argued by Anderson (2006, 2011), Harris (2017) and Caballero & Inkelas (2018).
A similar phenomenon can be observed in Nambikwara, where the features of the subject are expressed by two separate affixes. The person feature of the subject is expressed through a suffix attaching directly to the verb root, whereas the number feature attaches to the desiderative marker, as shown in (9).

(9) Subject marking in Nambikwara (Kroeker 2001: 84)
Ài-să-lxûn-sĩ̌n-nhă-wă.
go-1SG.OBJ-DESID-1PL-AFFECT-IMPFV
'We want to go'

The desiderative that intervenes between the doubled markers belongs to a group labeled *auxiliaries* by Kroeker (2001). The fact that these suffixes allow or require doubled marking of the subject can be explained taking the origin of the marker into account. Concretely, the auxiliaries originate from independent verbs that require verbal complements. In Nambikwara, there is a third auxiliary *tèn* - 'to want' that is less integrated than the other two auxiliaries in the sense that it allows the subjects of main verb and embedded verb to be different, as shown in (10a). Moreover, verbs embedded under *tèn* carry the *jùtă* marker which occurs only in this particular context and marks stative complements (Kroeker 2001). Interestingly, a cognate of *tèn* is found in the closely related language Mamaindê. In that language, however, it behaves like a fully integrated desiderative marker, as illustrated in (10b).

(10) *tèn* - 'to want'

a. Sxĩ̌hă tòn-âin-jùtă tèn-sà-nhă-wă.
house make-3PL-jùtă want-1SG.OBJ-AFFECT-IMPFV
'I want them to build a house.' Nambikwara, Kroeker (2001: 84)

b. ʔĩ̌un-ten-aʔ-wa
sleep-want-1SG.SUBJ-IMPFV
'I want to sleep.' Mamaindê, Eberhard (2009: 419)

The desiderative occuring with doubled agreement morphology in Nambikwara seems to be somewhere in between (10a) and (10b), in the sense that the complement marker *jùtă* never appears on the verb with these auxiliaries, yet agreement morphology is doubled. However, the sentence in (9) is **not** interpreted as 'I want us to go.' indicating that the different number specifications are not interpreted. In other words, there is evidence that the multiple exponence in (9) in fact results from univerbation of an auxiliary, thus matching the examples from Pero in (1) and the predictions by Anderson (2006, 2011), Harris (2017) and Caballero & Inkelas (2018). Another case of multiple exponence is described by Clem et al. (2020) for the Tibeto-

Burman language Tiwa. In Tiwa, the informational focus marker =*lô* typically attaches as the last clitic outside subject agreement, as shown in (11a). However, it is also possible that the subject agreement marker occurs outside the focus marker, thus moving to an externalized position. In this context, the past tense marker is doubled, as shown in (11b). Crucially, doubling happens only if agreement morphology is overt. With 3rd person subjects, agreement is covert and externalization of the past marker without the presence of an agreement marker is ungrammatical, as shown in (11c) vs (11d). The examples indicate that the multiple exponence of the past marker result from externalization. Moreover, the examples show striking similarities with Kuna and Washo in the sense that externalization of one inflectional category **feeds** externalization of another inflectional category.

(11) Multiple exponence of PST in Tiwa (Clem et al. 2020: 7)

a. Lí-ya-m-âng=lô
go-NEG-PST-1SG=FOC

b. Lí-ya-m=lô-m-âng
go-NEG-PST=FOC-PST-1SG
'I did not go'

c. Lí-ya-m=lô
go-NEG-PST=FOC

d. *Lí-ya=lô-m
go-NEG=FOC-PST
'She did not go.'

If deviations from the standard patterns of affix order in fact result from incomplete grammaticalization processes in the sense that some affixes are trapped in their old positions, it is predicted that:

- anomalies in affix order occur more often in contexts of categories that commonly occur as auxiliaries in auxiliary verb constructions.
- anomalies in affix order occur more often in contexts of categories that are commonly carried by auxiliary verb constructions.
- categories involved in affix ordering anomalies should appear as portmanteau morphemes as well.

