Allomorph selection precedes phonology: Evidence from the Yindjibarndi locative*

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Abstract

Theories of the phonology-morphology interface can be differentiated by their claims regarding the timing of phonologically conditioned suppletive allomorphy (PCSA) and regular phonology. Some (e.g. Paster 2006, Embick 2010) argue that PCSA occurs in a morphological component of the grammar that precedes phonology; others (e.g. Kager 1996, Mascaró 2007, Smith 2015) argue that at least phonologically optimizing PCSA occurs in the phonological component of the grammar, with regular phonology. This paper discusses a case of optimizing PCSA in Yindjibarndi (Pama-Nyungan, Wordick 1982), proposes an analysis in which suppletive allomorphy precedes regular phonology, and shows that the alternative – an analysis in which PCSA occurs in the phonological component of the grammar – is likely unworkable.

1 Introduction

Phonologically conditioned suppletive allomorphy (PCSA; Carstairs 1988, term from Paster 2006) is a type of suppletion in which the factors deciding which allomorph is selected are phonological in nature. One aspect of PCSA that has received a lot of attention is the degree to which it is *phonologically optimizing*. In some cases, allomorph selection appears to respect general phonotactic constraints elsewhere in the language; these cases are often referred to as phonologically optimizing. One well-known example of a phonologically optimizing case of PCSA comes from the Moroccan Arabic 3rd singular masculine clitic (Harrell 1962, Mascaró 2007). Here, the /u/ allomorph is selected following consonant-final roots, and the /h/ allomorph is selected following vowel-final roots. The result is that syllable structure is optimized through avoidance of hiatus (1a) and avoidance of complex codas (1b).

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(1) Allomorphy in the Moroccan Arabic 3rd singular masculine pronoun (Mascaró 2007:717)

	Allomorph	*Environment*	*Example*	*Gloss*
a.	/h/	/V_	[xtˤa-h]	‘his error’
			[ʃafu-h]	‘they saw him’
			[mʕa-h]	‘with him’
b.	/u/	/C_	[ktab-u]	‘his book’
			[ʃaf-u]	‘he saw him’
			[menn-u]	‘from him’

Not all cases of PCSA, however, are phonologically optimizing. A well-known example of non-optimizing PCSA comes from the Haitian Creole definite suffix (Klein 2003), where the /la/ allomorph is selected following consonant-final stems and the /a/ allomorph is selected following vowel-final stems. This distribution of allomorphs leads to apparently non-optimal syllables, as it results in the creation of both codas (2a) and hiatus (2b). (Depending on the vocalic environment, a glide is sometimes inserted to break hiatus; see [bato-wa].)

(2) Allomorphy in the Haitian Creole definite suffix (Klein 2003:2-3)

	Allomorph	*Environment*	*Example*	*Gloss*
a.	/la/	/C_	[liv-la]	‘the book’
			[ʃat-a]	‘the cat’
			[malad-la]	‘the sick (person)’
b.	/a/	/V_	[papa-a]	‘the father’
			[bujwa-a]	‘the kettle’
			[bato-wa]	‘the boat’

The sometimes-optimizing nature of PCSA has led to a protracted debate as to whether the analysis of PCSA should be integrated with the analysis of regular phonology. Generalizing over approaches, there are two main answers to this question. Some authors (e.g. McCarthy & Prince 1993a,b; Kager 1996, Mascaró 2007, Smith 2015) argue that the analysis of PCSA and regular phonology can or should be carried out in a single module of the grammar, noting that the same constraints often govern phonology and PCSA (in the case of (1), for example, these constraints are ONSET, requiring syllables to have onsets, and *COMPLEXCODA, penalizing syllables with more than one coda consonant). I refer to these analyses of PCSA as *phonological analyses*. Others (e.g. Paster 2006, Bye 2008, Embick 2010, Gouskova et al. 2015) argue that PCSA, regardless of whether it is optimizing or not, is a morphological process that precedes regular phonology. The idea is that despite the apparently optimizing nature of PCSA cases like Moroccan Arabic (1), the phonological grammar does not play a role in allomorph selection (though speakers may use their grammars to form generalizations over the lists of words that take a certain allomorph; see Gouskova et al. 2015). I refer to these as *morphological analyses*.

One of the likely reasons why there is so little agreement on this point is that most cases of PCSA, phonologically optimizing or not, can receive either phonological or morphological analyses. Take, for example, the Haitian Creole case in (2). Proponents of morphological analyses note that the case is obviously non-optimizing and treat this as a reason to give it a morphological analysis. Klein (2003), however, notes that it is possible to provide a phonological analysis of Haitian Creole by assuming that factors other than the optimization of syllable structure are in play (see also Bonet et al. 2007). The phonotactically non-optimal [liv.la] can be derived by assuming that the right edge of stems and syllables correspond; the constraint encoding this requirement, R-ALIGN-STEM-SYLL, would be violated by the more phonotactically optimal [li.v-a]. The occurrence of /a/ after vowel-final stems (as in [tu.a]) can be understood as the use of a default allomorph, its presence forced through the activity of a constraint like PRIORITY (Bonet et al. 2007:912). Thus even for cases of PCSA that appear to be non-optimizing, it is usually the case that both phonological and morphological analyses are possible (though see Kalin 2020 for an argument that a case of PCSA in Turoyo cannot receive a phonological analysis).

Arguments for one type of analysis over the other are usually based on analytic principles or the fit of theories to data, rather than on the data itself. Proponents of phonological analyses, for example, might accuse a morphological analysis of the Moroccan Arabic facts in (1) of missing a generalization: the pattern optimizes syllable structure, and not acknowledging this directly results in a loss of explanatory power. Proponents of morphological analyses, in turn, might argue that the phonological analysis of the Haitian Creole data in (2) is ad hoc: it incorporates constraints leading to phonotactically non-optimal structures, and in addition must include morphological constraints like PRIORITY. One of the the more influential arguments for morphological analyses of PCSA comes from Embick (2010), who argues for this type of analysis based on a comparison of the predictions of phonological analyses versus morphological analyses of PCSA. Embick claims that frameworks assuming phonological analyses of PCSA predict certain kinds of global interactions between PCSA and phonology that are not borne out cross-linguistically. While compelling, Embick's argument is an overgeneration argument: we should prefer morphological analyses because phonological analyses predict a superset of the cases of PCSA that actually exist. And overgeneration arguments are difficult to evaluate, because there are a number of reasons overgeneration might occur. One reason is certainly adoption of the wrong theory, but there is also the possibility of accidental gaps, or channel bias (e.g. Ohala 1981, Blevins 2004, Moreton 2008), or the reality that certain gaps in the typology exist because the relevant systems, while part of the learner's hypothesis space, would be difficult or impossible to learn (e.g. Boersma 2003, Alderete 2008, Heinz 2009, Stanton 2016). Thus arguments for phonological analyses over morphological analyses, or vice versa, are often inconclusive.

