

Semantic and Phonological Correlates of Affix Order

Project Description

Affix order has been crucial for the development of both, theories of cyclicity (Pesetsky 1979, Kiparsky 1982b), and the extension of optimization to morphology (Donohue 1998, Hyman 2003, Aronoff & Xu 2010; also Grimshaw 2001, Gerlach 2001 on clitics, Trommer 2001b, 2003, 2008 on agreement, and Stiebels 2006 on Mayan agent focus), but raises also substantial problems for both, especially the evidence for flat arbitrary ordering in so-called ‘templatic’ (Simpson & Withgott 1986, Nordlinger 2010, Good 2011) or position class morphology (Stump 1993, Crysmann & Bonami 2016), and the apparent discrepancies between morphological-semantic and phonological affix properties which have led to the demise of classical Lexical Morphology (Fabb 1988, Hay & Plag 2004, Plag & Baayen 2009).

Typologically, the motivation for this project is that research on affix order has left huge empirical gaps. While there are excellent case studies on specific aspects for single languages or language families (e.g. Rice 2000, Hyman 2003, McPherson & Hayes 2016), there have been no systematic typological studies relating basic phonological properties of affixes (such as affix size and the alternations they trigger) with affix order.

On the theoretical side, the shift from Lexical Phonology to Stratal OT has opened up the central theoretical question how to integrate affix ordering into an optimization approach. This challenge is especially pressing in face of a growing body of cases where phonology at least partially determines morpheme linearization (Kim 2010, Jenks & Rose 2015, Benz 2017). The correlation of semantic and phonological properties, which has been a recurrent topic in the literature on English for decades (Kiparsky 1982a, Hay 2000, Marvin 2003, Bermúdez-Otero 2012), has focused on degrees of compositionality/idiomaticity without explicit semantic analyses.

Our expectation is that taking into account phonological *and* semantic correlates of affix order in tandem, not only leads to principled solutions for cases of apparently arbitrary “templatic” affix ordering patterns (Nordlinger 2010), as argued for Washo by Benz (2017), but also allows for diagnosing hierarchical relations between prefixes and suffixes which cannot be done by virtue of their linear position.

In the following, we discuss the major strands of existing research on affix order, and its connections to phonology and semantics:

1 State of the art and preliminary work

State of the art

The Stratal tradition – Affix order predicts phonology and semantics: the most elaborate and influential stratal model linking affix order to phonology and semantics is the theory of Lexical Phonology and Morphology (LPM) developed by Kiparsky (1982a,b), of which crucial aspects have been inherited to Stratal Optimality Theory (Kiparsky 2000, 2015a, Bermúdez-Otero 2013). In LPM, morphology and phonology are organized in a set of strictly ordered strata (or levels) such that a morphological construction formed at stratum S_n by definition undergoes a specific set of phonological alternations associated with S_n . For affixation, this implies the hypothesis in (1):

- (1) **Affix Ordering Hypothesis (AOH):** Affixes exhibiting the phonology of stratum x are concatenated cyclically earlier than affixes concatenated at stratum $x+1$

A well-known minimal pair are the English negation prefixes *un-* and *in-*, where *in-* appears obligatorily inside of *un-* if they cooccur (*un-in-credible* vs. **in-uncredible*). This difference in linearization options also correlates with a contrast in assimilation processes (e.g. *un+logical* → *un-logical*, but *in+logical* → *il-logical*). In LPM both facts follow directly from the assumption that *in-* is obligatorily affixed at a lower (stem) stratum comprising nasal assimilation rules, and *un-* at a later (word level) stratum, which lacks such rules. Since strata in LPM are also assumed to correspond to degrees of lexical storage

for all grammatical aspects (complex words at earlier strata undergo more extensive listing than words formed at later strata), this also carries over to semantics and predicts more semantic idiosyncrasies for *in*-derivatives. The AOH has caused an intense debate (Fabb 1988, Halle & Vergnaud 1987b,a, Plag & Baayen 2009, Bermúdez-Otero 2018) based on two major problems in English word formation:

First, English seems to exhibit ordering paradoxes. Thus, it is often assumed that stem-level affixation triggers obligatory stress shifts whereas word-level affixation does not. In conjunction with (1), this predicts that stress-shifting affixation always happens inside stress-preserving affixation. But while this is true as a tendency, there are several systematic exceptions to this prediction in English (e.g. stress-shifting *-al* affixed outside non-stress-shifting *-ment*, cf. *góvern* → *góvern-ment*, but *góvern-ment* → *govern-mént-al*). *Second*, affix order restrictions seem to be more fine-grained than implied by a simple dichotomy between two strata, thus requiring fine-grained subcategorization restrictions for single affixes, which in turn seem to have the potential to render affix ordering by strata superfluous (Fabb 1988, Halle & Vergnaud 1987a). A variant of this argument is developed by Hay (2000), Hay & Plag (2004), Plag & Baayen (2009), who argue that ordering corresponds to gradient psycholinguistic decomposability of single affixes, again not forming two unitary strata.

On the other hand, Kiparsky (2020) shows that there are serious empirical problems with Fabb’s original argument. He provides evidence that apparent ordering paradoxes simply instantiate variable affix ordering, where the same affix is preferentially attached “high” (at the word level) as *-ment* in *góvern-ment*, but might be attached low (at the stem level), and therefore potentially preceding other stem-level affixes under specific morphological conditions, resulting in forms like *govern-mént-al*. Thus, assuming that morphological stem and word formation is achieved by abstract (phonologically empty) formatives, *-ment* is variably attached before and after the stem-forming formative.

An important empirical shortcoming of the affix ordering debate so far is its almost exclusive focus on English, where affix ordering options are restricted due to a highly impoverished inflectional system and derivational processes typically limited to bases of specific parts of speech. Even for languages that have been argued to obey the Affix Ordering Hypothesis, the empirical evidence used to justify this claim is often highly limited (for example Lesley-Neuman’s 2012 claim for Karimojong is exclusively based on vowel harmony data, and Kim 2003 on Auca only discusses stress data). A major motivation for our project proposal is to fill this empirical gap. Moreover, research in this area has only marginally taken into account semantic factors.

The Morphosyntactic tradition – Semantics and phonology predict affix order: A second major research tradition on affix order (see e.g. Baker 1985, Rice 2000) is driven by the hypothesis in (2):

- (2) **Ultimate External Motivation Hypothesis (UEMH):** Affix order is always motivated by independent extra-morphological factors (semantics, phonology, syntax, or processing).

