Metathesis is Deletion and Feature Spreading: Evidence from Uab Meto

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Abstract

Metathesis poses challenges for a typologically constrained theory of phonology: despite being simple to describe, its distribution is highly restricted, making it difficult to create analyses that adequately predict but not overgenerate. Here, I investigate metathesis in Uab Meto (Austronesian; Indonesia), an understudied language with CV metathesis that is synchronic and productive. Drawing on original fieldwork, I argue that metathesis is not transposition, but instead a serial copy-and-delete mechanism (cf. Takahashi, 2018, 2020). To support this, I present a deep case study into the language's phonology, showing that metathesis arises from spreading, deletion, and epenthesis patterns. I propose that synchronic metathesis systems like Uab Meto's can only emerge from the successive application of these mechanisms, and argue that true transposition, if it exists, is essentially a subtype of infixation. This study thus presents a new look onto the typology of synchronic metathesis, and offers an explanatory account of its typological rarity.

1 Introduction

Metathesis, the local transposition of two segments, has long been an area of debate in phonological theory: whether it exists at all, given its typological rarity (Webb, 1974; Powell, 1985; Montreuil, 1985), or whether it simply doesn't exist as a single transposition mechanism, and instead is the serial application of smaller copy-and-delete or coalescence operations (Besnier, 1987; Hume, 1991; Blevins and Garrett, 1998; Takahashi, 2018, 2020). Although work over recent years has confirmed the existence of metathesis (Hume, 1998, 2001; Canfield, 2016, a.o.), there is still considerable debate over how to analyze such alternations – are they best analyzed as transposition, coalescence, successive copy-and-delete mechanisms, or feature spreading?

The choice of how to analyze metathesis is important for our understanding of phonological grammars – if transposition is an operation in the phonology proper, then we might expect for it to arise in similar frequency and distribution to better-known patterns like epenthesis or deletion. Yet, the typology of metathesis is far more restricted, often only occurring between certain segments or in a few morphemes for a given language (Hume, 2001; Horwood, 2004, a.o.). Even more problematic is that the very existence of transposition in the phonology often leads to predictions of outputs with multiple transpositions, creating long-distance metathesis patterns (McCarthy, 2000; Takahashi, 2018). These types of long-distance metathesis have been argued to be synchronically unattested (Poser, 1982), and are generally regarded as undesirable predictions (McCarthy 2000, Horwood 2004; see potential counterexamples in Blevins and Garrett 1998, Mielke and Hume 2001, Chandlee et al. 2012).

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Within Optimality Theory, there have been numerous attempts to tackle these problems, often culminating in ad-hoc restrictions on metathesis so that it only occurs between particular segments, morphemes, or in certain sections of word (cf. Carpenter, 2002; Horwood, 2004; Heinz, 2005a; Canfield, 2016). However, stipulating these language-internal restrictions doesn't provide a clear explanation on why metathesis is so typologically rare, or why it tends to occupy the corners of a language's phonology. Instead, the problem seems to be with transposition itself: Takahashi (2018, 2020) proposes that transposition is not an operation in GEN, and that removing transposition resolves many issues in the typology of metathesis. I follow up on this approach here, and contend that transposition is not the source of metathesis in languages where metathesis is synchronically productive and not morpheme-dependent.

In this paper, I introduce novel data from original fieldwork on Uab Meto, an Austronesian language with robust synchronic metathesis that hasn't yet figured into these theoretical discussions. Some examples of Uab Meto metathesis are in (1). Metathesis occurs in phrase-medial roots (a.-b.), in roots with mora-bearing suffixes (c.-d.), and in roots where suffixation would create an illicit consonant cluster (e.). Altogether, metathesis in the language is very common, and occurs in almost every sentence to improve prosodic and segmental well-formedness at levels of root, word, and phrase.

(1) **Uab Meto**

a.	ˈmanu ˈnua	'two chickens'	(phrase-final)
	ma͡ʊn ˈmutiʔ	'white chicken'	(phrase-medial)
b.	ˈmepo	'to work'	(phrase-final)
	me͡op ˈlele	'work the field'	(phrase-medial)
c.	ʔa-ˈmepo-t	'worker'	
	ʔa-ˈme͡op-t-in	'workers'	
d.	ˈʔole-f	'his younger brother'	
	ˈʔo͡el-f-a̲m	'and his younger brother'	
e.	maˈnikin	'to be cold'	
	maˈnikni-t	'(the) cold'	

Even from these initial data, it's clear that Uab Meto metathesis is not some minor character like it is in many other languages. Uab Meto metathesis is productive and ubiquitous, occurring with almost all segments in the language, and shows robust interactions with many aspects of the language's phonology. Through an in-depth case study, I investigate how metathesis interleaves with other phonological processes in the language like epenthesis and deletion, and conclude that metathesis only surfaces where multiple phonological patterns interact.

From a theoretical standpoint, this study reinforces the current theoretical debate offered by Takahashi (2018, 2020), and argues that metathesis systems like Uab Meto's can only arise from successive copy-and-delete mechanisms, and not transposition. This view explains why Uab Meto metathesis has such rich interactions with epenthesis, deletion, and spreading in the language – these processes are the precursors to this type of phonological metathesis, and so metathesis can only surface where these processes interact. Transposition, if it exists, is thus relegated to a special type of infixation, and should be removed from analyses where metathesis cannot cross morpheme boundaries.

To summarize, this paper puts forward empirical and theoretical contributions to the status of metathesis in phonology. Empirically, it presents the first generative case study on metathesis in Uab Meto, drawing on data from original fieldwork, and goes to show that the depth of metathesis in the language can only be appreciated from how it interacts with various other processes in the language's phonology. From a theoretical standpoint, this paper proposes that Uab Meto metathesis is not transposition, but instead the serial application of smaller deletion, epenthesis, and spreading mechanisms, reinforcing the recent debate against transposition in phonology (Takahashi, 2018, 2020). This not only accounts for the productive metathesis in Uab Meto, but also accurately predicts how metathesis interleaves with other synchronic phonological processes. In turn, this analysis offers some explanatory power for the restrictive typology of metathesis: if productive metathesis is always accomplished through serial copy-and-delete type mechanisms, then synchronic metathesis should only arise in languages where these precursors occur in overlapping environments.

The paper is structured as follows: Section 1 introduces the metathesis patterns in Uab Meto, and reviews background on metathesis. Section 2 covers the background on Uab Meto, reviewing inventory, general phonotactics, and stress. Section 3 then provides an analysis of the Coalescence Puzzle, including coalescing metathesis in phrasal contexts. Section 4 analyzes the Epenthesis Puzzle. Section 5 then goes on to show that the basic operations of epenthesis, deletion, and spreading also surface independently of metathesis. Section 6 discusses typological implications of this analysis, and compares it to salient alternatives. Section 7 concludes.

1.1 Uab Meto Metathesis

Uab Meto has two main types of CV∼VC metathesis, coalescing metathesis and epenthetic metathesis. Coalescing metathesis goes from CV→VC, and reduces the syllable count of a root by diphthongizing the metathesized vowel onto the preceding syllable (e.g. [mepo] 'work' ∼ [me͡op-n-e] 'they work it'). On the other hand, epenthetic metathesis VC→CV, and serves to break up word-final consonant clusters in non-monosyllabic roots (e.g. [manikin] 'cold' ∼ [manikni-t] 'the cold', *[manikin-t]). Each of these metathesis processes is dependent on the shape of the root in some way, and where metathesis is ruled out, other processes like diphthongization, deletion, or epenthesis occur instead. Given the complementary distribution of metathesis with these other processes, I broadly term these clusters of alternations as the Coalescence Puzzle and the Epenthesis Puzzle.

The Coalescence Puzzle consists of alternations between diphthongization, deletion, and coalescing (i.e. diphthong-creating) metathesis. The alternations in the Coalescence Puzzle arise in identical prosodic environments – when the stress of a root does not align with the penult of a word, root-final syllables delete and fuse into the preceding vowel. This has the effect of reducing a stress lapse between the root and right edge of the word. For an example, in roots with underlying vowel hiatus (2a), diphthongization occurs, where the root-final vowel truncates and fuses with the preceding vowel (CVV→CV͡VC). In roots with no hiatus (CVCV or CVCVC structure), we see either coalescing metathesis (2b) or deletion (2c), depending on the sonority of the final vowel. If the final vowel is [a], deletion occurs, but if the final vowel is anything else, we get metathesis. Simple CVC roots show no alternations (2d).

(2) Coalescence Puzzle — **Uab Meto, Molo dialect**

a. *Diphthongization* — CVV → CV͡V

i.	ˈme.o	'cat'	
	ˈme͡o.-nu	'cat-PL'	*ˈme.o.-nu
ii.	ˈta.i-s	'sarong'	
	ˈta͡ɪ.-s-in	'sarong-PL'	*ˈta.i.-s-in

b. *Coalescing Metathesis* — CVCV(C) → CV͡VC(C)

i.	ˈme.po	'work'	
	ˈme͡op.-n-e	'work-PL-3SG'	*ˈme.po.-n-e
ii.	ˈta.si	'sea'	
	ˈta͡ɪs.-n-e	'sea-PL-DEF'	*ˈta.si.-n-e

iii.	baˈkaseʔ	‘horse’		
	baˈka͡esʔ-e	‘horse-DEF’	*baˈkaseʔ-e	
c.	*Deletion*			CVCa(C) → CVC(C)
i.	ˈpe.naʔ	‘corn’		
	ˈpenʔ-e	‘corn-DEF’	*ˈpe.na.ʔ-e, *ˈpe͡an.ʔ-e	
ii.	ˈkibaʔ	‘black ant’		
	ˈkibʔ-e	‘ant-DEF’	*ˈki.ba.ʔ-e, *ˈki͡ab.ʔ-e	
iii.	ˈʔu.lan	‘rain’		
	ˈʔuln-e	‘rain-DEF’	*ˈʔu.la.n-e, *ˈʔu͡al.n-e	
d.	*No change*			CVC → CVC
i.	ˈʔun	‘base’		
	ˈʔun-e	‘base-DEF’		
ii.	ˈnoʔ	‘leaf’		
	ˈnoʔ-e	‘leaf-DEF’		

The Coalescence Puzzle also extends to phrasal contexts, where roots at the *left edge* of a phonological phrase undergo compression. I set these cases aside for now, but return to them in Section 3.2.1.

The Epenthesis Puzzle (3), on the other hand, occurs when there is a word-final consonant cluster. In monosyllabic roots, this is repaired with default epenthesis (3a), but in larger roots, we get VC→CV “epenthetic” metathesis (3b). Unlike in the Coalescence Puzzle, the metathesized sequence does not form a diphthong.

(3) Epenthesis Puzzle **Uab Meto, Molo dialect**

a.	*Default Epenthesis*			Monosyllabic roots, V́CC# → V́Ca̲C#
i.	ˈnem	‘to come’		
	ʔa-m-ˈnema̲-t	‘newcomer’	/ʔa-m-nem-t/	*ʔa-m-ˈnem-t
ii.	ˈplen	‘to command’		
	ˈplena̲-t	‘command’	/plen-t/	*plen-t, *ˈplene-t
	ˈplen-t-e	‘the command’		*ˈplena̲t-e
iii.	ˈbsoʔ	‘to dance’		
	ʔa-ˈbsoʔa̲-t	‘dancer’	/ʔa-bsoʔ-t/	*ʔa-bsoʔ-t, *ʔa-ˈbsoʔo-t
	ʔa-ˈbsoʔ-t-e	‘the dancer’		*ʔa-bsoʔ-a̲t-e
b.	*Epenthetic Metathesis*			Non-monosyllabic roots, $VC_1C_2\# \rightarrow C_1VC_2\#$
i.	maˈnikin	‘to be cold’		
	maˈnikni-t	‘(the) cold’	/manikin-t/	*maˈnikina̲-t, *maˈnikini-t
ii.	ˈsonaf	‘palace’		
	ˈsonfa=m	‘and the palace’	/sonaf=m/	*ˈsonaf=m, *ˈsonafa̲=m
iii.	ˈkapan	‘Kapan (town)’		
	ˈkapna=t	‘While Kapan…’	/kapan=t/	*ˈkapan=t, *ˈkapana̲=t

Despite the differences between coalescing and epenthetic metathesis, neither type can occur in monosyllabic roots. This, I argue, is best understood as a positional restriction on metathesis: only post-tonic, root-internal vowels may metathesize. Monosyllabic roots bear stress, and so they have no post-tonic vowel to metathesize. Crucially, this positional restriction also applies to vowel deletion in the Coalescence Puzzle. In Section 1.3, I propose this is no accident – metathesis is fed by vowel deletion, and therefore inherits its positional restrictions.

In addition to these positional restrictions, Uab Meto metathesis tends to co-occur with increased consonant-vowel coarticulation. In these cases (4), the metathesized vowel colors intervening consonantal segments in a way that underlying adjacent segments do not. For instance, when a high vowel metathesizes past an /s/ in (4a), the /s/ palatalizes to [ta͡ɪsʲ], even though /s/ does not palatalize to the same degree when it follows an underlying high vowel (4b).

(4) Metathesis colors intervening consonants

a.	ta͡ɪsʲ ∼ ta͡ɪs	‘sea (phrase-medial)		cf. tasi	‘sea (phrase-final)’
b.	taɪ-s	‘sarong’	*taɪsʲ		

I also discuss a related, but distinct issue from metathesis in Uab Meto: epenthetic consonant assimilation. In this pattern (5), an epenthetic consonant prevents vowel hiatus across a morpheme boundary, and assimilates to the quality of the adjacent underlying vowel. The round vowels condition [b], high vowels [ɟ͡j], and mid vowels [l]. Other dialects like Amanuban insert glides [w, j] instead of [b, ɟ͡j, l].

(5) Epenthetic consonant assimilation **Uab Meto, Molo dialect**

(5)	a.	ˈʔau	‘lime’	ˈʔa͡ʊb̲-e	‘the lime’	
	b.	ˈmeo	‘cat’	ˈme͡ob̲-e	‘the cat’	
	c.	ˈfɪɪ	‘to open’	ˈfɪɟ̲͡j̲-e	‘open it’	
	d.	ˈʔai	‘fire’	ˈfaɟ̲͡j̲-e	‘the fire’	
	e.	ˈʔoe	‘water’	ˈʔo͡el̲-e	‘the water’	
(6)	a.	ˈfatu	‘stone’	ˈfatb̲-e	‘the stone’	*fa͡ʊtb̲-e
	b.	ˈmepo	‘work’	ˈmepb̲-e	‘work it’	*me͡opb̲-e
	c.	ˈlolɪ	‘sweet potato’	ˈlolɟ̲͡j̲-e	‘the sweet potato’	*lo͡ɪlɟ̲͡j̲-e
	d.	ˈtasi	‘sea’	ˈtasɟ̲͡j̲-e	‘the sea’	*ta͡ɪsɟ̲͡j̲-e
	e.	ʔaˈnoʔe	‘lontar palm’	ʔaˈnoʔl̲-e	‘the lontar palm’	*ʔaˈno͡eʔl̲-e

While this issue may appear unrelated to metathesis, epenthetic consonant assimilation provides crucial evidence for locality conditions on metathesis and assimilatory spreading. In (5), epenthetic consonant assimilation co-occurs with diphthongization (e.g. [me͡ob̲-e] ‘the cat’, *[meb̲-e]). However, in roots that are CV-final (6), coalescing metathesis is blocked by epenthetic consonant assimilation and no diphthong is formed (e.g. [mepb-e] ‘work’, *[me͡opb-e]).[1]

As a final note, Uab Meto also has evidence of partial metathesis (cf. Kwara'ae, Heinz 2005a), especially in fast, casual speech. In partial metathesis (7), we have a phrase-medial form that has diphthongized but still has the metathesized vowel (albeit devoiced) in its original position. These are likely to be speech errors in the Molo dialect, but they are also reported to occur in Leti (Renhard Saupia, p.c.) and occur as part of the regular metathesis pattern in the Ro'is Amarasi dialect of Uab Meto (Edwards, 2016). At minimum, an analysis of Uab Meto metathesis should be able to generate these forms without too much difficulty.

(7) Partial metathesis

a. me͡opo̥ ∼ me͡op ‘to work (phrase-medial)’

[1]This is subject to some variability – in (6e), for example, coalescing metathesis is still possible for some Molo speakers. One possibility is that these speakers are in the process of reanalyzing the [l] as underlying (e.g. /ʔanoʔel/), since these same speakers select the plural C#-allomorph [-in] for this word instead of the expected VV#-allomorph [-nuk]. See discussion of this issue in Edwards (2016) and Culhane (2018).

To sum up, Uab Meto has two types of consonant/vowel metathesis: coalescing and epenthetic metathesis. Both types are (a) restricted to the post-tonic syllable of a root and (b) at least partially prosodically driven, as they reduce lapses between the stressed root and the right edge of the phonological phrase, keeping stress penultimate where possible. As a result, both types of metathesis are not seen in monosyllabic roots, which have no post-tonic vowel. Uab Meto metathesis also increases consonant/vowel coarticulation, suggesting that displacement of the metathesized vowel results in increased gestural overlap with the intervening consonant. However, this must be distinguished from consonant/vowel assimilation, which occurs during consonant epenthesis in the language. Lastly, Uab Meto also sometimes shows partial metathesis, where a root-final vowel both diphthongizes onto the preceding vowel and also surfaces as a devoiced vowel in its original position.

