Featural Affixes: The Morphology of Phonological Features

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1   State of the art and preliminary work

State of the Art

Floating Features and Featural Affixes: By 'featural affix' we refer broadly to subsegmental and suprasegmental affixes which surface (partially or completely) as (a) phonological feature(s) of (a) segment(s) of the base word, or in procedural terms, every morphological construction which involves the partial phonological modification of base segments. This covers instances of German umlaut (Wiese 1994, Klein 2000) as in the plural of **Bruder** 'brother' ~ **Brüder** 'brothers' where plural is expressed by fronting, i.e. the phonological feature [-back] on the stressed vowel, 1st person singular in Texistepec Popoluca verbs which is expressed by nasalizing the initial consonant of a verb (**dastah** 'to dig' ~ **nastah** 'I dig', Reilly 2002), but also tonal and moraic affixes (e.g. verbal nouns in Hausa formed by lengthening/adding a mora to a final vowel, **gudù** 'walk' ~ **gudùː** 'walking', (Schuh 1989), and plural formation in Ngbandi monosyllabic verbs which is marked by replacing the underlying stem tone by a high tone as in **gwè** (SG) ~ **gwé** (PL) 'swam', Nida 1949), featural 'parafixes', i.e. features which are realized on multiple base segments such as 1sg in Terena that is marked by prenasalizing the first obstruent of a stem and nasalizing all vowels and glides to its left (e.g. **iwatako** '(s)he sat' ~ **ĩw̃ã^{n}dako** 'I sat', Bendor-Samuel 1960), and features that are parts of bigger partially segmental exponents, such as the vocalic feature [+high] which acts as part of an otherwise segmental masculine singular suffix in the Felechosa dialect of Spanish (**bwén** 'good' ~ **bwín-o** 'good-M.SG', Mascaró 2013). The best-known featural affixes typically appear as part of lexical roots, but in many cases they also emerge on other affixes. Thus in Kiowa, a nasal dual marker appears as part of the prefix complex (**bé-mǫ̂ǫ̂** 'you:PL lay down' ~ **mé-mǫ̂ǫ̂** 'you:DU lay down', Harbour 2003:555) that also hosts tonal affixes. While featural affixation is a peripheral phenomenon in many European languages, it is one of the most frequent affixation patterns crosslinguistically (cf. the survey in Zimmermann and Trommer 2013d), pervasive in many language families (e.g. consonant mutation in Celtic, cf. Iosad 2012, and morphological tone in Bantu, Hyman and Kisseberth 1998), and for some languages the major and fully productive type of morphological exponence (e.g. Dinka, Andersen 1995).

Featural Affixes in Theoretical Phonology: Featural affixes are inherently morphological objects, but the bulk of research on the phenomenon has been carried out in theoretical phonology. Tonal featural affixes have been essential in establishing Autosegmental Phonology as the standard model of phonological representations (Goldsmith 1976). Autosegmental Phonology implies that all types of phonological features should also occur 'floating' (i.e. not associated to segments, cf. Flynn 2011) as independent morphological objects, i.e. as affixes, a prediction which has been widely confirmed (see McCarthy 1983 on secondary consonantal articulation in Chaha, Lieber 1987 on consonantal features in Fula consonant mutation, Samek-Lodovici 1992 for morphological gemination as mora affixation, Lieber 1987, Wiese 1994 for vocalic features to account for umlaut). The advent of Optimality Theory (Prince and Smolensky 1993) and its focus on universal constraints have led to a further unification of featural and segmental affixes (thus Zoll 2003 shows that tonal affixes have basically the same linearization options, prefixation, suffixation and infixation, as segmental ones), and a systematic reevaluation of the general mechanisms that govern the realization of featural affixes. Wolf (2007) in one of the most comprehensive studies of the phenomenon concludes that underlyingly floating phonological material is subject to three basic phonological constraints: MAX FLOATING FEATURE, NO VACUOUS DOCKING, and NO TAUTOMORPHEMIC DOCKING, for whichTrommer (2011b) shows that they can be interpreted as effects of more basic constraints on autosegmental association (the requirement that all phonological nodes are associated to complementary nodes, the prohibition of tautomorphemic association, and the markedness of multiple association of single nodes).

Featural Affixes in Theoretical Morphology and Typology: Specific cases of featural affixation have played a central role in classical debates on the boundaries between phonological and morphological processes (Dressler 1985, Loporcaro 2011) and the question whether morphological exponence is piece-based or inherently procedural (cf. Anderson 1992 and Bye and Svenonius 2012 for divergent positions). However, the relevant literature focusses on ablaut and related processes in Indoeuropean (especially Germanic and English), which is highly irregular and susceptible to an alternative analysis in terms of stem suppletion (possibly involving analogy, cf. Rumelhart and McClelland 1986, Pinker and Prince 1994 on the English past tense). Thus it is fair to say that theoretical morphology in the last decades has largely ignored productive featural affixation as a research topic in its own right. This surprising fact is part of a more general development: The success of mainstream phonology in accounting for many nonconcatenative patterns in Autosegmental Phonology and Prosodic Morphology (McCarthy and Prince 1996, 1993) has lead to a tacit gradual shift of this area to theoretical phonology. In the last decades, specific nonconcatenative processes have been studied only marginally by theoretical morphologists as a phenomenon sui generis (see Wunderlich and Fabri 1995, Hannahs 2013 for exceptions). Similarly, featural affixes have been of peripheral concern to morphological typology (see Iosad 2010, Hyman 2008 for two tentative exceptions), probably because identifying featural affixes requires much more language-specific phonological analysis than for segmental affixation. As a result, our systematic knowledge of basic morphological patterns for featural affixes is minimal. Basic empirical questions have never been systematically investigated. Thus even for tonal affixes, for which the descriptive literature is most extensive, no one has ever undertaken a systematic crosslinguistic evaluation of linearization options. This holds to an even greater degree for allomorphy, syncretism, and other morphological properties of featural affixes. In fact, a number of basic empirical questions have hardly ever been asked. Thus many systems in featural morphology exhibit obviously suppletive allomorphy (allomorphy not reducible to phonological processes). For example, 'quirky mutation' (Lieber 1987, Wolf 2007) employs different phonological changes for different input consonants, thus the Breton mixed consonant mutation spirantizes labials (/b/ $\rightarrow$ [v]), but devoices coronal stops (/d/ $\rightarrow$ [t]). The same holds for chain-shifting morphology (cf. Gnanadesikan 1997 on Irish 'eclipsis' which changes underlying /p/ to [b], but /b/ to [m]), and featural polarity, cf. de Lacy 2012 on the Dholuo plural which involves voicing of stem-final voice-less (/t/ $\rightarrow$ [d]), but devoicing of voiced obstruents (/d/ $\rightarrow$ [t]). Although all these phenomena involve descriptively featural allomorphs, they are typically interpreted as evidence for phonological mechanisms unrelated to morphological suppletion (e.g. paradigmatic distinctiveness constraints as in Alderete 1999, Kurisu 2001). In effect, featural affixation provides a rich largely unexplored empirical area for testing independently developed theoretical hypotheses on affixation.

Documentation and Theory: There is a considerable gap between theoretical research on featural affixes and language documentation. Whereas there is a small set of fully productive featural affixes for most phonological dimensions that are well understood empirically and have been subject to extensive theoretical investigation (e.g. labial affixation in Chaha, McCarthy 1983, Rose 2007, Banksira 2011, consonant mutation in Fula (Pulaar), Anderson 1976, 1987, Paradis 1992, Mc Laughlin 2005, and voicing polarity in Dholuo, Alderete 1999, Trommer 2011b, de Lacy 2012), obviating occasional claims that featural affixation might be pure stem or word suppletion, many specific theoretical hypotheses on featural affixation are based on problematic data: Thus *mimetic palatalization in Japanese* – major evidence for conflicting directionality (the claim that prefixes might have a default preference for suffixation and vice versa, Zoll 1997) – is probably not productively bidirectional (Alderete and Kochetov 2009). *Data from Nilotic and Diegueño* cited as prime examples of featural affixes exhibiting polarity are restricted to minor lexical subclasses, and hence probably not productive (de Lacy 2012). The same holds for *voicing mutation in Aka*, a classic example of segmental consonant mutation cited in virtually every recent survey of featural affixation (Akinlabi 1996, 2011, Wolf 2007, Bye and Svenonius 2012). *Keley-I* taken as primary evidence for variable infixation of moraic affixes (Samek-Lodovici 1992) exhibits actually different mora affixes with fixed positions (Zimmermann and Trommer 2013b). On the other hand, the progress in documentation of endangered languages in the last years has produced a wealth of detailed descriptions of complex morphological systems employing featural affixation which have not been evaluated systematically by the theoretical and typological literature on featural affixation (cf. Akinlabi 2011).