The classical example for external motivation is found with scope-bearing affixes whose interpretation correlates with their ordering wrt. affixes in its scope, which provides strong evidence that affix order is directly sensitive to semantic properties; thus, cyclic peripherality corresponds directly to scope. This effect is illustrated with data from Yup’ik (Rice 2011) in (3-a,b), and with English examples (Kiparsky 2015b) in (3-c):

- | | | | | | | | |
|-----|----|-------------------|----|-------------------|----|-------------------|-------------------|
| (3) | a. | jug-par-cuar | b. | jug-par-cuar | c. | re-mis-interpret | mis-re-interpret |
| | | person-big-little | | person-little-big | | co-pre-production | pre-co-production |
| | | ‘little giant’ | | ‘big midget’ | | anti-neo-fascism | neo-anti-fascism |

However, semantic motivation may also be identified under fixed affix order in cases where the order of inflectional affixes instantiates a motivated (“iconic”) organization of semantic categories. Thus, Bybee (1985) has undertaken an extensive cross-linguistic study on morpheme ordering. Her approach is meant to account for the observation that derivational affixes strongly tend to appear closer to the stem than inflectional affixes. Bybee argues that these affixes show a higher relevance for the stem because they have a stronger semantic effect, changing, for instance, a stem’s lexical meaning, its Aktionsart or the number of its arguments (diathesis/valence markers). Bybee also tries to explain preferred

morpheme orders within inflectional categories of the verbs (relative distance to verbal stem: aspect < tense < mood) by her notion of relevance. Wunderlich (1993b), interpreting Bybee’s findings more explicitly, formalizes the observed morpheme order tendencies in terms of a hierarchy of functional categories, which mirrors the sequencing of inflectional affixes:

- (4) Hierarchy of functional categories (Wunderlich 1993b:63)
 DIA < ASP < TNS < MOOD < GEN < NUM < PER < CASE

Although categorically excluded by Paster (2005), there are also clear cases where external motivation for affix order seems to be provided by phonological well-formedness conditions. Thus, in Huave, several affixes such as the 1st person subordinate marker *n-/n* may show up as prefixes or suffixes to avoid consonant clusters (cf. the hypothetical forms **n-pajk-a* and **f-i-a-jtj-n*).

- (5) Huave (Kim 2010, 134)
- | | | | | | | | |
|--|----|-----------------|------------------------|--|----|---------------------|----------------------|
| | a. | pajk-a-n | ‘(that) I lie face up’ | | b. | f-i-n-a-jtj | ‘(that) I will give’ |
| | | face.up-v-1.SUB | | | | 1-FUT-1.SUB-TV-give | |

Similarly, Jenks & Rose (2015) show that prefixal vs. suffixal linearization of object markers in Moro depends on optimizing more general constraints on tone melodies (see also Benz 2017, Nawratil 2019 for further cases of phonological optimization of linearization).

While both semantic and phonological factors have been shown to partially correlate with affix order crosslinguistically and in single languages, it is also well-known that these correlations are not universal. Thus, many languages display scopal affixes whose linear ordering and scope do not perfectly match. Following Stiebels (2003), four scenarios for variable affix orders can be distinguished: transparent orders, restricted orders (although theoretically possible, the language only allows one of the two scopal interpretations), and two forms of opaque orders: one, in which a fixed order exhibits the scopal as well as the counter-scopal interpretation (= opaque₁), and one in which a fixed order only exhibits the counter-scopal interpretation (=opaque₂), all of which are empirically attested.

	Form	V-A-B	V-B-A
transparent			
	Scope	B(A(V))	A(B(V))
restricted		V-A-B	*V-B-A
		B(A(V))	*A(B(V))
opaque ₁		V-A-B	*V-B-A
		/ \ B(A(V)) A(B(V))	
opaque ₂		V-A-B	*V-B-A
		A(B(V))	*B(A(V))

Table 1: Morpheme orders in multiscope contexts (Stiebels 2003)

Proponents of bigram (Ryan 2010) and template models (Crysmann & Bonami 2016) have taken opaque ordering restrictions as crucial evidence against the synchronic relevance of semantic factors for affix order, and more generally against extra-morphological motivation. However, there are two types of typological evidence that opacity does not disprove the significance of semantic scope for affix order: (1) the typological distribution of opacity correlates with the specific semantics of the involved heads and (2) there is no polar-scope pattern, where the form V-A-B would correspond to the counter-scopal interpretation A(B(V)), and V-B-A to the counter-scopal interpretation B(A(V)). As shown by Hyman (2003), the latter fact follows straightforwardly if scope is not an inviolable principle, but a violable constraint in an optimality-theoretic grammar. More generally, under an optimization perspective the viability of the UEMH does not depend on the full generality of any specific type of motivation, but on identifying a set of general phonological, semantic, and combinatorial factors, whose different rank-

ings account for the actually observed ordering possibilities, a challenge the proposed project directly addresses by an integrated investigation of phonological and semantic factors.

Syntax vs. lexicon – The Mirror Principle debate: in a highly influential paper, Baker (1985) argues that the typical correspondence between semantics and affix order is just an epiphenomenon of the more general principle: that morphology “mirrors” syntax, i.e., in terms of our project that external semantic motivation is mediated by syntax:

- (6) **Mirror Principle** (Baker 1985, 375): morphological derivations must directly reflect syntactic derivations (and vice versa).

The most persuasive prima-facie evidence for this claim comes from valency-changing affixes on verbs whose ordering not only correlates with the interpretation of the verb, but also with phrasal syntax. Thus, in the following examples from Chichewa, the addition of the applicative affix *-ir* triggers the promotion of the oblique goal (‘leader’) to object position and ensuing passivization (with the suffix *-idw*) turns the goal argument into a subject (evidenced by its preverbal position and subject agreement).

- (7) Chichewa (Alsina 1999:9)
- | | | | | | |
|----|---|----------------------------|------------|------|---------------|
| a. | Ána | a-na-túmíz-a | zipátso | kwá | rítsogolēri. |
| | children.NCL2 | 2NCL-PST-send-FV | fruit.NCL8 | to | leader.NCL1 |
| | ‘the children sent fruit to the leader’ | | | | |
| b. | Mítsogolēri | a-na-túmíz-ir-idw-á | zipátso. | (ndí | ána). |
| | leader.NCL1 | NCL1-PST-send-APPL-PASS-FV | fruitNCL8 | by | children.NCL2 |
| | ‘the leader was sent fruit (by the children)’ | | | | |

Baker and much following work takes data such as (7) and the (presupposed) exceptionless universal validity of the Mirror Principle as conclusive evidence against lexicalist approaches, where morphology is restricted to the lexicon, and for a syntactocentric theory where word-level morphology and phrasal syntax are computed by the very same generative module. However, Baker’s arguments are far from conclusive. As shown by Alsina (1999) and Stiebels (2003), the correspondences between morphology and syntax in valency-changing morphology can be also derived in a lexicalist architecture if cyclic affixation is assumed to exert compositional changes on the relevant bases. Moreover, valency-changing morphology too often exhibits opacity of the type discussed above (Hyman 2003, Ryan 2010) leading to imperfect morphology/syntax “mirroring”. Thus, while we are subscribing to a lexicalist perspective here, we think that the more pressing question is to determine if (and how) the more general assumption underlying the Mirror Principle – External Motivation – can be maintained. In turn, the empirical correlations between affix order, semantics, and phonology we plan to investigate are also of immediate relevance to syntax-based approaches (as pursued in Syn[↔]Mor) and their extensions to morphophonological processes (Marantz 2001, 2007, Marvin 2003).