The last prediction refers to the observation by Anderson (2011) that portmanteaus of TMA and person marking result from the grammaticalization of TMA auxiliaries carrying person markers. Since these morphemes are in a morphologically tight relationship, it is expected that the combinations of categories involved in ordering anomalies should also appear as portmanteau morphemes, e.g. in a related language. In this dissertation, I have shown that the categories involved in displacement of inflectional morphology are mainly person and number, negation and tense-mood-aspect. In the exhausative, crosslinguistic study of auxiliary-verb construction by

Anderson (2006), the author lists the following attested functions of auxiliaries, with decreasing frequency: tense-mood aspect, negative polarity, voice, directionality and comparable functions, adverbial functions. I am not aware of any quantative comparative study that examines the frequency of verbal categories on auxiliaries. Anderson (2011) provides an overview of categories hosted by the auxiliary in so-called *split* constructions, in which some categories are hosted by the lexical verb while others are hosted by the auxiliary. Table 9.1 lists the attested patterns of split constructions according to Anderson (2006). Recall that the cases of non-transitivity in Kuna and Washo hypothetically resemble cases of univerbation where negation occurs on a TMA auxiliary. Table 9.1 shows that this assumption seems reasonable, since there are several genetically and geographically unrelated languages, where negation is the only category hosted by an auxiliary, namely Ngengomeri (Southern Daly, Australia), Ayoquesco Zapotec (Mayan, Mexico), Komi (Uralic, Russia) and Ika (Benue-Congo, Nigeria).

Lexical verb	**Auxiliary**	**Languages**
NEG	AGR & TMA	Buryat, Chukchi, Tulung, Remo, Baruya, Gimira, etc.
OBJ.AGR	SUBJ.AGR	Kinnauri, Eleme, Gela, Koasati, Canela-Krahô, etc.
TMA	AGR	Doyayo, Gurindji, Tairora, etc.
TMA_1	TMA_2	Chulym Turkic, Dagaare, Ambulas, Mandan, etc.
AGR	TMA	Ma'di, Halia, Coast Tsimshian, Retuarã, etc.
SUBJ.AGR	OBJ.AGR	Kugu Nganhcara, Cocama, Jakaltek, etc.
AGR, TMA	NEG	Ngengomeri, Ayoquesco Zapotec, Komi, Ika, etc.

Table 9.1: Categories in split auxiliary verb constructions, from Anderson 2006: 214

While the statements about the origins of these patterns are somewhat tentative, I would like to outline how the analytical devices I introduced in chapter 8 are capable in deriving these diachronic explanations as **rules in a synchronic grammar** and how diachronic change can be modeled. Crucially, I believe that a stratal model to morphology is advantageous to parallel models, since it provides a structure which suits diachronic explanations: as noted by Bermúdez-Otero (2019), the division of affixes into stem-level affixes and word-level affixes can often be explained when diachronic factors are taken into account. Let me sketch that idea for the case of multiple exponence in Nambikwara, described above in (9). As mentioned above, there is evidence to believe that the desiderative originates from a auxiliary verb construction. The fact that the anomaly that agreement is trapped inside the desiderative results from univerbation of the auxiliary, following the spirit of Anderson (2006), justifies to treat the auxiliaries differently in a theoretical model. Concretely, it could easily be assumed that the desiderative and outer agreement markers are lexically specified as word-level suffixes, while the inner agreement marker is a stem-level suffix. In that sense, the lexical specification is a remnant property of the diachronic origin. Concretely, Bermúdez-Otero (2019) would assume that the inner agreement affix is listed non-analytically as part of the stem-level. Bermúdez-Otero (2019) notes that stem-level affixes often exhibit semantic non-compositionality or phonological idiosyncrasies. While the poor phonological description of Nambiwara in Kroeker (2001) does not allow judgments about the phonological properties of this particular affix, it seems that the construction does in fact involve a semantic intransparency. Concretely, the subject of the sentence in (9) is 1PL. The inner agreement suffix is a 1SG marker while the outer suffix is the 1PL marker. That being said, it seems that the outer suffix is the one which is actually interpreted while the inner one is semantically opaque. Thus, the prediction by Bermúdez-Otero (2019) is borne out: the distinction between stem-level affixes and word-level affixes results from the diachronic origin of the construction and yields the effect that stem-level affixes are far more lexicalised than productive, analytically concatenated word-level affixes.

In this chapter, I suggested to include diachrony of a language into the discussion about anomalies in affix ordering patterns. While there is strong evidence for ongoing processes of grammaticalization in isiZulu, the extension of this generalization to Washo and Kuna is somewhat tentative. Thus, this chapter does not aim to provide full-fledged analyses or generalizations on these patterns. Rather, the striking similaries between the non-related languages isiZulu, Kuna and Washo with respect to the categories and surface forms participating in these anomalies serve as a call to scholars describing and analysing these patterns to take diachronic explanation into consideration if the relevant sources are available.

