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Prefix independence: typology and theory

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Noah Eli Elkins

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ABSTRACT OF THE THESIS

Prefix independence: typology and theory

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Noah Eli Elkins

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Professor Bruce Hayes, Co-Chair

Professor Kie Zuraw, Co-Chair

The prefix-suffix asymmetry is an imbalance in the application of phonological processes whereby prefixes are less phonologically cohering to their roots than suffixes. This thesis presents a large-scale typological survey of processes which are sensitive to this asymmetry. Results suggest that prefixes' relative phonological aloofness (*independence*) constitutes a widespread and robust generalization, perhaps more so than previously realized.

In terms of analysis, I argue that the key concept is the special *prominence* of initial syllables, supported by much evidence from phonetics, psycholinguistics, and phonology itself. My formal treatment consists of constraint families that serve to support such prominence. I propose that a highly-ranked CRISPEDGE constraint (Itô & Mester 1999) relativized to the left edge of root-initial syllables can account for much of the typological data. This proposal rests on the fact that root-initial syllables constitute a privileged position in phonological grammars (e.g.

Beckman 1998, Becker et al. 2012), and so to maximize the efficacy of the root-initial percept, segments are hesitant to share their features leftward to target prefixes – and vice versa – as this would blur the strong root-initial boundary.

The remaining set of phenomena that implement root-initial prominence are prosodic. For these, I argue that prosodic words, which are the domain for such processes, are preferentially aligned to the left edges of *roots*, as opposed to entire morphological words. This has a similar effect, namely preserving the environments in which root-initial segments are articulated most robustly. A preferential ranking of ALIGN-L(Root, PrWd) ≫ ALIGN-R(Root, PrWd) is proposed, instantiating a cross-linguistic bias.

The thesis of Noah Eli Elkins is approved.

Claire Moore-Cantwell

Bruce Hayes, Committee Co-Chair

Kie Zuraw, Committee Co-Chair

University of California, Los Angeles

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1 Introduction

In phonology, the *prefix-suffix asymmetry* is an imbalance in the application of phonological processes by which prefixes are far less likely than suffixes to cohere to their roots. Cross-linguistically, prefixes are both unable to condition and unable to be affected by processes which otherwise occur without incident within the root and/or across the root-suffix boundary. Experimental studies have found that speakers from a variety of language backgrounds are sensitive to this asymmetry even for phonological processes those languages lack (White et al. 2018). For the purposes of this thesis, I refer to this global exclusionary characteristic of prefixes as *prefix independence*. Prefixes' inability to affect or be targeted by root phonology has been documented for a variety of processes, from strictly local phonotactic repairs like hiatus resolution, to more long-distance dependencies like vowel harmony, to word-level prosodic demands like stress assignment.

A characteristic example of prefix independence, from the language **Lango** (Southern Nilotic, South Sudan), is given below. In terms of the Nilotic language family of which it is a member, Lango has a typical 10-vowel system, with five [+ATR] vowels [i e ə o u], and five corresponding [–ATR] vowels [ɪ ɛ a ɔ ʊ]. Vowel harmony in Lango is of the dominant-recessive type (Halle & Vergnaud 1981), whereby [+ATR] serves as the dominant value: the [+ATR] vowel feature is spread from both suffix onto root or vice versa (1a), however prefixes cannot undergo or condition vowel harmony, despite its propagation within the domain of the root+suffix (1b):

(1) Lango ATR harmony is opaque to prefixes (Noonan 1992)

a. /ɲîm + á/ → ɲímə̂ (root to suffix spreading of [+ATR])
forehead-1SA
'my forehead'

/lɛ̂b + í/ → lébî (suffix to root spreading of [+ATR])
tongue-1SA
'my tongue'

b. /ɛ̆ + bìt + ɔ̀ / → ɛ̀bítò *èbítò ([–ATR] prefix)
3s-lure-PERF
'(that) he lured'

/ĭ + lʊ̀b + ɔ̀/ → ìlʊ́bɔ̀ *ìlúbò ([+ATR] prefix)
2s-follow-PERF
'you followed'

Another example comes from the stress assignment pattern of **Mangap-Mbula** (Austronesian, Papua New Guinea). This language has default initial stress (2a), but prefixes are not considered for stress placement despite constituting the word's initial syllable (2b); this is realized as a lack of initial stress on prefixed words. Suffixes may receive secondary stress if the word is sufficiently long, though certain suffixes and enclitics always surface with secondary stress.

(2) Mangap-Mbula prefixes are not given initial stress (Bugenhagen 1991)

a. áβal 'mountain'
bóːβo 'be.staying'
ménder 'stand'
mólolo 'long (of plural objects)'
pópsopsop 'be.fishing'
páːza-ŋà-na 'something planted (plant-NOM-GIV)'

b. aŋ-bóːβo '1S-be.staying'
ti-ménder '3PL-stand'
ti-pómbol '3PL-be.strong'

This thesis has two main goals. The first is to identify cases of prefix or suffix independence, and demonstrate that prefix independence is far more widespread. Among languages with prefix independence, a survey of those processes which are sensitive to it is presented. While much research has been written on language- and family-specific processes that are opaque to prefixes, there is currently no thorough survey of all the possible forms prefix independence can take. Yet without such a survey, questions concerning the origin of such an asymmetric system and its maintenance, as well as how best to analyze the system in our current frameworks, suffer from a lack of empirical foundation. This paper, then, represents the results of a comprehensive survey of differential cohesion of prefixes versus suffixes. Over 85 languages are retrieved, from a diverse range of language families and geographical locations. Results suggest that this asymmetry is extremely widespread and robust; a proposed example of non-cohesion targeting suffixes instead is explainable through other mechanisms (Kabardian; see §4.3).

The second goal of this thesis is to explore a theoretical account of why this asymmetry should exist, using the typological findings as a metric of evaluation. The fact that prefix independence is so widespread means that any framework attempting to capture it ought to be grounded in some asymmetric bias of the language faculty. In the current theoretical landscape, there are three main frameworks of morphophonological cohesion, which I will briefly taxonomize below in §1.1. While these frameworks are not intrinsically biased toward particular asymmetric structures such as the prefix-suffix asymmetry, the following can be used to generate them via the motivated stipulation of asymmetric constraint rankings or level orderings. I arrive at the conclusion that *initial prominence* is a more preferable way to categorize the generalizations, as it is motivated by perceptual and psycholinguistic pressures, and moreover does not encounter issues faced by other cohesion frameworks.

1.1 A taxonomy of morphophonological cohesion

The first method of cohesion can be described as **order of construction**. Under such a theory, suffixes are argued to be more cohering because they attach to the root first in any given derivation; conversely, prefixes are less cohering because they attach at a later stage, following the suffixes. The framework which encapsulates this manner of derivation is Lexical Phonology and Morphology (LPM, Kiparsky 1982 *et seq.*), and its descendant Stratal OT (Kiparsky 2000, Bermúdez-Otero 2003, among others). Using level orderings, the Lango and Mangap-Mbula data above could be derived by having suffixes attach first to undergo harmony or receive stress, and only after these processes have applied would prefixes attach. However, there are numerous cases in which prefixes *must* attach first by morphosyntactic criteria, but still act as less phonologically integrated. Level ordering frameworks, then, are susceptible to *bracketing paradoxes* (Cohn 1989, Pesetsky 1985, Williams 1981, among others), in which there is disagreement between morphosyntactic attachment level and phonological integration. An oft-cited example of such a paradox in English (e.g. from Cohn 1989) is the word *ungrammaticality*, in which the prefix and root form a morphological constituent (an adjective) first, which must be selected for by the nominalizing suffix *-ity* only afterward via its subcategorization, yet the suffix is more integrated to the root phonologically by virtue of its triggering stress shift. For an order-of-construction framework, then, the asymmetrical stipulation that certain affixes must always attach first is actually problematic.

The second framework of morphophonological cohesion is **faithfulness to a base**, where a base is defined as some surface form with which some derived form is in correspondence (e.g. Benua 1995). Under this theory, affixes are unwilling to cause their roots of attachment to undergo change because certain constraints maintain the identity of that root under concatenation; affixes causing their roots to change, on the other hand, can be accomplished by some wellformedness requirement outranking that demand. The main framework under which affixed forms correspond to their respective bases is Transderivational Output-Output Correspondence (Tr-OO, Benua 1997 *et seq.*), which proposes constraints enforcing faithfulness to bases. In a development of this framework, Bakovic (2000) relativizes these same constraints to particular affixes (i.e. BP-CORR, reflecting the relationship between a base and its prefixed form, and BS-CORR, which does the same, but between the base and its suffixed form). Under this framework, then, prefixes in Lango or Mangap-Mbula could be argued to be independent with a universally preferred ranking of BP-FAITH ≫ BS-FAITH, such that whatever markedness constraint drives cohesion (such as a stress assignment rule or harmony process) targets either both equally, or only suffixes but not prefixes. I am here defining a "universally preferred ranking" as a constraint hierarchy which, while logically reversible due to the theoretical capacity of Optimality Theory, is cross-linguistically so common that it is almost never actually reversed. It may also serve as the default ranking an L1 learner stores before learning a more sophisticated ranking with more evidence at a later stage of phonological acquisition. The above ranking of BP-FAITH ≫ BS-FAITH is somewhat weak because it takes the typology alone to be enough evidence for its proposal; these universally preferred rankings ought to be grounded in articulatory-phonetic or perceptual motivations to support the typological preference (as is argued by, e.g., Kager 1999:11). This means that the reverse of the above ranking should also be possible, which may lead to incorrect predictions. For example, Bakovic (2000) notes that these constraints can be reranked to produce unattested languages, for example languages in which prefixes trigger dominant vowel harmony. OO-Correspondence likewise encounters the *missing base problem* (e.g. Mascaró 2016), in which some surface form shows faithfulness to a base, however that base is never a stand-alone output form: the OO constraints are therefore unable to be used to evaluate such a form.

The last methods of morphophonological cohesion are the **theories of domains**, in which phonological processes are delimited by the boundaries of hierarchically-ordered prosodic domains. Under this theory, some element's cohesion to some other element means that it is necessarily included into that element's domain. Material thus included is then targeted by certain markedness constraints which are specifically evaluated over only that material which falls within that domain. In such a way, alignment creates the boundaries within which observable phonology takes place. A widely adopted theoretical mechanism achieving the alignment of prosodic and morphological categories is the framework of Generalized Alignment (GA, McCarthy & Prince 1993b), which provides a constraint schema dictating which morphological domains become matched by which prosodic domains. Asymmetries like prefix independence can be accounted for under Generalized Alignment via an asymmetric ranking. For example, the delimiting of featural propagation to the prosodic word, to exclusion of the prefix (as is seen in (1) for Lango), or the assignment of stress to only the prosodic word (as is seen in (2) for Mangap-Mbula), can be achieved through ALIGN-L(Root, PrWd) ≫ PARSE where PARSE enforces integration into the PrWd domain.

It becomes apparent from the above taxonomy, then, that all of the frameworks which account for morphophonological cohesion can generate asymmetries via particular constraint rankings or level orderings. Certain frameworks, however – such as LPM and OO-Correspondence – encounter issues which make them less suitable for motivating prefix independence. Of course, this is not to say that those frameworks are inadequate for accounting for language data *at all*, or that it is incorrect to posit that certain constraint families be necessary, or rankings be biased toward or against occurring; the objection put forth here is that these two frameworks do not inherently contain principled derivations for those requirements or biases. It will be shown in the following sections that appealing to prosodic domains (for the purposes of maintaining initial prominence, explained below) actually has a principled motivation, and will be adopted to account for prefix independence data (see section §2.6.1).

Ideally, phonological theory would allow for prefix independence to arise on account of some inherent asymmetry of the language faculty, since the following typology will demonstrate that prefix independence itself is both widespread and sensitive to essentially every domain of phonology. In the sections to follow, I will show how appealing to a positional bias, namely **initial prominence**, can provide a new way to capture prefix independence data. Initial prominence is a principle grounded in a bias of the language faculty which privileges the left edges of roots, and is therefore less stipulative than many of the above models: it is firstly motivated by articulatory-phonetic and psycholinguistic pressures, and secondly it does not encounter issues inherent to other frameworks, such as the missing base problem for OO or bracketing paradoxes for LPM.

1.2 Overview of initial prominence

This section will briefly describe a suite of evidence (besides the existence of the prefix-suffix asymmetry) that initial prominence is more prevalent and less marked than non-initial or final prominence. The "strength" of initial positions, as opposed to non-initial or final positions, is manifested in a variety of ways, which gives rise to a natural asymmetry: segments and syllables at these positions are articulatorily robust, and often resistant to phonological alternation, two factors that make them particularly perceptually salient. I would argue that such salience serves as a boundary signal indicating the onset of the most informationally beneficial portion of the word, namely the root.

Firstly, it has been shown by various researchers that initial syllables are protected from alternation cross-linguistically (e.g. Alber 2001, Beckman 1998, Casali 1998). A recent typological survey conducted by Becker et al. (2012) demonstrates that across many unrelated languages, alternations are sensitive to phonological size, and are more likely to target non-initial syllables over initial syllables (or monosyllables). Their artificial grammar learning studies of native speakers of English (whose laryngeal alternation of *leaf* ~ *leaves*, which targets monosyllables more than polysyllables, runs counter to the typological generalization) nonetheless resulted in the protection of novel forms' root-initial syllables from alternation over non-initial ones. This fact is attributed to an underlying analytic UG bias of initial syllable faithfulness.

A typological survey by Houlihan (1975) shows that languages tend to have more phonemic contrasts word-initially, and more neutralizations word-finally. In certain languages, particular contrasts are only licensed in initial position (e.g. Mongolian, Turkic, and Yokuts rounded vowels (Kaun 1993, Steriade 1979)). Wedel et al. (2019) confirm that crosslinguistically, neutralizations are more likely to target the ends of lexical domains rather than the beginnings, as phonetic cues at the beginnings of lexical domains contribute more information than those presented later (e.g. Wedel et al. 2018, Aylett & Turk 2004). Indeed, since Keating et al. (2004), it has been demonstrated that articulatory strength at initial positions is greater than at medial or final position across languages. The perceptual salience of initial syllables aids lexical access: the more robust the signal word-initially, the easier for the listener to retrieve the item from the mental lexicon (Fougeron & Keating 1997).

The reason why these above characteristics must necessarily be afforded to initial positions comes from their robust informational cues. In the domain of language processing, experimentation informed by the "cohort model" (such as performed by Gaskell & Marslen-Wilson 2002, Marslen-Wilson 1987) has shown that after exposure to just the first 100-150 milliseconds of a word (equivalent to the first few phonemes), a lexical search has already been limited to a small cohort of candidates. Maximizing the salience of such a position phonetically and resisting its alternation in the phonology, then, serve as important cues for word recognition.

Prefixes, however, are generally not subject to such salience: a line of psycholinguistic research has indicated that prefixed words are actually processed via *prefix stripping*, whereby a prefixed word is interpreted by its root first, the prefix being reinterpreted only after the root has been processed (Taft & Forster 1975, Taft 1994; though see Schreuder & Baayen 1994). Additionally, because prefixes tend to pattern like other affixes in terms of their smaller phonemic inventories (Bybee 2004, Willerman 1994), they do not necessarily convey the same informational signals as root-initial segments. Therefore, the initial position that is most likely protected from alternation, most articulatorily salient, and most informationally beneficial to listeners, is the *root*-initial position, not word-initial. This distinction is crucial to not only understanding prefix independence, but also in examining past data and guiding future research: if a word excludes prefixes, the word boundary and the root boundary coincide; therefore the definition of "initial" is ambiguous (indeed, Becker et al. (2012) do not include prefixes in any of their experimental stimuli, and do not make distinctions between unprefixed roots and other word types in their typological discussion).

In sum, converging evidence from phonological typology, articulatory phonetics, and psycholinguistics shows that root-initial syllables have a more salient position in the lexicon than non-initial or final syllables, all else being equal. These characteristics are afforded to initial positions in order to make the root boundary clearer, which aids in perception and lexical access. If the root boundary were not a clear signal to the perceiver, then the chance of misperception would increase. The positional asymmetry this pressure gives rise to is helpful in understanding prefix independence: if prefixes are unable to affect the identity of salient root-initial material – and vice versa (as will shortly be demonstrated, see §2.2.1) – then they should inevitably be phonologically independent. I will argue below that it is precisely this maximization of the root-initial percept that makes prefixes unwilling to affect or undergo root phonology, as this would blur the strong root-initial boundary.

1.3 Organization of the thesis

In §2 to follow, I will show how the phonologization of root-initial percept maximization can account for prefix independence data. I suggest that in order to analyze prefix independence in such a way, a twofold approach is needed: one method to account for the inability of features to be shared between roots and prefixes, and one method to account for the prosodic invariance of roots under prefixation. Firstly, to account for the inability of roots to trigger change in prefixes I implement a highly-ranked CRISPEDGE constraint (Itô & Mester 1999) relativized to the left edges of root-initial syllables. The details of this of this proposal are discussed in §2.2.1. Secondly, to account for the characteristic prosodic invariance of roots under prefixation, I will make use of a universally preferred ranking of ALIGN-L(Root, PrWd) ≫ ALIGN-R(Root, PrWd). The details of this proposal are discussed in §2.6.1. Both of these mechanisms are shown to be phonologized instantiations of different properties afforded specifically to initial positions, and follow naturally from the assumption that the robustness of initial positions aids lexical access.

In §3 I present cases of languages which, while all suffixes cohere to root phonology as would be expected, only a particular class of prefixes, not all, are independent. This typically falls along a morphosyntactic division: in certain languages, only derivational prefixes are independent; in other languages, only inflectional prefixes are independent. I use a subcategorization analysis informed by Bennet (2018) to account for these patterns.