1.2 Issues in analyzing metathesis

In this section, I review empirical and formal issues surrounding metathesis in phonology. The typological picture for metathesis is known to be complicated: it's rare, where few languages have synchronic metathesis patterns, and far fewer have metathesis that is productive (Hume and Seyfarth, 2019). Even in languages with productive metathesis, metathesis is often relegated to the corners of the language's phonology, and bears restrictions based on segment type, morpheme identity, or the position in the word (Horwood, 2004). The empirical picture of metathesis is thus twice restricted: once cross-linguistically, with few languages having productive metathesis, and a second time language-internally, with languages that have metathesis limiting it to very specific circumstances. Any analysis of metathesis therefore has a difficult task: to generate a variety of metathesis patterns, but not overgenerate the typological or language-internal distribution.

For the formal picture, metathesis has historically been analyzed as transposition. While easy enough to formulate, this comes at the expense of gross overgeneration and lack of explanatory adequacy for the known typology. In SPE-style phonological rewrite rules for instance, the transposition operation required a new form of rule: 1 2 3 → 1 3 2 (see English, Chomsky and Halle 1968, Lithuanian, Kenstowicz 1971). These rules were not only exceptionally powerful, but also gave the impression that transposition should be like any other operation in phonology, a primitive that should be equally available from language to language. This doesn't adequately predict the restricted typology of metathesis, nor does it easily predict where metathesis occurs in complementary distribution with other processes like deletion or epenthesis (e.g. Rotuman, McCarthy, 1995, 2000).

Contemporary Optimality Theory (OT) (Prince and Smolensky, 1993, 2004) also usually treats metathesis as transposition, most commonly with the constraint LINEARITY (McCarthy and Prince, 1995). However, just like rewrite rules, transposition-based accounts of metathesis in OT tend to overgenerate. For one, LINEARITY must be ranked low in order for metathesis to occur, and so we expect transposition to be a preferred operation throughout the entire phonology of a language. Yet, many languages restrict metathesis to only occur between particular morphemes (e.g. Georgian, Butskhrikidze and van de Weijer 2003), particular segments (e.g. Faroese, Lithuanian, Hume and Seo 2004), or at the ends of roots (e.g. Kwara'ae, Sohn 1980). These restrictions have led to new families of LINEARITY-based constraints, which imply a richer typology of metathesis than what actually exists (Horwood, 2004).

A greater problem for Parallel OT accounts using LINEARITY is that the degree of violation should not matter for a dominated constraint – if one transposition is not sufficient, the derivation should still prefer a candidate with multiple transpositions over other operations (cf. McCarthy, 2000). However, this often over-predicts metathesis: metathesis occurring in words of the wrong templatic shape, or long-distance metathesis moving a segment too far. This led to numerous proposals for how to fix this overgeneration issue, ranging from adjacency-preservation constraints (e.g. IO-ADJACENCY, Carpenter 2002; CONTIGUITY, Heinz 2005b) to constraint conjunction of LINEARITY (Horwood, 2004) or positional faithfulness constraints (Canfield, 2016). Yet, none of these proposals adequately explains why the typology is the way it is: why should transposition be rare? why should multiple transpositions be unattested, when multiple applications of other phonological processes (like deletion or epenthesis) are fine?

In response to this, Takahashi (2018, 2020) argues that the problem is not LINEARITY, but transposition in GEN. Takahashi dispenses with LINEARITY entirely, and argues that all metathesis stems from successive fission and coalescence, cast in a serial OT framework. In this way, Takahashi is able to (a) remove several long-distance predictions and (b) derive complementary deletion and metathesis patterns in Rotuman, where templatic word shape determines the alternations present. In contrast, these alternations posed persistent challenges for transposition-based analyses for reasons already discussed – dominated LINEARITY overgenerates, by both distance and templatic word shape.

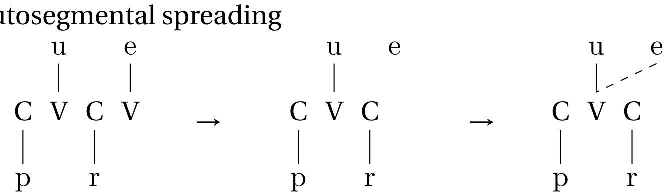
Takahashi's (2018, 2020) proposal is not without precedent, and bears many similarities to other non-transpositional accounts to metathesis in Autosegmental Phonology and rule-based grammars. In Autosegmental Phonology for instance, metathesis has also been analyzed as feature-spreading along autosegmental tiers of consonants and vowels, where CV-metathesis arises from spreading of a delinked vowel feature to an earlier timing slot (McCarthy, 1979; Besnier, 1987; Hume, 1991). For rule-based grammars, Blevins and Garrett (1998) proposed that some types of productive metathesis arise from vowel-vowel coarticulation followed by vowel deletion, such as what they term "pseudometathesis" in Leti (cf. Mills and Grima, 1980). As a result, synchronic, productive metathesis should be limited to languages that historically had both vowel-vowel assimilation or epenthesis mechanisms and deletion. These non-transpositional approaches to metathesis are summarized in (8).

(8) Non-transpositional approaches to metathesis

a. Copy-and-delete in Harmonic Serialism — Rotuman, Takahashi (2018)

pur_1e_2	→	$pue_2r_1e_2$	→	pue_2r_1
		Copying		Deletion

b. Autosegmental spreading — Rotuman, Besnier (1987)



Underlying	V-Slot Deletion	Spreading
pure	pur	puer

c. (Diachronic) copy-and-deletion – "pseudometathesis" — Leti, Blevins and Garrett (1998)

uli_1t_2	→	$uli_1t_2i_1$	→	ult_2i_1
		Vowel-vowel assimilation or copy-epenthesis		Final vowel deletion

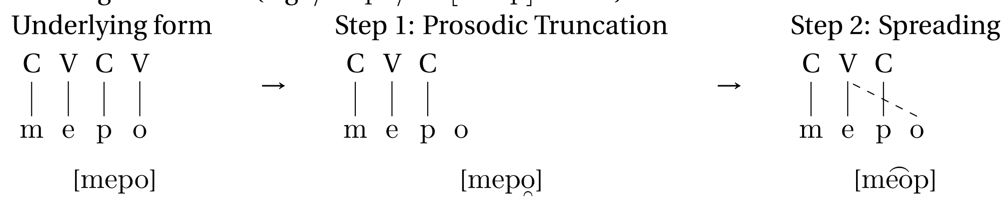
For the proposal here, I follow a non-transpositional approach for metathesis in Uab Meto, where metathesis arises from the successive application of deletion, spreading, and epenthesis mechanisms. I use an enriched CV-skeleton, following Autosegmental approaches like McCarthy (1979); Besnier (1987); Hume (1991), and contend that there is no metathesis in GEN, following (Takahashi, 2018, 2020). In the next section, I give a complete outline of the proposal and its representational assumptions. In Section 6.1, I return to transposition-based alternatives, and conclude that none offer the same explanatory coverage as the present analysis.

1.3 Proposal

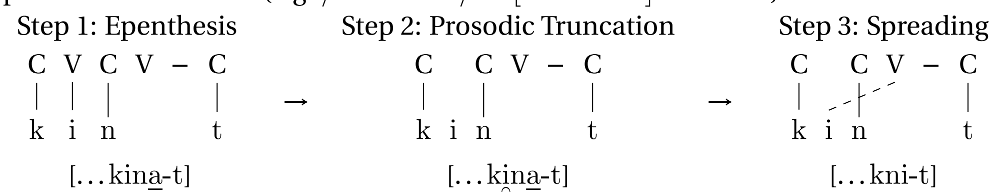
In this proposal, I represent metathesis as covert spreading along a CV-skeleton (cf. McCarthy, 1979; Besnier, 1987; Hume, 1991). The core aim under this framework is to capture the facts that Uab Meto metathesis (a) is ultimately a type of coalescence and (b) involves increased gestural overlap, where "metathesized" vowels color intervening consonantal segments.

In particular, I argue that metathesis occurs when vowels become delinked after prosodic truncation and need to spread to a new C/V timing slot. In coalescing metathesis (9a), the delinked vowel features spread leftwards to the preceding vowel. In epenthetic metathesis (9b), there is an additional step, where a V-slot is epenthesized to break up a consonant cluster, and then the delinked vowel features spreads rightwards to the epenthetic V-slot.

(9) a. Coalescing Metathesis (e.g. /mepo/ → [me͡op] 'work')



b. Epenthetic Metathesis (e.g. /manikin-t/ → [manikni-t] 'the cold')



In each of these cases, the spreading step crosses a line associating a consonant feature to a C-slot, which I assume corresponds to greater coarticulation between the vowel and consonant gestures (cf. Kimper, 2011).

The analysis proposed here also bears on the question of why these systems are only known to occur in the Austronesian family (e.g. Leti, van Engelenhoven 2004; Kwara'ae, Sohn 1980, Heinz 2005; Rotuman, Churchward 1940; Uab Meto, Steinhauer 1993, 1996). I argue this follows from the fact that the sub-processes of spreading and deletion are robust in this area. In many languages throughout the Pacfic, vowels coalesce or shorten to optimize prosodic well-formedness (Zuraw, 2018), a close parallel to the root-final prosodic truncation seen in Uab Meto. Additionally, some languages also show robust consonant-vowel assimilation – for instance Uffmann (2006) shows evidence that Samoan loanword epenthesis involves place assimilation between the epenthetic vowel and the preceding consonant. This pattern is an inverted version of the spreading seen in epenthetic consonant assimilation, where underlying vowels spread to epenthetic C-slots.

1.3.1 Representational Assumptions

This account departs from existing spreading-based analyses on several grounds. For one, I do not assume that consonants and vowels fall onto separate autosegmental tiers, but rather that metathesis always involves autosegmental line-crossing between consonants and vowels. Despite appearances, this approach is not deeply at odds with many spreading-based accounts to vowel harmony (cf. Kimper, 2011, 2017). Avoiding violations of the so-called No Crossing Constraint (NCC) (Goldsmith, 1976) is a major issue for almost all spreading-based accounts of vowel harmony, requiring elaborate representational moves such as assuming planar segregation of consonants and vowels (McCarthy, 1979, 1981; Steriade, 1986, a.o.), extensive feature geometries (Clements, 1980, 1991; Sagey, 1988), or other ways of limiting violations of the NCC to only apply between legitimate targets (see review in Odden, 1994; Ní Chiosáin and Padgett, 2001). By casting this as line-crossing, I table the issue of representational choice, and contend that the universal prohibition on line-crossing applies only for like spreading over like (cf. Archangeli and Pulleyblank, 1994).

Representing metathesis as consonant-vowel line crossing also provides additional layers of distinction between different types of consonant-vowel interactions. For instance, I cast epenthetic consonant assimilation as the result of vowel features spreading directly to an epenthetic C-slot. On the other hand, the increased consonant-vowel coarticulation that occurs during metathesis (e.g. tasi ∼ ta͡ɪsʲ 'sea') is a result of consonant-vowel line-crossing.

Even though I treat metathesis as a violation of autosegmental line-crossing, Uab Meto still bears restrictions on non-local spreading. For one, only vowels may spread, and spreading is limited to post-tonic environments. Parallels to this exist in vowel harmony as well, where some languages only allow harmony to apply in post-tonic environments (e.g. Grabo metaphony, Walker, 2005, 2010). In the analysis, I prevent spreading from creating a full-scale vowel harmony system by only relaxing the restriction against line-crossing for delinked features. If features have no associated timing slot, they may spread non-locally, but if associated, spreading must be strictly local. I introduce further locality restrictions on spreading as needed.

One alternative to line-crossing is to instead adopt a strictly local approach to spreading (McCarthy and Prince, 1994; Padgett, 1995; Ní Chiosáin and Padgett, 2001; Walker, 2005, a.o.). Under this perspective, metathesis would require a vowel to first associate with the intervening C-slot, and then spread to the vowel beyond it. This would predict that intervening consonants in metathesis and epenthetic vowel assimilation targets are similar – they both are C-slots associated with vowel features, the only difference is that intervening consonants in metathesis are also associated with consonantal features. This approach is similar to the present one in that spreading during metathesis (2b) comes at a greater cost than spreading during diphthongization (2a). In the line-crossing approach, the cost is line-crossing, but in the strictly local approach, the cost is for a vowel feature to associate with a C-slot. I table this option for the time being, and acknowledge that the analysis proposed here is broadly compatible.

1.4 Formalism: Harmonic Serialism

I cast the analysis in Harmonic Serialism (McCarthy and Pater, 2016). Harmonic Serialism is a relative of Optimality Theory that combines aspects of rule-based and constraint-based frameworks. Derivations are cyclic, where the optimal output for one cycle becomes the input to the next. Derivations converge when the faithful candidate wins, which then becomes the output for the entire derivation. Harmonic Serialism also imposes a gradualness restriction on Gen, meaning that each candidate may only differ from the input by at most one change. Exactly what constitutes one change is an open area of research for Harmonic Serialism. I follow McCarthy (2008) in assuming that deletion involves two steps: deletion of a timing slot and deletion of features.

2 Background

This section gives an overview of Uab Meto inventory and phonotactics, based on original fieldwork in North Molo, West Timor, Indonesia. There are some significant differences between the Molo dialect reported here and the Amarasi dialect in earlier work (e.g. Edwards, 2016) – unless otherwise noted, the data here apply to the Molo dialect.

2.1 Inventory

Uab Meto has twelve consonants in its phonemic inventory (10), and is unusual in the region in having no implosives or phonemically glottalized stops (Klamer, 2002). There has been some debate as to whether glottal-stop sequences (ʔb, ʔt, ʔk) should be analyzed as glottalic stops (e.g. ˀb, ˀt, ˀk) – I analyze them as clusters, following Edwards (2016).

(10) Uab Meto Consonant Inventory (Molo dialect)

	Labial	Alveolar	Palatal	Velar	Glottal
Plosive	b p	t		k	ʔ
Nasal	m	n			
Fricative	f	s			h
Affricate			ɟ͡ʝ		
Lateral		l			

(11) Inventory of diphthongs

	i	e	a	o	u
i	i		i͡a	i͡o	i͡u
e	e͡ɪ	e	e͡a	e͡o	e͡ʊ
a	a͡ɪ	a͡e	a	a͡o	a͡ʊ
o	o͡ɪ	o͡e	o͡a	o	o͡ʊ
u	u͡i	u͡e	u͡a		u

Uab Meto has a seven-vowel inventory of [i, e, ɪ, a, o, ɔ, u], and diphthongs combining all of the five main vowels (i, e, a, o, u) other than *[i͡e] and *[u͡o].[2] The vowels [ɪ] and [ɔ] have a restricted distribution, possibly due to their status as a recent innovation, and so they rarely occur as the first member of a diphthong. When they occur as the second member of a diphthong, they neutralize to the same diphthongs as for [i] and [o]. Some dialects also lack [ɔ] entirely (e.g. Amarasi, Edwards 2016). The possible diphthongs are shown in (11).

2.2 Phonotactics

The syllabic structure of Uab Meto is fairly restricted: complex codas are ruled out, and all syllables must have an onset except in very limited circumstances. Complex onsets are common, and while they are capped at a two-segment maximum, they include heteroorganic stop sequences such as kb, bn, tn, kn, bk, mb, mf, ms, ʔb, ʔt, ʔk, among others. However, complex onsets bear somewhat uncertain status prosodically, as the C_1 of a C_1C_2 complex onset can either (i) resyllabify leftwards onto a preceding word or (ii) create a new syllable with an epenthetic vowel when in word-initial position. In this way, complex onsets are often realized with the C_2 being an onset, and the C_1 becoming an onset or coda for a preceding syllable. Lastly, codas are not always licit in Uab Meto, and may be deleted when they are word-final and precede the primary stress of a phonological phrase (see Section 5.2).

For vowels, there are no trimoraic sequences in Uab Meto (V͡V.V, V͡VV., V.V͡V, V.V.V), and vowel hiatus (V.V) is highly restricted. Vowel hiatus can never occur across morpheme boundaries, and so epenthesis occurs to prevent this from surfacing. This is discussed at further length in Section 5.1.

While Uab Meto has a large inventory of diphthongs (11), only a subset of them are possible in as the result of metathesis. Categorically, all diphthongs with [a] as V_2 are not possible in coalescing metathesis environments, and instead assimilate fully to V_1 (see Section 3.3). A similar assimilation process also occurs in fast speech, where underlying V_1V_2 diphthongs involving a mid-vowel (e, o) as V_1 and the vowel [a] as V_2 often assimilate to the V_1 vowel, resulting in e͡a→e and o͡a→o. This results in these diphthongs being less frequent than otherwise expected. For the purposes of the present study, I table this issue, and note that the status of these V͡a diphthongs requires further study.

[2] The ɪ/e distinction is sometimes written as e/ɛ (Edwards, 2016). Neither is perfect – the Uab Meto /ɪ/ is realized slightly lower than the English /ɪ/, but the important thing is that /i/ and /ɪ/ both are high vowels in this model, and so share similar characteristics in diphthongs and consonant epenthesis contexts.