Chapter 10

Conclusion

In this dissertation, I discussed the role of morphology and its interplay with other grammatical factors conditioning the relative order of affixes on the verb across languages. In chapter 4 and chapter 5, I reach several empirical conclusions indicating that there are independent rules on the morphological wellformedness of the word, thus necessitating independent, morphological rules on affix order. These empirical conclusions can be summarized as follows:

1. Previous generalizations on the relative order of verbal categories by Bybee (1985), Speas (1991a), Wunderlich (1993) or Cinque (1999) serve as crosslinguistic tendencies, but are clearly violable. The most common violations of these hierarchies arise from the placement of agreement morphology, which is interspersed between other inflectional categories.

2. In chapter 4.5, I reviewed previous work by Trommer (2001, 2003, 2008) and Julien (2000) showing that the affixal status of certain inflectional categories, that is, if an affix is attached as a prefix or a suffix, is not arbitrary, but subject to independent rules of morphology. More specifically, Trommer (2001, 2003, 2008) shows that exponents of person features tend to be realized closer to the left edge of the word than number exponents. Consequently, person exponents are more likely to be prefixes than number suffixes. As for the distribution of tense and aspect exponents, Julien (2000) shows the overwhelming tendency that aspect is closer to the verb root than tense morphology. If both categories are distributed on both sides of the verb, however, only tense can be a prefix. In chapter 4.6, I revealed another status asymmetry for causatives. Concretely, I provided qualitative and quantitative evidence pointing towards a prefixation bias of causative markers, such that causative exponents are far more likely to be prefixes than other verbal categories.

3. Semantic approaches on the one hand and syntactic approaches on the other hand make different predictions about variable affix order: while both accounts predict variable affix order in cases where the underlying semantic composition/syntactic derivation is flexible, e.g. when scope is reversible, Rice (2000)

further states that affix order may be flexible in cases where two affixes are not in a semantic relationship with each other. Chapter 4.3 examines the phenomenon of variable affix order in further detail. I show that affix order the relative order of affixes with reversible scope may be variable in some languages, but invariable in others. As a consequence, variable affix order occurs less often than predicted. This observation provides further evidence for the existence of independent rules on affix order and points towards a general dispreference against affix variability.

4. In chapter 5, I presented evidence that rules on morphological wellformedness do not only contribute to the determination of the affixal status, but are active in areas which are claimed to be mainly driven by syntactic and semantic considerations on affix order. I showed that non-compositional combinations of valency affixes suggest that morphological rules on the relative ordering of affixes **overwrite** semantic/syntactic requirements on transparency. Consequently, optionality often arises from the competition between rules on morphological wellformedness and rules implementing semantic transparency. Moreover, these morphological rules are not completely arbitrary. Rather, there is the general pattern that the causative exponents are always closer to the root than other derivational affixes.

5. In chapter 5.2, I discussed instances of nontransitivity and noncumulativity that have previously been observed in the literature. As for nontransitivity, I reach the preliminary conclusion that many of these cases can be explained taking the semantic or the phonological structure into account. Since many of examples suffer from a massive underdescription of their phonological and semantic correlates, it cannot ultimately be concluded that morphologically conditioned nontransitivity and noncumulativity actually exist.

Given these empirical generalizations which imply the existence of independent morphological rules on affix order, the question arises how these morphological rules and their interactions with other factors on affix order, such as syntax, semantics and phonology, may be modeled in linguistic theory. Especially the influence of rules of phonological wellformedness is extensively discussed in the literature (see Paster 2006, 2009). In chapter 6, I presented an overview of previously observed patterns of phonologically conditioned affix order concluding that many of these examples instantiate cases of true phonologically optimizing affix order. Consequently, this interaction suggests that the phonology has access to affix boundaries, at least temporarily.

In chapter 7, I reviewed previous influential contributions that make use of morphological rules on affix order, more precisely the approaches by Ryan (2010), Crysmann & Bonami (2016) and Müller (2020). I showed that these contributions differ with respect to the structure of the morphological module and the theoretical make-up of the rules they implemented therein. More specifically, there is an ongoing debate on whether morphology is pre-syntactic or post-syntactic, realizational or incremental and whether it operates in parallel or in a cyclic fashion. In chapter 8 of this dissertation, I combine the empirical generalizations and deficiencies of previous analyses to suggest a proper model of the morphological rules on affix order. Concretely, I assume a cyclic model couched in Stratal OT where different types of constraints - that is, rules implementing semantic transparency and rules implementing morphotactics - operate in parallel, thus explaining the competition between the two factors. Moreover, I assume that phonology has access to morphological structure within the cyclic domain only. Hence, patterns of phonologically conditioned affix order can be allowed without allowing morphological access to phonology globally.