Lastly, in §4 I give a typology of other logically possible morphophonological cohesion systems besides prefix independence: symmetrical application of phonology to both affix types, phonology restricted to roots (i.e. opaque to both affix types equally), and suffix independence. Suffix independence, while logically possible, should be rare or otherwise more marked than prefix independence and other symmetrical systems, as it disobeys the root-initial prominence generalization and is therefore less beneficial to perceivers with respect to lexical access. I examine Kabardian (NW Caucasian) – the only language I have found argued to have true suffix independence – and show how aspects of its proposed suffix independence are actually illusory.

2 A typology of prefix independence

This section presents the cross-linguistic data on differential cohesion of prefixes versus suffixes, given in order of process. I have attempted to reproduce the data from an expressly theory-neutral standpoint, with an attempt to simply show the data as given by the sources, and to evaluate from a theoretical perspective only afterward. All analyses to follow are supported by and were checked using software: either recursive constraint demotion (Tesar & Smolensky 2000) as implemented in OTSoft (Hayes et al. 2013); or Microsoft Excel's Solver function (Fylstra et al. 1998) within a Maximum Entropy Harmonic Grammar model (Goldwater & Johnson 2003; Smolensky 1986).

2.1 Methodology

Firstly, a comprehensive typology of prefix independence must draw on as many languages and language families as possible. Ideally, the typological survey will include languages from a variety of families across all continents, without relying too heavily on well-documented or widely-spoken languages, which may bias our judgements. In addition, an ideal typology needs an exhaustive list of all of the phonological processes which are sensitive to the prefix-suffix asymmetry.

A helpful starting point was Downing & Kadenge (2020), which provides a brief survey of 8 languages which demonstrate the prefix-suffix asymmetry, and provides case studies on two of them (Shona and Limbu). This paper builds a more wide-reaching survey, though all languages explicitly mentioned in Downing & Kadenge (2020) are incorporated into the present typology.

The literature on language sampling, which sets forth several criteria for assembling a cross-linguistic typological survey, has been growing for many years (Bakker 2010, Rijkhoff 1999, Rijkhoff & Bakker 1998, Rijkhoff et al. 1993, Perkins 1989). Nonetheless, size and diversity have remained the most consistently valued features of a sufficiently-sampled typology. Rijkhoff et al. (1993) have a particularly detailed algorithm for obtaining a sufficient sample: for a typology of any given size, the algorithm provides the researcher with the appropriate genetic family (and specific phyla) from which to sample, calculated by a diversity score informed by the size and relative intra-phylum diversity of a family. The appropriate number of members from each family or phylum is also specified, and changes depending on the intended scope of the survey. This algorithm, then, served as a guide for my typological search, and my findings roughly conform, though with some important differences. First, many large language families simply lack prefixes. Such families (Dravidian, Mongolic, Pama-Nyungan, Tungusic, Turkic, etc.) are necessarily excluded, as the question of prefix independence becomes moot when there are no prefixes with which to contrast the phonological behavior of other affixes.

This prevalence of suffixing-only languages is symptomatic of the suffixing preference in morphology. Cross-linguistically, languages tend to be more suffixing than prefixing (Hupp et al. 2009, Cysouw 2006, Bybee 1990, Hawkins & Gilligan 1988, Greenberg 1957). The connection between these two phenomena – the suffixing preference in the morphological typology and prefix independence in the phonological typology – has been argued to be causal: because suffixes are more common, even within languages that have both, they become more integrated to the root and form a “stem” unit distinct from prefixes which then becomes the locus for phonological processes (see Hyman 2008, Himmelmann 2014 for more discussion; I will not make claims about the validity of the causation hypothesis here).[1] Even without suffixing-only families, however, my typology is quite large (>85 languages), and contains members from many language families across five continents. All of the data come from previously published descriptive grammars and journal articles.

A second typological issue concerns defining what a prefix is. As will be shown in the survey, prefixes often behave differently than other affixes in the nature of their cohesion such that they pattern more with proclitics, and in some cases prefixed roots exhibit the behavior of compounds. This does not mean, however, that prefixes are subsumed by either of these categories. Clitics are specifically phonologically *deficient* items which rely on an adjacent host to be pronounceable. While affixes may be bound morphemes, they are not necessarily deficient, and their reliance on being bound to root morphemes is systematic: affixes are highly idiosyncratic and selective of their root of attachment, whereas clitics attach to any host based on the syntactic structure (Anderson 2005, Zwicky & Pullum 1983). Additionally, while a clitic+host is not a syntactic constituent, the affix+root combination *is*; therefore, clitics can only be attached postlexically via syntactic operations, whereas affixes are built during the lexical stage via morphophonological operations.

The second case, of whether prefixes are simply compounding elements, is somewhat more difficult to pin down. Prefixes in many languages may carry more lexical or semantic content than a typical affix, though this is not required for prefix independence: even inflectional prefixes may be treated as phonologically independent without bearing any particular lexico-semantic weight. Differentiating features between prefixes and compounding roots have been

[1] The Evolutionary Phonology approach to historical linguistics (Blevins 2004), by which synchronic phonological patterns across many languages are argued to reflect similar sound change processes over time, would perhaps support this same idea that the cross-linguistic prevalence of prefix independence results from similar diachronic phonetic/prosodic pressures.

proposed, though there is no consensus: Scalise (1984)'s typology puts forth the claim that prefixes are distinct based on two characteristics: (1) prefix order is fixed whereas root order is more lenient, and (2) that only roots can be factored out of conjunction phrases. Both these claims are shown by Peperkamp (1997), however, to not succeed in capturing language data from English. Indeed, any cross-linguistic, categorical differences between true compounding roots and prefixes which display the behavior of such continue to elude adequate description. In this thesis, I will present prefixes in my examples as true prefixes rather than compounding elements when the authors from whose work I have cited the data present them as such.

The final issue at hand is what constitutes a case of prefix non-cohesion. Non-cohesion is observed if there is a documented phonological process for a particular language which either is not triggered by the prefix but is otherwise triggered by a root or suffix, or if there is propagation of a phonological process from suffixes to root – or vice versa – but not onto prefixes. The following sections outline these processes for which prefixes are more phonologically aloof than suffixes.

2.2 Affix control

Perhaps the most striking asymmetry in the application of phonological processes to suffixes compared with prefixes is *affix control*. Affix control is a specific subtype of dominant-recessive harmony systems, in which a dominant feature specified in some affix spreads to change those corresponding recessive features in root segments (but the same feature in a root could also spread to recessive affix vowels). Affix-controlled harmony systems as an exemplar of the prefix-suffix asymmetry in phonology has been widely observed (White et al. 2018, Nevins 2010, Finley & Badecker 2009), due to the fact that there are *no* documented cases of affix control systems in which prefixes condition dominant harmony (Hansson 2001, Bakovic 2000). Affix control is a feature of both vowel harmony and consonant harmony systems, and in neither do there exist prefix triggers.

One of the better examined language families which exhibit prefix independence in affix control is Nilotic. Nilotic languages typically have 9- or 10-vowel systems, with either all or all non-low vowels participating in dominant [+ATR] harmony. All three branches of Nilotic (Western, Eastern, and Southern), exhibit this dominant harmony, in which roots and affixes agree with respect to the [ATR] feature of the root; in some languages, however, dominant suffixes specified for [+ATR] will condition [+ATR] in underlyingly [–ATR] roots. An example of this comes from **Maasai** (Eastern Nilotic, Tanzania). In this language, the vowels [i e o u] are [+ATR], and [ɪ ɛ ɑ ɔ ʊ] are [–ATR]; [ɑ] lacks a [+ATR] counterpart and is opaque. Maasai roots may be either dominant or recessive, and all affixes cohere symmetrically, as shown in (3a,b) below; dominant suffixes condition change in roots, but prefixes are unable to (3c). Note that in (3c), the meaningless theme vowel "prefix" [ɪ] is invariant, and considered part of the stem (Bakovic 2000):

(3) Maasai dominance (Archangeli & Pulleyblank 1994, Levergood 1984)

a. *Spreading from the root*

/kɪ + norr + ʊ/	→	kiñorru	*(dominant root)*
1PL + love + EF		'we shall love	
/kɪ + ɪdɪm + ʊ/	→	kɪdɪmʊ	*(recessive root)*
1PL + be.able + EF		'we shall be able'	

b. *Spreading from the suffix*

/ɪsʊj + ɪšɔ/	→	ɪsʊɪšɔ	*(recessive suffix, all recessive)*
wash + INTR		'wash!/do the washing!'	
/ɪsʊj + ɪšɔ + r**e̲**/	→	isujišore	*(dominant suffix)*
wash + INTR + APPL		'wash with something!'	

/rɔk + u/	→	roku	*(dominant suffix)*
black + INCEP		'become black'	

c. *Prefix vowels cannot condition change in stems*

/e + ɪ-ting /	→	eiting	*(dominant root)*
3SG + V-end		's/he ends'	
/e + ɪ-dɪp/	→	eɪdɪp	*(recessive root)*
3SG + V-finish		's/he finishes'	
/lɛ + m + **e** +ɪ-rɔ/	→	le̱meɪrɔ	*(recessive root)*
REL + NEG + 3SG + V-speak		'who doesn't speak'	
/nɛ + m + **e** + ɪ-rrag/	→	ne̱meɪrrag	*(recessive root)*
FUT + NEG + 3SG + V-speak		's/he will not lie down'	

As the above data show, even though prefixes may *become* dominant, that is, be affected by root or suffix vowels, dominant prefix vowels are unable to make vowels within the rest of the word undergo any change, even though they *can* cause other prefixes to change. This means that while the prefix-root boundary cannot be crossed, the same is not necessarily true of the prefix-prefix boundary.

As mentioned above, consonant harmony also obeys this asymmetry in affix control. Hansson (2001)'s comprehensive typology of consonant harmony systems includes none in which prefixes condition harmonic change. An instance of prefixes being unable to condition consonant harmony comes from **Yaka** (Bantu, Zaire). Yaka has a system of nasal consonant harmony whereby the voiced alveolar stop [d], such as occurs in the perfective suffix /-idi/, harmonizes with any root nasal to become an alveolar nasal, as illustrated by the minimal pairs in (4a,b). Prefixes, however, cannot condition nasal harmony, which would cause root-initial /d/ to become /n/, for instance (4c):

(4) Yaka nasal consonant harmony (Ruttenberg 1970, Hyman 1995)

a.	búd-idi	'to break'	
	yád-idi	'to spread'	
	tsúb-idi	'to wander'	
	kúd-idi	'to hunt someone'	
b.	bún-ini	'to fart'	
	yán-ini	'to scream in pain'	
	tsúm-ini	'to sew'	
	kún-ini	'to plant'	
c.	ma-dáfú	'palm wine'	*ma-náfu
	ma-dókísí	'noise'	*ma-nókísí
	ma-déemba	'softness'	*ma-néemba

In order to arrive at this asymmetry in affix control, we must introduce the first constraint family which is argued to be an instantiation of initial faithfulness: CRISPEDGE.

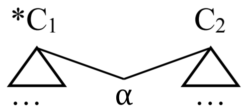
2.2.1 Positional CRISPEDGE

In order to restrict affix features from crossing the left root boundary, a particular property must be granted to left edges of root-initial syllables such that features cannot spread past it to target prefix segments, and vice versa: *crispness*. A "crisp edge" (Itô & Mester 1994, 1999) is an edge of any phonological category (PCat) which does not tolerate features to spread across it; crisp edges are enforced via an active CRISPEDGE constraint. Any PCat has crisp edges, then, if it adheres to the following formalism in (5):

(5) Formalism for crisp edges (Itô & Mester 1999)

a. *Definition*
Let /A/ be a terminal (sub)string in a phonological representation, C a category of type PCat, and /A/ = | C | (*the-content-of* C). Then C is crisp (has *crisp edges*) if and only if A *is-a* C: ∀A (/A/ = | C | ⊃ /A/ ≡ C).

b. *Multiple linking prohibited*



The above formalism essentially means that if some phonological representation A is dominated by some domain C, no other category dominates A. More concretely, this means that a crisp edge does not tolerate features from inside some category to spread across it into another category.

While the formalism above requires that both PCat edges be crisp at once, relativization to specific PCat edges is baked into the theory. CRISPEDGE constraints can easily be created to evaluate violations at a specific edge only (which has been frequently been done: see, e.g. Selkirk 2011, Basri et al. 1999). It is proposed here, then, that root-initial syllables cross-linguistically have crisp left edges, which is a phonologized instantiation of the articulatory strength and informational robustness of root-initial positions. The rationale for crisp edges to occur at the left edges of roots is clear from the discussion in §1.2: the root boundary acts as a strong signal for lexical access, whereas the initial boundary of a prefix is not nearly as salient. Features are unwilling to spread leftward from root-initial syllables, then, because this would "blur" the root boundary. It is certainly not inconceivable to posit that these "extragrammatical" biases in articulation and perception become phonologized over time and enter the grammar and/or lexicon (as is argued by Ussishkin & Wedel 2009; see there for further citations). Having the left edge of a root-initial syllable be crisp when necessary, while also allowing for its right edge to be uncrisp, keeps prefixes from undergoing root(+suffix) phonology. The specific relativization of CRISPEDGE which I propose to use here is defined below in (6):

(6) CRISPEDGE-L(σ_1)
Assign a violation to any candidate in which a feature associated to a root-corresponding segment in the initial syllable of the output is shared across the left boundary of the initial syllable containing any root-corresponding segments.

The definition in (6) above relativizes the locus of the CRISPEDGE violation specifically to the left edge of the root-initial syllable. This is in contrast to plain CRISPEDGE(σ), which blocks feature spreading across any boundary of any syllable.

The tableaux below demonstrate how CRISPEDGE-L(σ_1) can be used to achieve asymmetric affix control. The analyses below use the Yaka data as a representative example. Two other constraints – the markedness constraint driving alternation, and the faithfulness constraint maintaining featural identity – are defined in (7):

(7) SPREAD[nasal] (this and other SPREAD constraints based on Ní Chosáin & Padgett 1997)
If there is a [+nasal] consonant in the output, assign a violation to each alveolar consonant which is not associated with it (i.e. also [+nasal]).

IDENT[nasal]
Assign a violation for each segment whose specification for the feature [nasal] in the output is different from its specification for that feature in the input.

MAX[nasal]
Assign a violation for each [–nasal] segment in the input which was [+nasal] in the input.

Below, it is shown how the ranking of CRISPEDGE-L(σ_1) ≫ SPREAD[nasal] ≫ IDENT[nasal] will arrive at the correct patterns throughout the language. MAX[nasal] is also included as an undominated constraint to ensure that nasal consonants do not become [–nasal] alveolars to avoid SPREAD[nasal] violations. The initial syllable whose left edge is protected by the CRISPEDGE-L(σ_1) constraint is underlined, and the [+nasal] association lines are shown for explicitness.

(8) Crisp edges and asymmetric affix control (ex. from Yaka)

a. No spreading without a trigger

/búd -idi/	Max[nasal]	CrispEdge-L(σ_1)	Spread[nasal]	Ident[nasal]
☞ a. bú.di.di				
[+nas] b. bú.di.ni			*!	*

b. Spreading to suffix

/bún -idi/	Max[nasal]	CrispEdge-L(σ_1)	Spread[nasal]	Ident[nasal]
[+nas] ☞ c. bú.ni.ni				*
[+nas] d. bú.ni.di			*!	

c. No spreading from prefix

/ma- dáfú/	Max[nasal]	CrispEdge-L(σ_1)	Spread[nasal]	Ident[nasal]
[+nas] ☞ e. ma.dá.fu			*	
[+nas] f. ma.ná.fu		*!		*
g. ba.dá.fu	*!			*

As is shown in the above tableaux, the CRISPEDGE-L(σ_1) constraint being at the top of the grammar restricts the spreading of the nasal feature to the root-suffix domain (as is shown in successful candidate (8c)): prefix nasals will be unable to undergo *or* trigger nasal consonant harmony, as is the case in this language – this is represented by candidate (8e) being preferred over the "expected" (8f). Constraints which are relativized to particular affixes, such as SS- or SP-IDENT[F] (as postulated by Bakovic 2000, for example), are therefore unnecessary.

2.2.1 Insufficiency of an initial faithfulness account

It becomes important here to briefly outline how a commonly used initial faithfulness constraint, IDENT-σ_1, is insufficient for harmony systems, and by extension, other processes which ban featural alternation in initial syllables.

Previous work on initial prominence has been grounded in the use of a positional faithfulness constraint, IDENT-σ_1, which is IDENT specified for segments in initial syllables. Originally proposed by Beckman (1998), this constraint specifically evaluates output segments in initial syllables with respect to their faithfulness to their underlying representations. Work on initial syllable faithfulness by Becker et al. (2012) lends insight into what an analysis using positional faithfulness should look like, however it is insufficient for capturing the observed patterns of prefix independence.

Becker et al. (2012) lay out three potential phonological grammars in terms of OT constraint interactions which demonstrate the possible interactions of markedness, faithfulness, and positional faithfulness. If a grammar has both a general faithfulness constraint (IDENT) and a faithfulness constraint which particularly enforces faithfulness in initial syllables (IDENT-σ_1), together with the relevant markedness constraint (MARKEDNESS), the grammar in which alternations avoid initial syllables would have IDENT-σ_1 outrank MARKEDNESS, which would in turn outrank plain IDENT. However, the constraints can be reranked to give rise to two other systems, in which alternations are observed either nowhere or everywhere:

(9) Positional faithfulness and alternation (Becker et al. 2012)

IDENT-σ_1 ≫ MARKEDNESS ≫ IDENT	initial syllables protected from alternation
IDENT, IDENT-σ_1 ≫ MARKEDNESS	alternations observed nowhere
MARKEDNESS ≫ IDENT, IDENT-σ_1	alternations observed everywhere

It should be noted that one additional logically-possible ranking, IDENT ≫ MARKEDNESS ≫ IDENT-σ_1, would generate the same pattern as IDENT, IDENT-σ_1 ≫ MARKEDNESS, namely that alternations would be observed nowhere. Because all six possible rankings nonetheless result in the same three patterns, the suite described above in (9) leads to an inherently asymmetrical model, as it noticeably excludes a grammar in which there is more alternation observed in initial syllables than in non-initial syllables. Becker et al. (2012) argue that such a system should be impossible to learn or generalize over, and indeed their artificial grammar learning studies showed that the counter-typological laryngeal alternation pattern attested in English was not extended to novel forms by English speakers. But again, it must be noted that what constitutes an "initial" syllable protected by an IDENT-σ_1 constraint can only be the initial syllable of the *root*, not the entire morphological word. This follows from the discussion above in §1.2, in that prefixes, though comprising the initial syllables of the entire morphological word, are not nearly as phonetically salient, informationally beneficial, or contrast-rich as roots are, meaning that they should not be privileged under a model of initial syllable faithfulness. A revised definition of the positional faithfulness metaconstraint above can be given as follows:

(10) IDENT[F]-[$_{ROOT}$ σ_1
Assign a violation for each root-corresponding output segment in the initial syllable of the root whose value for feature [F] differs from that of its correspondent in the input (i.e. IDENT-σ_1 specified for the root domain).