Preliminary Work

The project builds on two major lines of our research, on the morpho-phonology of nonconcatenative morphology and on the morphology of segmental affixation:

Nonconcatenative Morphology: *Mora Affixation:* The project is a direct extension of our research on quantity-manipulating morphology, i.e. morphological processes that involve lengthening, shortening, epenthesis, or deletion of single segments. In Zimmermann and Trommer (2013a), we develop a unified approach to three processes that have been persistently problematic for an affixational analysis (morphological vowel shortening, vowel length polarity, subtractive morphology), and show that they can be derived from affixation of prosodic material, especially of floating moras. Based on this approach, Zimmermann (2013e) is a detailed case study on subtractive morphology in Yine (Piro), and Trommer (2013a) on morphological shortening and length polarity in Anywa; an extension to templatic vowel length in Dinka is developed in Trommer (2012b). Further consequences of mora affixation in morphological metathesis and affix copying are explored in Zimmermann (2009) and Zimmermann (2013a) respectively. In Zimmermann and Trommer (2013b), we present results of a crosslinguistic survey of lengthening morphology, and interpret the results as evidence for an extension of the pivot-approach for linearization (Yu 2007) to mora affixation. The dissertation of Eva Zimmermann will integrate these results in a broader typological survey of quantity-manipulating morphology, and add a further case study on Aymara. *Featural Affixation in Western Nilotic:* Trommer (2011b) is a detailed case study of non-segmental morphology in the Western-Nilotic languages Dinka, Anywa, Päri, Dholuo, and Mayak. Moreover, the thesis develops a more general model of affixation, and morphology-phonology interaction that will serve as the theoretical point of departure for the project. Trommer (2012b, 2013a,c) are extended studies on specific phenomena discussed in the monograph. Trommer (2012a) shows that apparently problematic patterns of multiple-feature affixation in Nuer, a further Western-Nilotic language, are actually the result of affixing multiple single-feature affixes, providing evidence that a detailed morphological analysis of featural affixation leads to substantial simplification of the necessary phonological mechanisms. *Other Areas of Nonconcatenative Morphology:* We have explored in detail the feasibility of analyzing nonconcatenative morphology as affixation: Trommer (2005, 2008b) shows that the root-and-pattern morphology in the Ethiopian-Semitic language Amharic is the result of infixing single vowels and moras that pattern morphologically in a way completely parallel to segmental affixes. Trommer and Zimmermann (2011) defend a similar analysis for denominal verb formation in Modern Hebrew and for overwriting morphology in general, and explore the consequences of this approach for cases involving reduplication. Zimmermann (2013b) shows that the structurally similar system of morpho-prosodic templates in Miwok can be derived from the combined affixation of moras and empty consonantal root-nodes. Zimmermann (2013d) provides evidence for affixation of a segmentally empty foot node to account for the allomorphy by either stress shift, vowel lengthening, syllable insertion, or reduplication in Upriver Halkomelem. Trommer and Zimmermann (2013) show that specific types of lexical blending can be captured by affixation of a prosodic word node. Zimmermann and Trommer (2013c) summarize the state-of-the-art in research on nonconcatenative morphology. Our work on nonconcatenative morphology has crucially benefited from cooperation in the DFG-Network 'Core Mechanisms of Morphological Exponence' (project TR 521/2-1), which has also produced important insights in this area, documented in the first of two volumes collecting the results of the network (Trommer 2012c), specifically in the chapters on reduplication (Inkelas), polarity (de Lacy & Wunderlich), truncation (Arndt-Lappe & Alber), and non-concatenative morphology (Bye & Svenonius). The programmatic chapter by Bermúdez-Otero will serve as the major conceptual background for the project.

Segmental Affixation: We have done extensive research on segmental affixation in all 4 empirical areas that are the focus of the project (linearization, cooccurrence, allomorphy, and syncretism of affixes, cf. section 2.2 – **Ziele**). A substantial part of this work is direct or indirect output of the DFG-projects 'Micro- and Macrovariation: Hierarchy Effects in Kiranti and Broader Algic' (DFG-project TR 521/3-1) and 'The Internal Structure of Person Portmanteaus' (part of DFG-research group FOR 742/2): (i) *Linearization:* Trommer (2001, 2003b,e, 2008a) provides a crosslinguistic typological survey of affix order among agreement affixes, and develops a comprehensive approach to the linearization of agreement affixes, integrating morphology and syntax.

The methodology and the results of these studies are the immediate starting point for our surveys of agreement, linearization and morphological typology in the project. Zimmermann (2013c) addresses the problem of variable affix order in Kiranti verb inflection. (ii) *Cooccurrence:* Trommer (2003b) identifies two sources for the blocking of affixes, opaque blocking by syntactic input features (worked out in detail in Trommer 2003f) vs. competition for surface realization, and provides a comprehensive optimality-theoretic approach for both phenomena. Trommer (2006c) provides crucial empirical arguments for this account from effects of feature hierarchies on cooccurrence restrictions in Dumi, and Trommer (2008c) from 3rd person agreement in Menominee. Trommer (2006b) and Trommer (2007) on Yurok show that cooccurrence restrictions and hierarchies are partially based on head-sized, and partially on chain-sized domains. In an alternative line of research Trommer (1999a, 2006d, 2012d) relates cooccurrence to contextually triggered zero morphology or deletion of exponents (Trommer 2011a) deriving hierarchy effects by licensing schemata (Trommer 2012d) over zero-rules (see also Bank and Trommer 2013a, 2013b on the impact of Ø-morphology on learnability and typology). Henze and Zimmermann (2010, 2011) develop a variant of this approach where cooccurrence restrictions are directly linked to linearization and derivational priority of affix spellout. (iii) *Allomorphy:* Trommer (1997, 1999b) implements an efficient computational model of allomorphy in inflectional morphology, Trommer (2002) provides an explicit model of locality domains in allomorphy. Trommer (2003b, 2006d) develops detailed formalisms for the possible context specifications of vocabulary items in allomorphy. Based on these formal options, Trommer (2003d, 2006d) shows that apparent cases of portmanteau agreement actually instantiate suppletive allomorphy. Trommer (2013e) demonstrates that apparently non-optimizing phonologically conditioned suppletion corresponds to optimizing suppletion of subexponents. (iv) *Syncretism:* Trommer (2003c,d, 2006d) show that apparently unnatural types of syncretism are an epiphenomenon of abstract morphosyntactic feature systems and zero exponence. Similarly, Trommer (2003a, 2006a) interprets syncretism in direct-inverse syncretism as the result of feature-hierarchy effects on zero realization. Trommer (2010, 2013b) develops a new extension-based framework for syncretism that doesn't correspond to natural classes.

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. Jochen Trommer & Eva Zimmermann (2011) Overwriting as Optimization. *NLLT* 29(2):561-580.

2. Jochen Trommer (2012) Constraints on Multiple-feature Mutation. *Lingua* 122(11):1182-1192.

3. Jochen Trommer (2012) (ed.) *The Morphology and Phonology of Exponence.*
   Oxford University Press.

4. Jochen Trommer & Eva Zimmermann (accepted for publication) Inflectional Exponence.
   In: Matthew Baerman (ed.) *Oxford Handbook of Inflection.* Oxford University Press

1.1.2 Other publications

5. Jochen Trommer (2011) *Phonological Aspects of Western-Nilotic Mutation Morphology.*
   Habilitation thesis, University of Leipzig.

6. Jochen Trommer & Eva Zimmermann (2013) How to Linearize Morphological Weight.
   Linguistische Arbeits-Berichte 90:123-162. Universität Leipzig: Institut für Linguistik.

2 Objectives and work programme

2.1 Anticipated total duration of the project: 01.01.2014 – 31.12.2016

2.2 Objectives

Creating a Representative Crosslinguistic Database for Featural Affixation: Given that theoretical and typological research on featural morphology takes into account only a fraction of the relevant descriptive literature, a central goal of the project is the creation of a cross-linguistic database which conspicuously documents basic distributional patterns of featural affixation. The database will contain annotated paradigms in the format developed in the projects 'Micro- and Macrovariation: Hierarchy Effects in Kiranti and Broader Algic' (DFG-project TR 521/3-1) and 'The Internal Structure of Person Portmanteaus' (part of DFG-research group FOR 742/2) for the theoretical evaluation of segmental morphology (cf. http://proalki.uni-leipzig.de/project/resources.html). The major challenge of featural affixation in this context is that it requires a much more elaborate encoding of phonological processes. The paradigms will be annotated for four central empirical phenomena (i) linearization (ii) cooccurrence, (iii) allomorphy, and (iv) syncretism of featural affixes. These 4 areas have been the subject of intensive recent empirical and theoretical research for segmental affixes, (cf. Trommer 2003e, Stiebels 2003, Yu 2007, Ryan 2010 on affix linearization, Hippisley et al. 2004, Paster 2006, Embick 2010, Wolf 2013 on allomorphy, Trommer 2006c, Müller 2007, Embick and Marantz 2008, Béjar and Rezac 2009, Harris 2009, Nevins and Sandalo 2011, Inkelas and Caballero 2013 on affix cooccurrence, and Cysouw 2003, Baerman et al. 2005, Müller 2005, Pertsova 2011, Albright and Fuß 2012 on syncretism), but have received little attention with respect to featural affixation. In contrast to most earlier studies on featural affixation which are restricted to capturing isolated affixation patterns (e.g. Akinlabi 1996,Wolf 2007), these four empirical domains guarantee a focus on the interaction of featural affixes with other (featural or segmental) affixes.