The search for formal unification: besides a focus on the substance of possible affix ordering patterns crosslinguistically (e.g., the claim that aspect suffixes precede tense suffixes, not vice versa), an important second research question has been the formal nature of the rules or constraints which govern it. Thus, a major motivation behind approaches locating the derivation of affix order in syntax (enshrined by Baker’s Mirror Principle, see above) seems to be to capture ordering restrictions in a unitary way (e.g. by relating it to asymmetric c-command as in Julien 2007). This seems to be impossible in a purely semantic account, given the semantically heterogeneous character of affixes (Rice 2000, Crysmann & Bonami 2016). Thus, while semantic scope accounts for specific affix ordering patterns, not all affixes have scopal properties in a technical semantic sense. However, under the optimality-theoretic cross-modular perspective adopted here, there is no a priori reason to presuppose that all constraints governing affix order are formally of the same type. In fact, we would rather expect that constraints reflecting semantic factors are of a distinct type than phonological wellformedness constraints. Empirical evidence for this position is provided by Trommer (2003), who shows that basic categories of verb inflection are governed by formally different types of constraints: tense and aspect by scope

criteria, (split) agreement by edge alignment, and the interaction of tense and agreement by bigram-like constraints.

Extragrammatical factors: another important recent approach to affix order connects ordering directly to the psycholinguistic decomposability of stored lexical items, corresponding to relative frequencies of basic and derived forms, semantic transparency, and phonotactic reflexes of affix boundaries (see Hay 2000, Plag & Baayen 2009, and Manova 2015, Talamo 2015 for critical discussion). This approach seems also to be at least partially compatible with the stratal architecture assumed here. Thus, Bermúdez-Otero (2012) argues that the external motivation for the difference between the stem level and the word level in Stratal OT is two different types of psycholinguistic storage, and that stratum-internal cyclicity at the stem level is subject to principled relative-frequency effects. Since our research will be based in large part on lesser documented languages lacking large corpora, we will not be able to address the frequency correlates of affix order, but will investigate the two other correlates of ordering in accounts based on decomposability and semantic and phonotactic transparency.

It has also been pointed out that some semantically aberrant affix orders have arisen by independent processes of grammaticalization (see, for instance, Mithun 2011, Denk 2019 on Athabascan). Whereas we won't directly address the historical evolution of affixes in this project, the phonology of affix order provides a natural link to diachronic processes. Thus, Mithun (2011) shows that affix order in Athabascan is closely reflected by the prosodic shape of affixes, one of the phonological factors we hypothesize to play a role in the synchronic explanation of semantically unexpected orderings (see section 2.3.3). A second component of our theoretical approach where synchrony is linked to diachrony (and semantic factors are potentially thwarted, see section 2.3.4) is the phonological stratification of affixes, which arguably reflects pathways of grammaticalization (see Bermúdez-Otero 2019 on Portuguese clitics).

Central open questions:

- **Phonological correlates:** Hardly any typological work so far has systematically addressed possible phonological correlates of affix order such as prosodic integration and the tendency of affix size to correspond to closeness to stems hypothesized by Rice (2011). Whereas recent reports have documented more and more data where phonological well-formedness seems to drive ordering (Kim 2010, Gowda 2014, Jenks & Rose 2015, Benz 2017, Newell et al. 2018), the evidence is still far from conclusive.
- **Semantic granularity:** Apart from the seminal work by Rice (2000), the classification of semantic correlates to affix order in the literature has been rather coarse, but as shown by recent research, even similar types of scope-taking affixes such as valency-changing affixes behave markedly differently in the semantic transparency they exhibit (Stiebels 2003, McPherson & Paster 2009).
- **The density of cycles:** In the version of Stratal OT by Bermúdez-Otero (2013), true cyclicity coincides with the strata. Under the AOH, stratal models predict only the order between affixes of different strata, but not between affixes on the same stratum. Thus, the implications for semantics and phonology depend on the number of assumed strata. Given the trend to limit the number of word-level strata to two, this potentially leads to an explanatory gap for languages with a rich gradient differentiation between affixes in different positions, as argued by McPherson & Hayes (2016) for Tommo-So (see also Hay & Plag 2004 for gradience correlating with English affix order though not strictly for semantic interpretation and phonological alternations).
- **Prosodic subcategorization:** Whereas prosodic subcategorization has been argued to account for many aspects of morphophonology (e.g., suppletive allomorphy and cooccurrence restrictions as for English comparative *-er* which only attaches to “short bases”), the potential consequences of this mechanism for affix order have hardly been addressed at all.
- **Ordering of semantically overlapping affixes:** There are proposals in the literature (Wunderlich & Fabri 1995, Müller 2020) that in extended exponence, less specific affixes tend to appear closer to the stem than more specific affixes. However, this observation again seems to be subject to fine-grained semantic differentiation. Thus, Trommer (2001a) shows that (more specific) pronominal portmanteaux affixes typically precede (less specific) *simple* pronominal affixes.
- **Phonological opacity in affix order.** In a number of well-documented cases, affixes seem

to have phonological effects in a position which is not their surface position (Hyman 1994, 2002, 2003, Rolle 2018, Kushnir 2018). Should this be captured by interfixation (Kiparsky 2011, Kushnir 2018), morphological movement operations (Müller 2020)/Mor[↔]Mor or other means?

Our own previous research

Stiebels & Wunderlich (1994) is one of the first – still pre-OT – suggestions to apply a cyclic optimization approach to morphophonology; it also provides basic background for the study of affix order in preverb-verb complexes. Downing & Stiebels (2012) demonstrate that the affix order of morphologically complex nouns in Kham does not require an arbitrary template (as postulated by Watters 2002), but follows directly from the compositional semantic analysis of the affixes involved (see the incremental derivation of the form (8-a) in (8-b)).

- (8) Kham (Watters 2002, 70)
- a. u-zihm-ni-ka-o-ra-sə
3SG-house-ABL-LOC-NOML-PL-COM
'with those from his house'
- b. /zihm/; λu HOUSE(u)
→ /zihm/; $\lambda v \lambda u$ [HOUSE(u) & POSS(v,u)]
→ /u-zihm/; $\lambda u \exists v^{<-1,-2,-pl>} [HOUSE(u) \& POSS(v,u)]$
→ /u-zihm-ni/; $\lambda u \exists v^{<-1,-2,-pl>} \sim PROX[HOUSE(u) \& POSS(v,u)]$
→ /u-zihm-ni-ka/; $\lambda x \exists u \exists v^{<-1,-2,-pl>} LOC(x, \sim PROX[HOUSE(u) \& POSS(v,u)])$
→ /u-zihm-ni-ka-o/; $\lambda x \exists u \exists v^{<-1,-2,-pl>} [PERSON(x) \& LOC(x, \sim PROX[HOUSE(u) \& POSS(v,u)])]$
→ /u-zihm-ni-ka-o-ra/; $\lambda x^{<+pl>} \exists u \exists v^{<-1,-2,-pl>} [PERSON(y) \& LOC(x, \sim PROX[HOUSE(u) \& POSS(v,u)])]$
→ /u-zihm-ni-ka-o-ra-sə/; $\lambda y \exists x^{<+pl>} \exists u \exists v^{<-1,-2,-pl>} BE_ACCOMPANIED(y, [PERSON(x) \& LOC(x, \sim PROX[HOUSE(u) \& POSS(v,u)])])$

Stiebels (2003) provides a foundational reference point on semantic correlates of affix order and their typology. A general framework for affix order in OT, especially for heterogeneous constraints of different formal types is developed in Trommer (2001b, 2003, 2001a, 2008). Trommer (2011) contains a formalization of Stratal Optimality Theory, which will be the starting point for our modeling of lexical strata. Trommer (2015a,b) develops a concatenative approach to prosodic templates, which will be integrated into the modeling of phonologically triggered semantics-ordering mismatches in the project.