This paper presents a case of apparently optimizing PCSA in Yindjibarndi (Pama-Nyungan, Wordick 1982) that strongly argues in favor of morphological analyses. In Yindjibarndi, the form of the locative suffix for common nouns depends on phonological information: the distribution of two suppletive allomorphs, /la/ and /ŋka/, is phonologically determined. Enriching the picture is the fact that both /la/ and /ŋka/ have phonologically predictable allomorphs of their own (/la/ → [la], [ta], [ʈa], [ca], and [a]; /ŋka/ → [ŋka], [wa], and [a]). I argue that although both suppletive and predictable allomorphy reference the same phonological factors, they must reside in different components of the grammar. The proposed analysis, in sketch form, is that morphology determines the distribution of /la/ and /ŋka/, while phonology determines the distribution of [la], [ta], [ʈa], [ca], [a], and (separately) [ŋka], [wa], and [a]. The argument for this position is that the alternative, a phonological analysis integrating suppletive and predictable allomorphy, predicts that suppletion should repair more phonotactic problems than it does. More specifically, the analysis incorrectly predicts that whenever the language has a choice between suppletion and consonant deletion, it should choose suppletion. The technical problem is that the rankings necessary for suppletive and non-suppletive allomorphy are at odds with one another. Attempting a unified analysis of the two types of allomorphy results in a ranking paradox.

1.1 Preliminaries

Before discussing allomorphy in the Yindjibarndi locative, it is first necessary to introduce the language's inventory as well as several assumptions regarding distinctive features and prosody. These assumptions will be referenced in the analyses that follow.

1.1.1 Vowel inventory and distinctive features

The vowel inventory is provided in (3). Yindjibarndi has three short vowels /a i u/, and four long vowels /aː iː uː oː/. The fourth long vowel, /oː/, is usually created through the deletion of [w] and subsequent coalescence of [u] and [a] in [uwa] sequences, though the word [loːpu] 'Friday' has no such origin and leads Wordick (p. 17) to posit that [oː] is contrastive. Since the contrastive status of [oː] does not matter for our purposes, I follow Wordick here.

(3) Yindjibarndi vowel inventory

Short			*Long*	
/i/	/u/		/iː/	/uː/
/a/			/aː/	/oː/

The vowels in (3) are arranged according to the distinctive features I assume. One relevant distinction for this paper is between [+back] /u uː oː/ and [-back] /i a iː aː/; another is the distinction between [+high] /i u iː uː/ and [-high] /a aː oː/.

1.1.2 Consonant inventory and distinctive features

The consonant inventory is provided in (4); I assume that vowels are [+syllabic] and consonants are [-syllabic]. Like many other Australian languages, Yindjibarndi's consonant inventory features a limited number of manner contrasts but a large number of place contrasts. Wordick's orthography is in brackets, and I have converted the orthography to IPA following his description and categorization of the sounds (Wordick pp. 10-13).

(4) Yindjibarndi consonant inventory

	Bilabial	*Dental*	*Alveolar*	*Retroflex*	*Palatal*	*Velar*
Stop	/p/ <p>	/t̪/ <th>	/t/ <t>	/ʈ/ <rt>	/c/ <ty>	/k/ <k>
Nasal	/m/ <m>	/n̪/ <nh>	/n/ <n>	/ɳ/ <rn>	/ɲ/ <ny>	/ŋ/ <ng>
Liquid			/l/ <l>	/ɭ/ <rl>		
Glide	/w/ <w>	/ʋ/ <yh>	/ɾ/ <rr>	/ɻ/ <r>	/j/ <y>	

Focusing first on place of articulation, I assume that the coronal consonants (in gray) are [+coronal] and the non-coronal consonants are [-coronal]. Among the coronals, I assume that minor place distinctions are encoded by [±anterior] and [±distributed]. Dental and alveolar consonants are [+anterior], while retroflex and palatal consonants are [-anterior]; dental and palatal consonants are [+distributed], while alveolar and retroflex consonants are [-distributed]. Among the [-coronal] consonants, I assume velars are [+dorsal] and labials are [-dorsal].

Focusing now on manner of articulation, I assume that stops and nasals are [-continuant] while liquids and glides are [+continuant]. The distinction among the [-continuant] consonants is made by [±sonorant], with nasals as [+sonorant] and stops as [-sonorant]; the distinction among the

[+continuant] consonants is made by [±lateral], with liquids as [+lateral] and glides as [-lateral]. The glide /ɾ/ often patterns with vowels, to the exclusion of other glides, in phenomena like (but not limited to) lenition and deletion; see Wordick pp. 20-40 for discussion of phonological processes in Yindjibarndi. This suggests that it forms a natural class with the vowels, to the exclusion of other glides. Since this issue is not central to the larger points of the paper, I do not address it here.

1.1.3 Prosody

Yindjibarndi stress is weight-sensitive and variable; stress is not central to the major points of this paper but for details, see Wordick pp. 41-42 (and my footnote 5). Of more interest here is the fact that only vowels are moraic. Long vowels carry two moras and short vowels carry one.

1.2 Roadmap

Section 2 details allomorphy in the Yindjibarndi locative. Section 3 proposes an analysis in which suppletion is analyzed as part of the morphology and predictable allomorphy is analyzed as part of the phonology. Section 4 discusses a potential alternative analysis, in which all allomorphy is analyzed as part of the phonology, and shows how the analysis fails. Section 5 briefly discusses a serial alternative and show how that fails as well. Section 6 briefly discusses other cases of PCSA in Yindjibarndi and Section 7 concludes.

2 Allomorphy in the Yindjibarndi locative

The form of the Yindjibarndi locative depends on both lexical and phonological information. On the lexical side, its form depends on the class of noun it attaches to. Yindjibarndi has five noun classes: common, proper, retroflex, and two classes of directional nouns (one declining like *north*, and another declining like *south*). Among these, the common nouns form the largest class and the retroflex nouns the smallest; there is only one noun in the retroflex class (Wordick 1982:46). Each noun class is also associated with a distinct realization of the locative suffix (Table 1). Throughout this paper, numbers in parentheses refer to page numbers in Wordick's (1982) grammar.