A remaining question is the origin and the motivation of the morphotactic rules established in this dissertation. In chapter 9, I opened the tentative discussion that many of these morphological peculiarities seem to have a diachronic origin. More specifically, it seems that morphological idiosyncrasies, where inflectional morphology is closer to the verb than derivational morphology or other categories, show striking similarities with auxiliary verb constructions, where some categories are hosted by the auxiliary, while others are hosted by the lexical verb. Anderson (2006) shows that grammaticalization of these auxiliary verb constructions yields patterns where inflectional categories are stuck between the former lexical verb and the former auxiliary. In that sense, morphological idiosyncrasies are remnants of syntactic structure. Although the crosslinguistic overview by Anderson (2006) does not discuss the morphological issues of the languages considered in this dissertation, the striking similarities justify to take this hypothesis into account when describing and analyzing affix ordering patterns.

This dissertation also highlighted the importance of studying semantic and phonological correlates of affix order. More specifically, I have shown that these properties do not only provide potential explanations for patterns such as nontransitivitiy or noncumulativity, but offer valuable insights into the internal structure of the word.

Appendix A

Additional materials

A.1 Samples

(1) 130-language sample on the positon of causatives

Language	Position of causative	WALS 26A
Apurinã	suffix	equal prefixing and suffixing
Adyghe	prefix	equal prefixing and suffixing
Caddo$_1$	suffix	weakly prefixing
Caddo$_2$	prefix	weakly prefixing
Kuna	prefix	strongly suffixing
Mixtec	prefix	strongly prefixing
Zulu	suffix	strongly prefixing
Southern Pomo	suffix	strongly suffixing
Tukang Besi	prefix	weakly prefixing
Chukchi	prefix	weakly suffixing
Misantla Totonac	prefix	equal prefixing and suffixing
Yagua	suffix	strongly suffixing
Alamblak	prefix	strongly suffixing
Tiwi	suffix	strongly prefixing
Udihe	suffix	strongly suffixing
Huallaga Quechua	suffix	strongly suffixing
Ainu	suffix	equal prefixing and suffixing
Arosi	prefix	little affixation
Asmat	suffix	strongly suffixing
Barasano	suffix	strongly suffixing
Batak$_1$	prefix	strongly suffixing
Batak$_2$	suffix	strongly suffixing
Beja$_1$	prefix	weakly prefixing
Beja$_2$	suffix	weakly suffixing
Blackfoot	suffix	weakly prefixing

Bororo	suffix	weakly suffixing
Brahui	suffix	strongly suffixing
Buriat	suffix	strongly suffixing
Burushaski	prefix	weakly suffixing
Campa (Axininca)	suffix	strongly suffixing
Carib	suffix	equal prefixing and suffixing
Cebuano	prefix	little affixation
Chamorro	prefix	little affixation
Chinantec	prefix	little affixation
Choctaw	suffix	equal prefixing and suffixing
Chuvash	suffix	strongly suffixing
Comanche	suffix	strongly suffixing
Cree (Plains)	suffix	equal prefixing and suffixing
Diegueño (Mesa Grande)	prefix	weakly prefixing
Diola-Fogny	suffix	equal prefixing and suffixing
Diyari	suffix	strongly suffixing
Doyayo	suffix	strongly suffixing
Evenki	suffix	strongly suffixing
Fijian	prefix	little affixation
Grebo	suffix	strongly suffixing
Guaraní	prefix	strongly prefixing
Gujarati	suffix	strongly suffixing
Guugu Yimidhirr	suffix	strongly suffixing
Hausa	suffix	little affixation
Hawaiian	prefix	little affixation
Hindi	suffix	strongly suffixing
Hixkaryana	suffix	equal prefixing and suffixing
Huitoto (Minica)	suffix	strongly suffixing
Hungarian	suffix	strongly suffixing
Hunzib	suffix	strongly suffixing
Indonesian	suffix	strongly suffixing
Igbo	prefix	equal prefixing and suffixing
Ingush	suffix	strongly suffixing
Iraqw	suffix	strongly suffixing
Japanese	suffix	strongly suffixing
Jaqaru	suffix	strongly suffixing
Kadazan	prefix	little affixation
Kalkatungu	suffix	strongly suffixing
Kambera	prefix	little affixation
Kannada	suffix	strongly suffixing
Kanuri	prefix	strongly suffixing