The project also builds on the results of earlier projects, especially the DFG Project TR 521/3-1 ("Micro- and Macrovariation: Hierarchy Effects in Kiranti and Broader Algic"), which has established essential correlations between affix order and hierarchy effects (Henze & Zimmermann 2010), but also potential problems for external motivation of affix order (Zimmermann 2015). In a second DFG project (TR 521/6-1 "Featural Affixes: The Morphology of Phonological Features"), we have identified important links between affix order and the morphophonological behavior of competing featural affixes, lending additional support to a parallel optimizing over a derivational approach (Trommer 2020).

1.1 Project-related publications

1.1.1 Articles published by outlets with scientific quality assurance, book publications, and works accepted for publication but not yet published

1. Stiebels, B. & D. Wunderlich (1994) Morphology Feeds Syntax: The Case of Particle Verbs. *Linguistics* 32:913–968.
2. Stiebels, B. (1996) *Lexikalische Argumente und Adjunkte: Zum semantischen Beitrag von verbalen Präfixen und Partikeln* (Studia Grammatica 39). Akademie Verlag, Berlin.
3. Stiebels, B. (1998) Complex denominal verbs in German and the morphology-semantics interface. *Yearbook of Morphology* 1997:265–302.

4. Stiebels, B. (2003) Transparent, restricted and opaque affix orders. In: U. Junghanns & L. Szucsich (eds.) *Syntactic structures and morphological information*. Berlin, Mouton de Gruyter, 283–315.
5. Trommer, J. (2003) The Interaction of Morphology and Syntax in Affix Order. *Yearbook of Morphology 2002*. Kluwer, Dordrecht, 283–324.
6. Trommer, J. (2008) Coherence in Affix Order. *Zeitschrift für Sprachwissenschaft* 27:99–140.
7. Trommer, J. (2015) Syllable-counting Allomorphy by Prosodic Templates. In: Bonet, E. & Lloret, M. & Mascaró Altimiras, J. (eds.) *Understanding Allomorphy: Perspectives from Optimality Theory*. Equinox.
8. Trommer, J. (2015) Moraic Affixes and Morphological Colors in Dinka. *Linguistic Inquiry* 46(1):177–112.

1.1.2 Other publications, both peer-reviewed and non-peer-reviewed

9. Trommer, J. (2001) A Hybrid Account of Affix Order. In: Mary Andronis and Christopher Ball and Heidi Elston and Sylvain Neuvel (ed.) *CLS 37: The Panels. Papers from the 37th Meeting of the Chicago Linguistic Society*. Chicago: Chicago Linguistic Society, 469-480.
10. Downing, L. & B. Stiebels (2012) Iconicity. In Jochen Trommer (ed.), *The morphology and phonology of exponence*, 379-426. Oxford: Oxford University Press.

2 Objectives and work programme

2.1 Anticipated total duration of the project

48 months

2.2 Objectives

Affix order has been studied in two quite distinct research traditions, one based on semantic scope or syntactic properties (Greenberg 1963, Baker 1985, 1988, Rice 2000, 2011), with a broader typological streak, and one based on the model of Lexical Phonology and Morphology correlating affix order with differential behavior in phonological alternations and with a bias on in-depth studies on single languages (Kiparsky 1982b, Mohanan 1986). The empirical goal of this project is a broad typological study of affix order which integrates both perspectives, morphophonology, and lexical semantics, and substantially extends the level of grammatical granularity in cross-linguistic comparison beyond the standard of existing studies. Our expectation is that the integrated evaluation of typological evidence from phonology and semantics contributes to a better empirical basis for cyclic optimization effects in phonology, morphology and semantics, as a basis for the other RU-projects in these areas (Mor^{Phon}Mor, Mor^{Mor}Phon, Syn^{Mor}Mor, Syn^{Phon}Mor). Theoretically, we aim at the first systematic study of affix ordering in a lexical Stratal OT-account focusing on cases of variable morpheme order corresponding to both phonological and semantic factors for which there have been uncovered recently a rich array of additional cases (Kim 2010, Gowda 2014, Jenks & Rose 2015, Benz 2017, Newell et al. 2018).

2.3 Work program incl. proposed research methods

The project has three major components: **A.** a broad-scale theory-neutral typological study of affix order and its phonological and semantic correlates, which lays the empirical basis for the two other parts of the project, but also extends the range of data for the more theoretically oriented projects in the RU with a focus on affixational morphology (Mor^{Phon}Mor, Mor^{Mor}Phon, Syn^{Mor}Mor). **B.** a theoretically oriented evaluation of the retrieved data based partially on semi-automated heuristic algorithms for larger samples and in-depth manual examination of more narrow samples. **C.** the formal modeling of broadly non-cyclic or non-optimizing patterns in our data in a restrictive lexical approach that combines

concepts from Stratal OT for the phonological side (Kiparsky 2000, Bermúdez-Otero 2018, Trommer 2011) and Lexical Decomposition Grammar (Joppen & Wunderlich 1995, Stiebels 2002) for incremental semantic interpretation.

2.3.1 Timeline and Division of Labor

The data collection for the broad sample (A1.) and the narrow samples (A2.) will be evenly distributed over the first two years of the project. The initial phases of the corresponding typological evaluation (B1. and B2.) will consequently be time-shifted to the second and third year, concluded by a synoptic overall typological evaluation (B3.) which will crucially feed the doctoral thesis by the PhD student. Formal analysis will proceed in an initial 18-month phase focusing on representative examples from the existing literature (C1.), followed by a second phase which integrates the data from the empirical part of the project (and from other sub-projects in the RU).