Extending Descriptive and Theoretical Categories from Segmental Affixation to Featural Affixes: An essential precondition for the empirical and theoretical goals of the project is to operationalize the application of affixational categories to subsegmental features. For example, it is commonplace in the descriptive and theoretical literature to classify tonal affixes which occur consistently at the beginning (end) of base words as prefixes (suffixes) (cf. Zoll 1996, Hyman 2008, Akinlabi 2011), but in contrast to segmental affixes this doesn't imply that the affix tone is pronounced *before* the segments of the tone. Tonal prefixation could in principle mean that tone is affixed (associated) to the first tone-bearing unit (TBU) of a base (a notion of prefixation often employed in work on African tone, e.g. Clark 1990), but also that the tone targets the first tone of the base (see e.g. Tranel 1995 on Mixteco for affixes which seem to work along these lines), which makes markedly different predictions given that not all base-TBUs are necessarily associated to tone. In turn, identifying the proper descriptive categories for featural affixes has immediate theoretical consequences. Thus attachment of tonal affixes to peripheral tones is consistent with the conservative extension of the morphological pivot approach to Yu (2007) to affix linearization proposed in Trommer (2011b), where affixes on autosegmental tier X generally affix to tier X of their base, whereas the affixation of tone to tone-bearing units would require a substantial revision to this approach. Similarly the notion of segmentability (Hay 2002, Plag and Baayen 2009, Inkelas and Caballero 2013) which plays an important role in recent work on affix blocking and linearization is usually defined by transition probabilities between segments which are not directly applicable to phonological features. Thus a central challenge addressed by the project is to identify featural equivalents to established theoretical concepts from segmental phonology.

Testing Hypotheses Developed for Segmental Affixation on Featural Affixes Theoretical and typological research of the last decade has generated highly specific hypotheses on the possible interaction of affixes. For example, there is a broad consensus that suppletive allomorphy has a strong bias for being triggered by structurally innermost affixes (Carstairs-McCarthy 1987, Paster 2006, Embick 2010), there are elaborate proposals for the correlation of morphosyntactic features and possible affix orders (Wunderlich and Fabri 1995, Julien 2002, Trommer 2003e, 2008a, Harbour 2007, 2008), and of the conditioning of affix blocking by phonological segmentability (Hay 2002, Plag and Baayen 2009, Inkelas and Caballero 2013). Featural affixation as one of the most segment-like types of nonconcatenative morphology provides an ideal testing ground for examining the

empirical validity of the theoretical hypotheses in a broader empirical domain. In fact, there are good reasons to assume that a detailed study of non-segmental affixation will lead to a substantial qualification of typological generalizations. For example the crosslinguistic preponderance of segmental suffixation over prefixation and infixation (Greenberg 1963, Cutler et al. 1985) does not extend to reduplication which has a strong bias for prefixation (Marantz 1982, Nelson 2003) and morphological gemination (featural μ-affixation) which targets typically non-peripheral consonants (Saba Kirchner 2007). We expect that this qualification will overall lead to more general and abstract notions of the formal mechanisms involved in affixation – for example Zimmermann and Trommer (2013b) show that in linearization moras target stem moras in a similar way as affixal segments target stem segments, but will also lead to generalizations straddling the simplistic division between segmental and non-segmental affixation. Thus subsegmental featural affixes, but not tonal and moraic affixes, seem to provide the only clearcut cases of variable infixation (Yu 2007). Since featural affixation is attested for virtually all phonological dimensions (prosodic length, suprasegmental tone, and primary/secondary features of vowels and consonants), it is especially suited for factorizing out general morphological principles of affixation and restrictions that are specific to particular phonological modalities.

Integrating Featural Affixation into a Restrictive Grammatical Architecture: Complex or partially unpredictable cases of featural morphology have been interpreted as major evidence for supplementing affixation by special mechanisms such as morphological readjustment (morpheme modification) rules (Halle and Marantz 1993, Embick and Halle 2005), morpheme-specific phonological constraints or constraint rankings (Flack 2007, Pater 2009, Inkelas 2012), or rules/constraints requiring phonological contrast between paradigmatically related forms (Alderete 1999, Kurisu 2001, Carstairs-McCarthy 2008). A major goal of the project is to integrate featural affixation into a grammar model that combines Minimalist Distributed Morphology (Trommer 1999a, 2003c,d, 2012d), a maximally restrictive implementation of DM, where all morphological rules are affixation operations, and the version of Stratal OT developed in Bermúdez-Otero (2012), where morphological exponence is limited to introducing pieces of phonological structure subcategorizing for phonological bases, and the only access phonological computation has to morphology apart from general processes of stratification is by partial sensitivity to specific phonological boundaries, and general structural properties. Representationally, we will assume the version of Colored Containment Theory (van Oostendorp 2006, 2008) of Optimality Theory developed in Trommer (2011b) with special consideration of featural affixes.

2.3   Work programme incl. proposed research methods

Compilation of Language Samples: The empirical starting point of the project is the compilation of different (albeit partially overlapping) samples of languages with featural affixation:

- *Large-Scale Sample:* A 100-language sample of languages with featural affixation

- *Agreement Sample:* A 30-language sample of languages with featural affixes instantiating verbal subject and/or object agreement

- *Affixation Sample:* (Western Nilotic) A 10-language sample of closely related languages – 5 languages with featural affixation/5 languages with genetically corresponding segmental affixation

- *Feature Samples:* Three 20-language samples of languages with featural affixation involving the same phonological dimension (tone, vocalic height, and consonantal stricture)

The sample languages must minimally satisfy the requirements that (i) the language is not included in standard surveys of featural affixation (Lieber 1992, Zoll 1996, Akinlabi 1996, Wolf 2007) (ii) at least one of the relevant featural affixation processes in the language is fully productive, and (iii) there is consistent and detailed documentation of the raw data (paradigms) exhibiting featural affixation, and of the major phonological processes in the language. Data for the samples will mainly be drawn from the published descriptive literature. To ensure access to additional unpublished data, we will organize three empirically oriented workshops on featural morphology (see section 4).

A major focus of the *Large-Scale Sample* is the inclusion of areal and genetic domains which are under- or unrepresented in the theoretical literature on featural affixation, especially Australia, Meso-America, and

Papua. The *Agreement and the Affixation Sample* will allow us to study parallels and differences between segmental and subsegmental affixes. Agreement affixes are the typologically and theoretically best-understood type of inflectional affixes (cf. e.g. Cysouw 2003, Baerman et al. 2005, Baker 2008, Adger et al. 2008), and also richly attested in featural morphology (see e.g. Trommer 2011a,b), and thus the ideal empirical area to test to which degree the morphological properties of featural and segmental affixes converge. Western Nilotic languages offer the unique possibility to study historically closely related languages where close relatives of languages with extensive featural affixation have clear segmental counterparts. The *Feature Samples* are designed to study systematic differences between featural affixes for different phonological dimensions. To ensure maximal availability of data, we focus on three features which behave phonologically markedly differently and are at the same time among the crosslinguistically most wide-spread types of featural affixation. The feature samples will be complemented by an additional sample on moraic morphology that we have compiled in previous research (Zimmermann and Trommer 2013b). All samples (except the *Affixation Sample*) will be balanced areally with respect to large geographical areas and genealogically for large-scale language families. The Large-Scale Sample will additionally cover all smaller-scale areas and maximize distribution over different genealogical language stocks. For all areal and genealogical categories, we rely on the classification of the Autotyp Project (Nichols and Bickel 2009).