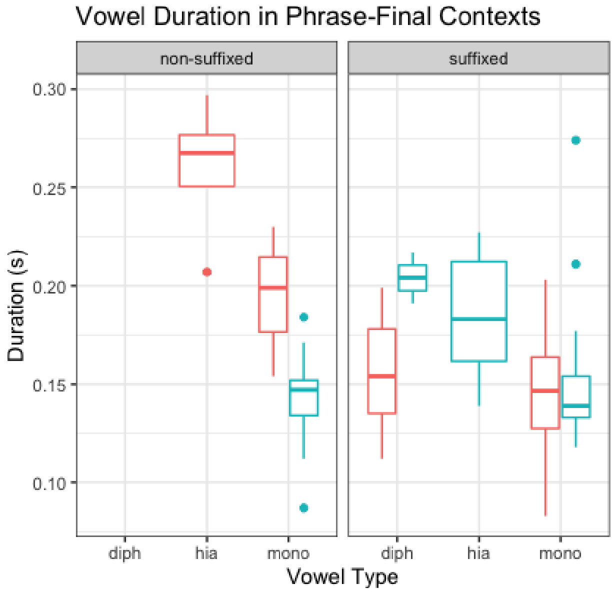


Figure 1: Effect of prosodic context on duration for vowels with primary stress in phrase-final contexts.

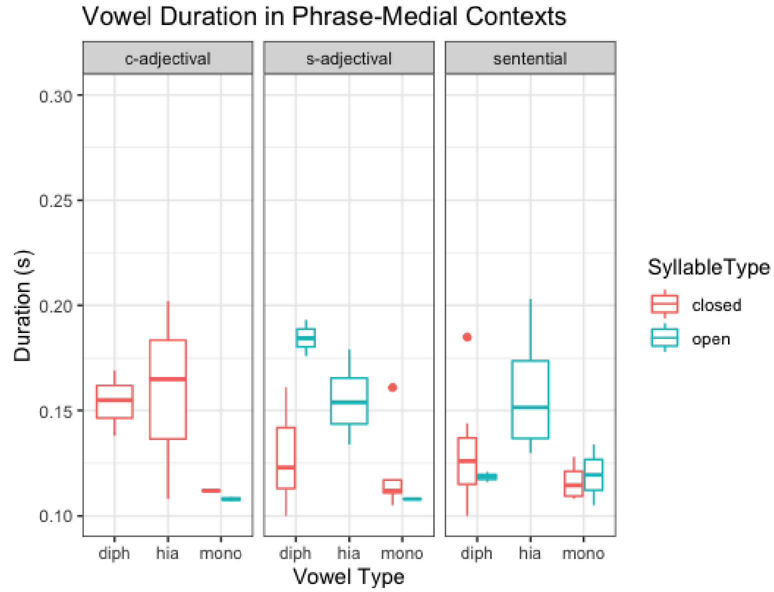


Figure 2: Effect of prosodic context on duration for vowels with secondary stress in phrase-medial contexts.

2.3 Diphthongs and Vowel Length

Distinguishing diphthongs, vowel hiatus, and monomoraic vowels is an important issue for Uab Meto phonology, since this is what determines if there is really an alternation in cases like [me.o] 'cat' and [me͡o-nu] 'cats' from Section 1.1. In this section, I present a small pilot study that confirms there is a length contrast between these three categories.

For this study, I recorded a young native speaker of the Molo dialect, using a Shure SM35 head-mounted microphone and a Zoom H4n Pro recorder. A total of 36 nominal roots were elicited in isolation and in carrier phrases, for a total of 245 target words. All data were segmented in Praat (Boersma and Weenink, 2018). Vowels were tagged for vowel type (diphthong, monophthong, underlying hiatus), syllable type (open or closed), position relative to stress (pre-tonic, stressed, post-tonic), prosodic context (phrase-medial or phrase-final), and morphological context (suffixed, non-suffixed, simple-onset adjectival, complex-onset adjectival, sentential). Sample elicitation frames are in (12).

(12)

		Phrase-final		Phrase-medial		
	Pattern	non-suffixed	suffixed	adjectival		sentential
				simple-onset	complex-onset	
(12)	*coalescing met.*	ˈta.si	ˈtas.ɟ͡j-e	ˌta͡is ˈmate	ˌta.si m.ˈna.nuʔ	ʔau. ʔit. ˌta͡is. ˈma.te
		'sea'	'the sea'	'green sea'	'wide sea'	'I see the green sea'
	diphthongization	ˈme.ob	ˈme͡o.b-e	ˌme͡o. ˈmu.tiʔ	ˌme͡o m.ˈna.siʔ	ʔau. ʔit. ˌme͡o. ˈmu.tiʔ
		'cat'	'the cat'	'white cat'	'old cat'	'I see the white cat'
	deletion	ˈki.baʔ	ˈkib.ʔ-e	ˌkib. ˈme.tan	ˌki.ba m.ˈna.siʔ	ʔau. ʔit. ˌkib. ˈme.tan
		'ant'	'the ant'	'black ant'	'old ant'	'I see the black ant'

The important thing to observe from (12) is that vowel hiatus can only occur phrase-finally. In contrast, diphthongs may occur in phrase-final suffixed environments or phrase-medially. Recall, the aim here is to confirm a length distinction between surface vowel hiatus (e.g. [me.o] 'cat') and diphthongs (e.g. [me͡ob-e] ‘the cat’).[3]

The results for nominal roots are shown in Figures 1 and 2. All data were analyzed in R and significance was assessed with a Welch’s t-test. In the phrase-final contexts (Figure 1), non-suffixed words with underlying vowel hiatus had significantly longer durations than any other vowel by around 0.109 seconds ($t = 6.083, df = 6.260, p \leq 0.001$). In contrast, underlying vowel hiatus in suffixed contexts was more similar to diphthongs, and no significant differences were found ($t = 1.729, df = 34.482, p \geq 0.05$). This is in line with there being a length contrast between [me.o] ‘cat’ and [me͡o.b-e] ‘the cat’, confirming the diphthongization pattern in the Coalescence Puzzle.

In phrase-medial contexts (Figure 2), vowel length still varied, but this time underlying vowel hiatus patterned with diphthongs. Both underlying vowel hiatus and diphthongs were generally longer than monophthong counterparts (diphthongs avg. 0.035 seconds longer, $t = 6.7347, df = 68.084, p \leq 0.001$; hiatus avg. 0.067 seconds longer, $t = 5.0189, df = 20.999, p \leq 0.001$), but this difference was much smaller than what we saw for vowel hiatus in phrase-final contexts. However, metathesis-derived diphthongs (closed diphthongs in simple adjectival/sentential contexts) are significantly shorter than other diphthongs by 0.041 seconds ($t = 2.8173, df = 20.054, p \leq 0.05$). I understand this variation as a limit on the inherent compressibility of certain diphthongs: in order to reach multiple gestural targets, diphthongs generally need more time. However, in the case of consonant-vowel overlap during metathesis, cues to the vowel are preserved on the coda consonant, allowing the diphthong to be shorter. I conclude that these results are consistent with diphthongs and underlying vowel hiatus being monosyllabic in phrase-medial contexts.

To sum up, the results here confirm that vowel hiatus in words like [me.o] is significantly longer than any diphthong or monophthong. From this, I conclude that underlying vowel hiatus is disyllabic in phrase-final, non-suffixed contexts, but surfaces as a monosyllabic diphthong elsewhere. I also found that diphthong length in phrase-medial position is somewhat variable, but that metathesis-derived diphthongs are markedly shorter than underlying or hiatus-derived diphthongs.[4] I argue that metathesis-derived diphthongs can be shorter because cues to the vowel are maintained on the intervening consonant. I conclude that all diphthongs are monosyllabic, even if they vary slightly in their compressibility.

2.4 Stress

Uab Meto metathesis is largely prosodically driven, and reduces lapses between stress and edge of a prosodic domain by compressing the root. In this section, I present an analysis of stress placement in Uab Meto, where the same constraints that determine stress assignment also trigger the alternations that feed metathesis.

[3] Note that this speaker pronounces [me.o] ‘cat’ as [me.ob], where the final [b] is epenthetic. I analyze this as some speakers having an additional restriction against superlight syllables, which consist of a onsetless and codaless vowel.

[4] There is also metrical evidence in poetry that suggests that diphthongs are equivalent to monosyllables, and are representationally different from vowel hiatus. The couplet in (1) shows that the monophthong in *tah* ‘we eat’ fills the same slot in the meter as diphthong *ti͡un* ‘we drink’. We see a similar pattern in the ritual invocation in (2), where *puah* ‘areca nut’ is disyllabic, maintaining parallel structure with other trochaic words like *makaʔ* ‘rice’.

(1) a.

σ́	σσ́	σ	σ́σ	σσ́
t-ah	ta-mnon	bi	mutis	sasun
1PL-drink	1PL-together	LOC	Mutis	around

We eat together where Mutis gathers,

b.

σ́	σσ́	σ	σ́σ	σσ́
t-i͡un	ta-mnon	bi	mutis	sasa͡ɪ
1PL-drink	1PL-together	LOC	Mutis	is.archaic

we drink together where Mutis lies.

(2) ʔaum sium man...
‘Please come receive...’ (Middelkoop, 1963)

a.

σ	σ́σ	σ	σ́σ	σ	σ́σ
ho	ˈsisi,	ho	ˈmakaʔ,	ho	tˈnapu
2SG	meat	2SG	rice	2SG	sacrificial.meal

‘...your meat, your rice, your sacrificial meal,’

b.

σ	σσ́σ	σ	σ́σ	σ	σ́σ
ho	buˈkae,	ho	ˈpuah,	ho	ˈmanus
2SG	food	2SG	areca.nut	2SG	betel.leaf

‘...your food, your areca nut, your sirih.’

Stress in Uab Meto is overwhelmingly penultimate. Stress is always assigned to the penultimate syllable of a root, unless the root is monosyllabic, in which case the final (and only) syllable is stressed.

(13) Roots have penultimate stress

a.	ˈʔun	$\acute{\sigma}$	'base'
b.	ˈnaʔ	$\acute{\sigma}$	'blood'
c.	ˈme.o	$\acute{\sigma}\sigma$	'cat'
d.	ˈko.lo	$\acute{\sigma}\sigma$	'bird'
e.	ba.ˈka.seʔ	$\sigma\acute{\sigma}\sigma$	'horse'
f.	bi.ˈfe.e	$\sigma\acute{\sigma}\sigma$	'woman'
g.	ka.bu.ˈpa.ten	$\sigma\sigma\acute{\sigma}\sigma$	'regency (Indonesian loan)'

Within Optimality Theory, these patterns can be easily captured with NONFIN and ALIGN(X,R) constraints, which militate against final stress and non-rightmost stress.

(14) NONFIN: Stress does not fall on the final syllable of a maximal stress domain. (cf. Prince and Smolensky, 1993)

(15) ALIGN(X,R): Assign one violation for each stress that does not occur in the rightmost syllable of a maximal stress domain. (cf. McCarthy and Prince, 1993; Gordon, 2002, a.o.)

Following Elfner (2009), I assume stress assignment is a faithfulness-violating operation (STRESSFAITH) that occurs in order to make sure a stress mark is placed in a given phonological domain (HAVESTR).

(16) HAVESTR: 'Each phonological phrase must have stress'
Assign a violation for a phonological phrase that does not bear a primary stress. (cf. CULMINATIVITY, Kager 1989, 1999, ONESTRESS, Gordon, 2002)

(17) STRESSFAITH: 'Don't add or change stress marks.'
For a V-slot V_X in the input in a relation with V-slot V_Y in the output, assign a violation mark if either V-slot bears an $_n$ stress grid mark that is not borne on its correspondent.

In monosyllables, HAVESTR outranks all other constraints, and so stress is assigned to the only syllable, even though this violates both STRESSFAITH and NONFIN.

(18)

Step 1: Assign stress

/ʔun/	HAVESTR	STRFAITH	NONFIN	(X,R)
a. ʔun	*!			
☞b. ˈʔun		*	*!	

Step 2: Convergence

/ˈʔun/	HAVESTR	STRFAITH	NONFIN	(X,R)
☞a. ˈʔun			*	
b. ʔun	*!	*		

In larger roots, NONFIN is shown to outrank ALIGN(X,R), which results in stress being assigned to the rightmost non-final syllable. After that initial stress assignment, HAVESTRESS is satisfied, and so further violations of STRFAITH are not tolerated. The derivation converges, yielding penultimately-stressed [baˈkaseʔ].

(19)

Step 1: Assign stress

/bakaseʔ/	HAVESTR	STRFAITH	NONFIN	(X,R)
a. bakaseʔ	*!			
b. ˈbakaseʔ		*		**!
☞c. baˈkaseʔ		*		*
d. bakaˈseʔ		*	*!	

Step 2: Convergence

/baˈkaseʔ/	HAVESTR	STRFAITH	NONFIN	(X,R)
☞a. baˈkaseʔ				*
b. baˈkaˈseʔ		*!	*	*
c. ˈbaˈkaseʔ		*!		***
d. bakaseʔ	*!	*		

When mora-bearing suffixes attach to roots, stress assignment behaves identically to when the roots are in isolation – monosyllabic roots are stressed, and larger roots receive penultimate stress. However, this pattern generates additional violations of ALIGN(X,R) at the word level. I argue that these ALIGN(X,R) violations trigger prosodic truncation and coalescence at the end of the root, reducing the right-edge lapse (e.g. /ˈme.o-nu/→[ˈme͡o-nu] 'cats'). This pattern of prosodic truncation forms the basis of all metathesis alternations in the language, discussed in Section 3 and Section 4.

In cases where there are multiple roots in a single phonological domain, such as compounds, the rightmost root always receives primary (word-level) stress. This preference for right-root promotion is strong enough to even create stress-final words, as in (20a).

(20) Compounds promote rightmost root's stress

a.	kol-ˈkaʔ	'crow'	UR: /kolo-ˈkaʔ/
b.	me͡o-ˈʔanaʔ	'kitten'	UR: /meo-ˈʔanaʔ/
c.	fa͡if-ˈʔanaʔ	'piglet'	UR: /fafi-ˈʔanaʔ/
d.	ʔato͡in-ˈkase	'city man'	UR: /ʔatoniʔ-ˈkase/
e.	ʔato͡in-ka͡es-ˈmutiʔ	'foreign man'	UR: /ʔatoniʔ-kase-ˈmutiʔ/

Compounds are important because they reveal evidence that Uab Meto prefers for stress to also align with the *left edge* of the word. This preference is secondary to right alignment, and so while it does not effect stress assignment, left-alignment preferences surface through diphthongization or coalescing metathesis. In (20b), the disyllabic /me.o/ 'cat' diphthongizes into [me͡o-ˈʔanaʔ] 'kitten', reducing the lapse between primary stress and left edge.[5] This is discussed at further length in Section 3.2.1.

From these facts, we see that stress is always assigned to the penultimate vowel of a root, but that alignment constraints are evaluated relative to the edges of larger prosodic constituents. Intuitively, this means that need some way of assigning stress to the penult of the root and having it stay there, even as the evaluation window for alignment constraints increases. There are multiple ways to accomplish this: cyclicity in SPE-style rules (Chomsky and Halle, 1968; Bresnan, 1973), transderivational faithfulness relations (Benua, 1997), or phase-based spellout (Chomsky, 2001; Adger, 2007; Dobashi, 2004, 2009; Ishihara, 2007; Kratzer and Selkirk, 2007). For simplicity, I set aside the particular choice of analysis here, and only look at derivations where a root has already received penultimate stress. I also assume that stress alignment constraints are always evaluated relative to the phonological phrase edge (φP).

3 The Coalescence Puzzle and Prosodic Reduction

This section provides an analysis for the Coalescence Puzzle, where prosodic factors condition diphthongization, coalescing metathesis, or deletion. I argue that each of these processes is parasitic on prosodic truncation – a timing slot deletes, and the delinked features must either spread to a new slot (diphthongizing or metathesizing) or delete fully.

Intuitively, Uab Meto has a preference for the stressed syllable, the penult of the root, to align with the right edge of the phonological phrase. The final syllable of a root undergoes vowel deletion and coalescence to address this, and thus reduces the right-edge lapse by one. In short, the analysis of the Coalescence Puzzle involves two main components:

[5] Alternatively, we could assume that [me͡o] bears secondary stress in this position, and that this pressure for right-edge stress alignment applies to both primary and secondary stresses. This would be typologically unusual, since then Uab Meto would be a language that actually prefers sequences of stress clash (e.g. [ʔaˌto͡in-ˌka͡es-ˈmutiʔ] $\sigma\grave{\sigma}\grave{\sigma}\acute{\sigma}\sigma$, *[ʔaˌtoniʔ-ˌkase-ˈmutiʔ] *$\sigma\grave{\sigma}\sigma\grave{\sigma}\sigma\acute{\sigma}\sigma$). I leave this matter for future work.

1. **Prosodic truncation.** A root-final V-slot deletes, leaving delinked vowel features. Monosyllabic roots cannot truncate, and so they do not undergo alternations as part of the Coalescence Puzzle.

```
C  V́  V  -  C  V         C  V́  C  V  C  -  V         C  V́  C  V  C  -  V
|  |        |  |         |  |  |     |     |         |  |  |     |     |
m  e  o     n  u         k  o  k  ɪ  s     e         k  i  b  a  ʔ     e
```

2. **Elimination of delinked vowels.** Delinked vowel features can either reassociate through spreading or delete fully.

   (a) **Spreading.** Delinked vowel features spread leftwards onto preceding V-slot. Spreading may either be local (diphthongization, Section 3.1) or non-local, crossing an intervening consonant (coalescing metathesis, Section 3.2).

   Diphthongization *Coalescing Metathesis*

```
C  V́  V  -  C  V         C  V́  C  V  C  -  V
|  |`.      |  |         |  |``|`.   |     |
m  e  o     n  u         k  o  k  ɪ  s     e

   [me͡o-nu]                 [ko͡ɪks-e]
```

   (b) **Deletion.** Delinked vowel features delete. This is dispreferred relative to spreading, and so it only occurs when the delinked features cannot spread (Section 3.3).