Table 1: Locative allomorphs by noun class

Noun class	Locative allomorph	Example	Gloss	
Common nouns	/la/	[paɽkara-la]	'plain-LOC'	(210)
		[piɽtara-la]	'ceremonial feast-LOC'	(230)
	/ŋka/	[muci-ŋka]	'hole-LOC'	(203)
		[malu-ŋka]	'shade-LOC'	(273)
Proper nouns	/la/	[kujupuju-la]	'Cooya Puuya-LOC'	(228)
		[minkala-la]	'Minkala-LOC'	(252)
Retroflex nouns	/ʈa/	[cuntaː-ʈa]	'that way-LOC'	(32)
North-declining nouns	/t/	[ciŋka-t]	'upstream-LOC'	(230)
		[jawu-t-pa]	'downstream-LOC-EMP'	(259)
South-declining nouns	/ju/	[jaː-ju]	'east-LOC'	(213)
		[wulu-ju]	'west-LOC'	(230)

This paper focuses on the two locative allomorphs associated with the common nouns. Their distribution is phonologically predictable: /ŋka/ is selected following bimoraic vowel-final stems, while /la/ is selected following consonant-final roots as well as those that are trimoraic or longer. Both /la/ and /ŋka/ have a number of phonologically predictable allomorphs; Table 2 summarizes how several phonological factors determine which allomorph surfaces. For the bimoraic vowel-final stems that take /ŋka/, one major determining factor is whether or not the stem contains an immediately preceding nasal-stop cluster. If it does not, /ŋka/ surfaces faithfully as [ŋka] (as in [malu-ŋka]). If the stem does contain an immediately preceding nasal-stop cluster, then /ŋka/ surfaces as either [a] (as in [maɲci-a] and [waɳʈa-a]) or [wa] (as in [wuntu-wa]). Moving onto the consonant-final roots that take /la/: in these cases, the allomorph that surfaces depends on the identity of the stem's final consonant. If the stem ends in a nasal, the lateral in /la/ hardens to a stop and place-assimilates to that stem-final nasal (as in [majtan-ta], [kaɾwaɳ-ʈa], [wiɽtaɲ-ca]). If the root ends in a stop or the glide [ɾ], the lateral in /la/ deletes. Note that the only licit final consonants in Yindjibarndi are [n ɳ ɲ t ʈ c ɾ], so what's recorded in Table 2 exhausts the space of possible allomorphs.[1]

Table 2: Locative allomorphs for common nouns are conditioned by phonological factors

Morpheme	Final seg. type	μ	NC in stem?	Final seg.	Allomorph	Example Gloss (all -LOC)
/ŋka/	Vowel	2μ	No		[ŋka]	[malu-ŋka] 'shade' (149)
			Yes	[i] or [a]	[a]	[maɲci-a] 'death adder' (33)
						[waɳʈa-a] 'stick' (33)
				[u]	[wa]	[wuntu-wa] 'river' (33)
/la/		3μ			[la]	[paɽkaɾa-la] 'plain' (210)
	Consonant			[n]	[ta]	[majtan-ta] 'my gum tree' (22)
				[ɳ]	[ʈa]	[kaɾwaɳ-ʈa] 'summer' (210)
				[ɲ]	[ca]	[wiɽtaɲ-ca] 'path' (247)
				[t]	[a]	[kuɳʈat-a] 'daughter' (23)
				[ʈ]		[ʈ̪uɾuʈ-a] 'prescribed' (23)
				[c]		[kaɲkac-a] 'loose' (23)
				[ɾ]		[maʈaɾ-a] 'red ochre' (23)

[1]The instrumental case behaves identically, with the only difference that its allomorphs end in [u]. All of the points I raise with respect to the locative apply equally to the instrumental. I focus on the locative because it is more frequent.

Evidence that all of these allomorphs are exponents of the same morpheme comes from patterns of case concord within the noun phrase (Wordick pp. 142-143). As is clear from (5), locative case concord occurs regardless of which allomorph is appropriate.

(5) Case concord in adjective-noun and noun-noun constructions

a. ŋuɽa-ŋka muʊumuʊu-la
ground-Loc cold-Loc
'in this cold ground' (206)

b. kupica-la-ŋu maɳʈa-a-ŋu
small-Loc-Abl rock-Loc-Abl
'onto a small rock' (214)

c. kupica-la t̪anpaʈan-ta
small-Loc bark.basin-Loc
'in a small bark basin' (229)

d. maɲcaɳ-ʈa-u piʈit̪a-la-u
bed-Loc-Obj dry.leaf-Loc-Obj
'on the bed of dry leaves' (247)

e. wuntu-wa ciŋka-t
river-Loc upstream-Loc
'up the river' (230)

While the phonological factors that govern the realization of the common nouns' allomorphs may seem arbitrary, the variation in Table 2 can be shown to follow from aspects of the language's regular phonology. The realizations of /ŋka/ as [wa] and [a] follow from the interaction of two processes, both general in the language: nasal cluster dissimilation (term from McConvell 1988) and /k/ lenition. The realizations of /la/ as [ta], [ʈa], [ca], and [a] occur to comply with restrictions on consonant cluster composition. The next section provides more details on these phonological regularities and sketches analyses of how phonology gives rise to the set of allomorphs in Table 2.

3 Analysis of allomorphy in the Yindjibarndi locative

This section focuses first on the morphological part of the analysis. Following this, I move on to the phonological part of the analysis and show how the allomorphs [ŋka], [wa], and [a] can be derived from /ŋka/ (Section 3.2). Then, I show how the allomorphs [la], [ta], [ʈa], [ca], and [a] can be derived from /la/ (Section 3.3).

3.1 Distribution of suppletive allomorphs, /ŋka/ and /la/

As the first piece of the analysis, I account for the distribution of /ŋka/ and /la/. I assume that the relationship between these allomorphs is one of suppletion, as there is no phonological process in Yindjibarndi that maps /ŋk/ to [l] or vice versa.

I propose that the distribution of suppletive allomorphs is determined in the morphological component of the grammar and is perhaps implemented by Vocabulary Insertion rules (Halle & Marantz 1993; (6)), though the exact formalization does not matter here. The rule in (6a) requires that the locative morpheme inserted is /ŋka/ given a preceding bimoraic vowel-final root, while the rule in

(6b) requires that the locative morpheme inserted is /la/ in the general case. Adopting the common assumption that more specific rules apply first (Halle & Marantz 1993), these two rules work together to ensure that /ŋka/ is inserted in the listed contexts and /la/ is inserted elsewhere.

(6) Vocabulary insertion rules for locative suffix on common nouns

a. [Loc] $\leftrightarrow$ ŋka / $\{C_0VC_0V \_\_ , C_0Vː \_\_\}$

b. [Loc] $\leftrightarrow$ la

This distribution could be captured with subcategorization frames (Paster 2006), or by assuming that (6a) refers not to phonological contexts, but rather to a list of forms, and that learners extract the phonological generalizations by phonotactic learning over this list of forms (Gouskova et al. 2015). All that is crucial is that the decision between /ŋka/ and /la/ is made in a component of the grammar that precedes regular phonology. While the distribution of the suppletive allomorphs is determined by phonological properties, the phonological grammar does not play a role in their selection.

3.2 Distribution of allomorphs of /ŋka/: [ŋka], [wa], and [a]

I now account for the variation in allomorph form that is summarized in Table 2. As a reminder, /ŋka/ attaches to bimoraic vowel-final stems, and its allomorphs [ŋka], [wa], and [a] are in complementary distribution. When /ŋka/ attaches to a stem that does not contain an immediately preceding nasal-stop cluster, it appears as [ŋka] (7).