The above constraint is only evaluated over root-corresponding material in the output, and does not penalize, say, a consonant that has been resyllabified into the root-initial syllable. The above can also be specified for which particular process must maintain initial syllable identity, for example vowel agreement for a vowel harmony system. Assume, however, a language in which prefixes are not affected by root-outward vowel harmony (as is quite common – see §2.3 to follow). This process preserves the integrity of the root-initial syllable, however makes no prediction as to whether the prefix will undergo.

(11) Insufficiency of IDENT-σ_1 ≫ MARKEDNESS ≫ IDENT for root-outward vowel harmony

/–αF + √αF + –αF/	IDENT[F]-[$_{ROOT}$ σ_1	AGREE[F]	IDENT[F]
☹ a. –αF √αF αF		*!	*
💣 b. αF √αF αF			**
c. –αF √αF –αF		*!*	
d. –αF √–αF –αF	*!		*

Above, the ideal candidate in (11a) in fact loses because the prefix vowel and the root-initial vowel have opposite values for [F]. The unrightful winner in (11b) succeeds because the harmony spreads "too far", and violates prefix independence. Featural "overshoot" is attested in many languages, such as those with symmetrical harmony systems, but we see from the typology that prefix-independent systems are also widespread. As is seen here, and throughout the typology, IDENT-σ_1 constraints are actually never necessary to account for prefix independence.

Instead, it is shown in this section and in those to follow that positional CRISPEDGE can account for root-initial prominence much more accurately.

To conclude this section, I present the following table of languages which have been documented to have dominant harmony but no prefix trigger. There are no attested counterexamples, which is a strong prediction of the root-initial percept maximization theory.

Language	Family	Region	Citation
Maasai (ATR)	Eastern Nilotic	Kenya	Levergood 1984, Archangeli & Pulleyblank 1994, Bakovic 2000
Turkana (ATR)	Eastern Nilotic	Kenya	Vago & Leder 1987, Albert 1995, Bakovic 2000
Karimojong (ATR)	Eastern Nilotic	Uganda	Lesley-Neuman 2007
Kalenjin (ATR)	Southern Nilotic	Kenya	Local & Lodge 2004
Cherang'any (ATR)	Southern Nilotic	Kenya	Mietzner 1993
Anyuak (ATR)	Western Nilotic	Ethiopia, South Sudan	Reh 1996
Pulaar (ATR)	Atlantic-Congo	Senegal	Krämer 2003
Yaka (nasal)	Bantu	Zaire	Ruttenberg 1970, Hyman 1995
Assamese (ATR)	Indo-Aryan	India	Mahanta 2007
Itelmen (ATR)	Chukotko-Kamchatkan	Siberia	Bobaljik & Wurmbrand 2001
Nez Perce (ATR)	Sahaptian	NW United States	Hall & Hall 1980
Karajá (ATR)	Macro-Jê	Brazil	Ribeiro 2002, Ribeiro 2012

Table 1: Dominant harmony languages with no prefix triggers

2.3 Vowel harmony

Root-conditioned vowel harmony is essentially a set of restrictions which limits the cooccurrence of particular vowels within a word (Nevins 2010). Some or all vowels in a word are specified for a particular feature [αF], and all other vowels in the word with segments of that feature assimilate to [αF] (though of course there do exist transparent vowels which are not targeted and opaque vowels which block the spreading of the feature).

As we have already seen from the Lango example in §1, the process of vowel harmony is often opaque to prefixes; if the domain of vowel harmony is limited to a subpart of the grammatical word, that part tends to be the root+suffix, to the exclusion of the prefix. This exclusion is another striking example of prefix independence, as it can create two word-parts within a single grammatical word, each with differing harmonic values. The propagation of harmony, while occurring without interruption within roots and across the root-suffix boundary, is blocked at the prefix-root boundary, showing that the prefix is more phonologically aloof than the suffix is.

An example of this comes from **Kikuyu** (Bantu, Kenya), whose vowels can be divided into two sets based on [ATR] value: [i e o u] which are [+ATR] and [ɪ ɛ a ɔ ʊ] which are [–ATR]. When a mid vowel in the Kikuyu root is specified for [αATR], all other mid vowels must also be specified for [αATR] (see (12a,b) below). However, prefix mid vowels are not targeted by this process (12c):

(12) Kikuyu harmony targets mid vowels (Peng 2000)

a. *Root spreads [+ATR]*

tiɣ-er-ek-a	'abandon, be left over'
ɣer-er-ek-a	'have something fetched for'
hoθ-er-ek-a	'be used'
βaθ-er-ek-a	'become rich'

b. *Root spreads [–ATR]*

tɛm-ɛr-ɛk-a	'cut down into specific shapes'
βɔɣ-ɛr-ɛk-a	'calm down, slow down'

c. *Prefix vowels are opaque to harmony*

toraamoɣɔnɛra

to-	raa-	mo-	**ɣɔn**	-ɛr	-a
1PPL	PST	3PS	ROOT	FOR	FV

'we made a deep sonorous sound for him'

As shown above in (12c), even though the prefixes contain mid vowel targets, they do not agree with respect to the [αATR] value of the root. The fact that this and systems like this are so widespread may come down to the general tendency of vowel harmony to be perseverative (left-to-right) rather than anticipatory (right-to-left). It is not the case, however, that all languages with both vowel harmony and prefixes exhibit prefix independence with respect to that harmony. Many languages exhibit a symmetrical application of harmony, applying to both prefixes and suffixes, such as in Akan (Kwa, Ghana; O'Keefe 2003), where both prefixes and suffixes cohere with respect to [ATR] and rounding. (See §4 of this paper for a discussion of other systems of morphophological cohesion such as symmetry.)

The tableau below in (14) shows how a constraint of the type CRISPEDGE-L(σ_1) will ensure that the initial syllable's feature will not spread leftward and blur its edge; this ensures that the prefix-independent candidate is the correct output. The markedness constraint assumed here is AGREE[ATR], which will outrank a positionally non-specific CRISPEDGE(σ) constraint:

(13) AGREE[ATR] (adapted from Lombardi 1999)
Assign a violation for each vowel which does not agree with its adjacent vowel with respect to the feature [ATR].

CRISPEDGE(σ)
Assign a violation for each feature which is multiply linked across any syllable boundary (i.e. left or right) of any syllable.

Below, a ranking of CRISPEDGE-L(σ_1) ≫ AGREE[ATR] ≫ CRISPEDGE(σ) will derive the correct output of prefix independence. The autosegmental affiliation lines which represent the spreading of a feature (or lack thereof) are shown for explicitness.

(14) Left crisp edges results in prefix independence

a. No spreading if root and suffix agree

/toramo- √ɣɔn -ɛra/	CRISPEDGE-L(σ_1)	AGREE[ATR]	CRISPEDGE(σ)
[–ATR] ☞ a. toramoɣɔnɛra		*	
[–ATR] b. tɔramɔɣɔnɛra	*!		***
[+ATR] [+ATR] c. toramoɣonera	*!		**

b. Spreading to suffix but not prefix

/tɔramɔ- √ɣon -ɛra/	CRISPEDGE-L(σ_1)	AGREE[ATR]	CRISPEDGE(σ)
[+ATR] ☞ d. tɔramɔɣonera		*	*
[+ATR] e. toramoɣonera	*!		****
[+ATR] f. toramoɣonɛra	*!		***

As shown above in tableaux (14), all losing candidates are ruled out because the [ATR] feature from the root has spread over the initial syllable's crisp left edge, thus causing prefix features to change. The winners, the candidates in (14a,d), do not violate CRISPEDGE, nor do they have their root-initial syllables alternate; only a prefix-independent candidate can achieve both these things. Crisp edges will also account for the inability of a dominant prefix feature to spread to the root *even if* the root-initial syllable is transparent to that process. Despite being transparent, the initial syllable is still positionally strong because it bears a crisp edge. It is proposed, therefore, that even if it is not expressly necessary for a particular theoretical analysis, all root-initial syllables have a crisp left edge as a default. This serves as a grammaticalization of their resistance toward featural change or spreading under affixation.

Below is a table of languages in the present typological survey which display prefix independence with respect to vowel harmony.

Language	Family	Region	Citation
*Hungarian (backness) [2]	Uralic	Hungary	Ládanyi 2000
*Finnish (backness)	Uralic	Finland	Wuolle 1990
Itelmen (ATR)	Chukotko-Kamchatkan	Siberia	Bobaljik & Wurmbrand 2001
Coeur d'Alene (ATR)	Salishan	Idaho (U.S.)	Doak 1992, Bessell 1989
Anyuak (ATR)	Western Nilotic	Ethiopia, South Sudan	Reh 1996
Luwo (ATR)	Western Nilotic	South Sudan	Storch 2014
Kikuyu (ATR)	Atlantic-Congo	Kenya	Peng 2000
Fungwa (backness)	Kainji	Nigeria	Akinbo 2018
Nsenga (ATR)	Bantu	Southeast Africa	Simango 2013
Chichewa (ATR)	Bantu	Southeast Africa	Simango 2013
Shona (height)	Bantu	Zimbabwe, Botswana	Downing & Kadenge 2020

[2] In certain languages, there is not sufficient evidence to conclude that there are true prefixes, as opposed to just compounding elements. For such languages, I have marked their entries with asterisks.

Yaka (ATR)	Bantu	Republic of Congo	van den Eynde 1968, Hyman 1995
Swahili (ATR)	Bantu	East Africa	Marten 1996

Table 2: Vowel harmony languages for which prefixes are independent

2.4 Consonant harmony

Consonant harmony is an assimilatory process by which a consonant specified for a particular feature causes another consonant to also share that feature (Hansson 2001). Consonant harmony is distinct from vowel harmony not only in that it affects consonants, but in that harmonic interactions can occur at greater distances: many segments, including vowels and transparent consonants, may intervene between the consonants standing in a harmonic relationship.

Like vowel harmony, consonant harmony may be unable to condition change across the prefix-root boundary. For example, **Kinyarwanda** (Bantu, Rwanda) contrasts alveolar and retroflex coronals: each of the three [ts s z] has a retroflex counterpart [ʈʂ ʂ ʐ]; some examples of this contrast are given in (15a). Harmony applies such that a retroflex coronal triggers other alveolar coronals to become retroflex (15b). The retroflex trigger spreads its [+retroflex] feature regressively onto all participating targets, except when blocked by alveolar stops, postalveolar stops, affricates, and palatals (15c). Particular suffixes, such as the causative /-iiʂ/ cause spreading from themselves, but other suffixes, such as perfective /-ie/, trigger retroflection on an immediately preceding coronal, which then spreads leftward. Critically, coronal harmony does not affect prefixes; the prefix-root boundary acts as a blocker just as certain segments do, which gets realized as prefix alveolars which would otherwise be targets of coronal harmony not undergoing (15d):

(15) Kinyarwanda coronal harmony (Walker et al. 2008, Mpiranya & Walker 2005)

a. *The alveolar-retroflex contrast*

[gusuka]	‘pour (INF)’
[guʂuka]	‘deceive (INF)’
[akazuːᵑga]	‘vertigo (DIM)’
[akaʐuːᵑga]	‘spear sp. (DIM)’

b. *Spreading from suffixes*

/baaz + -iiʂ/	→	[baaʐiiʂa]	‘plant (CAUS)’	*[baaziʂa]
/mes +-iiʂ/	→	[meʂeeʂa]	‘wash cloth (CAUS)’	*[mesiiʂa]
/sáaz- + ie/	→	[ʂáaʐe]	‘become old (CAUS)	*[sáaze]
/úzuz- + ie/	→	[úʐuʐe]	‘fill (CAUS)’	*[úzuze]

c. *Blocking*

[zi**t**uʐe]	‘to cause someone to detatch (PERF)’
[zú**j**aʐe]	‘to become warm (PERF)’

d. *Prefix independence*

/zi- +	saaz- +	-ie/	→	[ziʂaaʐe]	‘to become old (PERF)’
CL	become.old	PERF		*[ʐiʂaaʐe], *[zisaaʐe]	
zi- +	ːz +	- ie/	→	[ziiʐe]	‘to come (PERF)’
CL	come	PERF		*[ʐiiʐe]	

The theoretical analysis of consonant harmony such as given above for Kinyarwanda is very much the same as in the vowel harmony analysis for Kikuyu in the previous section: a crisp edge aligned to the root-initial syllable’s left edge will ensure that the spreading of the [+retroflex] feature will not blur the prefix-root boundary. The markedness constraint driving alternation here is SPREAD[+retroflex], a non-local markedness constraint which has been used before in analyses of spreading and blocking in Kinyarwanda (Mpiranya & Walker 2008), which is superior to AGREE[+retroflex] for its ability to incorporate the possibility of consonant blockers. I also assume here the existence of an undominated constraint of the type *[–retroflex]-BEFORE-ie which is violated whenever a coronal is not retroflected by an adjacent idiosyncraticallytriggering suffix such as /-ie/. The constraints to be used for this analysis which have not been previously introduced are given below:

(16) *[–retroflex]-Before-ie (self-proposed)
Assign a violation for any coronal which does not bear a [+retroflex] feature in the output when adjacent to a retroflecting suffix trigger, such as /-ie/.

NCC (“No-Crossing” Constraint, adapted from Goldsmith 1976; Hyman 2014)
Some feature [αF] associated with some segment S_i may not be associated with some other segment S_j without also being associated to all eligible segments $S_{i<x>j}$. (i.e. no skipping)

The ranking of CrispEdge-L(σ_1) ≫ Spread[+retro] ≫ Ident[retro] will yield the correct result, whereby the prefix is exempt from consonant harmony despite having a potential coronal target:

(17) Left crisp edges block spreading of [+retroflex]

/zi + √saaz + ie/	*[–retro]-Before-ie	CrispEdge-L(σ_1)	NCC	Spread[+retro]	Ident[retro]
☞ a. ziʂaaʐe				*	**
b. zisaaʐe				*!*	*
c. ʐisaaʐe			*!	*	**
d. ʐiʂaaʐe		*!			***
e. zisaaze	*!				

Above, the candidate in (17a) wins because although it fails to spread the [+retroflex] feature onto the prefix, doing so ensures that it does not violate CrispEdge-L(σ_1). All other candidates either fail to spread [+retroflex] a fatal number of times (17b), violate CrispEdge-L(σ_1) (17d), or are otherwise ill-formed (17b,c,e).

While prefix independence has been shown to be sensitive to consonant harmony, other languages demonstrate a symmetrical application of spreading onto any affix type, such as sibilant harmony in Ineseño (Chumashan; Applegate 1974, Poser 1982, Hansson 2001). Languages where consonant harmony *does* result in prefix independence are given in Table 3 below:

Language	Family	Region	Citation
Misantla Totonac (uvular)	Totonacan	Mexico	McKay 1994
Anyuak (dental)	Western Nilotic	Ethiopia & South Sudan	Reh 1996, McKenzie 2016
Luwo (dental)	Western Nilotic	South Sudan	Storch 2014
Yaka (nasal)	Bantu	Republic of Congo	van den Eynde 1968, Hyman 1995
Mwiini (lateral)	Bantu	Somalia	Kisseberth & Abasheikh 1975

Table 3: Consonant harmony languages where prefixes are unaffected

2.5 Tone spread

The propagation of tone spread, common to many register tone languages, can also be blocked at the prefix-root boundary. For languages in which tone spreads from some trigger onto affix vowels, it is much more likely that the spreading applies to suffix vowels but not to prefix vowels. If the spread cannot reach prefixes, or if the prefix has a potential trigger but cannot spread onto its targets in the root, then it is evidence that the prefix is less phonologically integrated to the root than suffixes.

A language which shows the inability of a prefix tone to spread onto vowels of the root domain is **Paicî** (Oceanic, Vanuatu). Paicî was originally argued by Rivierre (1978, 1974) to have three level tones (H M L), though a more recent reanalysis (Lionnet 2019) has revealed the existence of only two underlying tones (H L), and that the L is often downstepped in particular phonologically-conditioned environments. Paicî has both prefixes and suffixes, but while all suffixes (along with enclitics, which may be extensively concatenated) receive their tonal specifications from the root, prefixes do not spread their tones onto root vowels. Additionally, a root-initial vowel following low-tone monomoraic prefixes (which is the vast majority of prefixes) receives a juncture H-tone, indicating a prosodic boundary (Rivierre 1974). This asymmetry in tone spread is shown in (18):

(18) Prefix independence in Paicî tone (Lionnet 2019, Rivierre 1983)

a. *Suffixes and enclitics receive their tonal specification from the root*

-ri (TRANSITIVIZER)	/árú -ri/	[árú-rí]	‘poison with othalam’
	/èàù -ri/	[èàù-rì]	‘laugh at’
	/pá tèèpà -ri/	[pá tèèpà-rì]	‘take something home’

/tɔ́pwɔ́	=boo	=naa	=wee/
[tɔ́pwɔ́	=bóó	=ná̰á̰	=wéé]
put	down	at	there

‘put down there’

b. *Prefix concatenation triggers juncture H-tone*

pì- (MIDDLE)	/pì- cɔ̀/	[pì-cɔ́]	‘move forward’
	/pì- wà̰dò/	[pì-wá̰dò]	‘get drunk’
	/pì- tʌmʌ̰̀rḭ̀/	[pì-tʌ́mʌ̰̀rḭ̀]	‘give birth’
à- (AGENT)	/à- wéà/	[à-wéà]	‘one who guards’
	/à- còò/	[à-cóò]	‘one who stands’
	/à- ìlà/	[à-ílà]	‘one who demands’

The data above show that for tone languages, the asymmetry may also extend to enclitics, not simply suffixes. Indeed, the integration of enclitics into the root has been shown for many languages to be less robust than the integration of proclitics, even when both clitic types are less integrated than either affix type (cf. Bermúdez-Otero 2017, Bermúdez-Otero & Luís 2009 on European Portuguese).