Kashmiri	suffix	strongly suffixing
Kayardild	suffix	strongly suffixing
Kemant	suffix	strongly suffixing
Kewa	prefix	strongly suffixing
Khasi	prefix	little affixation
Khmer	prefix	little affixation
Kinyarwanda	suffix	strong prefixing
Kiowa	suffix	equal prefixing and suffixing
Kiribati	prefix	equal prefixing and suffixing
Kisi	suffix	equal prefixing and suffixing
Kongo	suffix	strong prefixing
Koromfe	suffix	weakly suffixing
Kutenai	suffix	weakly suffixing
Kwaio	prefix	little affixation
Lavukaleve	suffix	weakly suffixing
Lezgian	suffix	strongly suffixing
Luvale	suffix	strongly prefixing
Maasai_1	prefix	weakly prefixing
Maasai_2	suffix	weakly prefixing
Malagasy	prefix	little affixation
Malayalam	suffix	strongly suffixing
Manobo (Western Bukidnon)	prefix	strongly prefixing
Martuthunira	suffix	strongly suffixing
Meithei	suffix	weakly suffixing
Muna	prefix	equal prefixing
Nez Perce	prefix	equal prefixing and suffixing
Nicobarese (Car)	prefix	strongly suffixing
Nivkh	suffix	weakly suffixing
Paakantyi	suffix	strongly suffixing
Paiwan	prefix	equal prefixing and suffixing
Palauan	prefix	weakly prefixing
Pipil	suffix	equal prefixing and suffixing
Pirahã	suffix	strongly suffixing
Puluwat	prefix	little affixation
Sawu	prefix	little affixation
Sirionó	suffix	weakly prefixing
Slave	prefix	strongly prefixing
Squamish	suffix	strongly suffixing
Supyire	suffix	weakly suffixing
Swahili	suffix	weakly prefixing
Rapanui	prefix	little affixation

Taba	prefix	little affixation
Tahitian	prefix	little affixation
Tagalog	prefix	little affixation
Timugon	prefix	little affixation
Tondano	prefix	weakly prefixing
Tongan	prefix	little affixation
Tonkawa	prefix	weakly suffixing
Turkana	prefix	strongly prefixing
Turkish	suffix	strongly suffixing
Tuvaluan	prefix	little affixation
Tzotzil	prefix	equal prefixing and suffixing
Ulithian	prefix	little affixation
Una	suffix	strongly suffixing
Uradhi	suffix	strongly suffixing
Usan	suffix	strongly suffixing
Ute	suffix	strongly suffixing
Uzbek	suffix	strongly suffixing
Wambaya	suffix	strongly suffixing
Wichita	suffix	weakly prefixing
Yankuntjatjara	suffix	strongly suffixing
Yaqui	suffix	strongly suffixing
Yidiny	suffix	strongly suffixing
Yukaghir (Kolyma)	suffix	strongly suffixing

Table A.1: Positioning of morphological causatives

(2) 63-language sample on the positon of causatives 4.6

Language	**Position of causative**	**WALS 26A**
Apurina	suffix	equal prefixing and suffixing
Adyghe	prefix	equal prefixing and suffixing
Caddo1	suffix	weakly prefixing
Caddo2	prefix	weakly prefixing
Kuna	prefix	strongly suffixing
Mixtec	prefix	strongly prefixing
Zulu	suffix	strongly prefixing
Southern Pomo	suffix	strongly suffixing
Chukchi	prefix	weakly suffixing
Misantla Totonac	prefix	equal prefixing and suffixing
Yagua	suffix	strongly suffixing
Alamblak	prefix	strongly suffixing
Tiwi	suffix	strongly prefixing