   Deletion

```
C  V́  C  V  C  -  V
|  |  |     |     |
k  i  b  a  ʔ     e

   [ˈkibʔ-e]
```

In the following sections, I go through diphthongization, coalescing metathesis, and deletion patterns in turn, and show that these alternations are parasitic on a broader process of prosodic truncation.

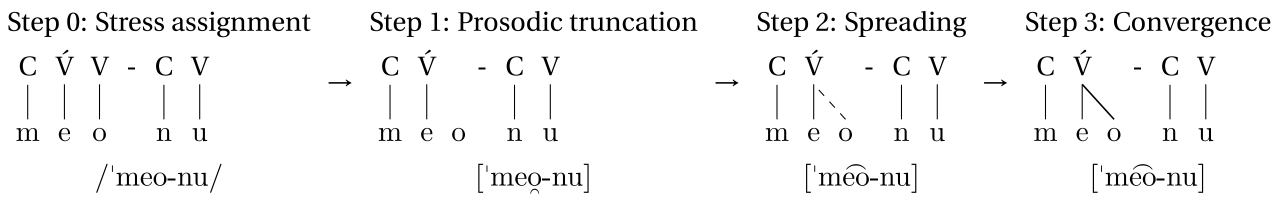
3.1 Local Diphthongization

For words with vowel hiatus, this right-edge prosodic reduction is realized simply as diphthongization (CVV(C) → CV͡V(C)). The syllabic status of the second vowel is removed, and so the vowel fuses onto the preceding syllable to create a diphthong. Diphthongization rightwards does not occur, as this often would constitute spreading past a morpheme boundary (see Section 4.1).

(21) Diphthongization

a.	ˈme.o	$\acute{\sigma}\sigma$	'cat'	*ˈme͡o	$\acute{\sigma}$
	ˈme͡o-nu	$\acute{\sigma}\sigma$	'cats'	*ˈme.o-nu	$\acute{\sigma}\sigma\sigma$
b.	ˈfa.i	$\acute{\sigma}\sigma$	'night'	*ˈfa͡ɪ	$\acute{\sigma}$
	ˈfa͡ɪ-nu	$\acute{\sigma}\sigma$	'nights'	*ˈfa.i-nu	$\acute{\sigma}\sigma\sigma$
c.	ˈta.i-s	$\acute{\sigma}\sigma$	'sarong'	*ˈta͡ɪ-s	$\acute{\sigma}$
	ˈta͡ɪ-s-in	$\acute{\sigma}\sigma$	'sarongs'	*ˈta.i-s-in	$\acute{\sigma}\sigma\sigma$
d.	ˈlo.i-t	$\acute{\sigma}\sigma$	'money'	*ˈlo͡ɪ-t	$\acute{\sigma}$
	ˈlo͡ɪ-t-e	$\acute{\sigma}\sigma$	'the money'	*ˈlo.i-t-e	$\acute{\sigma}\sigma\sigma$

In this analysis, I cast diphthongization as a two step process (22): first, prosodic truncation of a syllabic V-slot, and second, spreading of the delinked vowel features leftwards. This reduces the lapse between the stressed V-slot and the right edge by one, while also preserving the features of the truncated vowel. Throughout the paper, delinked vowels are written with the non-syllabic subscript V̯.

(22) 

I introduce three constraints, MAX$_V$, *DELINK, and *MULTIPLE. The MAX$_V$ constraint militates against V-slot truncation, *DELINK against unassociated features or slots, and *MULTIPLE against multiple linkage of a single feature with multiple slots.

(23) MAX$_V$: 'Don't delete V-slots.'
For a V-slot V_X in the input, there must be a corresponding V-slot V_Y in the output.

(24) *DELINK: 'Features and timing slots should be associated.'
For a feature [±F], assign a violation if it is not associated with a timing C/V-slot, and vice versa. (cf. *FLOAT, Zoll, 1994)

(25) *MULTIPLE: 'Don't associate a feature with more than one slot.'
Assign one violation for a feature [±F] associated with more than one C/V-slot. (cf. Uffmann, 2006)

In (26), the pressure for V-slot deletion comes from a stress alignment constraint, ALIGN(X,R) (abbreviated (X,R), see Section 2.4), which assigns a violation for each syllable separating the stressed syllable from the right phrase edge. In Step 1 the faithful candidate (a.), /me.o-nu/ 'cats', stress is antepenultimate and so it receives two violations. The only way to reduce the lapse is to delete a syllabic V-slot by violating MAX$_V$ (c.) – other changes, such as deleting features (b.) or simply delinking (d.) will not repair the illicit lapse. In Step 2, the optimal candidate /meo̯-nu/ from Step 1 becomes the input. The faithful candidate has a delinked vowel (*DELINK), which is optimally repaired by spreading to the preceding vowel. Spreading across morpheme boundaries is not possible in Uab Meto, ruling out rightwards spreading (Section 4.1).

(26)

Step 1: Prosodic truncation

/ˈme.o-nu/	(X,R)	*DLNK	MAX$_F$	*MULT	MAX$_V$
a. ˈme.o.-nu	**!				
b. ˈme.V.-nu	**!	*	*		
☞c. ˈmeo̯.-nu	*	*			*
d. ˈmeo̯V.-nu	**!	**			

Step 2: Spreading

/ˈmeo̯.-nu/	(X,R)	*DLNK	MAX$_F$	*MULT	MAX$_V$
a. ˈmeo̯.-nu	*	*!			
☞b. ˈme͡o.-nu	*			*	
c. ˈme.-nu	*		*!		
d. ˈme.o.-nu	**!				

After Step 2, /me͡o.-nu/ becomes the new input, but no further changes harmonically improve the output and the faithful candidate wins. The derivation thus converges, yielding [me͡o.-nu] as the output.

At this point, it's important to note that only a root-final, unstressed V-slot may delete. This means that truncation may only occur at most once per root, and that monosyllabic roots do not alternate as part of the Coalescence Puzzle. An example of this is the word [kan] 'name'. When suffixed, this root does not undergo alternations, even when stress is antepenultimate (e.g. [ˈkan-in-e] 'the names')[6]. In this analysis, prosodic truncation feeds all alternations of the Coalescence Puzzle, and so where prosodic truncation is ruled out, no alternations are predicted. There are other positional restrictions on truncation – I discuss these as needed in the coming sections.

[6]Note that [kn] is licit as an onset cluster in the language (cf. [knapan] 'butterfly'), and that CV-final roots select -n as the plural allomorph. Therefore one possibility is for [ˈkan-in-e] 'the names' to be realized as *[ˈkna-n-e], but this does not occur.

3.2 Coalescing Metathesis Reduces Right-Edge Lapses

In cases with coalescing metathesis, we see the same pattern: affixation creates a large right-edge lapse, and so prosodic truncation reduces the end of the root. The root's final vowel then diphthongizes onto the preceding syllable. What's different from the simple diphthongization cases is that now diphthongization crosses over an intervening consonant, creating the surface appearance of CV transposition. Crucially, truncation is only possible with root-final vowels, and so once metathesis has taken place once, additional metathesis is not possible. On the surface, this means that antepenultimate stress can occur, but only when there are multiple suffixes (27h).

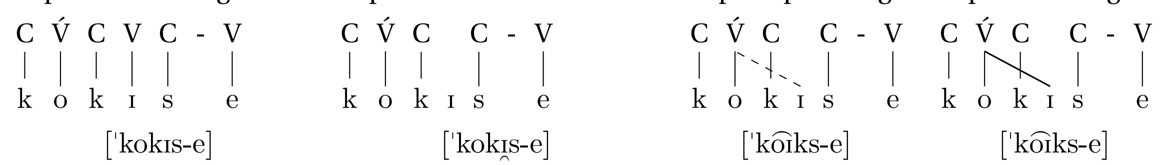
(27) Coalescing metathesis

a.	ˈkokɪs	σ́σ	'bread'	*k͡oiks	σ́
b.	ˈk͡oiks-e	σ́σ	'the bread'	*ˈkokɪs-e	σ́σσ
c.	baˈkaseʔ	σσ́σ	'horse'	*bak͡aes	σσ́
d.	baˈk͡aesʔ-e	σσ́σ	'the horse'	*baˈkaseʔ-e	σσ́σσ
e.	ˈmepo	σ́σ	'to work'	*ˈm͡eop	σ́
f.	ʔa-ˈmepo-t	σ́σ	'worker'	*ʔa-ˈm͡eop-t	σσ́
g.	ʔa-ˈm͡eop-t-in	σσ́σ	'workers'	*ʔa-ˈmepo-t-in	σσ́σσ
h.	ʔa-ˈm͡eop-t-in-e	σσ́σσ	'the workers'	*ʔa-ˈmepo-t-in-e	σσ́σσσ

In a derivation, coalescing metathesis is carried out in two main steps (28). First, the root's final V-slot deletes, resulting in a delinked vowel feature. Deletion of anything else is ruled out by a $\text{M}{\small\text{AX}}_{\text{N}{\small\text{ON}}\text{F}{\small\text{IN}}}$ constraint, which prohibits deletion of any material before the final syllable of a root. After that, the delinked vowel spreads to the preceding syllable to create a diphthong. This gives the impression of true transposition, even though the features remain in the same underlying order.

Step 0: Stress assignment Step 1: Prosodic truncation Step 2: Spreading Step 3: Convergence

(28)



At this point, the constraint that governs spreading is not *MULTIPLE but XSPREAD, which militates against consonant-vowel line crossing (29). While *MULTIPLE is also violated by coalescing metathesis, we will need separate constraints to explain why some sequences can be derived through local spreading but not through (metathesizing) non-local spreading. This is discussed further in Section 3.3.

(29) XSPREAD: 'Don't let consonants and vowels cross each other's association lines' (cf. *SKIP, Uffmann 2006).

The derivation proceeds almost identically to the diphthongization cases, with XSPREAD having a similar ranking to *MULTIPLE. First, the right-edge lapse creates multiple violations of ALIGN(X,R), which forces deletion of a V-slot (*$\text{M}{\small\text{AX}}_{\text{V}}$). This creates a delinked vowel, which can be repaired by spreading to a new slot or deletion. Since $\text{M}{\small\text{AX}}_{\text{F}}$ outranks *MULTIPLE, the feature docks on an existing V-slot, creating a diphthong. After spreading, the derivation converges, since there are no operations that harmonically improve the output candidate.

(30)

Step 1: Prosodic truncation

/ˈkokɪs-e/	(X,R)	*DLNK	MAX$_F$	XSPR	MAX$_V$
a. ˈko.kɪ.s-e	**!				
b. ˈko.kV.s-e	**!	*	*		
☞c. ˈkokɪ̯.s-e	*	*			*
d. ko͡ɪ.kɪ.s-e	**!			*	

Step 2: Spreading

/kokɪ̯s-e/	(X,R)	*DLNK	MAX$_F$	XSPR	MAX$_V$
a. kokɪ̯.s-e	*	*!			
☞b. ko͡ɪk.s-e	*			*	
c. kok.s-e	*		*!		
d. ko.kɪ.s-e	**!				

Although spreading to other slots is in theory possible in Step 2, Uab Meto does not allow multiple-association with consonants or spreading past morpheme boundaries. As a result, delinked features will either spread towards a morpheme-internal V-slot or delete. There are some exceptions to this, such as when there is an (empty) epenthetic slot available, in which cases the features will prioritize spreading to the empty slot. These cases are discussed further in Section 4.

In summary, right-edge lapses trigger truncation of post-tonic vowels in roots. In order to preserve the underlying vowel features, spreading occurs, which creates a diphthong on the preceding syllable. In Section 3.3, we look at what happens when diphthongization is not possible due to restrictions on derived diphthongs.

3.2.1 Extension: Coalescing Metathesis Reduces Left-Edge Lapses

An account of Uab Meto metathesis would not be complete without acknowledging an additional context for coalescing metathesis that occurs in compounds and phrases. In these contexts, prosodic truncation occurs to improve lapses at the *left edge*. Just as in the suffixation cases in Section 3.2, metathesis, diphthongization, and deletion occur after prosodic truncation.

Recall from Section 2.4 that in compounds the rightmost root receives primary stress, which creates a lapse between the primary stress and the left edge of the word. This left-edge lapse is dispreferred, but due to positional restrictions on truncation, can only be improved by deleting a root-final vowel.[7] The first root of a compound thus reduces, undergoing diphthongization, coalescing metathesis, or deletion in order to reduce the syllables separating the second root from the left edge (31). Monosyllabic roots cannot truncate, and so are not expected to alternate in these contexts.

(31) Compounding creates left-edge lapses

Diphthongization					
a.	me͡o-ˈʔanaʔ	σσ́σ	'kitten'	*me.o-ˈʔanaʔ	*σσσ́σ
b.	no͡e-ˈnoniʔ	σσ́σ	'Silver River'	*no.e-ˈnoniʔ	*σσσ́σ
Coalescing Metathesis					
c.	ma͡ʊn-ˈfuɟ͡j	σσ́	'wild chicken'	*manu-ˈfuɟ͡j	*σσσ́
d.	kol-ˈkaʔ	σσ́	'crow'	*kolo-ˈkaʔ	*σσσ́
e.	fa͡ɪf-ˈʔanaʔ	σσ́σ	'piglet'	*fafi-ˈʔanaʔ	*σσσ́σ
f.	ʔato͡ɪn-ˈkase	σσσ́σ	'city man'	*ʔatoniʔ-ˈkase	*σσσσ́σ
g.	ʔato͡ɪn-ka͡es-ˈmutiʔ	σσσσ́σ	'foreign man'	*ʔatoniʔ-kase-ˈmutiʔ	*σσσσσσ́σ
Deletion					
h.	ʔut-ˈmutiʔ	σσ́σ	'mustard greens'	*ʔutan-ˈmutiʔ	*σσσ́σ

At the phrasal level, we see a parallel pattern: when there are multiple roots within a single phonological phrase, the rightmost root receives primary stress and preceding roots are reduced. Just as in compounds, metathesis of non-final roots reduces lapses with the left edge.

[7] An alternative way to state the positional restriction on truncation is through stress: only root-internal, post-tonic V-slots may delete. This alternative requires the stipulation of secondary stress assignment for all roots, e.g. [ˌfa͡ɪf-ˈʔanaʔ] 'piglet' (31e.). Further phonetic study is needed to determine the status of secondary stress in the language.

(32) Sentential prosody – Coalescing metathesis

a. Nominal Domain - Noun Adjective

i. [maʊ͡n ˈmutiʔ]$_{nP}$ nua
chicken white two
'two white chickens'

ii. [ˈmanu]$_{nP}$ nua
chicken two
'two chickens'

b. Nominal Domain - Noun Compounds

i. [faɪ͡f ˈʔanaʔ]$_{nP}$ ʔii
pig baby DEM
'this piglet'

ii. [ˈfafi]$_{nP}$ ʔii
pig DEM
'this pig'

c. Verbal Domain - Direct Objects

i. aʊ [ʔ-aɪ͡m baˈkase ʔii]$_{vP}$
1SG 1SG.AGR-look.for horse DEM
'I look for the horse.'

ii. baˈkase ʔii aʊ [ˈʔ-ami]$_{vP}$
horse DEM 1SG 1SG.AGR-look.for
'The horse, I look for it.'

d. Other areas - Adjuncts in fast, connected speech

i. jermy na-tonan jefri he-n meo͡p ne ˈlalan]$_{vP}$
Jermy 3-told Jefri IRR-3.AGR work LOC road
'Jermy told Jefri to work in the road'

ii. jermy na-tonan jefri he-n ˈmepo]$_{vP}$ ne ˈlalan]$_{vP}$
Jermy 3-told Jefri IRR-3.AGR work LOC road
'Jermy told Jefri to work in the road.'

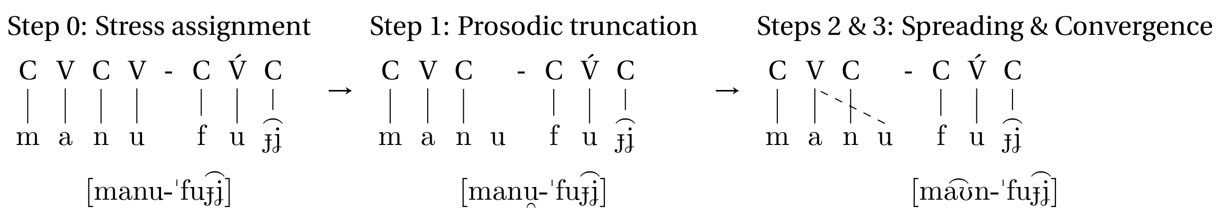
In example (32a.) [maʊ͡n ˈmutiʔ ˈnua] 'two white chickens', for instance, the phonological phrase includes only the noun and adjective, and excludes the following numeral. Primary stress is assigned to the modifier [ˈmutiʔ] 'white' since this is the rightmost root in the domain. To reduce the lapse between the stress and left edge, /manu/ undergoes coalescing metathesis to [maʊ͡n]. This contrasts with (32b.), [ˈmanu ˈnua] 'two chickens', where [ˈmanu] 'chicken' receives primary stress, and therefore has no reason to reduce.

Under this account, these cases are fairly simple to incorporate. I introduce ALIGN(X,L), which aligns stress to the left edge of the phonological phrase. This is ranked below ALIGN(X,R), and so it does not change the stress assignment process, but it is still ranked above *DELINK, and so it will trigger prosodic truncation.