(7) /ŋka/ realized as [ŋka] if not preceded by a nasal-stop cluster

a.	/malu+ŋka/	$\rightarrow$	[malu-ŋka]	'shade-Loc'	(236)
b.	/maɽa+ŋka/	$\rightarrow$	[maɽa-ŋka]	'hand-Loc'	(230)
c.	/juɹa+ŋka/	$\rightarrow$	[juɹa-ŋka]	'day-Loc'	(149)

When /ŋka/ attaches to a stem that does contain an immediately preceding nasal-stop cluster, it appears as [wa] or [a]. Whether [wa] or [a] surfaces depends on the identity of the stem-final vowel: if the stem-final vowel is [u] the suffix is realized as [wa] (8a); if the stem-final vowel is [i] or [a] the suffix is realized as [a] (8b,c).

(8) /ŋka/ realized as [wa] or [a] if preceded by a nasal-stop cluster

a.	/wuntu+ŋka/	$\rightarrow$	[wuntu-wa]	'river-Loc'	(236)
b.	/waɳʈa+ŋka/	$\rightarrow$	[waɳʈa-a]	'stick-Loc'	(230)
c.	/maɲci+ŋka/	$\rightarrow$	[maɲci-a]	'death adder-Loc'	(149)

These alternations arise from the interaction of two distinct processes. The first is nasal cluster dissimilation (Section 3.2.1) and the second is intervocalic /k/ lenition (Section 3.2.2).

3.2.1 Nasal cluster dissimilation

Yindjibarndi exhibits nasal cluster dissimilation (Wordick 1982, Stanton 2019; on the phenomenon more generally see Herbert 1986, McConvell 1988, Alderete 1997, Jones 2000, Blust 2012). In a sequence of two nasal-stop clusters, NC_1 and NC_2, the N that belongs to NC_2 deletes. Examples of nasal cluster dissimilation involving the topicalization clitic /mpa/ follow in (9a,b); the examples in (9c,d) confirm that the clitic surfaces as /mpa/ when there is no preceding nasal-stop cluster.

(9) Nasal cluster dissimilation with the topicalization clitic /mpa/

a.	/munti+mpa/	→	[munti-pa]	'really-TOP'	(34)
b.	/t̪aŋkaɾ+mpa/	→	[t̪aŋkaɾ-pa]	'enough-TOP'	(34)
c.	/n̪ula+mpa/	→	[n̪ula-mpa]	'at this-TOP'	(240)
d.	/paɾaː+mpa/	→	[paɾaː-mpa]	'long time-TOP'	(273)

Nasal cluster dissimilation is exceptionless in Yindjibarndi, though with a few caveats. First, nasal cluster dissimilation only occurs if the second nasal-stop cluster is homorganic labial [mp] or velar [ŋk]. Second, nasal cluster dissimilation occurs only when the nasal-stop sequences are separated by vowels and an optional stem-final consonant (as in (9b), Wordick p. 33). Any other intervening material likely blocks nasal cluster dissimilation, though Wordick provides no illustrative examples. This restriction on co-occurring nasal-stop sequences holds as a static restriction; the only exceptional form in Wordick's lexicon is [jantimpuɾwa], a place name (see Wordick p. 35).

For our purposes, only the generalization apparent from (9) is important: Yindjibarndi does not permit sequences of nasal-stop clusters. For discussion and analysis of more detailed facts regarding Yindjibarndi nasal cluster dissimilation, such as the restriction to labial and velar nasal-stop clusters, see Stanton (2019).

3.2.2 Intervocalic lenition

Yindjibarndi has productive intervocalic lenition, affecting most consonants (at least variably) in intervocalic position. I focus here on the behavior of /k/ in this position, but see Section 6.1 for brief discussion of /j/ and Wordick pp. 27-32 for the full set of facts.

In intervocalic position, a morpheme-initial /k/ either lenites or deletes, depending on the identity of the surrounding vowels. If the preceding vowel is /u/ and the following vowel is /a/, /k/ lenites to [w] (10a). Given any other combination of vowels, /k/ deletes (10b-f). (The absence of the contexts [u_i], [i_i], and [a_i] is due to the lack of /ki/-initial suffixes in Yindjibarndi. Wordick's description predicts that /k/ should delete in these contexts.) The inclusion of three separate suffixes in (10) – the possessive /kaɭaː/, the objective case clitic /ku/, and the direct allative suffix /kaʈa/ – illustrates that /k/ lenition applies generally in morpheme-initial intervocalic position and is not limited to any specific morpheme.

(10) /k/ lenition and deletion

a.	/paʈu+kaɭaː/	→	[paʈu-waɭaː]	'bird (feather-having)'	(28)
b.	/malu+ku/	→	[malu-u]	'shade-OBJ'	(208)
c.	/maja+kaʈa/	→	[maja-aʈa]	'house-DIR.ALL'	(30)
d.	/warapa+ku/	→	[warapa-u]	'grass-OBJ'	(188)
e.	/ŋamaji+ku/	→	[ŋamaji-u]	'tobacco-OBJ'	(188)
f.	/maɳi+kaɭaː/	→	[maɳi-aɭaː]	'striped (mark-having)'	(304)

When /k/ deletes, the newly adjacent vowels sometimes undergo modifications of their own. Identical short vowels obligatorily coalesce into a single long vowel (e.g. [a+a] → [aː]) (Wordick pp. 35-37), and certain combinations of short vowels can optionally coalesce into a long vowel (e.g. [i+u] → [iu] or [uː]). Coalescence of short vowels is not represented or analyzed in what follows.

3.2.3 Putting the pieces together

Wordick (p. 33) notes that the alternations in the locative (8) can be modeled as a feeding interaction between nasal cluster dissimilation and /k/ lenition. First, nasal cluster dissimilation results in the loss of suffixal /ŋ/ (e.g. /wuntu+ŋka/ → [wuntu-ka]). Then, /k/ lenition results in either deletion or lenition of /k/, depending on the vocalic context. Derivations visualizing this intuition are in (11).

(11) Locative alternations as a result of nasal cluster dissimilation and lenition

UR	/wuntu+ŋka/	/waɳʈa+ŋka/	/maɲci+ŋka/
Nasal cluster dissimilation	wuntu-ka	waɳʈa-ka	maɲci-ka
/k/ lenition	wuntu-wa	waɳʈa-a	maɲci-a
SR	[wuntu-wa]	[waɳʈa-a]	[maɲci-a]

An Optimality Theoretic analysis (Prince & Smolensky 2004) requires four markedness constraints and two faithfulness constraints. The first markedness constraint is *NCV(C)NC (12), which motivates nasal cluster dissimilation.[2]

(12) ***NCV(C)NC**:
Assign one * for each NCV(C)NC sequence in the output.

The second markedness constraint is *VkV (13), which penalizes intervocalic velar obstruents.