Udihe	suffix	strongly suffixing
Huallaga Quechua	suffix	strongly suffixing
Ainu	suffix	equal prefixing and suffixing
Asmat	suffix	strongly suffixing
Barasano	suffix	strongly suffixing
Bororo	suffix	weakly suffixing
Brahui	suffix	strongly suffixing
Buriat	suffix	strongly suffixing
Burushaski	prefix	weakly suffixing
Choctaw	suffix	equal prefixing and suffixing
Cree (Plains)	suffix	equal prefixing and suffixing
Diegueno (Mesa Grande)	prefix	weakly prefixing
Grebo	suffix	strongly suffixing
Guaraní	prefix	strongly prefixing
Gujarati	suffix	strongly suffixing
Hixkaryana	suffix	equal prefixing and suffixing
Huitoto (Minica)	suffix	strongly suffixing
Hungarian	suffix	strongly suffixing
Hunzib	suffix	strongly suffixing
Japanese	suffix	strongly suffixing
Jaqaru	suffix	strongly suffixing
Kanuri	prefix	strongly suffixing
Kayardild	suffix	strongly suffixing
Kemant	suffix	strongly suffixing
Kewa	prefix	strongly suffixing
Khasi	prefix	little affixation
Kiowa	suffix	equal prefixing and suffixing
Kutenai	suffix	weakly suffixing
Lavukaleve	suffix	weakly suffixing
Maasai1	prefix	weakly prefixing
Maasai2	suffix	weakly prefixing
Meithei	suffix	weakly suffixing
Nez Perce	prefix	equal prefixing and suffixing
Nivkh	suffix	weakly suffixing
Piraha	suffix	strongly suffixing
Sirionó	suffix	weakly prefixing
Slave	prefix	strongly prefixing
Squamish	suffix	strongly suffixing
Tonkawa	prefix	weakly suffixing
Turkana	prefix	strongly prefixing
Turkish	suffix	strongly suffixing

Tzotzil	prefix	equal prefixing and suffixing
Ulithian	prefix	little affixation
Una	suffix	strongly suffixing
Uradhi	suffix	strongly suffixing
Usan	suffix	strongly suffixing
Wambaya	suffix	strongly suffixing
Wichita	suffix	weakly prefixing
Yaqui	suffix	strongly suffixing
Yukaghir (Kolyma)	suffix	strongly suffixing

A.2 Additional examples

(3) Order of CAUS and APPL in Caddo (Melnar 1998: 51,74)

a. Hít=si-'n-baka-yán-yá^ʔah
PST-2.DAT-APPL-sound-CAUS-roam
'She talked to you.'

b. ku-n-dana-'i'n-u^ʔ-čah
1.DAT-APPL-blow-CAUS-MID-INTENT
'He is going to blow it for me.'

(4) Order of CAUS and ASSIST in Huallaga Quechua (Weber 1983: 144)

a. Aru-:shi-chi-shu-nki
work-ASSIST-CAUS-2.OBJ-2
'He makes you help (someone else) work.'

b. Aru-chi-:shi-shu-nki
work-CAUS-ASSIST-2.OBJ-2
'You help somebody to work by making someone else work.'

(5) Order of CAUS and REC in Huallaga Quechua (Weber 1983: 80)

a. Asi-pa:-nakU-chi-ma-nchi
laugh-BEN-REC-CAUS-1.OBJ-1.INCL
'He makes us laugh at each other.'

b. Asi-chi-naku-nchi
laugh-CAUS-REC-1INCL
'We make each other laugh.'

(6) Order of CAUS and REFL in Huallaga Quechua (Weber 1983: 81)

a. Huchalli-kU-chi-shu-nki
incur.guilt-REFL-CAUS-2.OBJ-2
'He makes you incur guilt to yourself.'

b. wañu-chi-ku-sha
die-CAUS-REFL-3.PFV
'He killed himself.'

(7) Order of PASS and CAUS in Huallaga Quechua (Weber 1983: 103, 148)

a. Achka-q-ta allcha-ka:-chi-sha ka-pti-n
many-human-OBJ fix-PASS-CAUS-PTCP be-ADV-3PL
'Because he had healed many .. '

b. Allcha-ka:-chi-pa-:-ma-y
fix-PASS-CAUS-BEN-1.OBJ-2.IMP
'Cure him for me.'

(8) Order of REC and APPL in isiZulu (Buell 2005: 26)

a. I-zigebengu zi-fihl-an-el-a a-bangani ba-zo.
CL10-thieves CL10.SUBJ-hide-REC-APPL-TV CL2-friends CL2-CL10
'The thieves hide each other for their friends.'
NOT: 'The thieves hide their friends from each other.'

b. I-zigebengu zi-fihl-el-an-a a-bangani ba-zo.
CL10-thieves CL10.SUBJ-hide-APPL-REC-TV CL2-friends CL2-CL10
'The thieves hide their friends from each other.'
NOT: 'The thieves hide each other for their friends.'