Additionally, *tone integration*, a form of tone spread involving the tonal specification of some element rewriting the tonal specification of another element under concatenation, can also be sensitive to the prefix-suffix asymmetry. **Hausa** (Chadic, West Africa), is a tonal language with two register tones (H and L), plus one contour tone (HL), which only occurs when a H+L tone pair must be borne on a single heavy syllable. Hausa has both prefixes and suffixes, but many suffixes (called *tone-integrating suffixes*), delete all the tonal specifications of the root and replace them with its own; if the root contains more syllables than tones specified by the suffix, then the left-most suffix tone spreads iteratively to the edge of the root. There are *no* tone-integrating prefixes in Hausa, meaning that prefixes never affect the tonal specifications of roots or trigger tone change. Some examples of tone-integrating suffixes, such as the many different plural morphemes, are given below in (19a), whereas lack of tone-integrating prefixes is shown in (19b):

(19) Hausa suffixes may trigger spread whereas prefixes are independent (Newman 1986)

a. *Tone integration targets root tones*

tà:tsú:nìyá:	+	-óc:í:	→	tá:tsú:níyó:yí:
'folktale'		'PL'		'folktales'
rì:gá	+	-únà:	→	rí:gúnà:
'gown'		'PL'		'gowns'
hànká:kà:	+	-ìí	→	hànkà:kìí
'crow'		'PL'		'crows'
yá:tsà:	+	-ú:	→	yá:tsú:
'finger'		'PL'		'fingers'

b. *Tone integration is blocked at the prefix-root boundary*

má	+	gínà	+	-ìí	→	má-gìnìí
'NMLZR'		'build'		AG		'builder'
má	+	káɾ̃àntá	+	-ìí	→	má-kàɾ̃àntá
'NMLZR'		'read'		AG		'reader'

bà	+	kàtsínà	+	-éè	→	bà-kátsínéè
'ETHN'		'Katsina'		EE		'a Katsina man'
bà	+	tú:r̃ái	+	-éè	→	bà-tú:r̃éè
'ETHN'		'Europe'		EE		'a European'

As is especially evident from the examples in (19b) above, the tone spreading instigated by the tone-integrating suffix affects only root vowels; the propagation of tone replacement is blocked at the prefix-root boundary. This is remarkable in that it provides evidence that prefix independence is not simply an exponent of the Hausa's right-to-left tone spread (as there is nothing to the left of prefixes, their tones have no potential tone-bearing units to propagate onto), but leftward tone spread is actually *blocked* at the prefix-root boundary as well. In sum, these examples show that even autosegments, not just segments and prosodic domain boundaries, are sensitive to morphology, and of particular importance to this thesis, the prefix-suffix asymmetry.

Below, I show how it is possible to treat tone like any other spreading feature, such as seen in the above examples of vowel harmony, and analyze these prefix independent patterns with the same constraint rankings. To take the Paicî example, tones can be said to spread onto suffixes but not to prefixes because spreading leftward to target prefixes will blur the root boundary. The markedness constraint necessarily dominated CRISPEDGE-L(σ_1) here is SPREAD[Tone]:

(20) SPREAD[T]
Assign a violation for each vowel that is not linked to a root-linked autosegment.

Like the analyses for Kikuyu and Kinyarwanda in the previous sections, the ranking of CRISPEDGE-L(σ_1) ≫ MARKEDNESS ≫ IDENT allow us to arrive at the correct patterns as well for Paicî:

(21) Tone spread blocked at the prefix-root juncture (ex. from Paicî)

a. Spreading from root to suffix

/√árú -ri/	CRISPEDGE-L(σ_1)	SPREAD[T]	IDENT[T]
☞ a. árúrí			*
b. árúri		*!	

b. Invariant prefix tone

/à- √wéà/	CRISPEDGE-L(σ_1)	SPREAD[T]	IDENT[T]
☞ c. àwéà		*	
d. áwéà	*!		*

The first tableau above gives a prototypical example of a toneless suffix receiving its tonal specification from the root, as a failure to do so would violate the markedness constraint SPREAD[Tone]. The second tableau shows that the tonal specification of prefixes is not overwritten (as in failed candidate (21d)), as this would constitute a violation of CRISPEDGE-L(σ_1).

A table of languages for which tone spread is opaque to prefixes is given below:

Language	Family	Region	Citation
Ayutla Mixtec	Mixtecan	Mexico	Gerfen 1996, de Lacy 2002
Paicî	Oceanic	Vanuatu	Lionnet 2019, Rivierre 1983
Hausa	Chadic	West Africa	Newman 1986
Kukuya	Bantu	People's Republic of the Congo	Paulian 1974, Hyman 1987
Shona	Bantu	Zimbabwe & Botswana	Myers 1987, 1998
Anyuak	Western Nilotic	Ethiopia & South Sudan	Reh 1996

Table 4: Languages for which tone spread does not target prefixes

2.6 Footing and stress assignment

Prefixes are often excluded from the stress assignment domain of the root+suffix: this either means that they can never be stressed, or that they are stressed independently. There are a number of descriptive accounts of stress assignment for particular languages in which the author(s) make no explicit reference to foot structure, but since stress assignment is determined by the organization of metrical feet with a prosodic word, I will include accounts of both types of languages here.

One example of a language which excludes prefixes from its stress assignment scheme is Sumatran **Indonesian** (Austronesian, Indonesia; Cohn 1989), which typically shows penultimate primary stress, with a secondary stress on the initial syllable (as long as it does not induce a stress clash with the primary stress), and in words of significant length (>6σ), an additional secondary stress two syllables to the left of the primary stress is added. This is shown in (22) below:

(22) Stress assignment in Indonesian (Cohn 1989)

σ́	cát	'print'
	hák	'rights'
σ́σ	cári	'search for'
	dúduk	'sit'
σσ́σ	bicára	'speak'
	acara	'plan'
σ̀σσ́σ	bìjaksána	'wise'
	màʃarákat	'society'
σ̀σσσ́σ	kòntinuási	'continuation'
	xàtulistíwa	'equator'
σ̀σσ̀σσ́σ	òtobiògráfi	'autobiography'
	èrodìnamíka	'aerodynamics'
σ̀σσσ̀σσ́σ	dèmilitèrisási	'demilitarization'
	àmerikànisási	'Americanization'

When prefixed, however, Indonesian words' stress assignment behaves differently; prefixes act as if they are invisible to stress placement, as evidenced by stress being placed in locations contrary to those shown above, examples of such being given below in (23). In fact, prefixes never bear stress (primary or secondary) in Indonesian (Cohn 1989:183). In suffixed forms, stress assignment acts in accordance to the rules presented in (22). The data below use near-minimal pairs, with the verbal passive prefix *di-*:

(23) Indonesian prefixes are invisible to stress assignment (Cohn 1989)

Unprefixed forms			Prefixed forms		
σ́σ	cári	'search for'	σ[σ́]	di[cát]	'printed'
	díduk	'educate'		di[tík]	'typed'
σ̀σσ́σ	bìjaksána	'wise'	σ[σσ́σ]	di[koréksi]	'corrected'
[[σ̀σ]σ́]σ	[[càri]kán]ña	'look for it'	[σ[σ]σ́]σ	[di[cat]kán]ña	'printed by s.o.'

As shown in the examples above, stress falls on the appropriate syllable if we consider the prefix outside the reach of stress assignment rules. Therefore, the typical stress pattern of Indonesian holds for the root+suffix only; prefixes are essentially invisible to the general pattern of stress assignment, and do not affect stress patterns or bear stress.

A second example, for which the researchers make explicit reference to prefixes being *footed* independently from root(+suffix) material, comes from **Samoan** (Austronesian, Samoa; Zuraw 2014). Samoan prefixes, already distinct in behavior compared to suffixes because they block typical hiatus resolution, additionally form their own domain for the purposes of organizing syllables into feet: monosyllabic prefixes are unfooted, and disyllabic prefixes form a foot of their own which does not influence the footing and stressing patterns of the rest of the word. The pattern for Samoan footing is straightforward: a moraic trochee containing the primary-stressed mora is aligned at the right edge of the prosodic word; secondary stress (though it is exceedingly rare to find native monomorphemic words comprising the necessary mora count to allow for secondary stress) falls on the first non-epenthetic mora of the word (though stress may fall on an epenthetic mora if it is absolutely required), forming a foot if necessary with the following syllable. The general footing scheme in Samoan is given in (24a), with epenthetic vowels shown in bold.

Suffixed forms in Samoan behave using the same stress patterns as in monomorphemic words. For example, words suffixed with the nominalizing morpheme /-ŋa/ show stress at the root-final vowel, with a bimoraic trochee built around it, as shown in (24b). Prefixes with two morae such as the causative /faʔa-/ form trochaic feet of their own (24c), and monomoraic prefixes such as plural morpheme /fe-/ never bear secondary stress (24d).

(24) Samoan footing on monomorphemic words (Zuraw et al. 2014)

a. *Typical footing scheme*

la(váː)	'energized'
le(léi)	'good'
(mánu)	'bird'
ma(nóŋi)	'to smell good'
(tàli)(éː)	'laugh'
(tèmo)k**a**(lási)	'democracy'
(ʔòli)m**i**(píka)	'Olympics'
(kòm**i**)pi(úta)	'computer'
(pèn**i**)si(óː)	'banjo'
p**a**(làni)(kéke)	'blanket
(sìk**a**)(lám**u**)	'scrum'

b. *Suffixes behave typically*

(páe)	'to set out'	pa(é-ŋa)	'presentation of food'
(móe)	'to sleep'	mo(é-ŋa)	'sleep'
ŋa(lúe)	'to work'	(ŋàlu)(é-ŋa)	'work'
sa(váli)	'to walk'	(sàva)(lí-ŋa)	'parade'

c. *Prefixes form their own trochaic feet*

(fàʔa)-(táu)	'buy' (/tau/ 'price')
(fàʔa)-ma(óni)	'loyal' (/maoni/ 'true')
(fàʔa)-ko(lúse)	'crucify' (/koluse/ 'cross')

d. *Monomoraic prefixes never bear secondary stress*

fe-ma(làŋa)-(áʔi)	'to travel around' (/malaŋa/ 'ceremonial visit')
fe-(àlo)(fá-ni)	'harmony, getting along' (/alofa/ 'lover')
fe-(fàʔa)-u(òː)-a(ʔí-ŋa)	'friendship' (/uoː/ 'friend')
(fàʔa)-fe-(ìlo)-(áʔi)	'to greet' (/ilo/ 'know')

As shown above, Samoan prefixes show distinct behavior from root+suffix words; if this were not the case, monomoraic prefixes would be expected to bear secondary stress, for example, which is not observed.

2.6.1 Left-alignment of the PrWd and the root as initial prominence

Unlike in previous sections which comprise cases of featural propagation being blocked at the prefix-root boundary, to account for asymmetric stress assignment under our current framework, we must utilize a second theoretical mechanism, namely ALIGN (McCarthy & Prince 1993b). The motivation for this proposal comes from the fact that in languages with predictable stress, stresses are not present in underlying representations, and are assigned within a particular prosodic domain, namely the prosodic word (PrWd). As such, there is no underlying feature to which an output form can be faithful. Because of this, there can be no feature sharing over the left edge of an initial syllable, and thus it is not possible to invoke CRISPEDGE. This lack of feature sharing unifies the following three phonological processes for which prefixes are very often independent (§2.6-§2.8): stress assignment, syllabification, and hiatus resolution.

Because prefixes are independent for the purposes of stress assignment, it is argued that prefixes must be excluded from this domain because including them would result in a similar consequence to features spreading over the initial syllable's crisp edge, namely that the initial root boundary would be blurred. Therefore, a theoretical mechanism which promotes the alignment of the left edge of the root with the left edge of the prosodic word is proposed. Specifically, it is argued here that ALIGN-L(Root, PrWd) must preferentially dominate ALIGN-R(Root, PrWd). This will allow suffixes to incorporate into the root's prosodic word to undergo stress assignment, but exclude prefixes from doing the same. The argument for this proposal is as follows.

We have established in previous sections that initial positions are more privileged cross-linguistically than word-medial positions, in that they are articulated with more magnitude and less inclined to share features with prefix segments. These properties afforded to initial segments could act as a boundary signal aiding lexical access, indicating to the perceiver that the most informational portion of the word, namely the root, is being uttered. Articulatory studies such as Keating et al. (1997) have shown prosodic domain-initial segments are articulated more robustly, which has been argued to allow for easier retrieval of an item from the mental lexicon by the perceiver (Fougeron & Keating 1997). The domain-initial strengthening research program, however, does not specifically examine prosodic words which are smaller than (i.e. embedded within) the morphological word, so I am proposing here that initial strengthening should play a similar role for these positions as well, though further proof is left up to future experimental investigation. Assuming that the beginnings of embedded PrWds are articulated more strongly, placing their left boundaries at the beginning of roots should cause the root-initial segments to be articulated more strongly, thus benefiting lexical retrieval. The ranking of ALIGN-L(Root, PrWd) ≫ ALIGN-R(Root, PrWd), which would cause root-initial segments to have their privileged status, is thus preferred or serves as default across world languages: the reverse of this setup –

right-alignment of the PrWd and the root over left-alignment – is logically possible but should be dispreferred or typologically rare, as it is arguably less perceptually beneficial to the perceiver.

The prediction, then, is that suffixes will be more likely than prefixes to prosodify together with the root containing the privileged initial material. So, for example, languages with right-aligned stress in which suffixed forms show a different stress pattern as compared to the unsuffixed form is predicted to be prevalent across world languages. And in fact, this does appear to be the case: in this paper's typological survey, prefixes are shown to be more independent than suffixes for the purpose of word-level prosodic considerations. Therefore, I argue that a bias toward maintaining the root-initial percept causes languages to have alignment of prosodic boundaries at the left edge of the root: this would both aid in perception and lexical access, and not cause otherwise articulatorily robust root-initial segments to undergo alternation (such an alternation being, for example, a root's initial vowel eliding because of hiatus avoidance, or typical root-initial syllable stress occurring on a different syllable when a root is prefixed).

This relationship between the PrWd and the root is not cyclic, and can therefore be contrasted with Transderivational OO's BA-CORR, which would posit that a form comprising a prefix+base would have to be faithful to the stress pattern of the base, but that a form comprising a base+suffix would not have to be faithful to it, due to a ranking of BP-FAITH ≫ BS-FAITH. Unlike in Tr-OO, there is no need for the arbitrary division into BP- and BS-CORR correspondence relationships, nor is there a need for this unmotivated ranking. Left- and right-alignment using ALIGN is also already used (and required) for accounting for the correct placement of stress feet in PrWds, among other things, so extending it in this manner is more parsimonious than adopting an entirely distinct mechanism. It also resolves the issues of encountering the missing base problem (Mascaró 2016), and of bound roots being unable to serve as licit bases, two major criticisms of the output-output framework (e.g. Bennett 2018)[3].

To take the Indonesian example from above, the prefix wants to be parsed into the PrWd via the markedness constraint PARSESYLL, but it cannot because PARSESYLL is lower-ranked than ALIGN-L(Root, PrWd) but higher-ranked than ALIGN-R(Root, PrWd), the definitions of which are given below:

(25) PARSESYLL
All syllables must be parsed into prosodic words.

ALIGN-L(Root, PrWd)
The left edge of every root coincides with the left edge of a prosodic word.

ALIGN-R(Root, PrWd)
The right edge of every root coincides with the right edge of a prosodic word.

This leads to suffixes being parsed into the PrWd domain through the violation of right-alignment, but prefixes are banned from acting similarly because of a stronger demand on left-alignment of the root and the PrWd, as shown in the representative tableaux in (26). Note that once segments are parsed into the correct prosodic domains, high-ranked language-specific markedness constraints (not shown) ensure that stress falls in the correct (here, penultimate) syllable within the PrWd by aligning stress feet to the correct edges of the PrWd.

[3] I will also note that a domains analysis employing recursive prosodic words in which a phonological process only occurs within the minimal PrWd – such as (prefix-(root-suffix)$_{\omega}$)$_{\omega}$ – achieves the same results as the present analysis. The theoretical differences between recursive and non-recursive prosodic structures is not explored here.

(26) Left alignment leads to prefix independence

a. Suffixes incorporated into the stress assignment scheme

/√bicara -kan/	ALIGN-L(Root, PrWd)	PARSESYLL	ALIGN-R(Root, PrWd)
☞ a. (bicarákan)			*
b. (bicára)kan		*!	

b. Prefixes excluded

/di- √koreksi/	ALIGN-L(Root, PrWd)	PARSESYLL	ALIGN-R(Root, PrWd)
☞ c. di(koréksi)		*	
d. (dikoréksi)	*!		

Above, the optimal candidate in the first tableau (26a) wins because it incorporates the suffix into the PrWd, and thus the stress assignment scheme. In (26c), it is the prefix-independent candidate which wins, because only such a candidate is able to maintain the alignment of the root and the PrWd under affixation; the expected candidate in (26d) does not arise because it aligns the PrWd to the left edge of the entire morphological word instead of the root.