	Year 1	Year 2	Year 3	Year 4
A. Data Collection	A1. Compilation of Broad Language Sample	A2. Compilation of Narrow Samples		
B. Typological Evaluation		B1. Evaluation of Broad Language Sample	B2. Evaluation of Narrow Samples	B3. Overall Evaluation
C. Formal Analysis		C1. Analysis of Prototypical Cases	C2. Analysis of Additional Data	

Since the project aims at integrating phonology and semantics, both project employees will be equally working on both aspects under the supervision by Barbara Stiebels for semantic and by Jochen Trommer for phonological aspects. The initial empirical phase of the project (A.) will be distributed by geographical macro-areas for the broad language sample (A1. Barbara Stiebels: America; Jochen Trommer: Africa; PhD student: Eurasia; postdoc: Papua & Australia) and for the 5 domain-specific samples specified below in A2. (Barbara Stiebels: category-preserving derivational affixes; Jochen Trommer: pronominal affixes; doctoral student: complex root+preverb bases; postdoc: adverbial markers and valency-changing affixes). For the two other project components, the doctoral student will focus on the typological evaluation of phonology-semantics correlations (B.), which is also an ideal well-circumscribed topic for a PhD-thesis. The postdoc position will be crucially responsible for the C. part (theoretical modeling), which is more demanding since it requires expertise in both semantics and theoretical phonology. We plan to fill the latter position with Marie-Luise Popp, who is currently finishing her doctoral thesis on non-transitive relations in affix ordering at Leipzig University (projected defense date: March 2021), and has not only a strong background on the typology of affix order, but also the rare combination of research records in both the syntax-semantics interface and phonological theory.

2.3.2 Typological data collection

Our sampling strategy is a response to the challenge of three competing and partially conflicting goals (i) broad typological coverage (ii) fine-grained phonological and semantic analysis, and (iii) comparability of data from different languages (and language families). Especially for the formulation of specific semantic regularities and their connection to phonology, it seems to be crucial to base our generalizations on a typologically balanced data set from affixes of the same semantic type, which is potentially in conflict with (i) since languages encode quite distinct semantic categories by affixation. (ii) also potentially conflicts with (i) since a detailed analysis of every language is unrealistic for a larger sample.

To balance these goals in a manageable amount of time, we will work with three types of differently sized and *overlapping* samples: (i) we will compile a sample of 50 languages for a broad typological survey. Second, (ii) we will focus on a subset of this sample of 10 languages more deeply, for which

we will evaluate more material (including corpora and work with language experts or native speakers). (iii) In parallel to the sampling of these general samples covering all types of affixes, we will assemble partial thematically defined samples, for which we only consider affixes of a specific semantic type in approximately 20 languages in the languages of our broad typological sample, but adding data from other languages, where necessary to achieve the projected sample size. Overall we estimate that our samples will include roughly 75 languages (NB: the numbers don't strictly add up due to overlapping samples):

		Size
Broad typological sample	≈	50 languages
Narrow typological sample	≈	10 languages
5 domain-specific samples	≈	5 × 20 languages
Overall:	≈	75 languages

For the 5 domain-specific samples, we will compile sub-samples of languages that exhibit an extended affix inventory for the following categories:

- **Valency-changing affixes:** we focus especially on those that enrich the meaning of the underlying verb (e.g., applicatives, causatives etc.). Departing from the extensive typological work on this class of affixes in general, we want to extend the granularity of their analysis by focussing on their interaction with semantically richer affixes (e.g., adverbial affixes, repetitive markers etc.).
- **Pronominal affixes:** (≈ agreement affixes). The specific positions of pronominal affixes usually do not yield truth-conditional effects in interpretation. However, pronominal affixes are interesting for the following reasons: (i) in some languages pronominal affixes may display a dual function as subject and object markers, depending on their position in the verb (e.g., in Arabic: leftwards *-na* = 1PL subject, rightwards *-na* = 1PL object). (ii) Pronominal affixes are expected to be peripheral to diathesis markers that license them (e.g., applied object by applicative marker). One can find confirming evidence (e.g., Adyghe: pronominal affix < licensing applicative < ... verbal root; Lander 2010) as well as counter-evidence (e.g., Mandan: applicative preverb < pronominal affix < ... verbal root; Kasak 2019); the latter may call for a phonological explanation. (iii) Pronominal affixes are subject to specific linearization constraints in terms of thematic role, salience etc. (e.g., role of person in Yimas; Wunderlich 2001; role of thematic role in Kinyarwanda).
- **Adverbial markers** (corresponding to low and high adverbs in syntax): these are affixes that correspond to free adverbs, which are often characterized as high or low adverbs depending on their preferred locus of adjunction (see Cinque's 1999 extensive hierarchy of adverbs and the motivation for ordering in Ernst 2001). We will compare the ordering of adverb-like affixes and similar functional morphemes (e.g., evidential or epistemic markers). Do these elements occur in similar positions?
- **Category-preserving derivational affixes:** since category-shifting derivational morphemes often exhibit a clear feeding and bleeding relation and are restricted in occurrence due to the categorial shift, we will focus on category-preserving derivational morphemes because the latter could occur in variable orders (e.g., combinations of diminutives and augmentatives, see example (3); cases such as Dyirbal *yibi-jarran-gabun* woman-two-another 'another two women' vs. *yibi-babun-jarran* 'two other women'). Do we find the expected variability and correlation with interpretation?
- **Complex root+verb bases:** particularly interesting from a cyclic perspective are cases of complex verbs: often, a verbal root/stem is combined with a preverb (e.g., verbal particles in Germanic languages, preverbs in Hungarian and in many native North-American languages, coverbs in Australian languages etc.). The preverb/coverb may fulfill multiple functions; it often shifts the aktionsart of the underlying verb and may thus influence the compatibility of TMA markers. These preverbs often stay in a word-peripheral position, which suggests a potential look-ahead problem for some of the affixes interleaved between the stem and the preverb. Do we find unexpected orders in these cases? More generally: if we look at discontinuous morphemes, do we find vio-

lations such that the conflicting morpheme is ordered correctly with one part of the discontinuous morpheme, but ordered incorrectly with the second part of the discontinuous morpheme?

The big majority of our data for all samples will be from published sources, but we will also cooperate with language experts on the semantics of under-documented languages since our approach requires an exhaustive documentation of morphologically relevant phonological and semantic information; this kind of information is often not provided by descriptive sources, which illustrate the respective phenomena often only partially; within the RU, we will also cooperate with Maria Kouneli (on Nilotic) and Philipp Weisser (on Uralic).

We will extract data from descriptive grammars, text collections, and corpora automatically (by computer algorithms), based on pilot studies by Marie-Luise Popp as part of her PhD thesis. Apart from categorically verifying the explicit claims in grammars, an additional benefit of this method is that we also obtain a gradient assessment of their empirical reliability (where a generalization is more reliable if it is based on more distinct data points). Automatic extraction and evaluation of affix ordering data also addresses a further methodological problem in morphological typology, which is often overlooked: descriptive generalizations in documentary work match the data in the same sources only imperfectly. A careful look into grammar sometimes reveals that exceptions to the templates/generalizations proposed in the grammar can already be found in the examples (e.g., the proclaimed and the actual behavior of the habitual suffix in Koasati, see Kimball 1991); fieldwork on the language may reveal further exceptions (Marquardt 2014 on affix orders in Mapudungun, which were overlooked by Smeets 2008). Descriptivists – as all linguists – look for generalizations and data often do not perfectly obey. For unclear cases, we will evaluate related languages for corresponding morphemes.