(9) Order of REC and CAUS in isiZulu (Buell 2005: 26)

a. A-bafana ba-bon-is-an-a a-mantombazane.
CL2-boys CL2.SUBJ-see-CAUS-REC-TV CL2-girls
'The boys are showing each other the girls.'

b. A-bafana ba-bon-an-is-a a-mantombazane.
CL2-boys CL2.SUBJ-see-REC-CAUS-TV CL2-girls
'The boys are showing the girls to each other.'

(10) Order of PASS and APPL in isiZulu (Buell 2005: 195)

a. E-sikole-ni ku-zo-fund-el-w-a
LOC.CL7-school-LOC CL17.SUBJ-FUT-study-APPL-PASS-TV
nga-bantwana.
by-child
'The school will be studied at by the child.'

b. *I-mali ibi-fihl-w-el-a a-bangani ba-zo.
CL9-money PST-hide-PASS-APPL-TV CL2-friends CL2-CL10
'Money was hidden for their friends.'

(11) Order of CAUS and PASS in isiZulu (Buell 2005: 12)

a. cul-is-w-a
sing-CAUS-PASS-TV
'someone is made to sing'

b. *I-mali i-fihl-w-is-a
CL9-money CL9-hide-PASS-CAUS-TV
'It was caused that money is hidden.'

(12) Order of APPL and REFL in Choctaw (Broadwell 2006: 99)

John-at holisso' il-i-chopa-tok
John-NOM book REFL-APPL-buy-PST
'John bought the book for himself.'

(13) Order of REC and COM in Choctaw (Broadwell 2006: 98)
Il-itt-ibaa-chaffa-h
1PL-REC-COM-one-TNS

'We agree' (lit: We are one with each other.'

(14) Order of REQ and CAUS in Tukang Besi (Donohue 2011: 219)
No-hepe-pa-wila te ana i 'one
3RLS-REQ-CAUS-go CORE child OBL beach
'She asked him to send the child to the beach.'

(15) Order of CAUS and PASS in Tukang Besi (Donohue 2011: 214)

a. No-to-pa-ala-mo na mia iso te wemba.
3RLS-PASS-CAUS-fetch-PFV NOM person yon CORE bamboo
'That person was made to fetch bamboo.'

b. *No-to-pa-ala-mo na wemba iso te mia.
3RLS-PASS-CAUS-fetch-PFV NOM bamboo yon CORE person
intended: 'That bamboo was made to be fetched by the person.'

(16) Order of CAUS and REC in Tukang Besi (Donohue 2011: 293)

a. No-pa-po-tandu-tandu-'e na wembe.
3.RLS-CAUS-REC-RED-horn-3.OBJ NOM goat
'He_i incited the $goats_k$ to butt each $other_k$.'

b. *No-po-pa-manga-manga.
3.RLS-REC-CAUS-RED-eat
'$They_i$ made each $other_i$ eat.'

(17) Order of PASS and REC in Tukang Besi (Donohue 2011: 294)
No-to-po-simbi-simbi-mo na hansu.
3.RLS-PASS-REC-RED-slash-PFV NOM sword

'The swords are used for mutual slashing.'

(18) Order of BEN and REC in Nambikwara (Kroeker 2001: 26)
Wa̖kòn-kǐ-nyhûh-nà-lǎ.
work-BEN-REC/REFL-EVID-PFV

'He_x is working for him_x.'

(19) Order of CAUS, PASS in Udihe (Nikolaeva & Tolskaya 2001: 307)

a. ña:ma-u-wan
curse-PASS-CAUS
'cause to be cursed'

b. eme-wen-e-u
come-CAUS-0-PASS
'be sent'

Appendix B

List of OT constraints

1. ADJACENCY$_{V,A}$ (ADJ$_{V,A}$):
   Assign * for each exponent between the verbal root and an exponent of category A.
   Domain: morphology, see 8

2. AGREE$_{CC}$(NASAL)
   Assign * for each pair of adjacent consonants that differ in their specification for [nasal].
   Domain: phonology, see Chapter 8

3. AGREE$_{CC}$(VOICED)
   Assign * for each pair of adjacent consonants that differ in their specification for [voiced].
   Domain: phonology, see Chapter 8