Stress assignment/footing is by far the most well-attested process in the present survey; a table presenting those languages for which stress assignment is sensitive to prefix independence is given below. I did not find any languages for which suffixes are entirely independent vis-à-vis stress assignment while prefixes *are* incorporated, though see §4.3 on the Kabardian case:

Language	**Family**	**Region**	**Citation**
Moses-Columbia Salish	Salishan	NW United States	Czaykowska-Higgins 1996, 1998
Thompson Salish	Salishan	NW United States	Thompson & Thompson 1992, 1996
Lushootseed	Salishan	Washington, U.S.	Urbanczyk 1996
Choctaw	Muskogean	SW United States	Lombardi & McCarthy 1991

Tenango Otomi	Oto-Manguean	Mexico	Blight & Pike 1976
Mosetén	Isolate	Bolivia	Sakel 2011
Ayutla Mixtec	Mixtecan	Mexico	Gerfen 1996, de Lacy 2002
Sacapultec	Mayan	Guatemala	Du Bois 1981
European Portuguese	Western Romance	Portugal	Vigário 2003
Catalan	Western Romance	Spain	Mascaró 1972
Bangor Welsh	Celtic	Wales	Fayes-Clinton 1913, Hannahs 2013
English	Western Germanic	Global	Hall 1999, Selkirk 1980b
Dutch	Western Germanic	the Netherlands	Booij 1999, van Oostendorp 2006
German	Western Germanic	Germany	Raffelsiefen 2000
Latvian	Baltic	Latvia	Kariņš 1996
Gujarati	Indo-Aryan	India	Cordona 1965, de Lacy 2002
Greek	Hellenic	Greece	Nespor & Ralli 1996
Chintang	Sino-Tibetan	Nepal	Bickel et al. 2007
Limbu	Sino-Tibetan	Nepal	Hildebrandt 2007
Balantak	Austronesian	Sulawesi	Broselow 2003
Samoan	Austronesian	American Samoa	Zuraw et al. 2014
Tongan	Austronesian	Tonga	Zuraw et al. 2019
Indonesian	Austronesia	Indonesia	Cohn 1989, van Zanten et al. 2003
Mangap-Mbula	Austronesian	Papua New Guinea	Bugenhagen 1991
Māori	Polynesian	New Zealand	de Lacy 2001
Tetun	Timoric	West Timor	van Klinken 1999
Maga Rukai	Formosan	Taiwan	Hsin 2000
Fijian	Oceanic	Fiji	Dixon 1988
Neverver	Oceanic	Vanuatu	Barbour 2010

Table 5: Languages for which prefixes fall outside of the stress assignment domain

2.7 Syllabification

Syllabification is yet another process which demonstrates sensitivity to the prefix-suffix asymmetry in phonology. In languages for which syllabification is subject to prefix independence, segments from the prefix cannot be resyllabified into root syllables under prefixation. Conversely, under suffixation, segments from the root are readily able to be resyllabified. An illustrative example comes from **Latvian** (Baltic, Latvia), in which the otherwise language-wide process of onset maximization is blocked if a prefix coda were to be resyllabified into a root syllable[4]:

(27) Latvian syllabification scheme (Kariņš 1996)

a. *Suffixes syllabify normally*

/karst -ums/ hot-NOMINALIZER.NOM	→	[kar.stums]	'heat'
/raksts-iks/ write-ADJECTIVIZER.NOM	→	[rak.stiks]	'written'
/adat-in^{j}a/ needle-DIMINUTIVE.FEM	→	[a.da.ti.n^{j}a]	'needle (DIM)'

b. *Prefixes resist resyllabification*

/ie- naːkt/ in-come	→	[ie.naːkt]	'to come in'
/sa- adiːt/ PERF-knit	→	[sa.a.diːt]	'to knit together, knit (PERF)'
/aiz- ause/ away-ear	→	[aiz.ause]	'area behind the ear'

The above data indicate that the syllabification of prefixes is independent from that of the root+suffix, even when doing so would lead to a marked V.V sequence or an otherwise onsetless syllable. While some prefixes in Latvian may be prepositional in nature, they are not purely compounding elements because they cannot occur in isolation, and there usually exist separate lexical prepositions with the same meanings.

[4] The author states that the source of much syllabification data, Liepa (1968), is tentative due to its methodology. Phonetic evidence for onset vs. coda position in Latvian is predominantly durational (Kariņš 1996), with onset position significantly shorter in duration than coda position, which is used to argue that Latvian codas are moraic.

A root-initial maximization analysis of such a language can be given under generally the same alignment strategy as in the previous section, whereby left-alignment outranks markedness, which in turn outranks right-alignment. The constraint driving prosidification, PARSE, can be used as in the analysis of Indonesian's asymmetric stress assignment. When ALIGN-L(Root, PrWd) ≫ PARSESYLL ≫ ALIGN-R(Root, PrWd), the correct derivations are obtained.

For clarity, in the analysis below I also include the constraint ONSET to show Latvian's general tendency to resyllabify codas into onsets. ALIGN-R(Root, σ) is also used to show that despite other candidates maintaining right-alignment of the root with the right edge of a syllable, the winning candidate demonstrates that right root edges actually prefer to resyllabify under suffixation: this constraint is violable by the winner if it is subordinated by PARSE and/or ONSET:

(28) ONSET (Itô 1989)
Assign a violation for each syllable lacking an onset consonant.

ALIGN-R(Root, σ)
Assign a violation to any candidate in which the right edge of the root is not aligned to the right edge of a syllable.

(29) Asymmetric resyllabification

a. Suffixes resyllabify

/√adat-in^{j}a/	ALIGN-L (Root, PrWd)	PARSESYLL	ONSET	ALIGN-R (Root, σ)	ALIGN-R (Root, PrWd)
☞ a. (a.da.ti.n^{j}a)				*	*
b. (a.dat).i.n^{j}a		*(!)*	*(!)		
c. (a.dat.in^{j}a)			*!		*

b. Prefixes do not resyllabify

/aiz-√ause/	ALIGN-L (Root, PrWd)	PARSESYLL	ONSET	ALIGN-R (Root, σ)	ALIGN-R (Root, PrWd)
☞ d. aiz.(au.se)		*	*		
e. (ai.zau.se)	*!				

Above, the candidate in (29a) is the preferred outcome because it has a minimal number of PARSESYLL violations despite violating ALIGN-R. The prefix-independent candidate in (29d) wins because its opponent violates undominated ALIGN-L. Other potential candidate such as *ai.z(au.se), which have the same violation profile as the winning candidate above, should not be generated by GEN, since the syllable domain is straddling a PrWd boundary.

A table of languages which show this asymmetry with respect to syllabification is given below in Table 6:

Language	Family	Region	Citation
*Korean	Koranic	Korea	Kang 1991, 1992, 1993
Choctaw	Muskogean	SW United States	Lombardi & McCarthy 1991
Kaqchikel	Mayan	Guatemala	Bennett 2018
German	Western Germanic	Germany	Raffelsiefen 2000
Dutch	Western Germanic	the Netherlands	Booij 1999, van Oostendorp 2006
*Polish	West Slavic	Poland	Rubach & Booij 1990
Latvian	Baltic	Latvia	Kariņš 1996
Sanskrit	Indo-Aryan	India	Selkirk 1980a

Table 6: Languages for which prefixes are not syllabified with roots

2.8 Hiatus resolution

Another striking asymmetry in phonological rule application regards hiatus resolution. Hiatus, broadly defined as sequences of vowels arising due to morphological or syntactic concatenation (Casali 1996), is not tolerated in many languages, and a wide range of strategies is employed to repair it. In many languages, hiatus brought about by either prefixation or suffixation are both repaired, though the exact strategies may differ amongst different affixation types; however, there are many languages in which hiatus *is* in fact tolerated, but only at the prefix-root boundary. If hiatus resolution does not occur at the prefix-root boundary, then the prefix must be somehow less phonologically well-integrated with the root.

An example of tolerated hiatus at the prefix-root boundary comes from **Georgian** (Kartvelian, Rep. of Georgia). In Georgian, any vowel-vowel sequence arising from the concatenation of the root and suffix(es) is typically repaired by epenthesizing the consonant [v] or [b] (there appears to be no identifiable pattern as to which). The general pattern is given in (30a), but critically, the prefix-root boundary *and* prefix-prefix boundaries are tolerant of hiatus, and do not repair it at those loci (30b):

(30) Hiatus resolution in Georgian (Slocum 2010, Butskhrikidze 2002)

a. *Resolution by epenthesis*

rje	'milk'	→	merje**v**e	'milkman (AGENT-milk-AGENT)'
t'χ'e	'forest'	→	met'χ'e**v**e	'forester (AGENT-forest-AGENT)'
ezo	'yard'	→	mezo**b**eli	'neighbor (PART-yard-PART)'

b. *Hiatus tolerated at prefix boundaries*

uto	'iron'	→	a-uto**v**ebs	's.o. irons (S.O.-iron-S.O.)'
int'erest	'interest'	→	sa-int'ereso	'interesting (ADJ-interest-ADJ)'
axal	'new'	→	u-axalesi	'newest (SUPERL-interest-SUPERL)'

prefix + prefix + root + suffix
/c’a-a-k’itx-a/ → c’aak’itxa
PREV-NEUT-read-PAST
‘made somebody read’

Hiatus resolution, however, is just one exponent of the larger generalization that the prefix-root boundary can support phonotactics which are otherwise militated against by other phonological restrictions. Prefixes in many languages, once concatenated, assimilate or dissimilate to roots in ways typical of free roots (such that the prefix+root unit behaves identically to a root+root compound). Suffixes, which conversely are more phonologically well-integrated to their roots, will show typical assimilatory and phonotactic behavior. In **Russian** (East Slavic, Russia), for example, root-final segments become palatalized to agree in backness to the following high and mid front vowels (31a); across word boundaries, instead of palatalization, the root-initial high front vowel is backed (typically called *retraction*), and the preceding consonant is velarized, as shown in (31b). Prefixes, however, behave like independent words, in that their concatenation to the root results in velarization, the opposite to what would be expected if prefixes behaved like other affixal material (31c).[5]

(31) Prefix independents in Russian assimilation (Gribanova 2008)

a. *Word-internal palatalization*

/obid + e/	→	[obʲidʲe]	‘offense.DAT’	
/alʲt + ist/	→	[alʲtʲist]	‘viola player’	

b. *Word+word velarization*

/ugol ivana/	→	[ugolˠɨvana]	‘Ivan’s corner’	*[ugolʲivana]
/sad iriny/	→	[satˠɨriny]	‘Irina’s garden’	*[satʲiriny]

c. *Prefixes trigger velarization*

/ot + iskatʲ/	→	[otˠɨskatʲ]	‘find.INF’	*[otʲiskatʲ]
/ob + ide/	→	[obˠɨde]	‘about Ida’	*[obʲide]

[5] For a discussion of the systematic differences between true Russian prefixes and prepositions, see Gribanova (2009).

Hiatus, as well as other phonotactic distinctions between prefixes and suffixes, can still be analyzed under our current framework. For examples such as the above, it is clear that under affixation, the left edge of the root still wants to be aligned with the left edge of the prosodic word, and that in general, hiatus is not tolerated due to a constraint such as *V.V, leading to its repair by consonant epenthesis. A ranking such as used above, namely ALIGN-L(Root, PrWd) ≫ PARSE can be applied such that only the root-initial boundary tolerates hiatus, as shown in the tableaux in (33) below. Along with *V.V, the upcoming analysis will also use the conflicting anti-epenthesis constraint DEP-C, defined here:

(32) DEP-C (McCarthy & Prince 1995a)
Assign a violation to any consonant segment in the output without a correspondent in the input.

*V.V (modified from Casali 1996)
Assign a violation to any candidate in which there is a heterosyllabic sequence of two vowels, only if those two vowels are both within the prosodic word.

The constraint *V.V above is defined as specifically being violated only if the two vowels in hiatus are not separated by a prosodic word boundary[6]. In tableaux (33) below, it is not immediately clear why this restriction must be stipulated, as even if it were defined as *any* output V.V sequence, the winning candidate in (33a) would still emerge. However, because hiatus is tolerated at the prefix-prefix boundary in Georgian, this parameter of *V.V will serve to rule out ill-formed candidates when prefix-prefix-root structures are evaluated (see tableau 34).

[6] Prosodic domain-bounded constraints have a long history of use in the phonological literature, and so employing them is not an original proposal. See, e.g. Bennett (2013), Kimper (2011), Mpiranya & Walker (2005), among others, for examples of how they have been utilized for a variety of processes.

(33) Asymmetric hiatus resolution (ex. from Georgian)

/a- √uto -ebs/	ALIGN-L (Root, PrWd)	*V.V	PARSESYLL	ALIGN-R (Root, PrWd)	DEP-C
☞ a. a.(u.to.vebs)			*	*	*
b. a.(u.to).ebs			**!		
c. a.(u.to.ebs)		*!	*	*	
d. (a.vu.to).ebs	*!		*		*
e. a.(vu.to.vebs)	*!		*	*	**
f. (a.vu.to.vebs)	*!			*	**

Above, it is shown using this alignment ranking that if the left edge of the PrWd incorporated prefix material, the otherwise robust left root boundary would be blurred by resolving hiatus. Only the prefix-independent candidate in (32a) is the preferred output, because it resolves hiatus by allowing the suffix to incorporate but not the prefix. The suffix-incorporating faithful candidate in (32c) is ruled out due to the interaction of *V.V ≫ DEP-C. Other candidates either misalign the left edge of the PrWd and the root, or have a fatal number of unparsed syllables. It should also be noted that candidates in which the epenthetic hiatus-resolving consonant appears at the left edge of the output PrWd does violate ALIGN-L, such as in (31d) above. Other potential failed candidates which perform better than the winner with respect to hiatus repair such as *a.v(u.to.vebs) should be ruled out because the syllable dominates the PrWd (such a construction, as it is in violation of strict layering (Selkirk 1978 *et seq.*) should not be admissible in GEN; refer to tableaux (28)).

It is also important to discuss cases in which hiatus resolution does not apply even across prefix-prefix boundaries, as is shown above in Georgian with words such as [c'aak'itxa] > /c'a-a-k'itx-a/ 'make someone read'. It is possible to assume that, if derivationality or OO-faithfulness were invoked, that in certain languages, each successively added prefix selects as its base the output from the previous instance of prefixation. Thus, the prefix /c'a-/ (PREV) could be appended to the base [ak'itxa], in which case hiatus would again not be able to adjust the left boundary of the base's initial syllable, and thus not resolve hiatus. Regardless, failed candidates such as *c'a.va.(k'itxa), where hiatus is indeed resolved, cannot be ruled out due to ALIGN-L(Root, PrWd), since the resolution occurs outside the PrWd. As such, this is proof that the constraint used in the above analysis in (33), *V.V, needs its restriction that it only applies when the two heterosyllabic vowels are contained within the prosodic word. Tableau (34) below shows how this constraint interaction works in practice with prefix-prefix-root forms:

(34) Prefix-prefix locus hiatus toleration in Georgian

/c'a-a-√k'itx-a/	ALIGN-L (Root, PrWd)	*V.V	PARSESYLL	ALIGN-R (Root, PrWd)	DEP-C
☞ a. c'a.a.(k'itxa)			**	*	
b. c'a.va.(k'itxa)			**	*	*!
c. c'a.(a.k'itxa)	*!		*	*	
d. c'a.(va.k'itxa)	*!		*	*	*

Above, the winning candidate in (34a) unexpectedly tolerates hiatus; this is allowed under the specific definition of *V.V set forth in (32). The candidate which resolves hiatus without violating the left-alignment of the root and the PrWd, (34b), is ruled out for its violation of DEP-C. All other candidates above violate highly-ranked ALIGN-L, and are thus ill-formed.

Because the prefix-prefix boundary is not expected to be as informationally beneficial to the perceiver, or as articulatorily robust, as the prefix-root boundary, I would argue that instances of prefix-prefix non-cohesion would be relatively rare. In the typology, I have only found three languages in which every additionally appended prefix is separated from its base prosodically, which supports this intuition: Georgian (cited above), Chintang (Sino-Tibetan, Nepal; Bickel et al. 2007), and Kaqchikel (Mayan, Guatemala; Bennett 2018 – but not for all prefixes, see §3 below). All these languages already show a prefix-suffix asymmetry, so I hypothesize an implicational relationship: no languages should have prefix-prefix non-cohesion without first having prefix-root non-cohesion. A language falsifying this prediction would be one in which the closest prefix to the root always coheres, but all successively added prefixes do not cohere to that prefix: the prediction of this current framework is that such a system should be impossible.

A table of languages in which the prefix boundaries obey separate phonotactic considerations including hiatus resolution, is given below:

Language	Family	Region	Citation
Spanish	Western Romance	Global	Peperkamp 1997
French	Western Romance	France	Selkirk 1980
Dutch	Western Germanic	the Netherlands	Booij 199, van Oostendorp 2006
Polish	West Slavic	Poland	Rubach & Booij 1990
Georgian	Kartvelian	Rep. of Georgia	Slocum 2010, Butskhrikidze 2002
Kulyma Yukaghir	Yukaghir	Siberia	Maslova 2003
Malay	Austronesian	Malaysia	Kassin 2000
Tetun	Timoric	West Timor	van Klinken 1999
Fijian	Oceanic	Fiji	Dixon 1988
Choctaw	Muskogean	SW United States	Lombardi & McCarthy 1991
Kaqchikel	Mayan	Guatemala	Bennett 2018
Uspanteko	Mayan	Guatemala	Bennett 2020

Table 7: Languages in which the prefix-root boundary tolerates otherwise fatal phonotactics

3 A complication: differential prefix behavior

Thus far we have been looking at cases with a straightforward prefix-suffix asymmetry; we turn now to a somewhat more complicated situation in which, while all suffixes cohere, some prefixes do not. This bifurcation of affixes appears regularly to happen along the inflection/derivation divide. A handful of languages have been found for which the phonological cohesion of either inflectional or derivational prefixes is distinguished, despite always having suffixes cohere as would usually be expected. In this subsection, I will provide an example of each kind.