(13) ***VkV (*[+syll][+dorsal, -son][+syll])**:
Assign one * for each intervocalic velar obstruent.

Although Wordick characterizes /k/ lenition as a phenomenon that applies to only morpheme-initial segments, there is a broader dispreference for intervocalic /k/s in the language. /k/ is a frequent consonant in Yindjibarndi: of the 7,604 consonants in Wordick's lexicon (n=2,273 words, entered by hand), 714 of these, or 9.39%, are /k/. (The only more frequent consonants are /m/, with 723 occurrences, and /ɾ/, with 799.) If all consonants were equally probable in all environments, we might then expect 9.39% of all VCV sequences to involve a /k/. What we find, however, is that only 2.05% (66/3218) do. Thus although /k/ is frequent, it is underattested between vowels; the observed/expected ratio in this environment is 0.21 (=66/302; see Pierrehumbert 1992 on observed/expected). This supports the formulation of (13) as a constraint that disprefers intervocalic [k], irrespective of its morphological environment.

The final two markedness constraints are: *{i,a}wV (14), which penalizes any [w] that is preceded by a front vowel and followed by another vowel; and *uw{i,u} (15), which penalizes any [w] that is preceded by [u] and followed by a high vowel. These constraints work together to prohibit intervocalic [w] in all contexts but [u_a].

(14) ***{i,a}wV (*[-back, +syll][-coronal, -cons][+syll]**:
Assign one * for each [w] preceded by a front vowel and followed by another vowel.

(15) ***uw{i,u} (*[+back][-coronal, -cons][+syll, +high]**:
Assign one * for each [w] preceded by [u] and followed by a high vowel.

Wordick does not posit a restriction on [w] occurring in these specific environments, but such a

[2] *NCV(C)NV is likely shorthand for a phonetically motivated constraint that penalizes nasal-stop sequences that are followed by nasal or nasalized vowels. For motivation and formalization, see Stanton (2019).

restriction could help us understand why /k/ deletes rather than leniting in all intervocalic environments except [u_a]. Although Wordick claims that /k/ deletion occurs only at a morpheme boundary, some evidence that the proposed restrictions on [w] hold throughout the lexicon comes from consideration of its distribution in different intervocalic environments. As shown in (16), [w] is most common when it occurs between [u] and [a]. (In these tables, long and short vowels have been collapsed. For example, the one instance of [aː_u] and twenty instances of [a_u] have been collapsed into a single category, [a_u], n=21.)

(16) Distribution of vowel contexts in VwV sequences (n=281)

VwV		V_2		
		a	i	u
	a	69 (24.60%)	25 (8.90%)	21 (7.47%)
V_1	i	36 (12.81%)	19 (6.76%)	5 (1.78%)
	u	**94 (33.45%)**	12 (4.27%)	0 (0.00%)

The distribution of VwV sequences looks quite different from the broader distribution of VCV sequences, as can be seen in (17). Of particular note here is the relative frequency of the [u_a] context: for VwV sequences this makes up 33.45% of the total, while for VCV it makes up 13.05%. (For readability, I have excluded from (17) one [oː_u] sequence and one [oː_i] sequence.)

(17) Distribution of vowel contexts in VCV sequences (n=3,216)

VCV		V_2		
		a	i	u
	a	768 (23.87%)	556 (17.28%)	351 (10.90%)
V_1	i	324 (10.07%)	265 (8.23%)	97 (3.01%)
	u	**420 (13.05%)**	129 (4.09%)	306 (9.51%)

Given this difference, it is unsurprising that the observed/expected ratios for the VwV sequences vary by context (18): [uwa] is clearly overattested relative to expectation, while the ratios for the rest of the vocalic contexts are lower. The observed/expected ratio of 0 for the [u_u] context can be attributed to a ban on [w] in this environment, discussed explicitly by Wordick (p. 32).

(18) Observed/expected ratios for VwV sequences

VCV		V_2		
		a	i	u
	a	1.02 (69/67.51)	0.53 (25/47.25)	0.69 (21/30.40)
V_1	i	1.25 (36/28.69)	0.82 (19/23.04)	0.58 (5/52)
	u	**2.54 (94/37.03)**	1.05 (12/11.48)	0 (0/26.90)

These patterns thus provide support for the markedness constraints *{i,a}wV and *uw{i,u}, as the only vowel combination not penalized by these constraints is overattested, relative to the rest.

In addition to these four markedness constraints, the analysis also requires two faithfulness constraints: MAX (19), which penalizes deletion; and IDENT[±continuant] (20), which penalizes lenition (see McCarthy & Prince 1995 on Correspondence Theory, which I assume throughout).

(19) **MAX**:
Assign one * for each input segment that does not have an output correspondent.

(20) **IDENT[±continuant]**:
Assign one * for each corresponding pair of segments that disagrees for [±continuant].

The phenomena in Sections 3.2.1-3.2.2 provide us with enough information to establish several crucial rankings among these constraints. First, we know that *NCV(C)NC dominates MAX, because when the stem contains co-occurring nasal-stop sequences, deletion of the suffixal /ŋ/ (21b) is preferable to its retention (21a). (I do not consider candidates that satisfy *NCV(C)NC in other ways, e.g. *[wunu-ŋka] or *[wuntu-ŋa]. For the purposes of this analysis I assume that deletion of the suffixal nasal is the only licit repair; see Stanton 2017:160-167 on deriving different repairs.)

(21) *NCV(C)NC ≫ MAX: /wuntu+ŋka/ → [wuntu-wa] (*[wuntu-ŋka])

/wuntu+$ŋ_1k_2$a/	*NCV(C)NC	MAX
a. [wuntu-$ŋ_1k_2$a]	*!	
☞ b. [wuntu-w_2a]		*!

Second, we know that MAX dominates IDENT[±continuant]. In /k/ lenition, [w] surfaces in the one context where it is allowed: between [u] and [a]. I take this as evidence that leniting /k/ (22a) is preferable to deleting it (22b) when the surrounding context allows.

(22) MAX ≫ IDENT[±continuant]: /wuntu+ŋka/ → [wuntu-wa] (*[wuntu-a])

/wuntu+$ŋ_1k_2$a/	MAX	IDENT[±continuant]
☞ a. [wuntu-w_2a]	*	*
b. [wuntu-a]	**!	

Third, we know that *{i,a}wV and *uw{i,u} dominate MAX, because in contexts where [w] is dispreferred (in all intervocalic environments aside from [u_a]), its deletion (23b) is preferable to its retention (23a). I illustrate only the *{i,a}wV ≫ MAX ranking below; evidence that *uw{i,u} ≫ MAX comes from forms like [malu-u] (/malu+ku/, (10b)).