(33) ALIGN(X,L): Assign one violation for each stress that does not occur in the leftmost syllable of a maximal stress domain. (McCarthy and Prince, 1993; Gordon, 2002, a.o.)

In a derivation, the constraint ALIGN(X,L) triggers prosodic truncation, and then spreading occurs to eliminate the delinked vowel. Spreading leftwards is the only option here, since spreading rightwards would cross a morpheme boundary (see Section 4.1).

(34)



To sum up, coalescing metathesis occurs to minimize lapses at both the right and left edge of a phonological phrase. There are several open questions that remain with this pattern: what constitutes a phonological phrase in the language, if the aligned accent is best described as stress or a H* tone, and how this bears on the syntax-phonology interface in the language. These questions are left for future research. In the next subsection, I review several arguments against an allomorphy-based approach to this metathesis pattern.

3.2.2 A Syntactic Alternative

In previous accounts, Edwards (2016) describes these examples as "syntactic metathesis", where metathesis is a phonological reflex of syntactic complementation to nouns and verbs. However, this incorrectly predicts that coalescing metathesis should only be possible with nouns and verbs, and yet it is attested with a variety of categories, including adverbs, numerals, and complementizers.

The main problem with a syntactic analysis is that it predicts that metathesis should be able to diagnose adjunct height. For instance, metathesis should only occur on a verb followed by a PP adjunct when the PP is interpreted in the same domain as that verb. Yet, adjunct attachment height is ambiguous in both (32d.i) and (32d.ii). The high-attachment reading persists regardless of metathesis, and the only difference between these two sentences is their intonational contour. This is not easily compatible with a syntax/allomorphy-based account, and is better analyzed as a type of prosodic wrapping (cf. WRAP, Truckenbrodt, 1999, 2006).

The syntactic approach also causes problems with contrastive focus intonation in the language, where a focus high tone (fH*) blocks coalescing metathesis. For instance, the phrase 'a white CHICKEN' (as opposed to a duck) would be [$^{\text{fH*}}$manu ˈmutiʔ], in contrast to the default intonation [ma͡ʊn ˈmutiʔ]. A syntactic analysis would have to contend that focus intonation coincides with movement of the focused noun, and yet word order and scopal relations are not changed by a focus high tone. These cases are discussed in more detail in Mooney (in preparation).

3.3 Loose ends: deletion and blocked diphthongization

Before moving on to the Epenthesis Puzzle, we first need to discuss a blocking condition on diphthongization. In example (35), we see some forms that we may expect to undergo coalescing metathesis, but do not. Instead, the root final vowel in [penaʔ] 'corn' deletes fully, yielding [penʔ-e] instead of the metathesized *[pe͡anʔ-e]. What unifies these cases is that they all have [a] as the V_2, and so I conclude that there is a prohibition against certain rising sonority diphthongs created by metathesis.

The same prohibition against rising sonority diphthongs does not extend to diphthongs that are underlying (36) or those derived through local diphthongization (37). Crucially, underlying diphthongs can be distinguished from derived ones in that they do not undergo any type of prosodic alternation. For instance, [ˈmne͡as] 'rice' in (36a.) can never become *[ˈmnesa].

(35) Deletion favored over metathesis for rising-sonority words

a.	ˈpe.naʔ	'corn'	
	ˈpenʔ-e	'corn-DEF'	*ˈpe͡an.ʔ-e
b.	ˈkibaʔ	'black ant'	
	ˈkibʔ-e	'ant-DEF'	*ˈki͡ab.ʔ-e
c.	ˈʔu.lan	'rain'	
	ˈʔuln-e	'rain-DEF'	*ˈʔu͡al.n-e

(36) Rising sonority diphthongs permitted when underlying

a.	ˈmne͡as	'rice'
b.	manˈsi͡an	'human'
c.	ˈbu͡abaʔ	'gather'

(37) Rising sonority diphthongs permitted in diphthongization

a.	ˈbi.an	'other'	
	ˈbi͡an-e	'the other'	*bi.n-e

b. ˈno.ah ‘coconut’
ˈno͡a.h-e ‘the coconut’ *no.h-e

c. ˈpu.ah ‘areca nut’
ˈpu͡a.h-e ‘the areca nut’ *pu.h-e

The rising diphthong prohibition has important implications for the representation of diphthongs in the language. There are three main types of diphthongs in the language: underlying, derived local diphthongs, and derived metathesized diphthongs. The rising sonority prohibition only applies to derived metathesized diphthongs.

To account for this, I assume the following representational structure for diphthongs in (38). While all three types involve two features associated with a single V-slot, only the metathesized type involves line-crossing. The rising diphthong prohibition can thus be understood as a prohibition against line-crossing of [a] vowel features.

(38) Diphthong structure in Uab Meto

Underlying diphthongs	Derived diphthongs		
No change	Diphthongization	Metathesis	*Phrase-medial alternation*
C V [F] [F] [F]	C V V [F] [F] [F]	C V C V [F] [F] [F] [F]	*Representation*
No	No	**Yes**	*Rising diphthong prohibition*

In constraint form, I capture this using XSPREAD[A], a constraint that militates against non-local spreading of high-sonority vowels. While XSPREAD is dominated in the language, allowing metathesis to repair a delinked vowel, XSPREAD[A] is not, and so [a] vowels cannot cross association lines.

(39) XSPREAD[A]: ‘Don’t have [+LOW] features cross association lines.’

For an example, consider the derivation of [kibʔ-e] ‘the ant’. In Step 1, the V-slot deletes and leaves a delinked vowel, just as in the diphthongization and coalescing metathesis cases. Ordinarily, delinked vowels in Step 2 would be repaired by spreading them to the preceding vowel to create a diphthong. However, in these cases, such spreading would violate XSPR[A], and so deletion is preferred instead (MAX$_F$).

(40)

Step 1: Prosodic truncation

/ˈkibaʔ-e/	(X,R)	*DLNK	XSPR[A]	MAX$_F$	XSPR	MAX$_V$
a. ˈki.ba.ʔ-e	**!					
b. ˈki.bV.ʔ-e	**!	*		*		
☞c. ˈkiba̯.ʔ-e	*	*				*
d. ˈki.ba̯V.ʔ-e	**!	**				

Step 2: Deletion

/ˈkiba̯ʔ-e/	(X,R)	*DLNK	XSPR[A]	MAX$_F$	XSPR	MAX$_V$
a. ˈkiba̯.ʔ-e	*	*!				
b. ˈki͡ab.ʔ-e	*		*!			
☞c. ˈkib.ʔ-e	*			*		
d. ˈki.ba.ʔ-e	**!					

An alternative to the crossing analysis presented here is to analyze the alternations in (35) as epenthesis, where the underlying forms are in fact CC#. In isolation, this final consonant cluster is broken up by epenthesis (e.g. /plen-t/→[plena̲-t] ‘command’), but no epenthesis is required when an affix is present (e.g. /plen-t-e/→[plen-t-e] ‘the command’). This alternative is not only plausible, but entirely in line with what I predict for epenthesis in the language (see Section 4). As a result, I do not dismiss this alternative, but simply acknowledge that the choice in underlying representation does not change the surface output in the present account. By Richness of the Base, the examples in (35) can either be CC# or CaC#, and the present analysis will uniformly map them to the same output.

To sum up, this section provided an analysis of vowel deletion, where CV_1CV_2(C) words with [a] as V_2 delete V_2 instead of diphthongizing it onto the V_1. I contend that this pattern follows from a prohibition against non-local spreading of high-sonority vowels (XSPREAD[A]), and so the only way to remove a *DELINK violation for [a] features is to delete them. The pattern reinforces the idea that non-local spreading of a vowel across a C-slot is not without cost – only low-sonority vowels may cross association lines, and high-sonority vowels must delete instead.

3.4 Interim Summary

In this section, I provided an analysis of the Coalescence Puzzle, where prosodic factors condition diphthongization, coalescing metathesis, or deletion. Under this analysis, each of these alternations is parasitic on prosodic truncation – a root-final V-slot deletes to improve prosodic well-formedness, leaving delinked vowel features that must either reassociate or delete. In diphthongization and coalescing metathesis, the delinked features spread leftwards to reassociate with another V-slot. In the deletion cases, non-local spreading is blocked due to the high sonority of the delinked vowel, and so the delinked features have no other option but to delete. In the next section, I turn to the Epenthesis Puzzle, where we see another type of metathesis in the language. Unlike the CV → VC coalescing metathesis, epenthetic metathesis is VC → CV and does not form a diphthong. However, like coalescing metathesis, epenthetic metathesis is parasitic on prosodic truncation, and so it can only surface in roots that are able to truncate.

4 The Epenthesis Puzzle

This section provides an analysis for the Epenthesis Puzzle, where word-final consonant clusters trigger default epenthesis or epenthetic metathesis. Again, I argue that metathesis is parasitic on prosodic truncation, but this time the delinked features spread rightwards to the epenthetic V-slot. The alternation between default epenthesis and epenthetic metathesis follows from which roots can truncate – monosyllabic roots cannot truncate and so epenthesis is default, whereas larger roots can truncate and may metathesize.

Intuitively, word-final consonant clusters trigger default epenthesis (CC#→C$\underline{a}$C#) in monosyllabic roots, and epenthetic metathesis (VC_1C_2#→C_1VC_2#) in larger roots. Examples of this are shown in (41) and (42). Unlike coalescing metathesis, epenthetic metathesis is VC→CV and forms a CV sequence that is indistinguishable from an underlying one.

(41) Monosyllabic roots undergo default epenthesis

a.	ˈʔut$\underline{a}$n	$\acute{\sigma}\sigma$	‘vegetable’	*ʔutn	
	ˈʔutn-e	$\acute{\sigma}\sigma$	‘the vegetable’	*ˈʔut$\underline{a}$n-e	$\acute{\sigma}\sigma\sigma$
b.	ˈplen$\underline{a}$-t	$\acute{\sigma}\sigma$	‘command’	*plen-t	
	ˈplen-t-e	$\acute{\sigma}\sigma$	‘the command’	*ˈplen$\underline{a}$t-e	$\acute{\sigma}\sigma\sigma$
c.	ʔa-ˈbsoʔ$\underline{a}$-t	$\sigma\acute{\sigma}\sigma$	‘dancer’	*ʔa-bsoʔ-t	
	ʔa-ˈbsoʔ-t-e	$\sigma\acute{\sigma}\sigma$	‘the dancer’	*ʔa-bsoʔ-$\underline{a}$t-e	$\sigma\acute{\sigma}\sigma\sigma$
d.	ˈna͡en	$\acute{\sigma}$	‘run’		
	ʔa-m-ˈna͡en$\underline{a}$-t	$\sigma\acute{\sigma}\sigma$	‘runner’	*ʔa-m-na͡en-t, *ʔa-m-nane-t	

(42) Larger roots undergo epenthetic metathesis

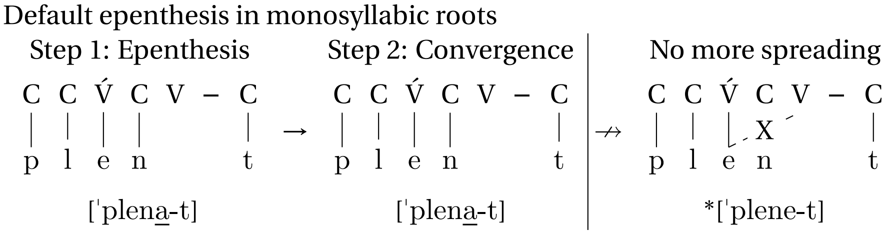
a. maˈnikin σσ́σ ‘to be cold’
maˈnikni-t σσ́σ ‘(the) cold’ *maˈnikina-t, *maˈnikini-t σσ́σσ

b. ˈkapan σ́σ ‘Kapan (town)’
ˈkapna=t σ́σ ‘While (at) Kapan…’ *ˈkapana=t σ́σσ

However, a question still remains: why is there no copy-epenthesis in monosyllables? From the data in (42), it appears as if Uab Meto prefers to color epenthetic segments from surrounding vowels instead of epenthesizing featural material. This makes Uab Meto largely fall into the set of languages with copy-epenthesis (cf. Gafos and Lombardi, 1999), and yet this behavior does not extend to monosyllabic roots. I propose here that Uab Meto doesn’t allow vowel splitting during line-crossing – while coalescence of two vowels into one V-slot is acceptable, a single vowel feature cannot surface on multiple non-adjacent V-slots. This means that non-local spreading is only possible for delinked features in the language, and so associated features cannot cross association lines.

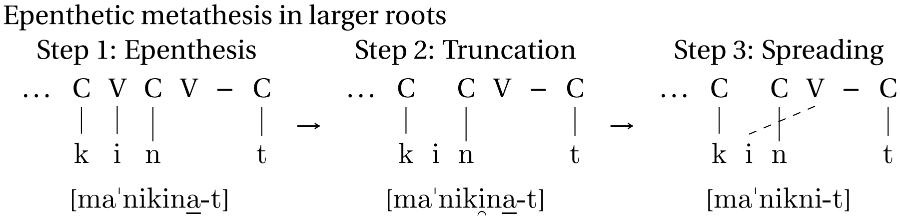
The schematics in (43)-(44) summarize the different derivations for default epenthesis and epenthetic metathesis. Monosyllables (43) insert an epenthetic V-slot, but cannot spread features from the underlying vowel since it remains associated.

(43) Default epenthesis in monosyllabic roots



In contrast, larger roots (44) insert an epenthetic vowel *and* undergo prosodic truncation, leaving delinked vowel features that are capable of non-local spreading.

(44) Epenthetic metathesis in larger roots

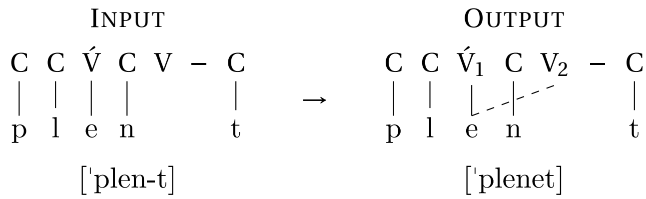


I propose a constraint *XUNI (45) to capture this preference against line-crossing of features that are already associated to a timing slot. Intuitively, this constraint militates against non-local gestural lengthening. When an associated feature spreads rightwards across an association line, its gestural offset is realigned but its onset remains the same, resulting in gestural lengthening across an intervening consonant. In comparison, when a delinked feature crosses an association line, it realigns with the intervening segment but does not significantly lengthen, which is represented by the one-to-one feature-slot correspondence. The constraint *XUNI will only penalize the first of these two circumstances, as the constraint wants features associated with multiple slots to obey strict locality. Note that *XUNI doesn’t say anything about a feature associating with multiple *adjacent* slots, just about multiple linkage that crosses association lines.

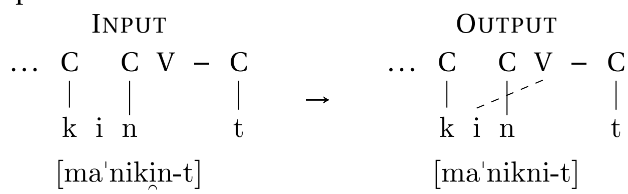
For an example, the output in (46a.) violates *XUNI, since (i) [e] is associated to V_1 in the input, and (ii) the association line between [e] and V_2 crosses an association line and is not in the input. In this case, *XUNI rules out copy-epenthesis. In contrast, the output in (46b.) does not violate *XUNI, because [i] is unassociated in the input. This allows metathesis to take place, even though an association line is crossed.

(45) *XUni (undominated): 'Associated features cannot spread across association lines'
For a feature [F$_X$] associated with a timing slot X in the input, assign one violation for an association line not in the input between [F$_X$] and timing slot Z that crosses an association line of another feature [F$_Y$] and timing slot Y.

(46) a. Output Violates *XUni



b. Output does not violate *XUni



I also introduce the more typical constraints *Complex and Dep$_V$, which militate against consonant clusters and V-slot epenthesis. To simplify exposition, I assume that default epenthetic segments are delinked, featureless slots, instead of assuming that default epenthesis involves insertion of featural material (cf. Archangeli, 1984, 1988; Pulleyblank, 1988).

(47) Dep$_V$ (dominated): 'Don't epenthesize V-slots'

(48) Dep$_F$ (undominated): 'Don't epenthesize features'

(49) *Complex: Assign a violation for any C-slot that is not adjacent to a V-slot. (cf. Prince and Smolensky, 1993)

I first account for the default epenthesis cases. In the derivation of /plen-t/→[plena̲-t] '(a) command' below, *Complex is violated by the word-final [nt#] cluster. In Step 1, an epenthetic V-slot removes this *Complex violation. In Step 2, no further changes harmonically improve the output, and the derivation converges. Spreading would incur a fatal violation of *XUni (cand. b.), and feature epenthesis is also ruled out by undominated Dep$_F$. I follow an underspecification approach to default epenthesis (cf. Archangeli, 1984, 1988; Pulleyblank, 1988), and so the empty V-slot is realized as [a].