In **Misantla Totonac** (Totonacan, Mexico), derivational prefixes undergo dorsal harmony, with underlying /k k'/ agreeing with dominant uvular /q q'/ (35a), but inflectional prefixes are not subject to harmony (35b):

(35) Totonac dorsal harmony does not affect inflectional prefixes (McKay 1991)

a.	*Derivational prefixes cohere*		
	[maqaɬɔ́qwaɬ]	/maka-**ɬuqwan**-la(ɬ)/ CAUS-be.tired-PFV	'(s)he tired (him/her)'
	[láχtʃáɴχʃ][7]	/lak-**tʃanqʃ/** DIST-chop	'(s)he chops (bones)'
b.	*Inflectional prefixes do not cohere*		
	[ʔḭ́kláqtsa̰qa̰]	/ik-lak-**tsa̰qa̰**/ 1SUBJ.-DIST-chew	'I chew (it)'
	[kḭ́sqɔjúniɬ]	/kin-**squ**-jan-ni-la(ɬ)/ 3OBJ.SG-smoke-I.O.-+OBJ-PFV	'(s)he smokes (it) for me'

A similar pattern is found in neighboring Tlachichilco Tepehua (Totonacan, Mexico; Watters 1988), where various prefixes and proclitics are subject to dorsal consonant harmony, but no

[7] The underlyingly velar stop in the surface representation of the prefix /lak-/ has harmonized by first becoming uvular [q] but spirantizing in this context to [χ].

harmony is attested in many inflectional prefixes, including the 1st person subject /k-/ and 1st person object /kin-/.

The reverse of this Totonac-type language pattern, whereby it is the *inflectional* prefixes that cohere but not the derivational ones, comes from **Kaqchikel**. Kaqchikel (Mayan, Guatemala), displays a split along the inflection/derivation divide: phonologically cohering prefixes tend to be used for TAM and case marking and non-cohering prefixes tend to be derivational. The divide is not entirely clean (cf. non-cohering absolutive agreement marker [ʔin=]), but is certainly the overwhelming generalization. Lack of phonological incorporation to the root is diagnosed by glottal stop epenthesis and failure to degeminate word-initially, as shown in (36a,b), with the '=' symbol representing non-cohesion and '-' representing cohesion.

(36) Kaqchikel cohering and non-cohering prefixes (Bennett 2018)

a. *Cohering prefixes are inflectional*
xojjote'/ʃ-oχ-χot-eʔ/ → [ʃoχoteʔ] 'we climbed'
yixxule' /j-iʃ-ʃul-eʔ/ → [jiʃuleʔ] 'y'all descended'
xok /ʃok/ → [ʃ-okʰ] '(s)he entered' *x'ok* [ʃ-ʔokʰ]
ruchuq' /r-utʃuq̥aʔ/ → [r-utʃuq̥aʔ] 'his/her strength' **r'uchuq'a'* [r-ʔutʃuq̥aʔ]

b. *Non-cohering prefixes are largely derivational*
aj- /aχ=/ AGT
(i) *ajejqa'n* [ʔaχ=ʔeχqaʔn] 'porter'
(ii) cf. *rejqa'n* [r-eχqaʔn] 'his/her cargo'
(iii) *ajjuku'* [ʔaχ=χukuʔ] 'boatman'
ix- /iʃ=/ FEM
(i) *ixajaw* [ʔiʃ=ʔaχaw̥] 'female leader'
(ii) cf. *rajaw* [r-aχaw̥] 'his/her lord'

ach- /atʃ=/ COM
(i) *achamaq'* [ʔatʃ=ʔamaq̥] 'federation'
(ii) cf. *r-amaq'* [r-amaq̥] 'his/her nation'

yaj- /jaχ=/ 'related by marriage'
(i) *yajal* [jaχ=ʔal̥] 'stepchild (of a woman)'
(ii) cf. *ral* [r-al̥] 'her daughter'
(iii) *yajjite'* [jaχ=χiteʔ] 'second wife of father-in-law of a man'

As shown in (36a), Cʔ clusters are not illegal in Kaqchikel, and are indeed quite widely attested, cf. [ʃ-ʔe] ‘she went’. Therefore, **x'ok* [ʃ-ʔokʰ] ‘(s)he entered’ and similar forms are not illegal because of phonotactics, but rather because the epenthesis would indicate a nonexistent PrWd edge.

A line of argument might also posit that cohering prefixes in Kaqchikel do so because they share a unifying phonological characteristic, however segmental/phonological factors do not play a part in the differential cohesion behaviors of the two prefix types (Bennett 2018:14), cf. /iʃ=/ (FEM) vs. /iʃ-/ (2PL.ABS). The near-minimal pair in (37) below shows how two prefixes with very similar segmental inventories nonetheless have distinct prosodic integration behavior:

(37) Distinctive prosodic integration of segmentally similar prefixes (Bennett 2018)

awikäq'	[ʔa.wi.keqˀ]	>	/ʔaw-ikeqˀ/	‘your slingshot’
ajikäq'	[ʔaχ.i.keqˀ]	>	/ʔaχ=ikeqˀ/	‘a slingshot user’

In all, the data above demonstrate that there are at least two types of language that demonstrate this differential prefix behavior: “Totonac-type” languages with cohering derivational prefixes and “Kaqchikel-type” languages with cohering inflectional prefixes[8]. In both, suffixes are already cohering, and it is instead a morphosyntactic condition which dictates prefix cohesion. The ability to account for this differential cohesion of particular prefix types is an important additional metric for evaluating potential theoretical analyses of the prefix independence data. For example, the fact that both types of languages exist, and appear to be equally as common, is evidence against Lexical Phonology and Morphology (LPM, Kiparsky

[8] There are attested languages, such as Tlachichilco Tepehua (Watters 1988), for which there is no there is no obvious morphosyntactic or semantic property which unite the group of prefixes which cohere or the group which does not (Hansson 2001). For such languages, a SUBCAT constraint would have to have its definitoino specified on an affix-by-affix basis instead of on some morphosyntactic criterion.

1982 *et seq*.), which predicts that derivation should always be more phonologically cohering than inflection.

To capture this differential prefix behavior in our current framework, however, we will once more have to appeal to crisp edges since cohering prefixes may violate the demand on root-initial syllable's crisp edges. Systems such as these, then, should be dispreferred from arising, because of course root-initial syllable faithfulness is a *bias*, not a rule. And it does appear to be the case that languages with a cohering/non-cohering divide among prefixes are particularly rare, the much more common phenomenon being individual exceptional affixes (see, e.g., Finley 2010, Pater 2007).

In Totonac, only derivational prefixes are subject to uvular consonant harmony, and inflectional prefixes, though they may contain dorsal targets, are not subject to such harmony; suffixes all cohere, regardless of their morphosyntactic specification. For such a language, it becomes clear that cohering prefixes represents a violation of CRISPEDGE, as the active harmonic feature spreads past the root-initial syllable. Non-cohering prefixes must all occur before crisp edges, since featural propagation is blocked at the left edge of the root. It is plausible, then, that cohering prefixes must be underlying subcategorized in such a way that they are allowed to occur to the left of an *uncrisp* edge, whereas non-cohering prefixes must select for a crisp edge. Prosodic subcategorization is the property of morphemes to select for the prosodic characteristics of their hosts (Bennett et al. 2018, Paster 2006, Inkelas 1990, among others). In OT grammars, the constraint which enforces this kind of phonological subcategorization has been called SUBCAT (e.g. by Bennett 2018). The particular subcategorization relevant here is given below (where the '=' symbol indicates phonological non-cohesion:

(38) SUBCAT
The subcategorization frame for a non-cohering prefix is PREF=[$_{\text{CRISP}}$ σ_1…].

With the above constraint active in the grammar, any non-cohering prefix will set off a crisp left edge; cohering prefixes make no particular selection for the prosodic properties of their bases. For languages in which it is not the propagation of a specific feature that differentiates between cohering and non-cohering prefixes, but rather some sort of distinction along the lines of prosodic constituency (as is seen in Kaqchikel), such can be stipulated via more specific subcategorization constraints. Under Bennett (2018)'s account of Kaqchikel, for example, non-cohering prefixes, (which are somewhat confusingly called *high-attaching*, though this does not correlate with morphosyntactic high-attachment), which occur outside of the root's prosodic word, are given the specific prosodic subcategorization: [$_\omega$ HIGHPREF=[$_\omega$ …]].

The tableaux below show how prosodic subcategorization can account for the distinctive cohesion strategies in Totonac and Kaqchikel. In (39), the SUBCAT constraint is defined as it is in (38) above; for Kaqchikel, I use Bennett (2018)'s language-specific definition. For Totonac, SUBCAT will be violated in candidates that show features spreading across the crisp left root boundary; it will be ranked above the markedness constraint driving such spreading (which is otherwise active in the language), SPREAD[+RTR], which assesses violations for every dorsal target which does not bear the trigger's spread uvularity. The feature [+RTR] has been argued by Hansson (2001) to distinguishing uvularity amongst dorsals (i.e. [k] is [—RTR] but [q] is [+RTR]).

(39) Subcategorization in Totonac uvular harmony

a. Cohering prefixes

/maka-√łuqwan-la(ɬ)/	SUBCAT	SPREAD[+RTR]	IDENT[RTR]
☞ a. maqa√łɔ́qwał			*
b. maka√łɔ́qwał		*!	

b. Non-cohering prefixes

/kin=√squ-jan-ni-la(ɬ)/	SUBCAT	SPREAD[+RTR]	IDENT[RTR]
☞ c. kḭ́√sqɔjúniɬ		*	
d. qḭ́√sqɔjúniɬ	*!		*

c. Suffixes induce spreading

/min-√ka̰a̰k-paqaʔ/	SUBCAT	SPREAD[+RTR]	IDENT[RTR]
☞ e. min√qa̰a̰qpaqaʔ			**
f. min√ka̰a̰kpaqaʔ		*!*	

Above, the prosodic subcategorization of non-cohering prefixes, namely that they must occur to the left of a crisp edge, is what distinguishes the winner in tableaux (a) and (b): the candidate in (39d) violates its subcategorization frame, allowing the [+RTR] feature to spread to its dorsal target. Cohering prefixes, which are not specifically targeted by SUBCAT, are not evaluated by that constraint, but rather by their markedness violations, leading to failed candidates like in (39b). Suffixes, which cohere, are similarly not evaluated over SUBCAT because they never occur immediately adjacent to crisp edges. Therefore, the ranking SPREAD[+RTR] ≫ IDENT[RTR] derives cases of suffix and (certain) prefix cohesion.

Next, an analysis of subcategorization in Kaqchikel is provided in (40). It is shown that cohering prefixes violate SUBCAT when they display the prosodic subcategorization of non-cohering prefixes (i.e. setting off a recursive prosodic word). The markedness constraint non-cohering suffixes obey is ALIGN-R(morph, syll), which aims to align the right edge of every morpheme at the right edge of a syllable; this constraint is violated by syllabification over a morpheme boundary, which is the behavior of cohering prefixes. Non-cohering prefixes likewise cause glottal stop epenthesis at the left boundary of the inner prosodic word to satisfy a language-wide onset requirement, so it violates the constraint DEP[ʔ], assuming that glottal epenthesis is the least marked in this language (following Bennett 2018:4).

(40) Subcategorization in Kaqchikel syllabification

a. Cohering prefixes

/ʔaw-√ikeqˀ/	SUBCAT	ONSET	DEP[ʔ]	ALIGN-R
☞ a. $(ʔa.wi.keq^{ʔ})_{\omega}$				*
b. $(ʔaw.(ʔi.keq^{ʔ})_{\omega})_{\omega}$			*!	
c. $(ʔaw.(i.keq^{ʔ})_{\omega})_{\omega}$		*!		

b. Non-cohering prefixes

/ʔaχ=√ikeqˀ/	SUBCAT	ONSET	DEP[ʔ]	ALIGN-R
☞ d. $(ʔaχ.(ʔi.keq^{ʔ})_{\omega})_{\omega}$			*	
e. $(ʔa.χi.keq^{ʔ})_{\omega}$	*!			*
f. $(ʔaχ.i.keq^{ʔ})_{\omega}$	*(!)	*(!)		
g. $(ʔaχ.(i.keq^{ʔ})_{\omega})_{\omega}$		*!		

c. Suffixes cohere

/r-√ʊts-il/	SUBCAT	ONSET	DEP[ʔ]	ALIGN-R
☞ h. $(\text{ru.tsil})_{\omega}$				*
i. $((\text{ruts})_{\omega}.\text{ʔil})_{\omega}$			*!	
j. $((\text{ruts})_{\omega}.\text{il})_{\omega}$		*!		

Above, the differential prosodic integration behavior of cohering and non-cohering prefixes is derivable from a constraint enforcing that their particular prosodic subcategorizations surface. Candidates with ideally cohering prefixes or suffixes displaying the prosodic behavior of non-cohering affixes (and vice versa) are immediately ruled out for their markedness violations. The winning candidates (40a,d,h) are those which not only obey their correct subcategorization, but also maintain other phonotactic wellformedness, such as bearing an appropriate onset.

4 The full typology: alternatives to prefix independence

Up to this point, only systems with full or partial prefix independence have been discussed. However, this is not the only logical or attested possibility. Such systems are important to bear in mind, since the ideal theoretical analysis of prefix independence must also be one which can be generalizable enough to account for other systems. In this section, I will explore the three other possibilities for affixes' phonological cohesion, and provide a brief example of each.

4.1 Symmetry

As we have seen before, many languages exhibit symmetrical application of phonological processes to both prefixes and suffixes. For example, a language might compel segments in either affix type to undergo vowel harmony, as is seen in **Akan** (Kwa, Ghana & Côte d'Ivoire). This language shows a root-outward bidirectional [ATR] harmony system, whereby the [±ATR] feature of the root conditions an [αATR] feature on all affixes, which are underlyingly unspecified for that feature:

(41) Akan vowel harmony is symmetrical (Bakovic 2003)

a.	/E + √bu̲ + O/ CL + nest + CL	→	[ebuo] 'nest'
b.	/E + √bʊ̲ + O/ CL + stone + SF	→	[ɛbʊɔ] 'stone'
c.	/O + bE + √tu̲ + I/ 3SG + COME + dig + PST	→	[obetui] 'he came and dug (it)'
d.	/O +bE + √tʊ̲ + I/ 3SG + COME + throw + PST	→	[ɔbɛtʊɪ] 'he came and threw it'

As is shown above, the root's [±ATR] feature spreads onto unspecified vowels regardless of morphological constituency. This means that the markedness constraint mandating the spreading of the [αATR] feature must dominate both CRISPEDGE-L(σ_1) and plain CRISPEDGE(σ), indicating that the left edge of the initial syllable is treated as equivalently privileged as the edges of any other syllables. The bias toward privileging initial syllables does not rule this out as a possibility, but posits only that the norm across languages should be that initial syllables be privileged either as much as or more so than other syllables:

(42) Symmetrical system

/E + √bu̲ + O/	AGREE[ATR]	CRISPEDGE-L(σ_1)	CRISPEDGE (σ)
☞ a. ebuo		*	**
b. ɛbuɔ	*!*		

4.2 Root conditions

Other languages possess phonological patterns which are bounded by the root, and do not spread to either prefixes or suffixes. A typical example would be root-internal coocurrence restrictions, such as those pertaining to voicing or laryngeal activity. In **Zulu** (Bantu, South Africa), there is a strictly root-internal consonant harmony pattern that holds for oral non-click stops such that they must agree with respect to voicing and aspiration; all affixes fall outside of this domain because they are root-external:

(43) Zulu's root-internal laryngeal harmony (Khumalo 1987, Hansson 2010)

a. *Well-formed verb stems with two stops*

ukú-pet-a	'to dig up'	(T…T)
úku-táp-a	'to collect (honey, etc.)	(T…T)
ukú-k^het^h-a	'to choose'	(T^h…T^h)
úku-p^hát^h-a	'to hold'	(T^h…T^h)
ukú-gub-a	'to dig'	(D…D)

b. *Cooccurrence restriction does not apply outside of roots*

ukú-**bi**-p^h-a	'to make a face'	(root: /bi/ 'ugly')
p^ha-ka-**de**	'forever'	(root: /de/ 'long, deep')
gigi-t^h-ek	'to giggle'	(root: /gigi/ 'giggling')

In systems such as these, the feature which would otherwise target all or some affix segments in a symmetrical or asymmetric system, respectively, fail to do so; the phonological process is bounded to the morphological domain of the root. This means that the markedness constraint driving alternation, say AGREE[Lar], should be dominated by both CRISPEDGE-L(σ_1) and CRISPEDGE(σ). Like in the symmetrical systems discussed above, this setup should also not be ruled out under our framework, since the initial syllable is still just as privileged as any other syllable, not less so:

(44) Root-conditional system

/ukú-√bi-p^h-a/	CRISPEDGE-L(σ_1)	CRISPEDGE(σ)	AGREE[LAR]
☞ a. ukúbip^ha			**
b. ugubiba	*(!)	*(!)*	

4.3 Suffix independence

The final logically possible system of morphophonological cohesion is that in which prefixes cohere, but suffixes do not. This “suffix-independent” system is the exact reverse of what the typology would suggest is the norm for independent systems, which cross-linguistically favor prefixes to be independent, should either affix type have such a status. To my knowledge, only a single language has been argued to have such a system, **Kabardian**. In Kabardian (Northwest Caucasian, Russia & Turkey; Gordon & Applebaum 2010), while prefixes appear to always be targeted by root phonology, nominal suffixes are argued to be independent, based on two main diagnostics: stress assignment and obstruent cluster voicing.

First, Kabardian stress falls on the final heavy (CVC or CVV) syllable, or else the penult, independent of part of speech (45a): certain suffixes which would be able to create heavy syllables and thus attract stress, do not; words thus suffixed bear stress on the penult (45b).