Empirical Evaluation: The first stage of empirical evaluation will consist in the annotation of the paradigms in an electronic database for the four central empirical areas of the project: (i) linearization (ii) cooccurrence, (iii) allomorphy, and (iv) syncretism of featural affixes. In addition, the database will contain basic information on the productivity of each featural affixation pattern, and on relevant phonological processes (especially harmony processes which might potentially interact with featural affixation) in the respective languages. All annotations will be published online after the completion of the project. The annotation process faces three major challenges, opacity, analytic ambiguity, and proper generalization. *The opacity problem* is most obvious in the domain of affix ordering: since featural affixes are usually realized as part of their bases, their surface position when they occur together isn't necessarily indicative of their respective order, and often the effect of one featural affix might erase the phonological effect of another one. This requires to operationalize affix order by indirect phonological effects along the lines of Trommer (2011b), where the order of tonal affixes is deduced from their behavior in autosegmental blocking of crossing association lines. Opacity is closely connected to the *ambiguity problem:* Since featural affixes are phonologically 'small', they have a grossly reduced potential for distinctiveness leading to massive ambiguity in the analysis of simple distributional patterns. Thus, in many Bantu languages, tonal morphemes occur in different positions in base words with different syllable numbers (e.g. the present negative in Lunyala which is expressed by a H-tone that is initial in mono- and bi-syllabic, but pen-initial in polysyllabic stems, cf. Marlo 2007:292ff.). But since also tonal morphemes consisting of a single H-tone might differ solely in their positioning (e.g. the Lunyala imperative singular which as the present negative consists of a single H-tone, but on the final syllable of the stem), and it is well known that segmental suppletive allomorphy (i.e., allomorphy not due to phonological alternations) might be sensitive to the syllable number of the base, it is equally plausible that there are two suppletive tonal allomorphs with different linearization specifications selecting bases of different syllable number. We will explore two different strategies to the ambiguity problem, (i) annotation of data with *all* possible interpretations, and selecting among possible interpretations according to linguistically motivated evaluation metrics. *Proper generalization* corresponds to the central descriptive and theoretical goal of the project: to extend categories from segmental to featural affixation. Two analytic choices which are important here are the analysis of 'quirky' featural affixation (i.e. polarizing, chain-shifting, or unsystematic) segmental changes in featural allomorphy as (potentially suppletive) allomorphy (see the Breton, Irish, and Dholuo examples above), and the interpretation of parafixes (e..g. vowel quality that spans more than one vowel), and overwriting featural affixes as the result of circumfixation (Finley 2009, Trommer 2011b). Thus, a featural high tone that is realized on the second through to the last syllable of its base (such as the Lunyala indefinite future in **bhichíkál-á** 'he will belch', Marlo 2007:281) is interpreted as a type of circumfix, a combination of a peninitial and a final affix tone with concomitant phonological spreading (**bhi^{H}chikala^H** $\rightarrow$ **bhi^{H}chi^{H}ka^{H}la^H**). The testing ground for these choices is whether they allow to capture general empirical patterns.

Based on the annotated language samples we want to evaluate 6 representative hypotheses on affixation from the theoretical literature on morphology (corresponding to the 4 empirical areas of the project):

Hypotheses:

- **Linearization**

  Hypothesis L1: *Linear Ordering of affixes is predictable from their morphosyntactic content:* This is a standard assumption in research on segmental affixation converging on the position that the major factors determining order among segmental affixes are syntactic/semantic (Wunderlich and Fabri 1995, Baker 1985, Rice 2000, Julien 2002, Harley 2010, Keine 2012), or reflect general morphological constraints (Trommer 2003b,e, 2008a, Harbour 2007, 2008, Zimmermann 2013c), whereas idiosyncratic order restrictions (Stiebels 2003, Ryan 2010) play only a peripheral, and phonological factors perhaps no role at all (Paster 2005). An open question is to which extent morphosyntactic primacy extends to affixal orientation (whether an affix is realized as prefix or suffix; see Trommer 2003e, Julien 2002, Bye and Svenonius 2012 for evidence that affixal orientation also reflects morphosyntactic constraints, and Kim 2008 for systematic phonological factors). Featural affixation is at least involved as a phonological trigger of variable affixal orientation. Thus Jenks and Rose (2013) show that the phonological shape of tonal affixes to verbs determines the directionality of affixation in Moro. We test this hypothesis with a focus on the Large-scale Sample and the Agreement Sample.

  Hypothesis L2: *Infixation targets are restricted to specific salient (peripheral or stressed) phonological nodes of the affix (and higher) tiers.* This is a central hypothesis of morphological/syntactic approaches to infixation (Yu 2007, Fitzpatrick 2004) in contrast to phonological-optimization accounts (Prince and Smolensky 1993, Klein 2005, Bye and Svenonius 2012) which predict a broad range of variable positions since they allow any type of phonological markedness to influence linearization. Featural affixation comprises some of the most plausible exceptions to the hypothesis, as well as to the claim that there is no partial infixation (infixation combined with pre/suffixation, Marušič 2003), e.g. 'deep' tonal infixation in Kuria, (Marlo et al. 2012), and labialization/palatalization in Chaha, (Rose 2007). We examine this hypothesis with a focus on the Large-scale Sample and the Feature Samples (to test whether different phonological features exhibit different infixation patterns).

- **Cooccurrence**

  Hypothesis C1: *Cooccurrence restrictions among agreement affixes reflect hierarchies of morphosyntactic features* (e.g. the blocking of 3rd person affixes by 'higher-ranked' 1st person affixes). This hypothesis is a corollary of constraint-based approaches to cooccurrence restrictions among pronominal morphemes (Grimshaw 1997, Gerlach 1998, Wunderlich 2003, Trommer 2006c, Nevins and Sandalo 2011), but also of accounts in terms of syntactic agreement (Béjar and Rezac 2009, Nevins 2007, Preminger 2011), where hierarchies are typically interpreted as complexity scales (e.g. 1st person is the feature set [1], but 3rd person is an empty feature set [ ]) See Stump (2001b) for the dedicated counterposition that cooccurrence restrictions are due to the item-specific assignment of affixes to templatic slots. A number of featural agreement systems exhibit similar patterns (e.g. segmental featural affixes in Texistepec Popoluca, Reilly 2002, and tonal morphology in Jumjum/Mayak Andersen 1999, Andersen 2004, p.c.). An interesting complication is that cooccurrence restrictions over featural affixes seem to be at least partially modality-specific (e.g. tonal affixes block tonal affixes, but not moraic and segmental ones, see Trommer 2012b). We test this hypothesis with focus on the Agreement Sample.

  Hypothesis C2: *Segmentability determines affix cooccurrence.* Hay and Plag (2004) argue that cooccurrence restrictions among English affixes are partially determined by the restriction that phonotactically integrated affixes cannot occur outside of affixes at strong phonotactic segment boundaries (i.e. infrequent segment transitions, cf. Saffran et al. 1996, McQueen 1998, on the role of segment transition probabilities for the acquisition and the processing of morphological boundaries). Similarly, Inkelas and Caballero (2013) claim that cooccurrence in multiple exponence is made possible by inner affixes of low segmentability which are 'enhanced' by outer affixes of high segmentability. If segmentability also determines affix order (Plag and Baayen 2009), it is clear that featural affixes cannot be generally less segmentable than affixal ones since

they may occur outside (have scope over) segmental ones (e.g. tonal affixes in Hausa, Inkelas and Zoll 2007 and affixal labialization in Chaha, Banksira 2011). We examine these hypotheses on the basis of the Affixation Sample to test whether featural affixes pattern differently from segmental ones, and with the Feature Samples to explore potential counterparts of segmentability with different phonological features. An obvious assumption is that tone (and possibly moraic length) are more segmentable than subsegmental features since they are phonologically and articulatorily more independent.

- **Syncretism**

  Hypothesis S: *There is a bias for natural morphosyntactic/semantic classes in syncretism.* This hypothesis, which implicitly underlies all major lines of research in theoretical work on syncretism (Minimalist Morphology: Wunderlich and Fabri 1995, Wunderlich 1996, 2003; Paradigm Function Morphology: Stump 2001b; Distributed Morphology: Halle and Marantz 1993, Harley 2008) is made explicit by the *Syncretism Principle* of Müller (2005). See Cysouw (2003), Pertsova (2011) for typological, Aalberse (2009) for dialectological, Nevins and Rodrigues (2013), Opitz et al. (2013) for experimental evidence, and Albright and Fuß (2012) for general discussion. Pertsova also develops a computational learning algorithm that derives this bias, but also allows for unnatural syncretism addressing the exceptionality problem (Baerman et al. 2005) and the problem of systematic syncretism not corresponding to natural classes (Aronoff 1994, Baerman 2005, Trommer 2010). Featural affixes are an excellent test case for the Syncretism Principle since they dispose of less phonological space to express paradigmatic distinctions, and are therefore necessarily more prone to accidental homophony. The impressionistic empirical evidence so far is contradictory: one of the prime examples for 'unnatural' syncretism in Baerman (2005) is a case of featural-affixation (verb agreement in Dhaasanac), whereas Trommer (2012a) finds a number of striking cases where syncretism among featural affixes instantiates natural classes. We examine the Syncretism Principle with a focus on the Agreement Sample since natural classes are especially well understood for agreement features (see e.g. the contributions in Adger et al. 2008).

- **Allomorphy**

  Hypothesis A: *There an inside-outside asymmetry in suppletive allomorphy:.* Outward-conditioned suppletion – an allomorph of an inner affix is triggered by features of an outer affix – is impossible. The validity of this hypothesis is the central question in current research on allomorphy (see Bonet and Harbour 2012 for an overview, and Bonet et al. 2013 for a collection of recent contributions). It is predicted to hold without exceptions in strictly lexicalist incremental approaches (Wunderlich and Fabri 1995, Paster 2006), with respect to allomorphy triggered by phonological features in DM-style architectures (Bobaljik 2000, Adger et al. 2003, Embick 2010), and in a relaxed form in varieties of semi-derivational OT (Wolf 2013, Trommer 2013e). Carstairs-McCarthy (1987, 2001) observes specific inside-outside asymmetries for morphosyntactic features. Suppletive allomorphy of featural affixes has hardly ever been discussed in the literature (see Trommer 2011b on Nilotic tone), but is well-documented for cases where featural affixes alternate with segmental exponents (e.g. the alternation of ablaut and segmental past-tense morphology in Germanic, Stump 2001a, and the Udihe perfective, where laryngealization alternates with the segmental suffix **-ge** (Bye 2008), and is an obvious analytic option for stem-alternating featural affixation involving idiosyncratic changes (Iosad 2008).