(23) *{i,a}wV ≫ MAX: /maɲci+ŋka/ → [maɲci-a] (*[maɲci-wa])

/maɲci+$ŋ_1k_2$a/	*{i,a}wV	MAX
a. [maɲci-w_2a]	*!	*
☞ b. [maɲci-a]		**

Fourth and finally, we know that *VkV dominates MAX, because deletion of an intervocalic /k/ (24b) is preferable to retaining it (24a), in contexts where lenition is not possible.

(24) *VkV ≫ MAX: /maɲci+ŋka/ → [maɲci-a] (*[maɲci-ka])

/maɲci+$ŋ_1k_2$a/	*VkV	MAX
a. [maɲci-k_2a]	*!	*
☞ b. [maɲci-a]		**

These ranking arguments are summarized in (25). The four top-ranked markedness constraints do not conflict and are not violated in the data, so we cannot rank them with respect to one another.

(25) Summary of nasal cluster dissimilation and lenition analysis

$$\begin{tikzcd}[column sep=small]
\text{*VkV} \arrow[drr] & \text{*\{i,a\}wV} \arrow[dr] & & \text{*uw\{i,u\}} \arrow[dl] & \text{*NCV(C)NC} \arrow[dll] \\
& & \textsc{Max} \arrow[d] & & \\
& & \textsc{Ident}[\pm\text{continuant}] & &
\end{tikzcd}$$

In sum, /ŋka/ has three allomorphs in complementary distribution: [ŋka], [wa], and [a]. The observed alternations can be understood as resulting from the interaction of two processes, both general in the language: nasal cluster dissimilation and /k/ lenition.

3.3 Distribution of allomorphs of /la/: [la], [ta], [ʈa], [ca], and [a]

The allomorph /la/ is inserted following trimoraic and longer vowel-final stems as well as all consonant-final stems. Its allomorphs [la], [ta], [ʈa], [ca], and [a] are in complementary distribution, their realization conditioned by the stem's final segment. When /la/ is suffixed to a vowel-final stem, it appears as [la] (26).

(26) /la/ surfaces as [la] when suffixed to a vowel-final stem

a.	/loːpu+la/	→	[loːpu-la]	'Friday-Loc'	(237)
b.	/paɽkaɾa+la/	→	[paɽkaɾa-la]	'plain-Loc'	(210)

When /la/ is suffixed to a consonant-final stem, the suffix-initial /l/ is modified or deleted. When /la/ is suffixed to a nasal-final stem, /l/ hardens to a stop and place-assimilates to the preceding nasal (27). When /la/ attaches to a stop-final stem or a stem that ends in [ɾ], /l/ deletes (28).

(27) /l/ hardens and place assimilates when /la/ attaches to a nasal-final stem

a.	/kaɾwaɳ+la/	→	[kaɾwaɳ-ʈa]	'summer-Loc'	(210)
b.	/majtan+la/	→	[majtan-ta]	'my gum tree-Loc'	(22)
c.	/wiʈaɲ+la/	→	[wiʈaɲ-ca]	'path-Loc'	(247)

(28) /l/ deletes when /la/ attaches to stop-final or [ɾ]-final stem

a.	/kuɳʈat+la/	→	[kuɳʈat-a]	'daughter-Loc'	(23)
b.	/t̪uruʈ+la/	→	[t̪uruʈ-a]	'prescribed-Loc'	(23)
c.	/kaŋkac+la/	→	[kaŋkac-a]	'loose-Loc'	(23)
d.	/maʈaɾ+la/	→	[maʈaɾ-a]	'red ochre-Loc'	(23)

These alternations are not predictable from regular phonology: there is no independent evidence that, say, /l/ hardens when it follows a nasal. The alternations do however appear to occur in response to, and in turn respect, constraints on cluster composition. The generalizations I discuss below are drawn in part from Wordick's description (pp. 14-16) and in part through consideration of lexical statistics. The numbers I report come from my own analysis of Wordick's lexicon.

3.3.1 Lateral place assimilation and hardening

I focus first on understanding why laterals harden and place-assimilate following a nasal. These alternations are likely in response to a prohibition on liquids as the second member of a consonant cluster. The table in (29) makes this clear: while liquids occur (if rarely) as the first member of a cluster, they do not occur as the second. (The one exception, [wutli], is a Yindjibarndi adaptation of the English first name Woodley.)

(29) Cluster frequencies in Yindjibarndi

		C_2			
		Stop	Nasal	Liquid	Glide
C_1	Stop [p t̪ t ʈ c k]	37	1	1	
	Nasal [m n̪ n ɳ ɲ ŋ]	734	42		
	Liquid [l ɭ]	3			5
	Glide [w ʋ ɾ ɽ j]	104	7		40

Given that clusters like [nl] cannot occur, we must ask why the /l/ is realized as a stop. This is likely due to the relative markedness of different cluster types in the language. As shown in (29), the only attested nasal-initial clusters are nasal-stop and nasal-nasal clusters. The nasal-stop clusters are far more frequent (n=734 vs. n=42), indicating that nasal-nasal clusters are marked relative to the nasal-stop clusters. Thus it makes phonotactic sense that post-nasal /l/ is realized as a stop.

The next question is: why does the resulting stop place-assimilate? Why, for example, is the underlying cluster /ɳ+l/ realized as [ɳʈ], and not [ɳt]? To understand this, we need to look at restrictions on the composition of nasal-stop clusters (30).

(30) Frequency of nasal-stop clusters in Yindjibarndi

		C_2					
		Labial [p]	Dental [t̪]	Alveolar [t]	Retroflex [ʈ]	Palatal [c]	Velar [k]
C_1	Labial [m]	75					
	Dental [n̪]		63				
	Alveolar [n]	26		97		19	59
	Retroflex [ɳ]	11			132	5	26
	Palatal [ɲ]	2				66	12
	Velar [ŋ]						141

One generalization clear from (30) is that homorganic nasal-stop clusters (n=574, in black) are more frequent than heterorganic nasal-stop clusters (n=160, in gray and white), even though both are licit. Another observation from (30) is that when a heterorganic nasal-stop cluster occurs, the nasal is usually coronal and the stop is usually labial or velar. Nasal-stop clusters that disagree in minor place (the shaded region in (30)) are limited in their distribution and, in all cases, the stop is palatal. Given the clear preference for homorganic nasal-stop clusters, as well as the prohibition on heterorganic coronal clusters with alveolar [t] as a second member, it makes sense that the alveolar lateral place-assimilates.

For an analysis of lateral hardening and place assimilation, I assume three markedness constraints. *CL (31) penalizes consonant clusters with a liquid as a second consonant, *NN (32) penalizes nasal-nasal clusters, and *nʈ (33) penalizes nasal-stop clusters that disagree in minor place (see e.g. Gouskova 2004 on syllable contact constraints, which *CL and *NN are examples of; see Itô 1986 on CODACOND, similar to *nʈ in claiming that codas cannot license their own place features). The analysis also includes four faithfulness constraints: IDENT[±continuant] (20); IDENT[±anterior] (34) and IDENT[±distributed] (35), which together penalize changes in minor place like those observed in /wiʈaɲ+la/ → [wiʈaɲ-ca]; and IDENT[±coronal], which helps explain why the suffixal /l/ does not map to [p] or [k]. Note that this collection of constraints is only sufficient for analyzing the alternations found in (27). Analysis of the more detailed picture of cluster phonotactics in (29-30) would require additional constraints.