(45) Kabardian suffixes fail to attract stress (Gordon & Applebaum 2010)

a. *Typical stress assignment*

məʔɐˈɾəsɐ			‘apple’	*(stress on penult light)*
saːˈbiː			‘baby’	*(stress on final heavy)*
wə-lɐʑ-aː-s 2ABS-work-PST-DECL	→	wəlɐˈʑaːs	‘you worked’	″″
jə-s-wəkʲ’ə-fə-n-s 3ABS-1ERG-kill-POT-FUT-DECL	→	əswə’kʲəˈfən	‘I will be able to kill him’	″″

b. *Independent suffixes fail to attract stress*

q’aːlɐ-kʲɐ	city-INSTR	→	ˈq’aːlɐ-kʲɐ	‘city (INSTR)’
daːmɐ-hɐ-m	wing-PL-ERG		ˈdaːmɐ-hɐm	‘wing (ERG PL)’
sə-tçə-s	1ABS-write-DECL		ˈsətçəs	‘I write’
məʃɐ-hɐ-kʲɐ	bear-PL-INSTR		ˈməʃɐ-hɐ-kʲɐ	‘bears (INSTR)’

Above, words that are prefixed with CV prefixes such as [ˈsətçəs] > /sə-tçə-s/ ‘I write’ demonstrates that prefixes are incorporated into the stress domain, since after this suffix (which never attracts stress) is excluded from the stress assignment domain, stress falls on the prefix antepenult instead of the root.

Additionally, there is a phonotactic restriction stating that two adjacent obstruents must agree in voicing (voiced vs. voiceless) and laryngeal activity (ejective vs. plain): prefixes all cohere to this rule (46a), but certain suffixes do not, indicating that they are less phonologically well-integrated to their roots (46b):

(46) Kabardian suffix consonants fail to agree (Gordon & Applebaum 2010)

a. *Prefix consonants agree*

s-oːʃ-ç	‘I eat it (HABIT)’	*underlying /s, t, f/*
t-łɐɣʷɐː-s	‘we saw him’	
f-łɐɣʷɐː-s	‘you (PL) saw him’	
z-daː-s	‘I sewed it’	*voicing agreement*
v-daː-s	‘you (PL) sewed it’	
s’-p’aː-s	‘I educated him’	*[+CG] agreement*
t’-p’aː-s	‘we educated him’	
f’-p’aː-s	‘you (PL) educated him’	

b. *Suffix consonants fail to agree*

/məz-t/	forest-PST	→	məz-t	‘it was a forest’
/ʃəd-s/	donkey-PRES	→	ʃəd-s	‘it’s a donkey’
/ʃ’əb-ʔəm/	back-NEG	→	ˈʃ’əb-ʔəm	‘it’s not a back’
/ʃ’əd-hɐ-m/	donkey-PL-ERG	→	ˈʃ’əd-hɐ-m	‘donkeys (ERG)’
/fəz-kʲɐ/	woman-INSTR	→	ˈfəz-kʲɐ	‘woman (INSTR)’

The fact that obstruent clusters agree in voicing when they include prefixes in Kabardian is actually derivable via another mechanism, such that this apparent instance of suffix independence is actually illusory. Kabardian’s nominal suffixes getting excluded from the stress assignment domain presents a more convincing case of suffix independence. This does not mean, however, that languages with "true" suffix independence – that is, where it is observed across all phonological processes – should not be possible (if extremely rare): it is only that so far, the only known case of such a setup happens to have much of its proposed suffix independence explainable by other means. Below are my analyses of the Kabardian phenomena.

The first critical phenomenon, that prefix obstruents agree in voicing to match the following root-initial segment, may actually simply arise due a ban on voicing disagreement in onset position specifically. Note that in all of the above examples, the agreeing segments form part of a complex onset. Words such as [məzt] > /məz-t/ 'it was a forest' show that the otherwise offending cluster is in coda position, and is thus not required to be repaired. An undominated positional AGREE[Laryngeal]-ONSET constraint could enforce this within the language. Evidence for this proposal also comes from the fact that heterosyllabic obstruent clusters between prefixes brought about via iterative prefix stacking, as well as those that appear at the prefix-root boundary, do not compel laryngeal agreement, cf. [səq'ɪzχʷɪʃɑχʷɛ√ˈzɑræ] 'the reason why I met him there (on my territory)' (Colarusso 1992:86), and [qəz√çɐɬɐm] 'running out from here (OBJ)' (Applebaum 2013:241).

This positional agreement constraint is necessarily ranked above IDENT[voice] because this alternation is allowed to overwrite the underlying laryngeal specification. This positionally-specific AGREE-ONSET is ranked above positionally non-specific AGREE, which allows for coda or ambisyllabic disagreement (which are both attested) but not onset disagreement (which is unattested). I also assume here a MAX[+Laryngeal] constraint, since agreeing obstruents always become voiced or ejective, and never lose a positive laryngeal feature value. The ranking MAX, AGREE-ONS ≫ IDENT ≫ AGREE derives the correct outputs for prefixation, suffixation, and derived ambisyllabicity without having to appeal to prosodic words:

(47) MAX[+voi]
Assign a violation to any output segment which has lost a [+voice] feature from the input.

AGREE[voi]
Adjacent obstruents must share a single [voice] feature.

AGREE[voi]-ONS
Adjacent obstruents must share a single [voice] feature only if those obstruents constitute an onset cluster.

IDENT[voi]
Assign a violation to any output segment which differs from its input segment with respect to the feature [voice].

(48) Asymmetric obstruent agreement in Kabardian

a. Prefixation of a single consonant forces agreement

/f-da-s/	MAX[+voi]	AGREE[voi]-ONS	IDENT[voi]	AGREE[voi]
☞ a. vdaːs			*	
b. fdaːs		*!		*
c. ftaːs	*!		*	

b. Suffixation of a single consonant allows disagreement

/məz-t/	MAX[+voi]	AGREE[voi]-ONS	IDENT[voi]	AGREE[voi]
☞ d. məzt				*
e. məzd			*!	
f. məst	*!		*	

c. Disagreement in ambisyllabic contexts

/fəz-kʲɐ/	MAX[+voi]	AGREE[voi]-ONS	IDENT[voi]	AGREE[voi]
☞ g. fəz.kʲɐ				*
h. fəz.gʲɐ			*!	
i. fəs.kʲɐ	*!		*	

Above, the winnings candidates are those in which agreement is repaired within onset clusters only (48a), or those in which clusters are not repaired when unnecessary (48g). Suffixation is shown to behave identically regardless of whether or not the suffix segments become syllabified together with the root.

The second point, that certain suffixes fall outside of the stress assignment domain, may be attributed to output-output correspondence. Colarusso (1992) indicates that these suffixes are all nominal (i.e. can only attach to nouns and never verbs, etc.) and shows that they are strictly inflectional, such as case, number, and predicative markers, all of which are never required for a licit output form (i.e. the base, uninflected forms are always freestanding). For example, the suffix /-s/ (declarative), which should form heavy syllables and thereby attract stress but does not, is never required for a licit output form; the bare nominal base without these suffixes are always attested. This also goes for the stress-inert case markings, such as /-kʲɐ/ (instrumental), /-r/ (absolutive) and /-m/ (oblique); past tense /-t/; as well as the nominal negatives /-ʔəm/ and /-q’əm/. It appears, then, that these suffixes are attached such that their base forms are unaltered with respect to stress assignment. Therefore, they may be attached in such a way that they maintain the identity of their bases. Because these suffixes are still affected by other prosodic word-internal phonological processes (such as vowel coloring), and are not phonetically distinct from known prosodic word-internal syllables (as diagnosed by overall pitch, pitch change, and vowel duration), Applebaum (2013) concludes (contra Gordon & Applebaum 2010) that these suffixes indeed do fall within the prosodic word domain despite their inability to attract stress; this indicates that stress is likely assigned within the base first, to which these stress-inert suffixes attach cyclically.

For an analysis of this phenomenon, I would argue that the affix-specific output-output correspondence constraint OO-IDENT[stress]-NOMSFX, evaluated over candidates bearing these stress-inert nominal suffixes, outranks the typical stress assignment constraint ALIGN-R(GrWd, Ft). I will also assume the constraint FTBIN (foot binarity) to be active, which assesses a violation for each foot that contains more or fewer than two morae – evidence for this constraint's existence in Kabardian comes from the fact that a single heavy syllable (either CVC or CVV) may bear stress.

(49) OO-IDENT[stress]-NOMSFX
Assign a violation for each syllable in a candidate (i.e. form suffixed with a nominal suffix) which bears a different value for the feature [stress] from its corresponding syllable in the base form.

FTBIN
Feet must have exactly two morae.

ALIGN-R(GrWd, Ft)
A foot must be aligned at the right edge of each grammatical word in the output.

With a ranking of OO-IDENT[stress]-NSFX, FTBIN ≫ ALIGN-R(GrWd, Ft), stress-inert suffixes will be unable to adjust the stress assignment of their base of attachment. If the base is the unaffixed form, as I am assuming it is, this analysis will work with both single and multiple suffixation. Some representative tableau are given below in (50):

(50) Output-sensitive stress assignment in Kabardian

a. Single suffixation

/ʃ’əb-ʔəm/ base: [ˈʃ’əb]	OO-IDENT[stress]-NOMSFX	FTBIN	ALIGN-R(GrWd, Ft)
☞ a. (ˈʃ’əb)ʔəm			*
b. ʃ’əb(ˈʔəm)	*!		

b. Multiple suffixation

/məʃɐ-hɐ-kʲɐ/ base: [ˈməʃɐ]	OO-IDENT[stress]-NOMSFX	FTBIN	ALIGN-R(GrWd, Ft)
☞ c. (ˈməʃɐ)hɐkʲɐ			*
d. (ˈmə)ʃɐhɐkʲɐ		*!	*
e. (ˈməʃɐhɐkʲɐ)		*!	
f. məʃɐ(ˈhɐkʲɐ)	*!		

Above, even though the winning candidates in (50a,c) fail to align the foot to the rightmost edge of the grammatical word, they obey the higher-ranked demand on faithfulness to their bases' stress pattern. Other candidates which are ill-formed but obey OO-IDENT[stress], such as (50d,e) violate the foot binarity requirement and are also ruled out.

In all, Kabardian actually extends its phonological processes from the root to both prefixes and suffixes (with the critical exception of the small class of nominal suffixes). Its voicing agreement among prefix obstruents is accountable with a simple positional markedness constraint, but output-output constraints must be invoked to address its stress-intert nominal suffixes. These facts indicate that Kabardian is, for at least most processes, a language where phonological processes extend to both prefixes and suffixes symmetrically. I would argue that a true suffix-independent system, in which phonological processes apply across the board to suffixes but not to prefixes, should be highly unlikely due to the psycholinguistic pressures of maintaining a robust root-*initial* signal, as it must constitute a language valuing final faithfulness over initial faithfulness. Although proposed instances of such a system would not falsify the claims made in this paper – as I argue that a prefix independent setup is a cross-linguistic *bias*, not a rule – their rarity is taken here as evidence that this bias is widespread and robust. Much more research into the nature of Kabardian, and indeed other potentially counter-typological languages, is required before a hard universal ranking of ALIGN-L ≫ ALIGN-R (that is, in lieu of a bias) can be proposed.

6 Conclusion

This thesis arrives at two results. The first result is that, using a typological survey, the prefix-suffix asymmetry has been shown to be extremely widespread, and is not limited to a handful of languages. Prefix independence is demonstrated to be a characteristic of many unrelated languages on almost every continent, which is sensitive to essentially every domain of phonology. A survey of over 85 languages, retrieved by following Rijkhoff et al. (1999)'s algorithm maximizing genetic diversity, demonstrates that the following phonological processes demonstrate prefix independence when languages have both affix types: affix control, vowel harmony, consonant harmony, tone spread, stress assignment/footing, syllabification, and hiatus resolution.

Additionally, in §3 languages emerged for which suffixes cohere, but only a particular class of prefixes acts as phonologically aloof, the distinction between which typically being morphosyntactic: those in which inflectional prefixes are independent, and those in which derivational prefixes are independent. A morpheme-specific subcategorization analysis informed by Bennett (2018) is shown to handle these cases.

A typology of all affix cohesion systems was provided next in §4. The reverse of the unmarked prefix-independent setup, suffix independence, is argued to be possible but highly marked; the only language proposed to have such a setup which was found, Kabardian, is able to have its much of its suffix independence accounted for by other mechanisms, such as by using positional AGREE, however its stress-inert suffixes require the use of OO-IDENT[stress]-NOMSFX constraints.

Using the typological survey as a metric of evaluation, I attempted to use this information to inform current phonological theory. I argue that appealing to root-initial percept maximization as a framework could provide a suitable alternative to level orderings (as in LPM and Stratal OT), and affix-oriented output-output correspondence (as in Tr-OO). The phonologization of root-initial segments' prominence is instantiated by psycholinguistic pressures which facilitate lexical access: (1) initial syllables are hesitant to spread their features leftward or receive features from prefixes, as this would blur their prominent left boundaries; and (2) for processes such as stress assignment which are not governed by feature sharing, but which are instead delimited by the prosodic word domain, the PrWd is preferentially left-aligned with the root, which allows root-initial material to remain in environments where it can be articulated most robustly.

If these properties are afforded to root-initial material, as I argue is the default or biased system cross-linguistically, then canonical prefix independence can be shown to follow from this. The second result of this thesis, then, is that the prefix-suffix asymmetry in phonology could arguably arise due to the bias toward privileging root-initial positions.

It remains to be shown how a prosodic domains analysis might be extended to account for other processes which are opaque to prefixes in lieu of CRISPEDGE, such as those which show feature spreading from the root to suffixes, but not to prefixes. Such an analysis does encounter certain issues, though, such as its inability to capture asymmetric affix control. In affix control languages, a dominant feature value on root or suffix vowels is able to affect prefix vowels, turning their recessive features into dominant features; however, dominant prefixes are unable to trigger featural change within the root+suffix domain (this pattern is attested in Maasai, among other languages: see §2.2). A prosodic domains analysis would not work for such cases, because prefixes would have to be within the PrWd to be affected by dominant root/suffix vowels, but exterior to the PrWd when attempting to trigger such change. The benefit of extending a prosodic domains analysis to more phonological processes is therefore left open for future investigation.

The results of this thesis also open the possibility of further lines of experimental research. For example, as I lay out in §2.6.1, the possibility of finding acoustic-phonetic evidence for domain-initial strengthening effects in embedded prosodic words (i.e. those prosodic words whose left edges do not align with the left edges of morphological words, as is argued to exist in many languages) is highly intriguing. Finding such evidence would lend more credence to the idea that the alignment of the PrWd domain to the root, instead of the entire morphological word, is beneficial for perceivers. It would also add to our knowledge of prosodic domain-initial strengthening effects, for which researchers have not yet examined domain junctures at misalignment with left word edges.

Appendix

This appendix lists every language collected the present typology. Many more languages are listed here than are used as illustrative examples in the main body of the thesis, so each language has the following information: language name, language family, language region, a brief explanation of its prefix-independent phonological feature(s), and citations. The list of languages is alphabetical, though alternative names for languages will also be included if necessary.

Anyuak (Western Nilotic, Ethiopia)

In Anyuak (Anywa, Anywaa), the prefix-root boundary blocks ATR harmony in vowels, dental harmony in consonants, and leftward high tone spread (Reh 1996; Trommer 2011). Prefixes have been argued by MacKenzie (2016) to comprise their own prosodic words.

Assamese (Indo-Aryan, India)

Assamese affix-controlled ATR harmony can be triggered by a suffix, but not from a prefix (Mahanta 2007).

Avestan (Indo-Iranian, Iranian Plateau)

Avestan pre-verbs could undergo tmesis and be fronted syntactically (Hale 1993).

Ayutla Mixtec (Mixtecan, Mexico)

Prefixes fall outside of the stress assignment domain. Only roots or suffixes can surface with tone. (Gerfen 1996; de Lacy 2002).

Balantak (Austronesian, Sulawesi)

Prefixes are not considered for stem stress assignment rules, but the root-suffix border does show more phonotactic possibilities, as evidenced by nasal and glottal stop alternations (Broselow 2003).

Belhare (Sino-Tibetan, Nepal)

Certain phonotactic rules such as intersonorant voicing on obstruents are blocked at the prefix-stem locus (Bickel & Hildebrandt 2005)

Catalan (Western Romance, Spain & Andorra)

While prefixes can either be stressed or unstressed, prefixes never affect the stress of the stem, while suffixes (and, in many varieties, enclitics) can (Mascaró 1972; Torres-Tamarit & Moll 2018).

Cherang'any (Southern Nilotic, Kenya)

Like its close neighbor Kalenjin, Cherang'any is a [+ATR]-dominant vowel harmony language where suffixes and roots may (or may not be) dominant, but prefixes can never trigger dominant harmony (Mietzner 1993).

Chichewa (Bantu, Southeastern Africa)

Chichewa (Chewa, ciCewa, Nyanja), like its close neighbor Nsenga, has root-controlled height harmony restricted to the stem; prefixes are not affected by harmony (Simango 2013).

Chintang (Sino-Tibetan, Nepal)

Chintang satisfies a global restriction on onsetless syllables beginning prosodic words by epenthesizing a glottal stop; when prefixes are attached, a vowel-initial stem will nonetheless bear an epenthesized glottal stop. Furthermore, endoclitics can attach between prefixes and stems, indicating that prefixes are their own prosodic words. Indeed, Bickel et all (2007) argue that all prefixes, which are freely orderable, are each their own prosodic word in Chintang.

Choctaw (Muskogean, SW United States)

Suffixes and roots cohere to left-to-right footing (as diagnosed by lengthening), but prefixes are excluded from this and a handful of phonological alternations (Lombardi & McCarthy 1991).

Coere d'Alene (Salishan, Idaho)

Vowel (faucal) harmony is root-triggered and regressive, but has been argued to exclude prefixes; the preferential harmony domain is the stem (Bessell 1989; Doak 1992).