Based on the Large-Scale Sample, we will also compute three basic distributions that have never been investigated with a representative language sample: (i) the frequency of different morphosyntactic and semantic categories (e.g. derivation vs. inflection) in featural affixation, (ii) the frequency of different phonological features involved, and (iii) potential correlations between phonological features and the morphosyntactic categories they express.

Theoretical Integration: In the theoretical evaluation phase, we will integrate the data and generalizations extracted in the project into a reductionist architecture of grammar combining Minimalist DM and Stratal OT based on the approach to featural affixation developed on the basis of Western-Nilotic in Trommer (2011b) and for moraic affixation in Zimmermann and Trommer (2013c), and will explore their consequences for alternative grammatical architectures. In particular, we want to address the following four theoretical questions:

- **Q1: Which Aspects of Affixation are Idiosyncratic (Affix-specific) and which follow General Principles?** This is a central question in the current theoretical discussion for all four empirical areas of the project. Thus there is an on-going debate on whether phonologically conditioned suppletive allomorphy is the effect of affix-specific subcategorization (Paster 2006, Bye 2008) or of allomorph selection by general phonological constraints (cf. hypothesis **A**). Ryan (2010) argues that there are cases where affix linearization is governed by arbitrary ordering restrictions over bigrams which are not reducible to general principles of affix order (cf. hypothesis **L1**). Similar controversies are virulent with respect to the nature of infixation (hypothesis **L2**) (Klein 2005, Yu 2007, Bye and Svenonius 2012), cooccurrence restrictions (hypotheses **C1** and **C2**, see Henze and Zimmermann 2010, 2011 for apparently affix-driven blocking in agreement), and the nature of morpheme-specific cophonologies (Pater 2009, Bermúdez-Otero 2012, Inkelas 2012, and **Q3**). Following Trommer (2011b), the working assumption of the project is that the idiosyncratic specification of affixes is restricted to selecting a linear target in its base, and to membership of the affix in the Stem-Level or Word-Level of the grammar, whereas other idiosyncratic properties of affixes follow from these specifications. Thus Trommer (2011b) shows that the fact whether a tonal affix is overwriting or additive (claimed to be due to affix-specific cophonologies in Inkelas and Zoll 2007) derives from its linearization properties – circumfixes lead to overwriting in the phonology, unilateral affixes result in monotonic feature addition.

- **Q2: What is the Fine Structure of Exponents?** One of the key insights of recent research in theoretical morphology is that morpheme-sized units show evidence for complex internal structure. This insight is expressed for example by the different versions of the 'fission' operation proposed in Distributed Morphology which split a head into multiple affixal exponents (Halle 1997, Frampton 2002, Trommer 2003c, Trommer and Müller 2006). Similarly, optimality-theoretic research on phonologically conditioned suppletive allomorphy typically assumes that morphemes are in the general case not single underlying forms, but sets (Kager 1996) or rankings (Mascaró 2007, Bonet and Harbour 2012) of allomorphs (cf. hypothesis **A**). Trommer (2011b, 2012a) shows that sub-exponents are also a pervasive phenomenon in featural affixation. In fact, specific patterns of complex exponents, circumfixal structures or combinations of segmental affixes with infixes seem to be much more frequent among featural affixes. Two important questions we want to approach in the project are: (i) Do subexponents correspond 1:1 to morphosyntactic features (as inherent in the concept of fission), or might different subexponents spell out the same features, resulting in multiple exponence (cf. hypotheses **C1** and **C2**)? (ii) Is idiosyncratic morphological information globally associated to morphemes or attached to smaller sub-exponents (cf. **Q1**). Thus employing circumfixes essentially admits the possibility that parts of an exponent (the prefixal and the suffixal part) independently select linear base positions (cf. hypothesis **L2**). Similarly, the reduction of syllable-counting allomorphy to general stratal cophonologies (cf. Trommer 2013d) presupposes that the separate allomorphs of a morphemes can differ for their membership in Word-Level/Stem-Level phonology (cf. **Q3**).

- **Q3: How does Phonology Access Morphological Information in Affixation?** Many cases of featural morphology can be interpreted as phonological processes without an overt trigger, or without a deterministic trigger (Inkelas 2012). Thus vowel fronting in German umlaut (cf. German **Bruder** 'brother' ∼ **Brüder** 'brothers') could in principle be analyzed as vowel harmony triggered by an 'invisible' front vowel. In Chamorro, umlaut is typically triggered by front vowels, but with exceptions in both directions (Klein 2000). Data of the latter type have lead many theoretical phonologists to the conclusion that phonological computation must have largely unrestrained access to morphological information, i.e. must be capable to refer to the identity of morphemes (e.g. to restrict a process to 3sg forms), and the hierarchical structure of morphosyntactic expressions (cf. Alderete 1999 for voicing alternations in Dholuo, Flack 2007 for morphological lengthening in Dinka, and Inkelas and Zoll 2007 for tonal affixation in Hausa). The working

hypothesis of the project is, in line with Stratal OT, that accessibility of morphology by phonology (Trommer 2011c) is restricted to a bare minimum, i.e., three factors: (i) morphophonological stratification (ii) local effects of the root/affix distinction on the prosodic structure of single morphemes, and (iii) morphological colors (van Oostendorp 2006), a generalized formal implementation of morpheme boundaries that allows to determine whether two phonological elements are tautomorphemic or not (or epenthetic, hence not associated to any morpheme at all). Thus we predict that all apparently morpheme-specific properties of featural affixes are either part of general distinctions between strata or morpheme types, or due to their idiosyncratic morphological specifications (especially their underlying phonological representation and their linearization targets, cf. **Q1**). In fact, Trommer (2011b) shows that many instances of apparently idiosyncratic featural affixation can be reduced to these three factors. The heuristic value of our restrictive take on the morphology-phonology interface is that it precisely circumscribes the explanatory burden for morphological representations and operations in featural affixation, and raises substantial new questions of detail. Thus it is unclear which types of phonological constraints may refer to morphological colors, and whether morphological coloring can differentiate between different sub-exponents (cf. **Q2**).

- **Q4: Are there Substantially Different Types of Affixation?** One of the most influential assumptions in the theoretical morphological literature, with immediate consequences for featural affixation, is the hypothesis that there are two substantially different types of affixation, e.g. regular vs. irregular (Pinker and Prince 1994), concatenative vs. non-concatenative (McCarthy 1989), and Stem-Level vs. Word-Level (Bermúdez-Otero 2012, Inkelas and Caballero 2013). The most articulated formulation of such a claim is made in Halle and Marantz (1993), Embick and Halle (2005): There are two types of featural morphology, one which is affixational in the way of segmental affixes, strictly feature-adding, referring only to natural morphosyntactic classes, and unrestricted in scope, and a second one which is due to procedural readjustment rules, potentially feature-changing, strictly local in scope (restricted to apply to single exponents), and occurring in arbitrary sets of morphosyntactic contexts. This means that featural affixation of the readjustment type should behave differently from genuinely affixal featural morphology in all four empirical areas of the project: it should exhibit different linearization mechanisms (for example, it should not be restricted to salient linearization targets, but be bound to occur inside of specific morphemes), no phonologically optimizing allomorphy (under the assumption that this is achieved by selection among allomorphs), less systematic syncretism, and should not obey standard conditions on cooccurrence. The working hypothesis of the project is in line with the adoption of Minimalist DM and Stratal OT that the only strict dichotomy between affix types is phonological (affixes have either Stem-Level or Word-Level phonology, cf. **Q3**), i. e. that the dual-nature hypothesis is wrong with respect to morphology and that there are no substantial differences between segmental/feature-adding and other cases of featural morphology. Thus we expect that systematic differences between segmental vs. featural affixes are completely reducible to their different phonological properties (or listing of stems), and that idiosyncrasies observable with featural affixes have exact counterparts in segmental morphology (cf. **Q1**). An important consequence of this assumption is the prediction that differences should be gradual, i.e. differences between featural affixes based on different phonological features (e.g. consonantal place and tone) should be of the same magnitude as differences between featural and segmental affixes.

3 Bibliography

Aalberse, S. P. (2009). Inflectional Economy and Politeness. PhD thesis, University of Amsterdam.

Adger, D., Béjar, S., and Harbour, D. (2003). Directionality of allomorphy: A reply to Carstairs-McCarthy. Transactions of the Philological Society, 101:109–115.

Adger, D., Béjar, S., and Harbour, D., editors (2008). Phi theory: Phi features across modules and interfaces. Oxford University Press.

Akinlabi, A. (1996). Featural affixation. Journal of Linguistics, 32:239–289.