(31) ***CL (*[-syllabic][+continuant, +liquid])**:
Assign one * for each consonant cluster with a liquid as its second member.

(32) ***NN (*[-continuant, +sonorant][-continuant, +sonorant])**:
Assign one * for each cluster of nasal consonants.

(33) ***nʈ (*[+sonorant, -continuant, αminor place][-sonorant, βminor place])**:[3]
Assign one * for each heterorganic nasal-stop cluster.

(34) **IDENT[±anterior]**:
Assign one * for each corresponding pair of segments that disagrees for [±anterior].

(35) **IDENT[±distributed]**:
Assign one * for each corresponding pair of segments that disagrees for [±distributed].

(36) **IDENT[±coronal]**:
Assign one * for each corresponding pair of segments that disagrees for [±coronal].

I begin by analyzing /l/ hardening in the form /majtan+la/ → [majtan-ta]. The mapping from input /l/ to output [t] violates IDENT[±continuant], so *CL must dominate IDENT[±continuant] (37). In addition, the realization of input /l/ as [t], instead of [n], shows that *NN is highly ranked. There is no evidence from these alternations that *NN conflicts with any other constraint, however, so to keep the tableaux maximally simple, I do not include *NN or candidates that violate it.

(37) *CL ≫ IDENT[±continuant]: /majtan+la/ → [majtan-ta] (*[majtan-la])

/majtan-la/	*CL	IDENT[±continuant]
☞ a. [majtan-ta]		*
b. [majtan-la]	*!	

The mappings /karwaɳ+la/ → [karwaɳ-ʈa] and /wiʈaɲ+la/ → [wiʈaɲ-ca] show that both *NP and IDENT[±coronal] dominate IDENT[±anterior] and IDENT[±distributed]. The mapping from alveolar /l/ to retroflex [ʈ] violates IDENT[±anterior] (38), and the mapping from alveolar /l/ to palatal [c] violates IDENT[±anterior] and IDENT[±distributed] (39). Crucially, these modifications in minor place are preferred to a change in major place (e.g. /karwaɳ+la/ → *[karwaɳ-ka]).

(38) *NP ≫ IDENT[±anterior]: /karwaɳ+la/ → [karwaɳ-ʈa], (*[karwaɳ-ta])

/karwaɳ+la/	*nʈ	IDENT[±coronal]	IDENT[±anterior]	IDENT[±distributed]
☞ a. [karwaɳ-ʈa]			*	
b. [karwaɳ-ta]	*!			
c. [karwaɳ-ka]		*!		

[3] I use [minor place] here as shorthand for the collection of [±anterior] and [±distributed]. *nʈ penalizes any nasal-stop sequence that disagrees for [±anterior] and/or [±distributed].

(39) *NP ≫ Ident[±distributed]: /wiʈaɲ+la/ → [wiʈaɲ-ca] (*[wiʈaɲ-ta])

/wiʈaɲ+la/	*nʈ	Ident[±coronal]	Ident[±anterior]	Ident[±distributed]
☞ a. [wiʈaɲ-ca]			*	*
b. [wiʈaɲ-ta]	*!			
c. [wiʈaɲ-ka]		*!		

A summary of the analysis is visualized in (40). (Note that I leave *NN out of this diagram, as there are no ranking arguments between *NN and the other constraints.)

(40) Interim summary of /la/ allomorph analysis

$$\begin{tikzcd}
 & \text{*nʈ} \arrow[dl] \arrow[d] & \text{Ident[±coronal]} \arrow[dll] \arrow[dl] & \text{*CL} \arrow[d] \\
\text{Ident[±anterior]} & \text{Ident[±distributed]} & & \text{Ident[±continuant]}
\end{tikzcd}$$

3.3.2 Lateral deletion

I turn my attention now to understanding why [l] deletes after a stop or [ɾ]. The prohibition on liquids from occupying the second member of a cluster remains relevant here; what needs explanation is why /l/ deletes in these contexts instead of mapping to another segment.

To understand why [l] deletes in words like [kuɳʈat-a], [t̪uruʈ-a], and [kaɲkac-a], rather than mapping to a stop (recall from (29) that stop-stop clusters are attested), we need to consider constraints on the composition of stop-stop clusters. Several such constraints are evident in (41).

(41) Frequency of stop-stop clusters in Yindjibarndi

		C_2					
		Labial	Dental	Alveolar	Retroflex	Palatal	Velar
C_1	Labial [m]						
	Dental [n̪]						
	Alveolar [n]	14				6	1
	Retroflex [ɳ]	1				1	1
	Palatal [ɲ]	11					2
	Velar [ŋ]						

First, note that homorganic stop-stop clusters (in black) are unattested: geminates are prohibited in Yindjibarndi. Second, to the extent that heterorganic stop-stop clusters are attested, almost all have a coronal as the first consonant and a labial or velar as the second (the apparent exceptions, which I do not treat here, come from clusters where the second consonant is palatal). We can use this information to motivate a couple of markedness constraints. The first, NoGem (e.g. Spaelti 1997, (42)), penalizes geminates. The second, *tʈ (43), penalizes heterorganic coronal-coronal clusters. (For more on constraints that govern cluster composition in Australian languages, see Hamilton 1995.) I assume that (43) dominates Ident[±anterior] and Ident[±distributed] and do not include *tʈ or candidates that violate it below.

(42) **NoGeminates**:
Assign one * for each geminate consonant.

(43) ***tʈ ([+coronal, -sonorant, αminor place][+coronal, -sonorant, βminor place])**:
Assign one * for each coronal-coronal sequence that disagrees for [±anterior].

Two additional faithfulness constraints become relevant here. The first is MAX (19), which penalizes deletion. The second is IDENT[±coronal] (36), which penalizes changes in major place. IDENT[±coronal] is a necessary addition to this analysis because it helps explain why /l/ does not map to, say, [p], given that /kuɳʈat+la/ → [kuɳʈat-pa] would result in a licit [tp] cluster.

One crucial ranking is between NOGEMINATES and MAX: the preference to delete the suffix-initial consonant, rather than realize it as a stop, shows that NOGEMINATES dominates MAX (44).

(44) NOGEMINATES ≫ MAX: /kuɳʈat+la/ → [kuɳʈat-a] (*[kuɳʈat-ta])

/kuɳʈat+la/	NOGEMINATES	MAX
☞ a. [kuɳʈat-a]		*
b. [kuɳʈat-ta]	*!	