2.3.3 Theoretically oriented evaluation

Based on the database, our evaluation proceeds in three stages: ① we will check heuristically for possible correlations between the main parameters of affix order and potential phonological/semantic correlates; ② we will evaluate more systematically hypotheses which have been prominent in the literature on affix order; ③ we will evaluate the working hypotheses of the project in detail, relating affix order with phonology and semantics under a lexicalist stratal optimization approach.

① Affix ordering parameters and possible semantic and phonological correlates:

Affix order is typically conceived as different orthogonal parameters. Only relatively few approaches consider the absolute relative order of affixes (in the following simply: “Linearity”) linguistically significant (see Julien 2007, Trommer 2001b, 2003, 2008, Cysmann & Bonami 2016 for notable exceptions). The bulk of the research literature addresses the relative order of affixes and roots or bases separately, i.e., whether a given affix is a prefix or a suffix (in the following: “Directionality”, Cutler et al. 1985, Hawkins & Gilligan 1988) or – abstracting away from Directionality – the ordering of an affix with respect to other affixes on the same side of the root morpheme (in the following: “Distance”).

Linearity	≈ The absolute linear position of <i>A</i> in a string of morphs (including roots)
Directionality	≈ + if <i>A</i> precedes the base root/- if <i>A</i> does not precede the base root
Distance	≈ The number of affixes which (potentially) intervene between <i>A</i> and its base root

Table 2: Linearization parameters

In this first, explorative part of the project, we check systematically how these ordering parameters are correlated with basic inherent and contextual properties of affixes listed in tables 3 and 4:

(i)	Affix size	≈ number of segments (or: tones, moras, etc.) and prosodic complexity (foot, syllable etc.) of <i>A</i> in surface and underlying representations
(ii)	Prosodic integration	≈ integration of <i>A</i> into prosodic structure (feet, prosodic word, etc.) as indicated e.g. by cumulative stress
(iii)	Alternation predictability	≈ the ratio of word form types where <i>P</i> applies to the types where it is predicted to apply
(iv)	Alternation density	≈ the number of alternations applying in domains including <i>A</i> ; alternatively: processes triggered by <i>A</i> or on <i>A</i> (maybe also: number of surface allomorphs instantiating <i>A</i>)
(v)	Alternation intensity	≈ the number of phonological features changed by processes involving <i>A</i>

Table 3: Phonological correlates of affix order for affix *A*

(i)	Specificity	≈ the cardinality of semantic primitives \in Semantic Form (<i>A</i>)
(ii)	Semantic integration	≈ the composition of the Semantic Form of <i>A</i> with the Semantic Form of the base
(iii)	Semantic predictability	≈ the ratio of word form types where <i>A</i> applies to the types where it is predicted to apply
(iv)	Mono-/polysemy	≈ the number of distinct semantic representations of <i>A</i>
(v)	Scope	≈ Semantic scope of $x \in$ Semantic Form (<i>A</i>) over ≈ $x' \in$ Semantic Form (<i>A'</i>)

Table 4: Semantic correlates of affix order for affix *A*

② **Evaluating existing hypotheses (from the literature):** whereas the first empirical project part (①) involves a general heuristic search for all possible correlations between different phono-semantic and linearization parameters, in this part of the project, we evaluate in more detail prominent hypotheses that have actually been proposed in the literature. Most of these claims may be understood as slightly more specific versions of the correlations relevant for part ①:

Phonological correlates of affix order:

- **Hypothesis P1 – Distance ~ affix size:** inner affixes are phonologically smaller than outer affixes (Rice 2011).
- **Hypothesis P2 – Distance ~ alternation density:** outer affixes undergo less phonological modifications than inner affixes (“Strong Domain Hypothesis”, Kiparsky 1985, Myers 1991, Borowsky 1986).
- **Hypothesis P3 – Distance ~ alternation intensity:** outer affixes undergo less *invasive* phonological modifications than inner affixes (Newell 2018) (e.g., rather featural change than deletion) or are less frequently modified by the same process (McPherson & Hayes 2016).
- **Hypothesis P4 – Distance ~ alternation predictability:** processes connected to outer affixes are more predictable than those connected to inner affixes (Bermúdez-Otero 2013).
- **Hypothesis P5 – Directionality ~ alternation intensity:** prefixes trigger less and less invasive phonological modifications than suffixes (Moskal 2015); this relates to the claim that prefixes (as well as outer affixes in general) should be less integrated prosodically than inner affixes (van Oostendorp 2004) (e.g. more likely to form independent syllables, feet, and prosodic words).

Semantic correlates of affix order:

While phonological parameters generally apply across the board, semantic parameters are often only

relevant for specific classes of affixes (not all affixes have scopal properties). Therefore, we focus here mainly on specific affix classes specified in section 2.3.2 above.

The following hypotheses relate to scope-sensitive affixes with fixed or variable scope (S1) or affixes that are associated with certain domains of interpretation, especially adverbial markers (S2). Hypothesis S3 is a consequence of S1 and S2.

- **Hypothesis S1 – Scope ~ Distance:** outer affixes scope over inner affixes (Muysken 1986, Rice 2000, Stiebels 2003).
- **Hypothesis S2:** speech-act-related affixes occur outside of proposition-related affixes, which occur outside of affixes operating on stem meanings (Cinque 1999).
- **Hypothesis S3 – Polysemy ~ Linearity:** Polysemous/vague affixes whose readings differ in their scopal properties or in their domain of interpretation should exhibit reading-dependent variable positions.

Note that the notion of scope presented here involves scope proper (with scope-taking operator affixes) and truth-conditional effects related to the order of composition of affixes (e.g., with valency-changing morphology). One important goal is to identify restricted and opaque_{1,2} orders in our data and look for explanations for these morphotactic restrictions, which, as we hypothesize, may be phonological/prosodic in nature. Based on the observation (Stiebels 2003) that some affix combinations are more likely to yield opaque orders (e.g., combinations of causative and applicative), we will evaluate the attested opaque orders in terms of frequently and less frequently involved categories. We will take attested cases of variable affix orders of scopal affixes as evidence that languages with equivalent categories should behave accordingly and systematically look for the patterning of the respective affixes in our sample.

We will also look at affixes for which strong cross-linguistic ordering tendencies have been observed (pronominal affixes; TMA markers: Bybee 1985, Wunderlich 1993, Cinque 2014). However, a full account of the semantics of the TMA markers is beyond the scope of our project. Hypothesis S4 relates to Bybee's relevance hypothesis. For affixes that target the same category, hypothesis S5 will be relevant.

- **Hypothesis S4:** inner affixes interact more strongly with the meaning of the stem (Bybee 1985)
- **Hypothesis S5 – Specificity ~ Distance:** less specific affixes are inside of more specific affixes (Müller 2020)
- **Hypothesis S6 – Semantic predictability ~ Distance:** outer affixes are more predictable than inner affixes (Hay & Plag 2004)

Hypothesis S6 reflects the fact that inner affixes tend to show more idiosyncracies (and more instances of lexicalization).