Akinlabi, A. (2011). Featural affixes. In van Oostendorp, M., Ewen, C. J., Hume, E., and Rice, K., editors, The Blackwell companion to phonology, pages 1945–1971. Wiley-Blackwell., Hoboken, NJ.

Albright, A. and Fuß, E. (2012). Syncretism. In Trommer (2012c), chapter 7, pages 236–288.

Alderete, J. (1999). Morphologically Governed Accent in Optimality Theory. PhD thesis, UMass Amherst.

Alderete, J. and Kochetov, A. (2009). Japanese mimetic palatalization revisited: implications for conflicting directionality. Phonology, 26:369–388.

Andersen, T. (1995). Morphological stratification in Dinka: On the alternations of voice quality, vowel length and tone in the morphology of transitive verbal roots in a monosyllabic language. Studies in African Linguistics, 23:1–63.

Andersen, T. (1999). Consonant alternation and verbal morphology in Mayak (Northern Burun). Afrika und Übersee, 82:65–95.

Andersen, T. (2004). Jumjum phonology. Studies in African Linguistics, 33:133–162.

Anderson, S. R. (1976). On the description of consonant gradation in Fula. Studies in African Linguistics, 7(1):93–136.

Anderson, S. R. (1992). A-Morphous Morphology. Cambridge University Press, Cambridge.

Aronoff, M. (1994). Morphology by itself: Stems and inflectional classes. Cambridge MA: MIT Press.

Baerman, M. (2005). Directionality and (un)natural classes in syncretism. Language, 80(4):807–827.

Baerman, M., Brown, D., and Corbett, G. (2005). The Syntax-Morphology Interface: A Study of Syncretism. Cambridge University Press.

Baker, M. C. (1985). The mirror principle and morphosyntactic explanation. LI, 16:537–576.

Baker, M. C. (2008). The syntax of agreement and concord. Cambridge University Press.

Bank, S. and Trommer, J. (2013a). Learning and the complexity of ø-affixation (accepted for publication). In Baerman, M., Brown, D., and Corbett, G. G., editors, Understanding and measuring morphological complexity. Oxford University Press.

Bank, S. and Trommer, J. (2013b). Paradigm learning and subanalysis complexity (accepted for publication). CLS, 48.

Banksira, D. P. (2011). Featural mobility and phonology-morphology interface in Chaha. In Proceedings of the 2011 annual conference of the Canadian Linguistic Association. http://homes.chass.utoronto.ca/∼cla∼acl/actes2011/actes2011.html.

Béjar, S. and Rezac, M. (2009). Cyclic agree. LI, 40(1):35–73.

Bendor-Samuel, J. (1960). Some problems of segmentation in the phonological analysis of Terena. Word, 16:348–355.

Bermúdez-Otero, R. (2012). The architecture of grammar and the division of labour in exponence. In Trommer (2012c), pages 8–83.

Bobaljik, J. D. (2000). The ins and outs of contextual allomorphy. University of Maryland Working Papers in Linguistics, 10:35–71.

Bonet, E. and Harbour, D. (2012). Contextual allomorphy. In Trommer (2012c), pages 195–235.

Bonet, E., Lloret, M.-R., and Mascaró, J., editors (2013). Understanding Allomorphy: Perspectives from Optimality Theory (to appear). Equinox, London.

Bye, P. (2008). Allomorphy: Selection, not optimization. In Blaho, S., Bye, P., and Krämer, M., editors, Freedom of Analsyis?, pages 63–92. Mouton de Gruyter, Berlin.

Bye, P. and Svenonius, P. (2012). Exponence, phonology, and non-concatenative morphology. In Trommer (2012c), pages 427–495.

Carstairs-McCarthy, A. (1987). Allomorphy in Inflexion. Croom Helm, London.

Carstairs-McCarthy, A. (2001). Grammatically conditioned allomorphy, paradigmatic structure and the ancestry constraint. Transactions of the Philological Society, 99:223–245.

Carstairs-McCarthy, A. (2008). System-congruity and violable constraints in German weak declension. NLLT, 26(775–793).

Clark, M. M. (1990). The tonal system of Igbo. Foris, Dordrecht.

Cutler, A., Hawkins, J. A., and Gilligan, G. (1985). The suffixing preference: A processing explanation. Linguistics, 23(5):723–758.

Cysouw, M. (2003). The Paradigmatic Structure of Person Marking. Oxford University Press.

de Lacy, P. (2012). Morpho-phonological polarity. In Trommer (2012c), pages 121–159.

Dressler, W. (1985). Morphonology: The dynamics of derivation. Karoma, Ann Arbor.

Embick, D. (2010). Localism versus Globalism in Morphology and Phonology. MIT Press, Cambridge MA.

Embick, D. and Halle, M. (2005). The status of stem in morphological theory. In Geerts, T. and Jacobs, H., editors, Proceedings of Going Romance 2003. Amsterdam: John Benjamins.

Embick, D. and Marantz, A. (2008). Architecture and blocking. LI, 39(1):1–53.

Finley, S. (2009). Morphemic harmony as featural correspondence. Lingua, 119(3):478–501.

Fitzpatrick, J. (2004). A concatenative theory of possible affix types. In Salanova, I. A., editor, Papers from EVELIN I. MIT Working Papers in Linguistics.

Flack, K. (2007). Templatic morphology and indexed markedness constraints. LI, 38:4:749–758.

Flynn, D. (2011). Floating yet grounded: Feature transmutation in optimality theory. Canadian Journal of Linguistics/Revue canadienne de linguistique, 56(3):377–402.

Frampton, J. (2002). Syncretism, impoverishment, and the structure of person features. CLS, 38:207–222.

Gerlach, B. (1998). Optimale Klitiksequenzen. Zeitschrift für Sprachwissenschaft, 17:35–91.

Gnanadesikan, A. (1997). Phonology with Ternary Scales. PhD thesis, UMass Amherst.

Goldsmith, J. A. (1976). Autosegmental Phonology. PhD thesis, MIT.

Greenberg, J. H. (1963). Some universals of grammar with special reference to the order of meaningful elements. In Greenberg, J. H., editor, Universals of Language, pages 58–90. MIT Press, Cambridge MA.

Grimshaw, J. (1997). The best clitic: Constraint conflict in morphosyntax. In Haegeman, L., editor, Elements of Grammar: A Handbook in Contemporary Syntactic Theory, pages 169–196. Kluwer, Dordrecht.

Halle, M. (1997). Distributed Morphology: Impoverishment and fission. MITWPL, 30:425–449.

Halle, M. and Marantz, A. (1993). Distributed Morphology and the pieces of inflection. In Hale, K. and Keyser, S. J., editors, The View from Building 20, pages 111–176. MIT Press, Cambridge MA.

Hannahs, S. (2013). Celtic initial mutation: pattern extraction and subcategorisation. Word Structure, 6:1–20.

Harbour, D. (2003). The Kiowa case for feature insertion. NLLT, 21(3):543–578.

Harbour, D. (2007). Morphosemantic number: From Kiowa noun classes to UG number features. Dordrecht: Springer.

Harbour, D. (2008). Discontinuous agreement and the syntax–morphology interface. In Adger, Harbour, and Béjar (2008), pages 185–220.

Harley, H. (2008). When is a syncretism more than a syncretism? impoverishment, metasyncretism and underspecification. In Adger, Harbour, and Béjar (2008), pages 251–294.

Harley, H. (2010). Affixation and the mirror principle. In Folli, R. and Ullbricht, C., editors, Interfaces in Linguistics, pages 166–186. Oxford University Press.

Harris, A. (2009). Exuberant exponence in Batsbi. NLLT, 27:267–303.

Hay, J. (2002). Affix ordering revisited. Language, 78(3):527–555.

Hay, J. and Plag, I. (2004). What constrains possible suffix combinations? on the interaction of grammatical and processing restrictions in derivational morphology. NLLT, 22:565–596.

Henze, D. and Zimmermann, E. (2010). Hierarchy-governed insertion and RFD-markers in Potawatomi. Linguistische Arbeits Berichte, Universität Leipzig, 88:23–63.

Henze, D. and Zimmermann, E. (2011). Collateral feature discharge. WSCLA, 16:74–91.

Hippisley, A., Chumakina, M., Corbett, G., and Brown, D. (2004). Suppletion: Frequency, categories and distribution of stems. Studies in Language, 28(2):387–418.

Hyman, L. M. (2008). Directional asymmetries in the morphology and phonology of words with special reference to Bantu. Linguistics, 46(2):309–350.

Hyman, L. M. and Kisseberth, C. W., editors (1998). Theoretical Aspects of Bantu Tone. CLSI, Standford.

Inkelas, S. (2012). The morphology-phonology connection. BLS, 34.

Inkelas, S. and Caballero, G. (2013). Word construction: Tracing an optimal path through the lexicon (to appear). In Trommer, J., editor, New Tools in the Modelling of Morphological Exponence. Special Issue of *Morphology*.