Comanche (Uto-Aztecan, Southern US)

Prefixes (such as possessive and object pronouns and subject markers) do not attract stress leftward from initial primary stress (Charney 1993).

Cupeño (†Uto-Aztecan, SW California)

Although Cupeño has primary stress, prefixes are not considered for stress placement. In certain rare sub-minimal "stressless" words, prefixes may bear exceptional stress. Suffixes frequently attract stress or bear their own exceptionless primary stress. A "stressless" root with both prefixes and suffixes bears stress exclusively on the suffix (Hill 2014).

Dutch (West Germanic, the Netherlands)

Dutch prefixes are independent domains of syllabification unless they lose their transparency. Prefixes are also independent in terms of footing unless they are long enough to comprise their own prosodic domain (Booij 1999). The prefix-root boundary also blocks schwa deletion (van Oostendorp 2006).

English (Western Germanic, Global)

Many monosyllabic prefixes are excluded from stress assignment and metrical foot structure after destressing, but suffixes are not thus excluded (Selkirk 1980b).

European Portuguese (Western Romance, Portugal)

Productive transparent prefixes are excluded from the prosodic domain of the roots to which they attach, as evidences by the lack of vowel reduction and stress patterns (Vigário 2003). Additionally, proclitics are less phonologically cohesive than enclitics, showing that a "left-right" asymmetry extends beyond just prefixes in certain languages (Bermúdez-Otero 2019; Bermúdez-Otero & Luís 2009).

Fijian (Oceanic, Fiji)

Prefixes are not included in the prosodic word with their roots, meaning that they are opaque to stress assignment rules, and hiatus is tolerated at the prefix-root boundary (Dixon 1988).

Finnish (Uralic, Finland)

Vowel harmony is almost entirely productive in roots, which trigger suffixes to necessarily harmonize; prefixes act like compounding roots in that they do not become affected by harmony (Ringen & Heinämäki 1999, Wuolle 1990).

French (Western Romance, France)

Prefixes in French comprise their own prosodic domain, to the exclusion of the root+suffix; this delimits the boundaries of glide formation and nasalization (Hannahs 1995).

Fungwa (Kainji, Nigeria)

In Fungwa (Ura), V prefixes are excluded from the backness harmony domain, while CV prefixes are included; this is argued to derive from an onset constraint on prosodic words outranking disyllabic minimality (Akinbo 2018).

Georgian (Kartvelian, Georgia)

The Georgian prefix-root boundary allow for hiatus and other consonantal phonotactics to apply, whereas these are always repaired in roots and suffixes. The prefix-prefix boundary also tolerates hiatus. (Butskhrikidze 2002; Slocum 2010).

German (Western Germanic, Germany)

All prefixes form their own prosodic words, as they are stressed and syllabified independently of the root+suffix. Suffixes do not always comprise a separate domain for stressing and syllabification (Raffelsiefen 2000).

Greek (Hellenic, Greece)

Greek prefixes exhibit the properties of independent stems when attached to other stems, in terms of the application of stress assignment rules (Nespor & Ralli 1996).

Gujarati (Indo-Aryan, India)

Gujarati prefixes are outside of the stress assignment domain (Cardona 1965, de Lacy 2002).

Hausa (Chadic, West Africa)

The prefix-stem boundary blocks leftward high-tone spread (initiated by certain tone-integrating suffixes). Additionally, no prefixes can trigger tone spread to any other material (Newman 1986).

Huave (Isolate, Oaxaca)

The usually productive process of vowel-copy epenthesis is blind to prefix vowels, instead epenthesizing the default vowel (Kim 2015).

Huehuelta Tepehua (Totonacan, Mexico)

Certain verbal prefixes are opaque to typical stress assignment rules and uvular harmony. Additionally, certain prefixes like past tense *x*- and 1st person *k*- are allowed to form consonant clusters which are otherwise impossible within stems; repairing them reveals clitic-like behavior (Kung 2007).

Hungarian (Uralic, Hungary)

Hungarian arguably has a small class of verbal prefixes, which appear not to alternate for backness like suffixes (Ladányi 2000; Vogel 1990; Tommer 2008).

Ibibio (Atlantic-Congo, Nigeria)

Ibibio's intervocalic lenition of stops applies within roots and across the root-suffix boundary (Akinlabi & Urua 1993); Beckman (2013) analyses this as stem-initial syllables being unwilling to undergo featural change under affixation.

Ilokano (Austronesian, Philippines)

In Ilokano, a stem-initial glottal stop is epenthesized following consonant-final and vowel-final prefixes, indicating a PrWd juncture, whereas root-suffix hiatus is typically resolved by gliding the stem-final vowel. The prefix-root boundary also disobeys the generalization that glides, if they must form, form out of the first vowel in the hiatus sequence – instead, a new glide is epenthesized following non-low prefix vowels. Furthermore, reduplication never targets prefixal material (Hayes & Abad 1988).

Indonesian (Austronesian, Indonesia)

Prefixes do not influence the stress pattern of the base, but suffixes do (van Zanten et al. 2003; Cohn 1989).

Italian (Southern Romance, Italy)

Vowel-final prefixes form their own prosodic words. The prefix-root boundary can additionally block intervocalic voicing of an initial voiceless root consonant (Peperkamp 1995).

Itelmen (Chukotko-Kamchatkan, Siberia)

Prefixes cannot trigger dominant [+ATR] harmony, nor are they affected by it (Bobaljik & Wurmbrand 2001).

Kalenjin (Southern Nilotic, Kenya)

Kalenjin is another affix-controlled [+ATR]-dominant system in which suffixes and roots can trigger harmony, but prefixes can't, though they may be affected by it (Local & Lodge 2004).

Kaqchikel (Mayan, Guatemala)

Kaqchikel has two classes of prefixes, falling mostly along the inflection/derivation divide: so-called "low-attaching" (cohering) and "high-attaching" prefixes (non-cohering). High-attaching prefixes are independent, in that they set off glottal stop epenthesis in the following vowel-initial prosodic word (i.e. do not resyllabify to the stem), and final consonants fail to degeminate with the following consonant-initial prosodic word. Low-attaching prefixes cohere with respect to both degemination and syllabification (Bennett 2018).

Karajá (Macro-Jê, Brazil)

Karajá has affix-controlled ATR harmony which can be triggered by suffixes but not prefixes (Ribeiro 2002).

Karimojong (Eastern Nilotic, Uganda)

Suffixes in Karimojong may trigger vowel harmony; prefixes, while they may undergo, can never trigger (an apparently identical system to other Eastern Nilotic languages like Maasai) (Lesley-Neuman 2007).

Kíhehe (Bantu, Tanzania)

Prefixes are outside of the prosodic word comprised of the stem (root+suffixes), as diagnosed by reduplication occurring between the prefixes and the base (Odden & Odden 1985).

Kikongo (Bantu, Zaire)

Prefixes are not subject to nasal consonant harmony, which is bounded by the stem domain (Ao 1991).

Kikuyu (Atlantic-Congo, Kenya)

Kikuyu (Gikuyu, Gĩkũyũ) prefix vowels do not participate in vowel harmony (Peng 2000).

Kinyarwanda (Bantu, Rwanda)

Prefixes are excluded from coronal harmony and therefore the morphological domain of the stem (Walker & Bird 2008; Walker et al. 2008; Mpiranya & Walker 2005).

Kolyma Yukaghir (Yukaghir, Siberia)

Prefixes, are separated from stems by a prosodic boundary, as evidenced by their lack of hiatus repair, whereas hiatus is usually repaired via glide formation within the stem (Maslova 2003).

Korean (Koreanic, Korea)

Korean has neutralization of many classes of lenis, fortis, and aspirated consonants in coda position, which is negated if the consonant is resyllabified into an onset position; this resyllabification is blocked in prefixes, as evidenced by the presence of neutralization in prefix-final coda position (Kang 1991, 1992).

Kukuya (Bantu, People's Republic of the Congo)

Prefixes are exterior to systems of lexical accent placement and tone patterns (Paulian 1974, Hyman 1987).

Kyirong Tibetan (Sino-Tibetan, Tibet)

While some suffixes, depending on the type, can cohere phonologically to the root or not, prefixes never do, and always get excluded from the prosodic word domains parsing of the rest of the morphological word, as evidenced by nasal intrusion (Hall & Hildebrandt 2008).

Lango (Southern Nilotic, South Sudan)

Prefixes can neither trigger or undergo vowel [ATR] harmony, which is otherwise productive across roots and between roots and suffixes (although certain prefixes show vacillation) (Noonan 1992).

Latvian (Baltic, Latvia)

Latvian prefixes are always syllabified externally to the stem. Additionally, many prefixes are excluded from the normal stress assignment domain (Kariņš 1996).

Limbu (Tibeto-Burman, Nepal & India)

Both stress assignment and the l~r alternation are stem-bounded in Limbu. Also, the prefix-root boundary has glottal stop epenthesis for vowel-initial roots, to satisfy an onset constraint PrWd-initially (Hildebrandt 2007; Schiering et al. 2010).

Lithuanian (Baltic, Lithuania)

Kushnir (2018) distinguishes four distinct pitch accent patterns that can be borne by Lithuanian suffixes, as opposed to only one for prefixes.

Lushootseed (Salishan, Washington State)

The Lushootseed PrWd matches the stem domain, to the exclusion of the prefix, and so prefixes are never stressed. Prefixes likewise do not incorporate into the base of reduplication, and the RED morpheme comes between segmentally specified prefixes and the stem (Urbanczyk 1996).

Maasai (Eastern Nilotic, Tanzania)

Although prefixes harmonize to the dominant [+ATR] value of the stem, there are no prefixes never trigger harmony, while suffixes may (Hall et al. 1974; Bakovic 2000).

Maga Rukai (Formosan, Taiwan)

All suffixes cohere to footing rules, but most prefixes do not (Hsin 2000).

Malay (Austronesia, Malaysia)

The prefix-root boundary blocks glide formation and gemination like in distinct morphological word boundaries; the root-suffix boundary does not block such processes (Kassin 2000).

Mangap-Mbula (Austronesian, Papua New Guinea

Verb prefixes do not shift initial stress placement; suffixes, however, can shift the stress rightward under particular circumstances. Like in other initial stress languages, prefixes may exceptionally bear stress if the root is subminimal (Bugenhagen 1991).

Manipuri (Sino-Tibetan, India)

Manipuri (Meetei, Meitheilon, Kathe) has a voicing assimilation rule that holds across the root-suffix boundary and between compounding elements, but not across the prefix-root boundary; some other phonotactic rules apply asymmetrically as well (Chelliah 1992).

Māori (Polynesian, New Zealand)

All Māori prefixes are bimoraic, and are grouped into their own prosodic words, except for “prefixal” monomoraic reduplicants, are incorporated into their bases’ prosodic words (de Lacy 2001).

Misantla Totonac (Totonacan, Mexico)

Misantla Totonac derivational prefixes cohere to their roots, but inflectional prefixes do not, as evidenced by failure to undergo dorsal harmony (McKay 1994; Hansson 2001).

Mohawk (Iroquoian, Southeastern Canada)

Certain prefixes, when attached to roots, result in hiatus which is tolerated; no suffixes behave this way, their hiatus always being resolved through deletion (Hopkins 1987; Michelson 1983).

Moses-Columbia Salish (Salishan, Idaho & Washington)

The stem forms the domain for progressive vowel retraction and stress; prefixes are never stressed, nor do they trigger progressive retraction (Czaykowska-Higgins 1996, 1998). They are, however, subject to regressive vowel retraction, which is argued to be word-, not stem-bound (Czaykowska-Higgins 1998).

Mosetén (Isolate, Bolivia)

In Mosetén (Chimané, Tsimané), stress is placed on the first syllable of a word, except if there is a prefix; prefixes are external to the stress assignment domain (Sakel 2011).

Mwiini (Bantu, Somalia)

Suffixes obey liquid harmony while prefixes fail to (Kisseberth & Abasheikh 1975; Hansson 2001).

Ndau (Bantu, Mozambique & Zimbabwe)

In Ndau (chiNdau, Ndzawu, Sofala), hiatus is often tolerated in verbs, both between prefixes and at the prefix-root border; however, in nouns, hiatus is never tolerated (Mutonga 2017).

Neverver (Oceanic, Vanuatu)

Prefixes are ignored for the purposes of stress assignment in verbs. On nearly every noun, a prefix of the kind *nV-* occurs, but this is now considered part of the noun stem as its morphemic status has been almost entirely lost; their incorporation into the stress assignment domain is therefore expected (Barbour 2010).

Nez Perce (Sahaptian, Idaho)

Nez Perce has a dominant-recessive [—ATR] harmony system where roots or suffixes can trigger dominant harmony; there exist prefixes, but they are unable to trigger (Hall & Hall 1980).

Nsenga (Bantu, SE Africa)

Nsenga (Senga, ciNsenga, ciNgoni) has root-controlled height harmony which spreads to suffixes only; prefixes are outside the harmony domain (Simango 2013).

Old Irish (Celtic, British Isles)

Old Irish pre-verbs could undergo tmesis (such as is seen in Avestan), displaying their morphophonological non-cohesion (Doherty 2000).

Paicî (Oceanic, New Caledonia)

Prefixes (which are mostly derivational), do not form a PrWd with the root, whereas suffixes all receive their tonal specification from the root (Rivierre 1974). Monosyllabic L-tone prefixes additionally provide a high tone to the following syllable, which marks a prosodic boundary (Lionnet 2019). Vowel harmony also excludes prefixes, but holds within stems. The schema for a Paicî prosodic word is the following (from Lionnet *personal communication*): pfx-[ROOT-sfx^{0}=clitic^{0}]$_{PrWd}$

Polish (West Slavic, Poland)

Prefixes are excluded from the root+suffix stem with respect to syllabification as evidenced by final devoicing PrWd-finally. Additional rules like the resolution of hiatus and phonotactic *GC constraints are not repaired at the prefix-root boundary (Rubach & Booij 1990).

Pulaar (Atlantic-Congo, Senegal)

Only suffixes, not prefixes, can trigger affix-controlled harmony (Krämer 2003).

Russian (East Slavic, Russia)

Prefixes interact phonologically with roots in the same way compounding morphemes do, indicating that there is a prosodic boundary between the prefix and the root; suffixes do not have such a boundary. This is diagnosed via phonotactics such as velarization (Gribanova 2008).

Sacapultec (Mayan, Guatemala)

While prefixes never receive primary stress because it is always final in Sacapultec, prefixes are also opaque to secondary stress assignment, even if they are in the appropriate place namely, a leftward alternating syllable preceding the stressed syllable (Du Bois 1981).

Samoan (Austronesian, Samoa)

Prefixes form their own prosodic domain for length and stress assignment (Zuraw et al. 2014).

Sanskrit (Indo-Aryan, India)

Prefixes are considered as a separate domain for *sandhi* and syllabification (Selkirk 1980a).

Shona (Bantu, Zimbabwe & Botswana)

Prefixes are excluded from the stem-bound domains of vowel harmony and reduplication, as well as minimality and Meussen's rule (an OCP-motivated constraint on high tone realization). Hiatus resolution is also resolved differently at the prefix-root boundary and within a stem (Hyman 2008; Odden 1981; Beckman 1977). However, in order to satisfy a disyllabic minimality condition on prosodic words, prefixes may be incorporated into the prosodic word of a monosyllabic (i.e. sub-minimal) root (Downing & Kadenge *forthcoming*).

Spanish (Western Romance, Global)

Prefixes are excluded from the prosodic domain of the root+suffix, as evidenced by *e*-epenthesis, initial *r*-strengthening, *s*-aspiration, and *n*-velarization (Peperkamp 1997).

Swahili (Bantu, East Africa)

Height harmony is only obeyed in suffixes; prefixes are outside of the harmony domain (Marten 1996).

Tenango Otomi (Oto-Manguean, Mexico)

Despite being exclusively prefixing, Otomi initial stress is always root-bounded, with primary stress always falling on the first syllable of the root, i.e. following all prefixes (Blight & Pike 1976).

Tetun (Timoric, West Timor)

All prefixes are extrametrical in Tetun; that is, prefixes are not considered for stress assignment principals (van Klinken 1999).

Thompson Salish (Salishan, Pacific NW)

Prefixes fall outside of the stress assignment domain; only roots and suffixes can bear a realizable lexical accent (Thompson & Thompson 1992, 1996; Revithiadou 1999).

Tlachichilco Tepehua (Totonacan, Mexico)

Dorsal consonant harmony does not affect many prefixes, though unlike its close neighbor Misantla Totonac, the cohering/non-cohering divide is not neatly a derivation/inflection divide (Watters 1988). Hansson (2001) argues that there are no obvious morphosyntactic or semantic properties which unite either group of prefixes.

Tongan (Austronesian, Tonga)

Prefixes in Tongan are excluded from the domain of stress assignment, showing a similar pattern to its close relative Samoan (Zuraw et al. 2019).

Turkana (Eastern Nilotic, Kenya)

Turkana prefixes, like its neighbor Maasai do not trigger harmony, while suffixes may (Dimmendaal 1984; Bakovic 2000).

Uspanteko (Mayan, Guatemala)

Unstressed root and suffix vowels syncopate when possible, however prefix vowels in environments which would otherwise trigger syncopation never undergo (Bennett 2020).

Welsh (Celtic, Wales)

Certain Welsh prefixes pattern like distinct phonological words; they fall outside of the stem domain of stress assignment (Fynes-Clinton 1913; Hannahs 2013). This means that they behaving like compounding roots with respect to stress and consonant mutation (Thorne 1993).

Yaka (Bantu, Republic of Congo)

Prefixes do not participate in vowel harmony, while roots and suffixes always obey it; prefixes likewise do not initiate nasal consonant harmony, though they do undergo (van den Eynde 1968; Hyman 1995).

Zulu (Bantu, South Africa)

The long-distance labial-palatal dissimilation rule holds within stems only; prefixes are not affected by this phonotactic alternation (Bennett 2013).

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