Affixes that also determine the syntactic projection potential of complex morphological forms (e.g., in affecting argument structure or the position of syntactic merger due to its categorial specification) may be subject to semantic constraints as well as some kind of syntactic mirror constraints.

- **Hypothesis S7:** an affix that determines the lexical category of the word form is more peripheral than affixes that would overwrite this category.
- **Hypothesis S8:** an affix that determines the realization of certain arguments in a given morphological form is more peripheral than affixes that would block/change the affixal effect on argument realization.

③ Evaluating project-specific hypotheses

The central theoretical point of departure for the project is the adoption of the Ultimate External Motivation Hypothesis in (2) in the more specific form in (9):

- (9) **Ultimate External Motivation Hypothesis (UEMH):** semantic intransparency in affix ordering is always motivated by constraints on phonological or stratal structure.

This interpretation of the UEMH logically implies that the Affix Ordering Hypothesis (1) is an active (though not necessarily inviolable) constraint on affix linearization. Moreover, in conjunction with a further tenet of stratal phonology – that Bracket Erasure takes place after every stratum – (9) further implies that semantic intransparency may not apply across strata but only *inside* a given stratum since reordering of affixes can only take place when morpheme structure (“brackets”) is still accessible:

- (10) **No reordering across strata:** intransparency in the semantic interaction of affixes A_1 and A_2 is only possible if A_1 and A_2 are affixed at the same stratum.

Kiparsky (2015b) provides evidence for this hypothesis from a number of Uralic languages. Thus, in Nenets possessive suffixes appear outside of case suffixes (*ngəno-xəq-na-ta* ‘boat-PL-LOC-3SG.P’), although the semantic transparent order would locate case outside of possession. Crucially, there is also evidence from epenthesis data that both types of affixes are attached in the same stratum.

A further implication of our theoretical assumptions is that morphophonological opacity (alternations motivated opaquely by embedded morphological domains) is induced by forms on an earlier stratum. Similarly, phonologically induced overwriting of semantically motivated ordering (= morphosemantic opacity) should apply strictly in stratal domains:

- (11) **Opacity theorem:** morphologically induced phonological and semantic opacity reflects stratal structure.

With Bermúdez-Otero (2012) and pace Trommer (2011) and Rubach (2011), we assume that stratal structure is minimal (12), and that Stem Level interpretation is substantially qualitatively different from the one at the Word Level (13) (since the Stem Level by assumption is subject to non-analytic listing):

- (12) **Minimal stratification:** stratal organization is universally restricted to stem level, word level, and phrase level.
- (13) **Semantics-phonology correlation:** stem level morphophonology is more likely to correlate with non-compositional semantics

The non-analytic listing assumption for the stem level also confers that “cyclic” effects at the stem level are actually “fake cyclicity” due to lexical race effects:

- (14) **The stem level syndrome** (Bermúdez-Otero 2013): cyclic effects at the stem level should be more prone to exceptions (and sensitive to relative frequency).

A final prediction of our assumptions on the phonological side is that

- (15) **Alternation cluster hypothesis:** affixes on the same stratum should cluster for heterogeneous phonological processes.

Note that (15) does *not* imply that affixes of a given stratum should be completely homogeneous under alternations (just as stress-shifting behavior of stem level affixes is not). However, it requires that same-level affixes share a substantial number of alternation types, not exhibited by affixes from different levels.

2.3.4 Formal Modeling

In the context of the RU, the strategic goal of the project is to act as a counterpart to the theoretically more innovative projects (especially Mor_{Phon} and Mor_{Mor}). Our working hypothesis is that affix order and its phonological effects can be captured in a theoretically conservative and minimalist way by pursuing minimal extensions to a classical lexicalist architecture of grammar by adopting the version

of Stratal OT proposed in Bermúdez-Otero (2018) and Lexical Decomposition Grammar for the incremental structure building of semantic representations. This claim requires to actually provide detailed formal analyses of phenomena that are potentially problematic for our minimalist approach in order to evaluate its merits in comparison to alternative accounts of affix order in the RU: Harmonic Serialism (Mor^h⊗Mor), syntax-driven spellout (Syn^h⊗Mor), and non-stratal layering (Mor^h⊗Phon).

2.3.4.1 Semantically arbitrary affix orders: Cases of semantically arbitrary affix linearization have been the major objection against the UEMH, but in the stratal optimization approach of this project, we rather expect them to instantiate evidence for ordering due to strata or higher-ranked phonological constraints. Our empirical focus here will be on context-dependent variable orders of single affixes, and different orders of allomorphs or of affixes of the same class (e.g. agreement affixes for the same syntactic argument, as in (16)).

Thus, we suspect that the apparent violations of the Person-Number generalization (person affixes precede number affixes, Trommer 2003) in complex Khiranti pronominal suffixation systems (Zimmermann 2015) is due to the fact that the relevant affixes instantiate two different lexical strata, and optimization for affix linearization happens cyclically for each stratum.

Semantically arbitrary (and variable) affix order may also be due directly to phonological optimization at the same stratum. As already mentioned in section 1, there are well-documented cases in Huave and Moro where prosodic constraints determine whether a given affix is linearized as a suffix or a prefix under cyclic organization.

A third potential morphophonological source for semantically arbitrary ordering are the effects of morphologically imposed prosodic templates. A possible case in point is Nepali, which for most affix combinations exhibits the crosslinguistically unmarked order of tense preceding subject agreement suffixes (Bybee 1985, Trommer 2003, 2008). However, this order is exceptionally reversed for the future suffix *-lā* and the 1SG/3LOW suffix *-aũ*.

(16) Nepali ‘forget’ (Crysmann & Bonami 2016, Boyé 1999)

	Present	Future
1	birsã-tʃ ^h a-aũ	birse-aũ-lā
2LOW	birsã-tʃ ^h a-s	birse-lā-s
2MID	birsã-tʃ ^h a	birse-lā
3LOW	birsã-tʃ ^h a-aũ	birse-aũ-lā
3MID	birsã-tʃ ^h a-n	birse-lā-n

If *-lā* is restricted by prosodic subcategorization to coincide with the last syllable of the Prosodic Word, phonological optimization motivates retraction of *-aũ* since it is vocalic and will thus necessarily project an independent syllable, whereas the other agreement suffixes, which are purely consonantal, will adjoin to the syllable projected by *-lā* itself and can thus instantiate the semantically motivated linearization without rendering *-lā* non-final.

Our work on prosodic subcategorization will happen in close cooperation with Syn^h⊗Phon, which investigates this mechanism in more detail for phrase-level processes.