Inkelas, S. and Zoll, C. (2007). Is grammar dependence real? A comparison between cophonological and indexed constraint approaches to morphologically conditioned phonology. Linguistics, 45(1):133–171.

Iosad, P. (2008). All that glistens is not gold: against autosegmental approaches to initial consonant mutation. Presentation at GLOW 31 Colloquium, Newcastle University, Newcastle upon Tyne, UK.

Iosad, P. (2010). Right at the left edge: Initial consonant mutations in the languages of the world. In Cysouw, M. and Wohlgemuth, J., editors, Rethinking Universals: How Rarities Affect Linguistic Theory, volume 45 of Empirical Approaches to Language Typology, pages 105–138. Berlin: Mouton de Gruyter.

Iosad, P. (2012). Representation and variation in substance-free phonology A case study in Celtic. PhD thesis, University of Tromsø.

Jenks, P. and Rose, S. (2013). Mobile object markers in Moro: The role of tone. Ms., UC Berkeley and UC San Diego.

Julien, M. (2002). Syntactic Heads and Word Formation. Oxford University Press.

Kager, R. (1996). On affix allomorphy and syllable counting. In Kleinhenz, U., editor, Interfaces in Phonology, pages 155–171. Akademie-Verlag, Berlin.

Keine, S. (2012). How complex are complex words? evidence from linearization. Lingua, 122:1268–1281.

Kim, Y. (2008). Topics in the Phonology and Morphology of San Francisco del Mar Huave. PhD thesis, UC Berkeley.

Klein, T. B. (2000). Umlaut in Optimality Theory: A comparative analysis of German and Chamorro. Niemeyer, Tübingen.

Klein, T. B. (2005). Infixation and segmental constraint effects: *um* and *in* in Tagalog, Chamorro, and Toba Batak. Lingua, 115(7):959–995.

Kurisu, K. (2001). The Phonology of Morpheme Realization. PhD thesis, UC Santa Cruz.

Lieber, R. (1987). An Integrated Theory of Autosegmental Processes. State University of New York Press, Albany.

Lieber, R. (1992). Deconstructing Morphology. University of Chicago Press, Chicago.

Loporcaro, M. (2011). Morphological complexity without abstractness: Italo-romance metaphony,. Poznań Studies in Contemporary Linguistics, 47(2):177–202.

Marantz, A. (1982). Re reduplication. LI, 13:483–545.

Marlo, M. R. (2007). The verbal tonology of Lunyala and Lumarachi: two dialects of Luluyia (Bantu, J.30, Kenya). PhD thesis, University of Michigan.

Marlo, M. R., Mwita, L. C., and Paster, M. (2012). Problems in Kuria H tone assignment. Ms., University of Missouri, Kenyatta University, and Pomona College.

Marušič, L. (2003). *aff-stem-ix: On discontinuous morphology. Ms., Stony Brook University.

Mascaró, J. (2007). External allomorphy and lexical representation. Linguistic Inquiry, 38(4):715–735.

Mascaró, J. (2013). Stress-dependent harmony and feature split in Felechosa Asturian. Handout of a talk given at the 21st Manchester Phonology Meeting, Manchester, May 25 2013.

Mc Laughlin, F. (2005). Reduplication and consonant mutation in the Northern Atlantic languages. In Hurch, I. B., editor, Studies on reduplication, pages 111–133. Mouton de Gruyter, Berlin.

McCarthy, J. (1983). Consonantal morphology in the Chaha verb. WCCFL, 2:176–188.

McCarthy, J. (1989). Linear order in phonological representation. LI, 20(1):71–99.

McCarthy, J. and Prince, A. (1993). Prosodic morphology. constraint interaction and satisfaction. ROA 485-1201.

McCarthy, J. J. and Prince, A. (1996). Prosodic morphology 1986. Technical Report 32, Rutgers University Center for Cognitive Science. Available at: http://works.bepress.com/john_j_mccarthy/54.

McQueen, J. M. (1998). Segmentation of continuous speech using phonotactics. Journal of Memory and Language, 39:21–46.

Müller, G. (2005). Syncretism and iconicity in Icelandic noun declensions: A distributed morphology approach.

Yearbook of Morphology 2004, pages 229–271.

Müller, G. (2007). Extended exponence by enrichment: Argument encoding in German, Archi, and Timucua. In Scheffler, T., Tauberer, J., Eilam, A., and Mayol, L., editors, Proceedings of the 30th Annual Penn Linguistics Colloquium, volume 13 of Penn Working Papers in Linguistics, pages 253–266.

Nelson, N. A. (2003). Assymmetric Anchoring. PhD thesis, Rutgers University.

Nevins, A. and Rodrigues, C. (2013). Naturalness biases, 'morphomes', and the romance first person singular (submitted). In Bermúdez-Otero, R. and Luís, A. R., editors, The morphome debate: diagnosing and analysing morphomic patterns. Oxford University Press.

Nevins, A. and Sandalo, F. (2011). Markedness and morphotactics in Kadiweu [+participant] agreement. Morphology, 2(2):351–378.

Nevins, A. I. (2007). The representation of third person and its consequences for person-case effects. NLLT, 25(2):273–313.

Nichols, J. and Bickel, B. (2009). The Autotyp genealogy and geography database: 2009 release. http://www.spw.uzh.ch/autotyp/download/autotyp.release2009.pdf.

Nida, E. A. (1949). Morphology: The Descriptive Analysis of Words. University of Michigan Press, Ann Arbor.

Opitz, A., Regel, S., Müller, G., and Friederici, A. D. (2013). Neurophysiological evidence for morphological underspecification in German strong adjectival inflection. Language, 89(2):231–264.

Paradis, C. (1992). Lexical Phonology and Morphology: The Nominal Classes in Fula. Garland, New York.

Paster, M. (2005). Pulaar verbal extensions and phonologically driven affix order. Yearbook of Morphology, pages 155–199.

Paster, M. (2006). Phonological Conditions on Affixation. PhD thesis, UC Berkeley.

Pater, J. (2009). Morpheme-specific phonology: Constraint indexation and inconsistency resolution. In Parker, S., editor, Phonological argumentation: Essays on evidence and motivation, pages 123–154. Equinox, London.

Pertsova, K. (2011). Grounding systematic syncretism in learning. LI, 42(2):225–266.

Pinker, S. and Prince, A. (1994). Regular and irregular morphology and the psychological status of rules of grammar. In Lima, S. D., Corrigan, R. L., and Iverson, G. K., editors, The Reality of Linguistic Rules. John Benjamins, Philadelphia.

Plag, I. and Baayen, H. (2009). Suffix ordering and morphological processing. Language, 85(1):109–152.

Preminger, O. (2011). Agreement as a Fallible Operation. PhD thesis,. PhD thesis, MIT.

Prince, A. and Smolensky, P. (1993). Optimality Theory: Constraint interaction in generative grammars. Technical reports of the Rutgers University Center of Cognitive Science.

Reilly, E. (2002). A survey of Texistepec Popoluca verbal morphology. Master's thesis, Carleton College, Northfield, Minnesota.

Rice, K. (2000). Morpheme Order and Semantic Scope: Word Formation in the Athabaskan Verb. Cambridge University Press.

Rose, S. (2007). Chaha (Gurage) morphology. In Kaye, A. S., editor, Morphologies of Asia and Africa, pages 399–424. Eisenbraums.

Rumelhart, D. and McClelland, J. (1986). On learning the past-tenses of English verbs. In Rumelhart, D. and McClelland, J., editors, Parallel distributed processing: Exploration in the microstructure of cognition, volume 2: Psychological and biological models. MIT Press, Cambridge, MA.

Ryan, K. M. (2010). Variable affix order: Grammar and learning. Language, 86(4):758–791.

Saba Kirchner, J. (2007). The phonology of lexical underspecification. Ms., UC Santa Cruz.

Saffran, J. R., Newport, E., and Aslin, R. N. (1996). Statistical learning by 8-month old infants. Science, 274:1926–1928.

Samek-Lodovici, V. (1992). A unified analysis of crosslinguistic morphological gemination. In Proceedings of CONSOLE 1, pages 265–283. Utrecht.

Schuh, R. G. (1989). Long vowels and diphthongs in Miya and Hausa. In Newman, P. and Botne, R., editors, Current Approaches to African Linguistics, pages 35–43. Foris Publications, Dordrecht.

Stiebels, B. (2003). Transparent, restricted and opaque affix orders. In Junghanns, U. and Szucsich, L., editors, Syntactic structures and morphological information, pages 283–315. Mouton de Gruyter, Berlin.

Stump, G. T. (2001a). Inflection. In Spencer, A. and Zwicky, A. M., editors, The Handbook of Morphology,

pages 13–43. Wiley Blackwell, London.

Stump, G. T. (2001b). Inflectional Morphology. Cambridge University Press.

Tranel, B. (1995). On the status of universal association conventions: Evidence from Mixteco. BLS, 21:299–312.

Trommer, J. (1997). Eine Theorie der albanischen Verbflexion in **mo_lex**. M.A. thesis, University of Osnabrück.