4. ALIGN-CAT-R (short CAT ⇒ R)
   Assign a * for each exponent between an exponent of category CAT and the right edge of the word.
   Domain: morphology, see Chapter 7 and 8

5. CAUS-CLOSE:
   Assign * for each exponent between the verbal root and an exponent CAUS.
   Domain: morphology, see Chapter 8

6. *CC
   Assign a * for each pair of consonant whhich is not separated by a vowel.
   Domain: phonology, see Chapter 8

7. *C$_{[\text{-cont}]}$i
   Assign a * for each phonological element with the feature [-cont] before /i/.
   Domain: phonology, see Chapter 8

8. *CLASH (Plag 1999, Pater 2000, Gordon 2002, Benz 2017)
   Assign * for a stressed syllable that is immediately followed by another stressed

syllable.
Domain: phonology, see Chapter 6

9. COH(ERENCE): adapted from Trommer (2008)
Assign * for each exponent that intervenes between the first exponents realizing features from one and the same feature set in the input.
Domain: morphology, see Chapter 8

10. DEP
Assign * for each segment in the output that was not present in the input.
Domain: phonology, see Chapter 8

11. F ⇒ R
Assign a * for each item separating an exponent of [F] from the right edge of the word.
Domain: morphology, see Chapter 7

12. ID:
Assign * for each feature that in the output that was changed from the input.
Domain: phonology, see Chapter 8

13. INCL-R (Benz 2017)
Assign * for every exponent intervening between INCL and the right edge of PrWd.
Domain: morphology, see Chapter 6

14. LINEARITY-IO:
Assign a * for each segment A which precedes segment B in the input, iff A and B have correspondents in the output and the correspondent of A follows the correspondent of B in the output.
Domain: phonology, see Chapter 8

15. LINEARITY-IO_{Morph}:
Assign a * for each segment A which precedes segment B in the input, iff A and B belong to the same morphological element, and have correspondents in the output and the correspondent of A follows the correspondent of B in the output.
Domain: phonology, see Chapter 8

16. L ⇐ PERS(ON): (Trommer 2001, 2003, 2008)
Assign a * for each exponent between an exponent of the feature PERSON and the left edge of the word.
Domain: morphology, see Chapter 8

17. L ⇐V   Assign * for each exponent between the base and the left edge of the word.
Domain: morphology, see Chapter 8

18. MAX$_{\text{Arg}}$
Assign * for each feature from the feature set Arg which is not realized on an exponent in the output.
Domain: morphology, see Chapter 8

19. MAX(F)   (Trommer 2008, Müller 2020)
Assign a * for each feature [F] of the input if it is not realized on an exponent in the output.
Domain: morphology, see Chapter 8

20. MAX$_{\text{STRESS}}$ (Benz 2017)
Assign * for a syllable that is stressed in the input but not in the output.
Domain: phonology, see Chapter 6

21. MERGE CONDITION$_{\text{F}}$ (MC$_{\text{F}}$)   (Müller 2020, Gleim et al. 2022)
A structure building feature [•F•] on a stem participates in (and is deleted by) a Merge operation with an inflectional exponent bearing [F].
Domain: morphology, see Chapter 7

22. *M(ULTIPLE) E(XPONENCE)$_{\text{F}}$
Assign * for each feature F which is realised by more than one exponent.
Domain: morphology, see Chapter 8

23. NEARFUT-R   (Benz 2017)
Assign * for every exponent intervening between NEAR.FUT and the right edge of PrWd.
Domain: morphology, see Chapter 6

24. NEG-R   (Benz 2017)
Assign * for every exponent intervening between NEG and the right edge of PrWd.
Domain: morphology, see Chapter 6

25. NONFIN(ALITY)   (Prince & Smolensky 1993, Benz 2017)
Assign * for a stressed syllable that is final in prosodic word.
Domain: phonology, see Chapter 6

26. *[-son,+nas]:
Assign * for each nasal obstruent.
Domain: phonology, see Chapter 8

27. V ⇒ R Assign * for each exponent between the base and the right edge of the word.
    Domain: morphology, see Chapter 8

28. *[-voiced, +nas]:
    Assign * for each voiceless nasal.
    Domain: phonology, see Chapter 8

29. *VV
    Assign a * for each pair of vowels which is not separated by a consonant.
    Domain: phonology, see Chapter 8

30. X-Y: (Ryan 2010: 767)
    Assign a * for each instance of X not immediately followed by Y.
    Domain: morphology, see Chapter 7

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