(50)

Step 1: Slot Epenthesis

/ˈplen-t/	*XUni	*Comp	Dep$_V$	(X,R)	*Dlnk	XSpr	Max$_V$
a. ˈplen-t		*!					
☞b. ˈple.nV-t			*	*	*		

Step 2: Convergence

/ˈplenV-t/	*XUni	*Comp	Dep$_V$	(X,R)	*Dlnk	XSpr	Max$_V$
☞a. ˈple.nV-t				*	*		
b. ˈple.ne-t	*!			*		*	
d. ˈplen-t		*!					*

For deriving epenthetic metathesis, let's look at the derivation of /manikin-t/→[manikni-t] '(the) cold'. *Complex is again violated by the word-final [nt#] cluster. In Step 1 (51), V-slot epenthesis removes the *Complex violation (cand. b.), but does so at the expense of *Delink and Align(X,R). Candidates with non-word-internal epenthesis (cand. c.) are ruled out by Dep-Anchor, since Uab Meto epenthesis preferentially occurs at word-internal morpheme boundaries (cf. ANCHORING, McCarthy and Prince, 1995). Consonant deletion (cand. d.), while possible in the language, only occurs when word-internal epenthesis cannot repair the *COMPLEX violation, and so DEP-ANCHOR outranks MAX$_C$. Consonant deletion cases are discussed in Section 5.2.

(51) Step 1: Epenthesis

/maˈnikin-t/	*XUNI	*COMP	DEP-ANCHOR	MAX$_C$	DEP$_V$	(X,R)	*DLNK	XSPR
a. ma.ˈni.kin-t		*!				*		
☞b. ma.ˈni.ki.nV-t					*	**	*	
c. ma.ˈni.kin.-tV			*!		*	**	*	
d. ma.ˈni.kin-t̯				*!		*	*	

In Step 2 (52), the derivation has an epenthetic V-slot that has created an additional ALIGN(X,R) violation, similar to what we saw with suffixation. This triggers prosodic truncation of the root-final vowel, adding an additional *DELINK violation. Spreading at ths point (candidate d.) is ruled out by *XUNI, but is also ruled out by the fact that it would not improve the highly-ranked ALIGN(X,R) violations.

(52) Step 2: Prosodic truncation

/maˈnikinV-t/	*XUNI	*COMP	DEP$_V$	(X,R)	*DLNK	XSPR	MAX$_V$
a. ma.ˈni.ki.nV-t				**!	*		
☞b. ma.ˈniki̯.nV-t				*	**		*
c. ma.ˈni.kin-t		*!		*			*
d. ma.ˈni.ki.ni-t	*!			**		*	

In Step 3 (53), spreading associates the delinked vowel to the epenthetic V-slot, repairing both *DELINK violations (cand. b.). Spreading from other sources, such as the stressed vowel (cand. c.), is dispreferred because it would violate *XUNI.

(53) Step 3: Spreading

/maˈniki̯nV-t/	*XUNI	*COMP	DEP$_V$	(X,R)	*DLNK	XSPR	MAX$_V$
a. ma.ˈniki̯.nV-t				*	**!		
☞b. ma.ˈnik.ni-t				*		*	
c. ma.ˈniki̯.ni-t	*!			*	*!	**	

To sum up, this section has shown that restrictions on metathesis follow from restrictions on truncation. In monosyllabic roots, where truncation is impossible, metathesis cannot occur. Larger roots can undergo truncation, and so they can undergo epenthetic metathesis. Embedded within this pattern is a general restriction against gestural realignment when features are already associated to a timing V-slot (*XUNI). Unlike in harmony or copy-epenthesis systems, where spreading can create multiple non-adjacent slots sharing a single feature value, Uab Meto only allows line-crossing when features are in a one-to-one relationship with their slots.

4.1 Loose ends: Epenthesis, Infixation and Locality of Spreading

Default epenthesis is not strictly limited to monosyllabic roots. In consonant clusters created by two single-consonant suffixes, default epenthesis is the only option, regardless of root size (54). This yields examples like (54a.) [ʔo͡el-fa̲=m] even though the root /ʔole/ is not monosyllabic.

In these cases, we may have incorrectly predicted that we should see infixation, where the truncated vowel metathesizes into the suffix to yield *[ʔol-f⟨e⟩-m]. Instead, the truncated vowel spreads leftwards and the epenthetic vowel remains default. I conclude that there is a prohibition against infixation in the language.

(54) a. ʔo͡el-fa̲=m ‘and the younger brother’ /ʔole-f-m/ *ʔol-f⟨e⟩-m

b. mu͡it-sa̲=t ‘while the big white one’ /muti-s-t/ *mut-s⟨i⟩-t

Typologically, this pattern is notable, since Uab Meto is a language with robust metathesis but no infixation. Horwood (2004) observes that productive metathesis systems often co-occur with infixation. Horwood goes on to predict that there should be no language with monomorphemic metathesis that does not also have infixation, since both should arise from dominated LINEARITY. At first glance, Uab Meto appears to be a counterexample to this generalization, since there is metathesis in monomorphemic words (see Section 3.2.1), but no infixation. However, under the present approach metathesis arises from line-crossing, so one possibility is that transposition does exist, but only as a special type of infixation. I return to this possibility in Section 6.4.

In this analysis, I represent this prohibition against infixation with an additional locality restriction on line-crossing: spreading cannot cross morpheme boundaries (XSPREAD[MORPH]).

(55) XSPREAD[MORPH]: ‘Don’t spread past morpheme boundaries.’[8]

In (56), the derivation for /ʔole-f-m/→[ʔo͡el-fa̲-m] ‘and the younger brother’ progresses similarly to the epenthetic metathesis cases above. First, a V-slot is epenthesized to satisfy *COMPLEX. Next, the final vowel of the root truncates in order to reduce ALIGN(X,R) violations.

(56)

Step 1: Slot Epenthesis

/ˈʔole-f-m/	XSPR[M]	*COMP	DEP$_{V}$	(X,R)	*DLNK	XSPR	MAX$_{V}$
a. ˈʔo.le-f-m		*!		*			
☞b. ˈʔo.le-.fV-m			*	**	*		

Step 2: Prosodic truncation

/ˈʔole-fV-m/	XSPR[M]	*COMP	DEP$_{V}$	(X,R)	*DLNK	XSPR	MAX$_{V}$
a. ˈʔo.le-.fV-m				**!	*		
☞b. ˈʔole̯-.fV-m				*	**		*
c. ˈʔo.le-.fe-m	*!			**		*	
d. ˈʔo.le-f-m		*!		*			*

However, in the third step, spreading is no longer possible because of the intervening morpheme boundary. As a result, the delinked vowel spreads leftwards instead, just as in the coalescing metathesis cases. The V-slot remains delinked and is realized as a default epenthetic vowel. At this point the derivation converges, since feature epenthesis (DEP$_{F}$) is higher-ranked than *DELINK.

(57)

Step 3: Spreading

/ˈʔole̯-fV-m/	XSPR[M]	*COMP	DEP$_{V}$	(X,R)	*DLNK	XSPR	MAX$_{V}$
a. ˈʔole̯-.fV-m				*	**!		
b. ˈʔol-.fe-m	*!			*		*	
☞c. ˈʔo͡el-.fV-m				*	*	*	

To summarize, the epenthesis patterns seen in this section provide us with two pieces of evidence for restrictions on non-local spreading in Uab Meto. First, lines may not cross when features are already associated with a timing slot. Broadly speaking, this corresponds to the generalization that gestural realignment (line-crossing) is only possible when it does not lengthen a gesture. Secondly, spreading may not cross past morpheme boundaries. This means that gestural lengthening and realignment are always restricted to morpheme-internal contexts.

[8] This bears conceptual similarities to other morphology-phonology alignment constraints like CRISPEDGE (Itô and Mester, 1994).

4.2 Interim Summary

In this section, I provided an analysis for the Epenthesis Puzzle, where word-final consonant clusters trigger default epenthesis or epenthetic metathesis depending on the length of the root. Both default epenthesis and epenthetic metathesis involved epenthesis of an empty V-slot, but they differ on the availability of non-local spreading. In monosyllabic roots, non-local spreading is unavailable because there is no prosodic truncation, and so epenthetic V-slots must remain empty and default. In contrast, non-monosyllabic roots do allow non-local spreading, reflecting that these vowels have become delinked through prosodic truncation, and so they associate with the epenthetic V-slot. This gives the impression of VC → CV transposition in non-monosyllabic roots, but no features change order. From this discussion, I reinforce two generalizations from Section 3: (i) metathesis is always parasitic on prosodic truncation, and (ii) non-local spreading is only permitted for delinked features.

As a side issue in this section, I examined another case of default epenthesis that was not dependent on root length. I argued that this pattern revealed a prohibition against infixation in the language. This was surprising: few languages allow morpheme-internal metathesis without having some type of infixation (cf. Horwood, 2004), and so Uab Meto occupies a previously unattested typological niche. Looking ahead to Section 6.4, this observation forms the basis of a broader proposal on the status of transposition in morpho-phonology: true transposition, if it exists, must be a special case of infixation, and not metathesis.

5 Additional evidence for the analysis

The account presented here belongs to a family of analyses that cast metathesis as non-local covert spreading (e.g. Arabic, McCarthy 1979; Maltese, Hume 1991; Rotuman, Besnier 1987). Previous work like Hume (1998) has argued against these types of analyses on the grounds that they predict spreading and epenthesis phenomena that are independent of metathesis. In this section, I review additional evidence in favor of this account, showing that Uab Meto does have spreading and epenthesis patterns that are independent of metathesis (Section 5.1). I then turn to a consonant deletion pattern (Section 5.2), where I show that metathesized sequences do not have the behavior expected of their surface order. I argue that this is further evidence that features do not transpose, since metathesized sequences maintain the phonological behavior of their un-metathesized counterparts.

5.1 Epenthetic Consonant Assimilation: more spreading and epenthesis

In this section, I focus on epenthetic consonant assimilation, a pattern where epenthetic consonants inherit the features of adjacent vowels. Following Culhane (2018) and Staroverov (2014), I argue that this pattern arises from epenthesis of a C-slot followed by spreading of delinked vowel features to the empty C-slot. While marked, this removes *DELINK violations and preserves the features of truncated vowels in a way similar to metathesis.

Descriptively, vowel hiatus is not permitted across morpheme boundaries in Uab Meto, and so consonant epenthesis occurs in order to prevent this from surfacing. In the northern dialects of Uab Meto (Molo, Miomafo, Amfo'an, Amanuban), epenthetic consonants are predictable from the underlying vowel. Notably, no dialect of Uab Meto uses metathesis to repair hiatus across a morpheme boundary.

The Molo data is shown in (58)-(59), where the consonants inserted are predictable, but opaque. Round vowels (u, o, ɔ) condition insertion of [b], high front vowels (i, ɪ) condition [ɟ͡ʝ], and the mid front vowel (e) conditions [l].

(58)	a.	ʔau	'lime'	ʔa͡ʊb̠-e	'the lime'
	b.	meo	'cat'	me͡ob̠-e	'the cat'
	c.	bi͡ɟʝae	'water buffalo'	bi͡ɟʝa͡el̠-e	'the water buffalo'

	d. fɪɪ	‘to open’	fɪɟ͡ʝ̠-e	‘open it’
	e. fai	‘night’	faɟ͡ʝ̠-e	‘the night’
	f. ʔii	‘this’	ʔiɟ͡ʝ̠-e	‘this one’
(59)	a. fatu	‘stone’	fatb̠-e	‘the stone’
	b. belo	‘monkey’	belb̠-e	‘the monkey’
	c. mepo	‘work’	mepb̠-e	‘work it’
	d. ʔanoʔe	‘lontar palm’	ʔanoʔl̠-e	‘the lontar palm’
	e. nafnafɪ	‘spider’	nafnafɟ͡ʝ̠-e	‘the spider’
	f. tasi	‘sea’	tasɟ͡ʝ̠-e	‘the sea’
	g. toti	‘tell’	totɟ͡ʝ̠-e	‘tell it’

These consonants are typologically unusual – most languages with this type of consonant epenthesis will insert glides (Staroverov, 2014). However, there are no glides in the Molo dialect and the consonants [b, ɟ͡ʝ, l] are the only oral voiced consonants. I argue that speakers map the vowel features to their closest consonantal target in the phonemic inventory (cf. Clements and Hume, 1995). In other dialects such as Amanuban, where glides are licit, the epenthetic consonants are [j, w].

(60) Epenthetic Consonants are Predictable from Vowel Quality

	[LABIAL]	[CORONAL]	[PALATAL]	
[+VOICE],[-CONSONANTAL]	o, u, ɔ	e	i, ɪ	
[+VOICE],[+CONSONANTAL]	b	l	ɟ͡ʝ	**Molo dialect**
	g^w	l	dʒ	**Amfo’an dialect** (Culhane, 2018)
	w	j	j	**Amanuban dialect**

I account for this pattern through vowel-to-consonant feature spreading (cf. Culhane, 2018; Staroverov, 2014). This is shown in (61), where the vowel spreads its place features onto the adjacent consonant:[9]

(61)

Step 1: Consonant epenthesis	Step 2: Truncation	Step 3: Spreading to C	Step 4: Spreading to V
C V́ V C – V	C V́ C – V	C V́ C – V	C V́ C – V
m e o e	m e o e	m e o e	m e o e
[meoC-e]	[meo̯C-e]	[meb-e]	[me͡ob-e]

The present analysis already favors this account, with only additional constraint ranking needed between *DELINK and *V-TO-C, which militates against vowel features associating only with a C-slot. Since *DELINK outranks *V-TO-C, vowel features will spread rightwards to the epenthetic C-slot. Association lines are never crossed in this derivation, and so XSPR and *XUNI are not violated. In derivations involving high front vowels (58g.-k.), multiple linking is not permitted, and so the final step with diphthongization does not occur (e.g. [fai] ‘night’ → [faɟ͡ʝ-e] ‘the night’, *[fa͡ɪɟ͡ʝ-e]).

In contrast, in the derivation of [fatb-e] ‘the stone’ (59a.), diphthongization is not possible after the consonant spreading step, because this would have an associated feature cross an association line (*XUNI). As a result, the derivation converges at Step 3, leaving an outstanding *V-TO-C violation.

[9] Another derivational possibility is that (i) vowel features spread to C-slot, yielding [meow-e], and then (ii) a *GLIDE constraint causes a violation of IDENT(CONS) to yield [meob-e]. To simplify exposition, I collapse these two steps.

(62) No diphthongization in the Molo dialect (*DELINK outranks *V-TO-C)

Step 1: Consonant epenthesis	Step 2: Truncation	Step 3: Spreading to C	No crossing to V
C V́ C V C – V	C V́ C C – V	C V́ C C – V	C V́ C C – V
f a t u e	f a t u e	f a t u e	f a t u e
[ˈfatuC-e]	[ˈfatu̯C-e]	[ˈfatb-e]	*[ˈfa͡ʊtb-e]

The order of spreading operations in (62) is important. For instance, in Step 3 the vowel features could also spread leftwards to the preceding V-slot [fa͡ʊtC-e]. In this case, we would expect subsequent spreading to the epenthetic C-slot to be possible, since that instance of spreading would not cross an association line. This is exactly what we see in the Miomafo dialect of Uab Meto (63), where the form of /fatu-e/ 'the stone' is in fact [fa͡ʊtb-e] (Nona Seko, p.c.). The crucial ranking here is *V-TO-C above *DELINK, which would force diphthongization before assimilation of the epenthetic consonant. This does not violate *XUNI, since line-crossing only occurs when the feature is delinked.

(63) Diphthongization allowed in the Miomafo dialect (*V-TO-C outranks *DELINK)

Step 1: Consonant epenthesis	Step 2: Truncation	Step 3: Spread to V	Step 4: Spread to C
C V C V C – V	C V C C – V	C V C C – V	C V C C – V
f a t u e	f a t u e	f a t u e	f a t u e
[fatuC-e]	[fatu̯C-e]	[fatb-e]	[fa͡ʊtb-e]

Crucially, the Molo and Miomafo dialects both have undominated *XUNI, and only differ in the ranking of *DELINK and *V-TO-C. This is important because some Molo speakers have the Miomafo pattern for certain lexical items. For instance, some Molo speakers will say [ʔutˈkakb-es] or [ʔutˈka͡ɔkb-es] 'the water spinach' (cf. /ʔutan-kako-es/). This suggests that the difference between the Molo pattern in (62) and the Miomafo pattern in (63) should not be from a high-ranked preference (e.g. *XUNI), but instead a smaller ranking difference (e.g. *DELINK and *V-TO-C).

In summary, epenthetic consonant assimilation reinforces two facts: (i) that there is spreading in Uab Meto and (ii) that spreading must be local once a feature is associated. These facts are intimately connected to the metathesis pattern in the language – the first is a necessary precursor, and the second prevents metathesis from mutating into a full-fledged vowel harmony or copy-epenthesis system.

5.2 Consonant Deletion

While consonant deletion does not directly figure into metathesis, its positional restrictions tell us a lot about representational differences between metathesized and underlying sequences, as well as reinforce the claim that metathesis does not change feature order. In this section, I review a pattern of pre-tonic coda deletion in the language, where underlying codas delete, but codas derived through metathesis are mysteriously immune. I propose that only word-final codas may delete in the language, and since metathesis-derived codas have a vowel feature to their right, they do not fulfill this requirement.

In descriptive terms, Uab Meto disprefers codas on pre-tonic syllables, and so the final consonant in certain pre-tonic words deletes. But, while underlying consonant-final words will have their coda delete (64)-(65), codas created by metathesis never delete (66). For instance, in (65a.) [tai-s] 'sarong' becomes [ta͡ɪ] phrase-medially, but the nearly-homophonous word [tasi] 'sea' (66a.) only metathesizes to [ta͡ɪs] and does not undergo further alternations.