Trommer, J. (1999a). Morphology consuming syntax' resources: Generation and parsing in a minimalist version of Distributed Morphology. In Retoré, C. and Stabler, E., editors, Proceedings of the ESSLI Workshop on Resource Logics and Minimalist Grammars.

Trommer, J. (1999b). Natural language allomorphy in **mo_lex**. In Proceedings of Vextal Conference, Venedig, November 1999.

Trommer, J. (2001). A hybrid account of affix order. CLS (Panels), 37:469–480.

Trommer, J. (2002). The post-syntactic morphology of the Albanian pre-posed article: Evidence for Distributed Morphology. Balkanistica, 15:349–364.

Trommer, J. (2003a). Direction marking as agreement. In Junghanns, U. and Szucsich, L., editors, Syntactic Structures and Morphological Information, pages 317–341. Mouton de Gruyter, Berlin and New York.

Trommer, J. (2003b). Distributed Optimality. PhD thesis, University of Potsdam.

Trommer, J. (2003c). Feature (non-)insertion in a minimalist approach to spellout. In Proceedings of CLS 39, pages 469–480.

Trommer, J. (2003d). Hungarian has no portmanteau agreement. In Siptár, P. and Pinón, C., editors, Approaches to Hungarian, volume 9, pages 283–302. Akadémiai Kiadó.

Trommer, J. (2003e). The interaction of morphology and syntax in affix order. Yearbook of Morphology 2002, pages 283–324.

Trommer, J. (2003f). Participant reduction and two-level markedness. In Spenader, J., Eriksson, A., and Östen Dahl, editors, Proceedings of the Workshop on Variation within Optimality Theory, pages 101–108.

Trommer, J. (2005). Amharic roots and patterns. Talk given at "Flexionstheorie im Osten", Leipzig, July 2005; slides available under http://www.uni-leipzig.de/~jtrommer/rup.pdf.

Trommer, J. (2006a). Direction marking and case in Menominee. In Kulikov, L., Malchukov, A., and de Swart, P., editors, Case, Valence and Transitivity, pages 91–114. John Benjamins, Amsterdem.

Trommer, J. (2006b). Head-level and chain-level constraints on spellout. In Costa, J. and Silva, M. C. F., editors, Studies on Agreement, pages 261–281. John Benjamins, Amsterdam.

Trommer, J. (2006c). Hierarchy-based competition and emergence of two-argument agreement in Dumi. Linguistics, 44(5):1011–1057.

Trommer, J. (2006d). Plural insertion is constructed plural. Linguistische Arbeits Berichte, Universität Leipzig, 84:197–228.

Trommer, J. (2007). Clitic-agreement doubling in Yurok. Linguistische Arbeits Berichte, Universität Leipzig, 85:129–172.

Trommer, J. (2008a). Coherence in affix order. Zeitschrift für Sprachwissenschaft, 27:99–140.

Trommer, J. (2008b). A feature-geometric approach to Amharic verb classes. In Bachrach, A. and Nevins, A., editors, Inflectional Identity, pages 206–236. Oxford University Press, Oxford.

Trommer, J. (2008c). Third-person marking in Menominee. In Adger, Harbour, and Béjar (2008), pages 221–250.

Trommer, J. (2010). Paradigmatic generalization of morphemes. Linguistische Arbeits Berichte, Universität Leipzig, 88:227–246.

Trommer, J. (2011a). ø-agreement in Turkana. In Richards, M., Bornkessel, I., and Malchukov, A., editors, Scales. Mouton De Gruyter, Berlin & New York.

Trommer, J. (2011b). Phonological Aspects of Western Nilotic Mutation Morphology. Habilitation Thesis, University of Leipzig.

Trommer, J. (2011c). Phonological sensitivity to morphological structure. In van Oostendorp, M., Ewen, C. J., and Rice, K. D., editors, The Blackwell Companion to Phonology, chapter 103, pages 2464–2489. London: Wiley Blackwell.

Trommer, J. (2012a). Constraints on multiple-feature mutation. Lingua, 122(11):1182–1192.

Trommer, J. (2012b). Moraic suffixes and circumfixes in Dinka. Ms., Universität Leipzig.

Trommer, J., editor (2012c). The Morphology and Phonology of Exponence. Oxford University Press.

Trommer, J. (2012d). ø-exponence. In Trommer (2012c), pages 326–354.

Trommer, J. (2013a). Moraic prefixes and suffixes in Anywa. Ms.

Trommer, J. (2013b). Paradigmatic generalization of morphemes (accepted for publication). In Trommer, J., editor, New theoretical tools in the modeling of exponence. Special Issue of *Morphology*.

Trommer, J. (2013c). Päri consonant mutation as defective root node affixation (submitted). In Cairns, C. and Raimy, E., editors, The Segment in Phonology and Phonetics. Wiley Blackwell, London.

Trommer, J. (2013d). Stress uniformity in Albanian: Morphological arguments for cyclicity. LI, 44(1):109–143.

Trommer, J. (2013e). Syllable-counting allomorphy by prosodic templates (submitted). In Bonet, Lloret, and Mascaró (2013).

Trommer, J. and Müller, G., editors (2006). Subanalysis of Argument Encoding in Distributed Morphology, volume 84 of Linguistische Arbeits Berichte. Institut für Linguistik: Universität Leipzig.

Trommer, J. and Zimmermann, E. (2011). Overwriting as optimization. NLLT, 29(2):561–580.

Trommer, J. and Zimmermann, E. (2013). Portmanteaus as generalized templates. In Renner, V., editor, Cross-disciplinary Perspectives on Lexical Blending, pages 233–258. De Gruyter, Berlin.

van Oostendorp, M. (2006). A theory of morphosyntactic colours. Ms., Meertens Institute, Amsterdam. Available under: http://egg.auf.net/06/docs/Hdt%20Oostendorp%20coulours.pdf.

van Oostendorp, M. (2008). Incomplete devoicing in formal phonology. Lingua, 118(9):1362–1374.

Wiese, R. (1994). Phonological vs. morphological rules: on German umlaut and ablaut. Journal of Linguistics, 32:113–135.

Wolf, M. (2007). For an autosegmental theory of mutation. In Bateman, L., O'Keefe, M., Reilly, E., and Werle, A., editors, University of Massachusetts Occasional Papers in Linguistics 32: Papers in Optimality Theory III, pages 315–404. Amherst: GLSA.

Wolf, M. (2013). Lexical insertion occurs in the phonological component (to appear). In Bonet, Lloret, and Mascaró (2013).

Wunderlich, D. (1996). A minimalist model of inflectional morphology. In Wilder, C., Bierwisch, M., and Gärtner, H.-M., editors, The Role of Economy Principles in Linguistic Theory, pages 267–298. Akademie-Verlag, Berlin.

Wunderlich, D. (2003). A minimalist view on inflectional paradigms: the expression of person and number in subjects and objects. Ms., Universität Düsseldorf.

Wunderlich, D. and Fabri, R. (1995). Minimalist morphology: An approach to inflection. Zeitschrift für Sprachwissenschaft, 20:236–294.

Yu, A. C. L. (2007). A Natural History of Infixation. Oxford: Oxford University Press.

Zimmermann, E. (2009). Metathesis without reordering. Master's thesis, University of Leipzig.

Zimmermann, E. (2013a). Affix copying in Kiranti. In Enrico Boone, K. L. and Schulpen, M., editors, Proceedings of ConSOLE XIX, http://media.leidenuniv.nl/legacy/console19-proceedings-zimmermann.pdf.

Zimmermann, E. (2013b). Affixation of segment-sized units: the case of Southern Sierra Miwok (submitted). BLS, 38.

Zimmermann, E. (2013c). Hierarchy-governed affix order in Eastern Kiranti (accepted for publication). In Manova, S., editor, Affix ordering across languages and frameworks. Oxford University Press.

Zimmermann, E. (2013d). Non-concatenative allomorphy is generalized prosodic affixation: The case of Upriver Halkomelem (accepted for publication). Lingua.

Zimmermann, E. (2013e). Vowel deletion as mora usurpation: the case of Yine. Phonology, 30:125–163.

Zimmermann, E. and Trommer, J. (2013a). Generalized mora affixation and quantity-manipulating morphology (submitted). Phonology.

Zimmermann, E. and Trommer, J. (2013b). How to linearize morphological weight. Linguistische Arbeits Berichte, Universität Leipzig, 90:123–162.

Zimmermann, E. and Trommer, J. (2013c). Inflectional exponence (accepted for publication). In Baerman, M., editor, Oxford Handbook of Inflection. Oxford University Press, Oxford.

Zimmermann, E. and Trommer, J. (2013d). A preliminary crosslinguistic survey of featural affixation. Ms., Univerity of Leipzig.

Zoll, C. (1996). Parsing below the Segment in a Constraint-based Framework. PhD thesis, UC Berkeley.

Zoll, C. (1997). Conflicting directionality. Phonology, 14:263–286.

Zoll, C. (2003). Optimal tone mapping. LI, 34(2):225–268.

Contents