2.3.4.2 Multiple endocentric domains: cyclic models of affixation are often taken to be synonymous with what Crysmann & Bonami (2016) call the “stem-centric” approach, where all cycles in a word are built around a single lexical root. However, as succinctly pointed out by Crysmann & Bonami, there are many cases where affix ordering is fixed for a local domain *D* consisting only of affixes (hence excluding the lexical root), whereas the ordering of *D* as a whole wrt. the root is variable. While we concur with the conclusion that data like these argue against a stem-centric approach, we don’t consider it a fatal problem for cyclicity. Instead we assume that complex word-forms may contain multiple cycles (including non-root-centered ones) in parallel to the cyclic modeling of compounding (Chomsky & Halle 1968, Kiparsky 1982b), and based on previous analyses where single affixes undergo independent cycles (Baker 2005, Trommer 2011, Bermúdez-Otero 2018). The challenge for such an analysis will be to

develop a principled compositional semantics for the diverse typology of such structures – auxiliary-like prefix complexes as in Bantu (Pietraszko 2018), classifier and coverbs in Murrinh-Patha (Nordlinger 2010, Mansfield 2017)+ and pronominal affix (“clitic”) clusters in Romance and other Indo-European languages. Strikingly, endocentric clusters for affix linearization often also seem to correspond to domains for the application of phonological alternations (see Trommer 1997, Kallulli 1995 for clitic clusters in Albanian, and Mansfield 2017 for coverbs in Murrinh-Patha), which follows from the stratal architecture assumed here, but remains accidental in Crysmann & Bonami’s template approach.

2.3.4.3 Gradient correlates of ordering: the restrictive three-level approach to cyclicity we pursue predicts that semantic and phonological correlates of ordering are not with single affixes, but with conglomerates of affixes, i.e. strata. This claim faces two potential empirical challenges. *First*, apparent cases where semantic and phonological correlates of affix order seem to be gradient across the morphology of the language, as argued by McPherson & Hayes (2016) for Tommo So, or inside single strata (see Hay & Plag (2004) for English), and *second*, languages with rich morphology which have been argued to exhibit more than two word-internal strata (Clark 1990 for Igbo, Lesley-Neuman 2012 for Karimojong, Jones 2014 for Kinande, Rubach 2011 for Macedonian).

Our analysis will be based on the working assumption that morphophonological differences between affixes on the same stratum do not provide evidence for different phonological grammars as in Construction Phonology (Inkelas 1998), but for defective (possibly gradient \rightarrow Mor \rightarrow Phon) underlying phonological representations, and subcategorization (selection). This predicts that differences between affixes of a given stratum should be qualitative and diverse, not quantitative and homogeneous. An interesting alternative assumption raised by Bermúdez-Otero (2018) is that languages with especially rich morphological structure might license additional strata in a principled manner. In the context of the RU, a natural account of this fact might be achieved by a model where the number and structure of strata itself is due to interface optimization. Another alternative we want to investigate together with the Mor \rightarrow Mor project is that stratum-internal cycles follow from a Harmonic-Serialism architecture.

2.3.4.4 Discontinuous phonological and semantic dependencies Discontinuous semantic dependencies are given when for example an inner affix or a root shows a lookahead behavior in that its interpretation presupposes semantic information provided by the outer affix. Well-known examples are idiomatic meanings of (potentially discontinuous) classifier/coverb combinations in Murrinh-Patha (Nordlinger 2010) and German particle verbs, (Stiebels & Wunderlich 1994). Pesetsky (1979) discusses a case from discontinuous semantic composition in Russian word formation: *sud* ‘court’ \rightarrow *sud-ba* ‘fate’ \rightarrow *sud-ba-in* ([sudebnyi]) ‘judicial’, where adjectivizing *-in* builds semantically on the meaning of *sud* not *sud-ba* from which it derives. Discontinuous dependencies in phonology have been diagnosed for Bantu valency-changing affixes by Hyman (2002), and Gleim et al. (2019) cite several cases where phonological processes are triggered non-locally across specific affixes: de-spirantization in Barwar Aramaic, accent shift in Lithuanian, *ni*-insertion in Quechua, and Kazakh vowel harmony.

Discontinuous dependencies between non-adjacent affixes pose probably the most severe challenge for our approach since cases like those discussed recently by Gleim et al. seem to require that an affix A_1 interacts phonologically with a base B and is subsequently linearly separated from B by another affix A_2 . While this falls out naturally in the Harmonic Serialism approach of Müller (2020) (pursued in Mor \rightarrow Mor), it leads to a dilemma in the context of strata without internal cyclicity since it would involve that A_1 and B are concatenated and interact at stratum S_1 , whereas their separation must happen at a later stratum S_2 so that the morpheme boundaries of A_1 and B would still have to be visible across strata. This would imply an infringement on a central assumption of Stratal OT: Bracket Erasure.

Our tentative approach to the phonological cases is to assume that phonological discontinuous dependencies reflect either long-distance phonological dependencies, infixation, or metathesis, driven by phonological subcategorization as investigated in Syn \rightarrow Phon. Kiparsky (2015b) discusses two further analytic possibilities: parallel (simultaneous) affixation and interfixation (insertion of an affix *inside* an already attached affix with cyclically interleaved phonology). Under our premises, both approaches would make interesting specific empirical predictions: Interfixation could only apply at the Stem Level

(and would hence be subject to “fake”, not standard cyclicity). Conversely, simultaneous affixation of a set of affixes would imply that their phonological and semantic evaluation happen simultaneously.

2.4 Other information – Cooperation within the Research Unit

The project will cooperate closely with project Mor^{Phon} on the tonal correlates of affix order, ordering diagnostic for purely tonal affixes, and theoretical aspects of morphophonological stratification (especially in the use of Gradient Symbolic Representations to capture non-binary effects of affix order). In turn, our project will provide a broader typological array of tonal data for Mor^{Phon} with its exclusive focus on African languages.

Our project will also provide typological data for the project Mor^{Mor} on phonological reflexes of affixes in non-canonical positions, and develop together competing analyses for this phenomenon (see section 2.3.4.4). We will further cooperate to explore the possibility to integrate serial optimization into the internal structure of single lexical strata.

The central common research area with project Syn^{Phon} are cases of affix and clitic linearization driven by prosodic subcategorization. Interestingly, some classical cases of lexical phonological stratification involve clitics in the sense of the Syn^{Phon} project (see e.g. Halle & Kenstowicz 1991 on coordinating clitics in Latin and Manam); thus, there is a direct overlap at the level of primary data.

The central topic of our project – affix order – is also of immediate relevance for project Syn^{Mor}, which in this respect focuses on the possible ordering of multiple affixes expressing the same hypothesized syntactic number head (‘overexponence’). Empirically, our project will provide additional typological data for this project (beyond the exclusive focus of the latter project on Eastern Sudanic languages). In turn, our project will benefit from new Eastern Sudanic data from the fieldwork in Syn^{Mor}. We also project a close cooperation on semantic correlates for different types of number exponents (e.g. for diagnostics to distinguish nominal and verbal number).

With the Syn^{Sem} project we share a common interest in cases where the polysemy/vagueness of formatives interacts with their morphosyntactic behavior, there in a clausal syntactic context, here in its impact on affix linearization leading to common methodological and theoretical questions (e.g., are affixes/sentence-embedding predicates with distinct morphosyntactic behavior the same (underspecified) or distinct lexical entries?).

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