(64) Pretonic codas in roots delete

a.	fo ˈleko	'good smell'	cf. ˈfof	'smell'
b.	hu ˈmate	'green grass'	cf. ˈhun	'grass'

c. sna͡e ˈmutiʔ ‘white sand’ cf. ˈsnaen ‘sand’

d. ko͡ek moloʔ ‘yellow bread’ *kokes moloʔ cf. ˈkokes ‘bread’

(65) Pretonic codas in suffixes delete

a. ta͡ɪ ˈmetan ‘black sarong’ cf. ˈtai-s ‘sarong (lit. wear-NMLZ)’

b. lo͡ɪ ˈmate ‘green money’ cf. ˈloi-t ‘money (lit. carry-NMLZ’)

c. ʔa-me͡ɔp leleʔ ‘field worker’ *ʔa-mepo-t leleʔ cf. ʔa-mepo-t ‘worker’

(66) Pretonic codas derived through metathesis do *not* delete

a. ta͡ɪs ˈmetan ‘black sea’ *ta͡ɪ ˈmetan cf. ˈtasi ‘sea’

b. kol ˈmoloʔ ‘yellow bird’ *ko ˈmoloʔ cf. ˈkolo ‘bird’

c. ma͡ʊn ˈmutiʔ ‘white chicken’ *ma͡ʊ ˈmutiʔ cf. ˈmanu ‘chicken’

This pattern suggests two possibilities: (i) that consonant codas created by metathesis are not truly word-final, and therefore cannot delete, or (ii) that consonant codas created by metathesis are not true codas. I follow both of these approaches here, which I will explain later on.

Formally, I represent this through the constraints MAX$_{\text{NonFinC}}$, which militates against deletion of non-word-final C-slots, and NO-CODA$_{\text{Pre}}$, which militates against pre-tonic codas.

(67) MAX$_{\text{NonFinC}}$: ‘Don’t delete consonant slots that are not the last segment of a word.’
Assign one violation for a C-slot in the input that is not in the output if the C-slot was not associated with the rightmost feature set of the word in the input.

(68) NO-CODA$_{\text{Pre}}$: ‘No codas in pretonic syllables’
For a V-slot that precedes primary stress within a phonological phrase, assign one violation for a C-slot that is not followed by a V-slot or a vowel feature. (cf. NO-CODA, Prince and Smolensky, 1993)

In the derivation of [fo ˈleko] ‘good smell’ (cf. /fo-f ˈleko/), NO-CODA$_{\text{Pre}}$ must outrank MAX$_{\text{C}}$ and DEP$_{\text{V}}$. Since word-internal epenthesis can’t remove the coda and word-final epenthesis violates DEP-ANCHOR, we are forced to delete the word-final C-slot. In the next step, the delinked features delete, since spreading is ruled out by an undominated restriction against multiple linkage of consonant features.

(69)

Step 1: C-slot deletion

/fo-f ˈleko/	MAX$_{\text{NonFinC}}$	NO-CODA$_{\text{Pre}}$	DEP-ANCHOR	MAX$_{\text{C}}$	DEP$_{\text{V}}$	MAX$_{\text{F}}$
a. fo-f ˈleko		*!				
b. fo-C ˈleko		*!				*
c. fo-a̲f ˈleko		*!			*	
d. fo-fa̲ ˈleko			*!		*	
☞e. fo-f̯ ˈleko				*		

Step 2: Feature deletion

/fo-f̯ ˈleko/	MAX$_{\text{NonFinC}}$	NO-CODA$_{\text{Pre}}$	DEP-ANCHOR	MAX$_{\text{C}}$	*DELINK	MAX$_{\text{F}}$
a. fo-f̯ ˈleko					*!	
☞b. fo- ˈleko						*

In contrast, the derivation of [kol ˈmoloʔ] ‘yellow bird’ does not incur a NO-CODA$_{\text{Pre}}$ violation at any stage, since the final consonant is always followed by a vowel feature.

This particular formulation of NO-CODA$_{\text{Pre}}$ is necessary to avoid a ranking paradox. If we assumed NO-CODA$_{\text{Pre}}$ also applied to metathesis-derived codas (e.g. [kol ˈmoloʔ] ‘yellow bird’), then we might predict for metathesis to be blocked in pre-tonic contexts (e.g. #[kolo ˈmoloʔ]). To avoid this, we would need ALIGN(X,L) to outrank NO-CODA$_{\text{PRE}}$. Since coda deletion occurs, we also know NO-CODA$_{\text{PRE}}$ must outrank MAX$_{\text{C}}$ and DEP$_{\text{V}}$. This yields ALIGN(X,L) » NO-CODA$_{\text{PRE}}$ » DEP$_{\text{V}}$. However, from the stress pattern of the language, we know that DEP$_{\text{V}}$ outranks NONFIN and other stress constraints ALIGN(X,R) and ALIGN(X,L), otherwise we would not expect to have any stress-final words. This yields a paradox – DEP$_{\text{V}}$ must simultaneously outrank ALIGN(X,L) and be dominated by ALIGN(X,L). The present formulation avoids this paradox, and correctly predicts coalescing metathesis in pretonic contexts (Section 3.2.1).

In summary, the deletion pattern here gives crucial evidence for the idea that C$\widehat{\text{VV}}$C sequences created by metathesis are different from ordinary CVVC or CVC sequences – not only do they show greater overlap (4), but the derived codas are not bound to the same restrictions. This reinforces the proposal that metathesis is not transposition: words in the language continue to behave as if metathesized features are still in their original positions. In this proposal, this is exactly the case: features cannot move, and so codas created by metathesis may not be interpreted as codas at all.

5.3 Interim summary

In this section, I've reviewed two main types of evidence in favor of casting metathesis as non-local covert spreading. First, epenthetic consonant assimilation (Section 5.1) shows us that there are spreading and epenthesis patterns independent of metathesis. In this account, this is no accident: metathesis is the culmination of these patterns taken too far, and so I predict that productive, sychronic metathesis processes like Uab Meto's should only occur in languages where these precursors are present. Secondly, I reviewed evidence in favor of keeping metathesized features in their underlying positions, drawing from pre-tonic coda deletion patterns (Section 5.2). If metathesis were transposition, it would be difficult to derive the differential behavior of underlying and metathesis-derived codas without invoking a ranking paradox (see Section 6.1). In contrast, the present account does not allow features to transpose, and so underlying and metathesis-derived codas are representationally distinct. In the next section, I discuss alternatives as well as the implications this proposal has for the known typology of metathesis.

6 Alternatives

In this section, I review alternatives to the analysis proposed here, and then turn to implications this proposal has for the typology of metathesis. Among the alternatives, I consider transposition-based accounts in Parallel OT, underspecified-input approach (cf. Arabic, McCarthy 1979), and allomorphy/rule-based approaches. Each of these has a tendency to over-generate metathesis, and does not offer an explanatory account of the typology. I then discuss what the present proposal means for the typology of metathesis, and lay out some discrete predictions for the distribution of spreading-based versus infixation-based metathesis.

6.1 Alternative: Transposition in Parallel OT

In this section, I focus on alternatives that make use of transposition in GEN. Regardless of the specific faithfulness constraint against it (LINEARITY, CONTIGUITY, or IO-ADJACENCY, see McCarthy and Prince 1995, Carpenter 2002, Heinz 2005b), these analyses struggle to make the necessary distinctions between underlying, derived, and metathesis-derived sequences in Uab Meto. As we saw with diphthongization (Section 3.3) and pretonic coda deletion (Section 5.2), metathesis-derived sequences in the language are often exceptional. Transposition-based accounts are generally forced to lump metathesis-derived sequences together with underlying or locally-derived sequences, and so have problems with over- or under-generation of metathesis.

Intuitively, this makes sense: the key issue with transposition in GEN is that it requires underlying order to not be important. Yet, templatic order *is* always important in Uab Meto, as it determines whether a root undergoes deletion, metathesis, consonant epenthesis, or diphthongization. In a transposition-based analysis, there's no good reason why metathesis should alternate with any of these other patterns, let alone why it should be so tightly connected to the templatic shape of the input. This issue forms the basis for each of the specific cases discussed in this section. I present two examples of this problem: (i) under-generation of metathesis in CVCV words, and (ii) over-generation of metathesis in CC# words.

(i) **Undergeneration of metathesis: pretonic codas.** As described in Section 5.2, pretonic coda deletion only applies to underlying codas. Codas derived via metathesis may not delete. In a Parallel OT model without the CV-structure used here, these differences lead to a ranking paradox. For the derivation of /tai-s ˈmetan/ → [tai͡ ˈmetan] 'black sarong', we see that NO-CODA$_{\text{PRE}}$ must outrank MAX$_{\text{C}}$.

(70)

/tai-s ˈmetan/	NO-CODA$_{\text{PRE}}$	MAX$_{\text{C}}$	ALIGN(L)	LIN	UNI
a. tai-s ˈmetan	*!		**		
b. ta͡i-s ˈmetan	*!		*		*
☞c. ta͡i- ˈmetan		*!	*		*

Yet, turning to /tasi ˈmetan/ 'black sea', this same ranking incorrectly predicts that metathesis should be blocked in this context. Changing the ranking of NO-CODA$_{\text{PRE}}$ is not an option, otherwise we would incorrectly predict consonant deletion instead of epenthesis to resolve *COMPLEX violations in the Epenthesis Puzzle in Section 4.

(71)

/tasi ˈmetan/	NO-CODA$_{\text{PRE}}$	MAX$_{\text{C}}$	ALIGN(L)	LIN	UNI
💣a. tasi ˈmetan			**!		
☹b. ta͡is ˈmetan	*!		*	*	*
c. ta͡i ˈmetan		*!	*	*	*

This problem could be solved by stipulating that codas created by metathesis are not codas. But what is transposition if it isn't actually changing the prosodic status of the transposed segments?

Again, this problem reinforces a key intuition in transposition based analyses: precedence relationships in the input are not important to preserve. This makes the prediction that words that differ in precedence alone should have similar behavior in the output (e.g. /tasi/ and /ta͡is/). However, this is not the case in Uab Meto: root precedence relations crucially determine whether a root metathesizes, deletes, or undergoes other alternations.

(ii) **Overgeneration of metathesis: final consonant clusters.** In the Epenthesis Puzzle, a transposition-based account generally over-generates metathesis. Recall from Section 4 that in this pattern, monosyllabic roots undergo default epenthesis, while larger roots undergo epenthetic metathesis. We know DEP must be ranked fairly high in the language, above NONFIN, otherwise we would see epenthesis to prevent word-final stress (see Section 2.4). In the derivation of /son-f/ → [son<u>a</u>-f], for example, it is difficult to prevent metathesis in monosyllables (cand. c.).

(72)

/son-f/	*COMPLEX	MAX$_{\text{C}}$	DEP	NONFIN	ALIGN(R)	LIN
a. son-f	*!					
☹b. son<u>a</u>-f			*!		*	
💣c. sno-f				*		*
d. son-		*!				

Again, these issues are not impossible to solve: one option is to use a monosyllabic faithfulness constraint (Becker et al., 2012) or a left edge faithfulness constraint (Beckman, 1998; Steriade, 1994) to prevent metathesis in monosyllables. However, each of these pose their own problems – monosyllables, for instance, do alternate in the language (e.g. [hun]∼[hu] 'grass', see Section 5.2), and so it seems unlikely that monosyllables have some special faithfulness. Left-edge or initial faithfulness is also complicated, since the relative order of s > n is not changed in the *[snof] example.

Although each of these problems is solvable, the possible solutions sidestep the issue of *why* the pattern is this way: if transposition comes at little cost, why does it have the positional restrictions it does? Why can it only occur in the same post-tonic context where we see vowels deleting? Why should it alternate with epenthesis or deletion patterns? The proposal offered here has a response: Uab Meto metathesis is not transposition, and is essentially a vowel feature-preservation strategy following prosodic truncation. As a result, Uab Meto metathesis inherits the positional restrictions of its precursors, and cannot create or remove markedness violations based on underlying feature order.

6.2 Alternative: Transposition through underspecification

A similar alternative to the transposition-based approaches is to appeal to an underspecified input, where consonants and vowels are separated onto separate tiers and have no inherent order between tiers (cf. McCarthy, 1979, 1981, a.o.). Only consonant-consonant and vowel-vowel orders are specified, and so only VV or CC metathesis will induce violations of LINEARITY. This approach would allow us to make LINEARITY undominated, since the only precedence relationships we want to change are those between consonants and vowels.

As a sample representation, the entry for [manu]∼[maʊ͡n] 'chicken' would appear as in (73). On the consonant tier [m] precedes [n] and on the vowel tier [a] precedes [u], but no further precedence relations are specified. All other surface alternations in order arise from syllable and prosodic wellformedness constraints like ONSET and ALIGN(X,R)/ALIGN(X,L).

(73) Underlying Representation of [manu]∼[maʊ͡n] 'chicken'

CONSONANT TIER	m	n
VOWEL TIER	a	u

Despite not involving violations of LINEARITY, this approach does not avoid the problems from Section 6.1. Words with the same underlying precedence relations (e.g. $C_1 \prec C_2$, $V_1 \prec V_2$) should all have identical phonological behavior. However, there are both CVCV words in Uab Meto (e.g. [manu]/[maʊ͡n] 'chicken') and CCVV words (e.g. [bna.o]/[bna͡o] 'boat'), and this approach incorrectly predicts that they should have identical behavior. They do not — CVCV words metathesize, but CCVV words diphthongize.

That being said, there are ways around these problems. One potential solution would be to stipulate that some vowel features must be adjacent in the linearized output. So in the case of [bnao], metathesis to *[bano] would be ruled out because the [a] and [o] are no longer surface-adjacent. However, this idea seems conceptually bankrupt – from an articulatory perspective, vowel gestures are always contiguous (Browman and Goldstein, 1990), even when separated by a consonant. So in terms of gestural adjacency, there should be no difference in VV-adjacency for [bnao] and *[bano], and the question becomes one of relative timing between consonant and vowel. In the proposal outlined here, metathesis is exactly this – gestural realignment without changing underlying precedence relationships.

6.3 Alternative: Allomorphy and rule-based approaches

Rule-based approaches to metathesis have proven descriptively robust (Edwards, 2016, 2018), but they rarely provide the same explanatory power as to when metathesis and epenthesis surface at all. In particular, a rule-based analysis is forced to independently assert the conditioning environments for deletion, epenthesis, and metathesis, instead of deriving them directly from the language's stress system. Edwards (2016, 2018) for instance is forced to stipulate a morphologically-determined CV skeleton in order to derive the correct distribution of these sub-patterns. This is essentially an allomorphy approach to metathesis, where the observed alternations could be arbitrary.[10]

In the present account, I argue that the co-occurrence of certain rules with apparent metathesis is not accidental – rather, they are important precursors to sychronic, productive metathesis patterns. Ultimately, any allomorphy-based approach will miss several key generalizations about prosodic organization in the language, since it remains unclear why suffixes and modifiers should both call for a metathesized root rather than one compressed in any other fashion, such as suppletion.

6.4 Implications for the typology of metathesis

In this proposal, Uab Meto metathesis is not transposition, but instead a type of covert non-local spreading, which feeds off of prosodic truncation and epenthesis. Features always remain in their underlying positions, and so metathesized sequences have behavior consistent with their underlying order rather than their surface order (recall pretonic coda deletion, Section 5.2). I thus predict that in order for a metathesis system like Uab Meto's to arise, there are three necessary precursors: V-slot deletion, V-slot epenthesis, and vowel spreading. However, some questions remain: (i) why is this type of metathesis so prevalent in Austronesian, but not other language families? (ii) is there transposition-based metathesis?

For the first question – why metathesis is so prevalent in Austronesian – I answer that non-transpositional metathesis requires several phonological precursors, and these precursors are widespread in Austronesian. For instance, prosodic truncation, which feeds metathesis in Uab Meto, is known to be prevalent throughout the Pacific (Zuraw, 2018). Similarly, vowel spreading has been observed in Samoan loanword epenthesis (Uffmann, 2006), where an epenthetic vowel inherits its place features from a preceding consonant. This pattern is an inverted version of the spreading seen in epenthetic consonant assimilation, where underlying vowels spread to epenthetic consonants. Copy-epenthesis in Austronesian languages is also fairly common (Blust, 1990; Kitto and de Lacy, 1999; Lin, 2014). Altogether, the fact that these precursors are prevalent in the family makes it more likely for phonological, non-transpositional metathesis to arise. I thus predict that similar types of metathesis should arise in language families with copy-epenthesis and some type of vowel deletion.

The second question – on the existence of transposition-based metathesis – is more difficult to answer. Here, I argue that if transposition exists, it exists only as a subtype of infixation, following Horwood (2004). Horwood (2004) proposes a typology for metathesis and infixation based off of LINEARITY, where both metathesis and infixation constitute LINEARITY violations – either between underlying segment order or morpheme order. As a result, Horwood predicts that when LINEARITY is dominated, it's impossible to have a language that has morpheme-internal metathesis but no infixation.[11] I agree with this formulation – metathesis in Uab Meto is very different from metathesis in Faroese (Hume and Seo, 2004), Georgian (Butskhrikidze and van de Weijer, 2003), Lithuanian (Hume and Seo, 2004), or Tagalog (Horwood, 2004). Metathesis in these languages crosses morpheme boundaries, has segmental or morphological restrictions, and cannot occur in non-derived environments. If transposition exists, it is likely to be similar to Horwood's (2004) proposal for LIN – a restriction on segment-morpheme realignment that militates against infixation. Whether this type of segment-morpheme realignment is best done in the morphology or phonology proper is left for future work, but it is clear that this type of anti-infixation mechanism will require morpheme-specific information.

[10] See Section 3.2.2 for discussion of how this approach causes problems at the syntax-phonology interface.

[11] Horwood dismisses the possibility of a constraint HETLIN, which only penalizes infixation but not morpheme-internal metathesis, on the grounds that this incorrectly predicts a typology where non-derived environments allow more faithfulness violations than derived ones. This would be an inversion of the observed typology.

From this, I predict that productive metathesis should come in two main varieties: (1) phonological metathesis, and (2) infixational metathesis. Phonological metathesis may occur only within morphemes, and should arise from the successive application of copy-and-delete or fuse-and-fission processes, as proposed here and in Takahashi (2018, 2020). I also predict that phonological metathesis will generally involve non-local spreading, and so should involve exceptional consonant-vowel or consonant-consonant overlap in a given language. Lastly, phonological metathesis does not involve featural transposition, and so other phonological processes in the language should still behave as if features remain in their underlying positions (cf. pretonic coda deletion in Uab Meto, Section 5.2).

Infixational metathesis does not require these copy-and-delete precursors to be productive, and should be able to cross morpheme boundaries.[12] Since infixational metathesis is essentially a subtype of infixation, we also expect segmental or morpheme-specific restrictions on metathesis. In contrast, phonological metathesis in Uab Meto occurs with almost every segment in the language, and is not restricted on the basis of morpheme identity. Further work is needed to assess exactly how infixational metathesis should fit into the syntax-phonology interface. One possibility is that infixational metathesis is always carried out as a type of morphological readjustment rule, in a way independent of language-general phonology. Another option is that infixational metathesis is done through LINEARITY, but that LINEARITY cannot distinguish between segment-segment and morpheme-morpheme precedence. This set of questions is left for future work.

To sum up, this section argued that metathesis is prevalent in Austronesian precisely because its precursors (deletion, epenthesis and spreading) are also widespread. I then turned to the question of whether there is transposition in phonology, and offered a proposal where if true transposition occurs, then it is a subtype of infixation. I then laid out some distinct predictions on the behavior of phonological, spreading-based metathesis, and infixational metathesis, which can be tested in future work.

7 Conclusion

In Uab Meto, metathesis occurs in complementary distribution with a variety of other phonological processes, including epenthesis, deletion, and coalescence. Instead of analyzing the intricate phonology of the language as happenstance, I derive metathesis from the combination of these synchronic subpatterns, so that metathesis is essentially a serial copy-and-delete mechanism in the phonology (cf. Takahashi, 2018, 2020, a.o.). While this approach is not new (see Besnier, 1987; Hume, 1991), this places Uab Meto in a previously undescribed position in the typology of spreading phenomena, where non-local spreading is possible only as long as features are not yet associated with a timing slot.

The typological rarity of metathesis thus follows from the complexity of metathesis as a phonological pattern. Phonological metathesis is always copy-and-delete, and may only arise in languages where the precursors are present and occur in overlapping environments. In the Austronesian family, it so happens that prosodic truncation, spreading, and epenthesis are all robust (cf. Blust, 1990; Kitto and de Lacy, 1999; Uffmann, 2006; Zuraw, 2018), and so it is unsurprising that metathesis is relatively widespread in the family. Outside of this pathway, I predict that all metathesis is infixational, and so is expected to bear segmental or morpheme-specific restrictions.

Through this distinction, this account is able to simultaneously predict the typological and language-internal rarity of metathesis. Languages with phonological metathesis are expected to be rare, since they require several precursors, but metathesis within these languages should be robust and surface in similar environments to prosodic truncation and epenthesis. In contrast, in languages with infixational metathesis, metathesis should be more sporadic and only occur where it is morphologically specified.

[12] Leti may be a language that has both phonological and infixational metathesis, termed "internal" and "external" metathesis by van Engelenhoven (2004). Internal metathesis has been analyzed as a copy-and-delete mechanism in the language (Mills and Grima, 1980), whereas external metathesis (a) always crosses a morpheme boundary and (b) has been argued to be an independent pattern from internal metathesis (van Engelenhoven, 2004).

The Uab Meto data is important in creating this distinction, since Uab Meto has phonological metathesis but no infixation. In previous work, languages of this type had been argued not to exist (Horwood, 2004).

To summarize, the present account reinforces the position that transposition is not an operation in GEN (following Takahashi, 2018, 2020), and proposes that synchronic metathesis in Uab Meto arises through a copy-and-delete mechanism. Outside of Rotuman, previous work had not reported phonological metathesis to co-occur with spreading or deletion patterns, making a successive copy-and-delete account somewhat tenuous (cf. Hume, 1998). However, Uab Meto does have synchronic evidence of each of these sub-patterns. Epenthesis is seen in monosyllables (Section 4), deletion is seen in CVCa(C) words (Section 3.3), and spreading is seen in epenthetic consonant assimilation (Section 5.1). Uab Meto is thus the missing link in the typology of metathesis, with independent evidence for spreading, deletion, and epenthesis mechanisms, which combine to create the impression of surface transposition.

References

Adger, David. 2007. Stress and phasal syntax. *Linguistic Analysis* 33:238–266.

Archangeli, Diana. 1984. Underspecification in Yawelmani Phonology and Morphology. Doctoral Dissertation, Massachusetts Institute of Technology, Cambridge.

Archangeli, Diana. 1988. Aspects of underspecification theory*. *Phonology* 5:183–207.

Archangeli, Diana B., and Douglas George Pulleyblank. 1994. *Grounded phonology*. 25. MIT Press.

Becker, Michael, Andrew Nevins, and Jonathan Levine. 2012. Asymmetries in Generalizing Alternations to and from Initial Syllables. *Language* 88:231–268.

Beckman, Jill N. 1998. Positional faithfulness. PhD Thesis.

Benua, Laura. 1997. Transderivational identity: Phonological relations between words. PhD Thesis.

Besnier, Niko. 1987. An autosegmental approach to metathesis in Rotuman. *Lingua* 73:201–223.

Blevins, Juliette, and Andrew Garrett. 1998. The Origins of Consonant-Vowel Metathesis. *Language* 74:508.

Blust, Robert. 1990. Patterns of Sound Change in the Austronesian Languages. In *Linguistic Change and Reconstruction Methodology*, ed. Philip Baldi. Walter de Gruyter.

Boersma, Paul, and David Weenink. 2018. Praat: Doing phonetics by computer [Computer program]. Version 6.0. 37. *URL http://www. praat. org/. Retrieved March* 14:2018.

Bresnan, Joan W. 1973. Sentence stress and syntactic transformations. In *Approaches to natural language*, 3–47. Springer.

Browman, Catherine P., and Louis Goldstein. 1990. Gestural specification using dynamically-defined articulatory structures. *Journal of Phonetics* 18:299–320.

Butskhrikidze, Marika, and Jeroen van de Weijer. 2003. On the formal description of metathesis: A case study of v-metathesis in Modern Georgian. *Lingua* 113:765–778.

Canfield, Tracy A. 2016. Metathesis is real, and it is a regular relation. PhD Thesis, Georgetown University.

Carpenter, Angela. 2002. Noncontiguous metathesis and adjacency. *University of Massachusetts Occasional Papers in Linguistics* 26:1–25.

Chandlee, Jane, Angeliki Athanasopoulou, and Jeffrey Heinz. 2012. Evidence for Classifying Metathesis Patterns as Subsequential 8.

Chomsky, Noam. 2001. Derivation by phase. *An Annotated Syntax Reader* 482.

Chomsky, Noam, and Morris Halle. 1968. *The Sound Pattern of English*. The MIT Press.

Churchward, Clerk Maxwell. 1940. *Rotuman grammar and dictionary: Comprising Rotuman phonetics and grammar and a Rotuman-English dictionary*. Printed by the Australasian Medical Publishing Company limited for the ....

Clements, George N. 1980. *Vowel Harmony in Nonlinear Generative Phonology: An Autosegmental Model*. Indiana University Linguistics Club.

Clements, George N. 1991. Place of articulation in consonants and Vowels. Working papers of the Cornell phonetics laboratory.

Clements, George N., and Elizabeth V. Hume. 1995. The internal organization of speech sounds. *The handbook of phonological theory* 7:245–317.

Culhane, Kirsten. 2018. Consonant Insertions: A synchronic and diachronic account of Amfo'an .

Dobashi, Yoshihito. 2004. Multiple spell-out, label-free syntax, and PF-interface. *Explorations in English Linguistics* 19:1–47.

Dobashi, Yoshihito. 2009. Multiple spell-out, assembly problem, and syntax-phonology mapping. *Phonological Domains: Universals and Deviations. Berlin: Mouton de Gruyter* 195–220.

Edwards, Owen. 2016. Metathesis and Unmetathesis: Parallelism and Complementarity in Amarasi, Timor .

Edwards, Owen. 2018. The morphology and phonology of metathesis in Amarasi. *Morphology* 28:25–69.

Elfner, Emily. 2009. Syllabification and stress-epenthesis interactions in Harmonic Serialism. *Ms, UMass Amherst. ROA* .

van Engelenhoven, Anne T. 2004. *Leti: A language of Southwest Maluku*. Number 211 in Verhandelingen van Het Koninklijk Instituut Voor Taal-, Land- En Volkenkunde. Leiden: KITLV Press.

Gafos, Adamantios, and Linda Lombardi. 1999. Consonant transparency and vowel echo 17.

Goldsmith, John. 1976. Autosegmental phonology. PhD Thesis, MIT Press London.

Gordon, Matthew. 2002. A Factorial Typology of Quantity-Insensitive Stress. *Natural Language & Linguistic Theory* 20:491–552.

Heinz, Jeffrey. 2005a. CV Metathesis in Kwara'ae. MA Thesis, University of California, Los Angeles.

Heinz, Jeffrey. 2005b. Reconsidering Linearity: Evidence from CV Metathesis. In *24th West Coast Conference on Formal Linguistics*, 200–208. Cascadilla Proceedings Project.

Horwood, Graham V. 2004. Order without chaos: Relational faithfulness and position of exponence in Optimality Theory. Doctoral Dissertation, Rutgers, The State University of New Jersey.

Hume, Beth, and Scott Seyfarth. 2019. *Metathesis*. Oxford University Press.

Hume, Elizabeth. 1991. Metathesis in Maltese: Implication for the Strong Morphemic Plane Hypothesis. *Proceedings of the North East Linguistics Society* 21:17.

Hume, Elizabeth. 1998. Metathesis in phonological theory: The case of Leti. *Lingua* 104:147–186.

Hume, Elizabeth. 2001. Metathesis: Formal and Functional Considerations 27.

Hume, Elizabeth, and Misun Seo. 2004. Metathesis in Faroese and Lithuanian: From speech perception to Optimality Theory. *Nordic Journal of Linguistics* 27:35–60.

Ishihara, Shinichiro. 2007. Major phrase, focus intonation, multiple spell-out (MaP, FI, MSO). *The Linguistic Review* 24:137–167.

Itô, Junko, and Armin Mester. 1994. Reflections on CodaCond and alignment .

Kager, Rene. 1999. *Optimality Theory*. Cambridge: Cambridge University Press.

Kager, René Willibrord Joseph. 1989. A metrical theory of stress and destressing in English and Dutch. PhD Thesis, University Utrecht.

Kenstowicz, Michael. 1971. Lithuanian Phonology. Doctoral Dissertation, University of Illinois at Urbana-Champaign.

Kimper, Wendell. 2017. Not crazy after all these years? Perceptual grounding for long-distance vowel harmony. *Laboratory Phonology: Journal of the Association for Laboratory Phonology* 8:19.

Kimper, Wendell A. 2011. Competing triggers: Transparency and opacity in vowel harmony. Ph.D., University of Massachusetts Amherst, United States – Massachusetts.

Kitto, Catherine, and Paul de Lacy. 1999. Correspondence and epenthetic quality .

Klamer, Marian. 2002. Typical Features of Austronesian Languages in Central/Eastern Indonesia. *Oceanic Linguistics* 41:363.

Kratzer, Angelika, and Elisabeth Selkirk. 2007. Phase theory and prosodic spellout: The case of verbs. *The Linguistic Review* 24.

Lin, Kuo-Chiao. 2014. Gradual Epenthesis: Echo Vowels in Austronesian Languages. *Oceanic Linguistics* 53:443–466.

McCarthy, John. 1979. Formal Problems in Semitic Phonology and Morphology. Doctoral Dissertation, Massachusetts Institute of Technology.

McCarthy, John J. 1981. A prosodic theory of nonconcatenative morphology. *Linguistic inquiry* 12:373–418.

McCarthy, John J. 1995. Faithfulness in prosodic morphology and phonology: Rotuman revisited. In *Ms., University of Massachusetts, Amherst. ROA-110, Rutgers Optimality Archive*.

McCarthy, John J. 2000. The prosody of phrase in Rotuman. *Natural Language and Linguistic Theory* 147–197.

McCarthy, John J. 2008. The gradual path to cluster simplification. *Phonology* 25:271–319.

McCarthy, John J., and Joe Pater. 2016. *Harmonic grammar and harmonic serialism*. Equinox Publishing Limited.

McCarthy, John J., and Alan Prince. 1993. Generalized alignment. In *Yearbook of Morphology 1993*, ed. Geert Booij, Jaap van Marle, Stephen Anderson, Mark Aronoff, Laurie Bauer, Mark Baker, Rudie Botha, Joan Bybee, Andrew Carstairs-McCarthy, Wolfgang Dressler, Jack Hoeksema, Rochelle Lieber, Peter Matthews, Franz Rainer, Sergio Scalise, Henk Schultink, Arnold Zwicky, Geert Booij, and Jaap Van Marle, 79–153. Dordrecht: Springer Netherlands.

McCarthy, John J., and Alan S. Prince. 1994. The emergence of the unmarked: Optimality in prosodic morphology .

McCarthy, John J., and Alan S. Prince. 1995. Faithfulness and reduplicative identity .

Middelkoop, Pieter. 1963. *Head hunting in Timor and its historical implications*. Sydney: University of Sydney.

Mielke, Jeff, and Elizabeth Hume. 2001. Consequences of word recognition for metathesis. *Surface syllable structure and segment sequencing* 135–158.

Mills, Roger F., and John Grima. 1980. Historical developments in Lettinese. In *Austronesian Studies: Papers from the Second Eastern Conference on Austronesian Languages*, 273–283.

Montreuil, Jean-Pierre. 1985. The Romansch 'Brat'. *Papers in Romance* 3:67–76.

Ní Chiosáin, Máire, and Jaye Padgett. 2001. Markedness, segment realization, and locality in spreading. *Segmental phonology in Optimality Theory: Constraints and representations* 118–156.

Odden, David. 1994. Adjacency Parameters in Phonology. *Language* 70:289–330.

Padgett, Jaye. 1995. Partial class behavior and nasal place assimilation .

Poser, W. 1982. Phonological representations and action at a distance. In *The Structure of Phonological Representations*, ed. H. van der Hulst and N. Smith, volume 2, 121–158. Foris: Dordrecht.

Powell, J. V. 1985. An Occurrence of Metathesis in Chimakuan. *Oceanic Linguistics Special Publications* 105–110.

Prince, A., and Paul Smolensky. 1993. Optimality Theory: Constraint interaction in generative grammar. *Optimality Theory in phonology* 3.

Prince, Alan, and Paul Smolensky. 2004. Optimality theory. *Constraint Inter* .

Pulleyblank, Douglas. 1988. Vocalic Underspecification in Yoruba. *Linguistic Inquiry* 19:233–270.

Sagey, Elizabeth. 1988. On the III-Formedness of Crossing Association Lines. *Linguistic Inquiry* 19:109–118.

Sohn, Ho-min. 1980. Metathesis in Kwara'ae. *Lingua* 52:305–323.

Staroverov, Petr. 2014. Splitting Theory and Consonant Epenthesis. Doctoral Dissertation, Rutgers University.

Steinhauer, Hein. 1993. Notes on verbs in Dawanese (Timor). *Semaian* 11:130–158.

Steinhauer, Hein. 1996. Morphemic metathesis in Dawanese (Timor). *Pacific Linguistics. Series A. Occasional Papers* 84:217–232.

Steriade, Donca. 1986. Yokuts and the Vowel Plane. *Linguistic Inquiry* 17:129–146.

Steriade, Donca. 1994. Positional neutralization and the expression of contrast. *ms., UCLA* .

Takahashi, Chikako. 2018. No Metathesis in Harmonic Serialism. *Proceedings of the Annual Meetings on Phonology* 5.

Takahashi, Chikako. 2020. No transposition in Harmonic Serialism. *Phonology* 36:695–726.

Truckenbrodt, Hubert. 1999. On the relation between syntactic phrases and phonological phrases. *Linguistic inquiry* 30:219–255.

Truckenbrodt, Hubert. 2006. The syntax–phonology interface 22.

Uffmann, Christian. 2006. Epenthetic vowel quality in loanwords: Empirical and formal issues. *Lingua* 116:1079–1111.

Walker, Rachel. 2005. Weak Triggers in Vowel Harmony. *Natural Language & Linguistic Theory* 23:917.

Walker, Rachel. 2010. Nonmyopic Harmony and the Nature of Derivations. *Linguistic Inquiry* 41:169–179.

Webb, Charlotte. 1974. Metathesis. PhD Thesis, Doctoral dissertation, University of Texas.

Zoll, Cheryl. 1994. Subsegmental Parsing: Floating Features in Chaha and Yawelmani .

Zuraw, Kie. 2018. Beyond trochaic shortening: A survey of Central Pacific languages. *Language* 94:e1–e42.