In addition, the preference for deletion of the suffix-initial consonant in /kuɳʈtat+la/ → [kuɳʈat-a], rather than a change in major place (e.g. /kuɳʈat+la/ → *[kuɳʈat-pa]), shows that IDENT[±coronal] dominates MAX: it is better to delete a coronal (45a) than it is to map that coronal to a labial (45b).

(45) IDENT[±coronal] ≫ MAX: /kuɳʈtat+la/ → [kuɳʈat-a] (*[kuɳʈat-pa])

/kuɳʈat+la/	IDENT[±coronal]	MAX
☞ a. [kuɳʈat-a]		*
b. [kuɳʈat-pa]	*!	

I turn to explaining /l/ deletion following [ɾ] (e.g. /maʈaɾ+la/ → [maʈaɾ-a]). First, the combination cannot surface faithfully since consonant clusters cannot have a liquid as their second member. In addition, the combinatorial properties of [ɾ] are limited: glides can only precede stops and other glides (and, less frequently, nasals). To understand why deletion is preferable to an unfaithful mapping in this case, consider the clusters that contain [ɾ] as a first member (46).

(46) Frequency of [ɾ]-initial clusters

		C_2													
		[-coronal]					[+coronal]								
		[p]	[m]	[k]	[ŋ]	[w]	[t̪]	[n̪]	[t]	[n]	[ʈ]	[ɳ]	[c]	[ɲ]	[j]
C_1	[ɾ]	2	6	32		38							2	1	2

Most clusters that contain [ɾ] as a first member have [-coronal] consonant as a second member, usually [k] or [w] (and less commonly [p] or [m]). I take this as evidence that there exists a markedness constraint, *ɾT (47), which penalizes each occurrence of [ɾ] that precedes a coronal consonant.

(47) ***ɾT (*[-liquid, +sonorant, +anterior][+coronal])**:
Assign one * for each [ɾ] followed by a coronal consonant.

Deletion occurs in this context, so *ɾT dominates MAX. In addition, given the ranking IDENT[±coronal] ≫ MAX (as established in (45)), the analysis correctly predicts that deletion should be the preferred repair in this case. As /l/ cannot surface as any kind of coronal (due to *ɾT, (48b)), deleting it (48a) is preferable to realizing it as a non-coronal (48c).

(48) *ɾT ≫ Max: /maʈaɾ+la/ → [maʈaɾ-a] (*[maʈaɾ-ta], *[maaɾ-ka])

/kuɳʈat+la/	*ɾT	Ident[±coronal]	Max
☞ a. [kuɳʈat-a]			*
b. [kuɳʈat-ta]	*!		
b. [kuɳʈat-ka]		*!	

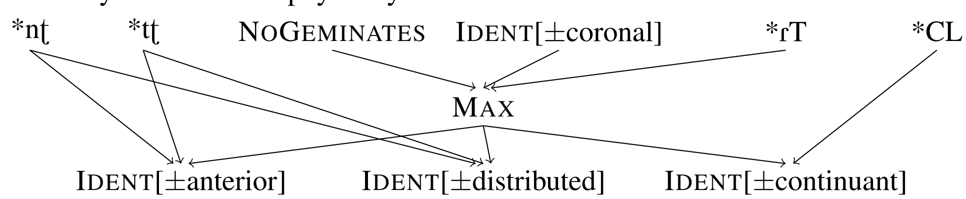
The rankings established in response to /l/ deletion are largely orthogonal to those established in response to /l/ hardening and assimilation, so integrating them into a single analysis is trivial. The only additional necessary ranking is between Max, Ident[±anterior], Ident[±distributed], and Ident[±continuant]. Since /l/ hardens and place-assimilates following a nasal, we know that Max dominates the other faithfulness constraints; modification of the /l/ is preferable to its deletion. The mapping /karwaɳ+la/ → [karwaɳ-ʈa] illustrates two rankings (49); the third, Max ≫ Ident[±distributed], is illustrated by /wiʈaɲ/ → [wiʈaɲ-ca] (*[wiʈaɲ-a]).

(49) Max ≫ Ident[±anterior], Ident[±cont]: /karwa+la/ → [karwaɳ-ʈa] (*[karwaɳ-a])

/karwa+la/	Max	Ident[±anterior]	Ident[±continuant]
☞ a. [karwaɳ-ʈa]		*	*
b. [karwaɳ-a]	*!		

A Hasse diagram is provided as a summary in (50); transitive rankings are not represented here. Recall that *NN (32) is not included below, as there are no ranking arguments between it and any other constraint in the analysis.

(50) Summary of /la/ allomorphy analysis



In sum, /la/ has five allomorphs that are in complementary distribution: [la], [ta], [ʈa], [ca], and [a]. These alternations can be understood as resulting from static constraints on cluster composition in Yindjibarndi, and independent support for these static constraints comes from consideration of the lexicon. The rankings summarized in (25), which account for the distribution of /ŋka/'s allomorphs, are consistent with the rankings necessary to account for the distribution of /la/'s allomorphs.

3.4 Local summary

Above, I have argued for the following analysis of Yindjibarndi locative allomorphy. The common noun's morpheme has two suppletive allomorphs, /la/ and /ŋka/, whose distribution is phonologically conditioned but governed by the morphology. Each suppletive allomorph gives rise to a set of predictable allomorphs (/la/ → [la], [ta], [ʈa], [ca], and [a]; /ŋka/ → [ŋka], [wa], and [a]), whose distribution is governed by the language's regular phonology. While I have proposed a specific formal analysis of these facts, few details of what has been presented above matter. The important distinction is between suppletive allomorphy (part of the morphology) and predictable allomorphy (part of the phonology).[4]

4 An alternative: all allomorphy is phonology

A potential criticism of the analysis of locative suppletion (Section 3.1) is that it misses phonological generalizations that link suppletive and non-suppletive allomorphy. All locative allomorphy, suppletive or predictable, is phonologically conditioned. What's more, the same phonological generalizations that govern suppletive allomorphy also govern predictable allomorphy. The [±syllabic] value of the stem's final segment, for example, plays a role in suppletive allomorphy: it determines whether the locative's allomorph is /ŋka/ (after a vowel) or /la/ (after a consonant). The [±syllabic] value of the stem's final segment also plays a role in predictable allomorphy: it determines whether /la/ is realized as [la] (after a vowel) or some other allomorph (after a consonant). Given that both suppletive and predictable allomorphy are governed by the same phonological factors, why not attempt to provide an integrated analysis in the phonology?

This section first develops an integrated, parallel analysis of suppletive and predictable allomorphy (an alternative to the analysis proposed in Section 3) and then shows how it fails. In short, the analysis fails because the rankings necessary to account for suppletive and predictable allomorphy are not compatible; there is a ranking paradox.

4.1 Analyzing suppletion

Determining whether the locative's allomorph should be /la/ or /ŋka/ requires us to take two independent factors into account: the stem's mora count (bimoraic vs. longer) and the identity of the stem's final segment (vowel vs. consonant). I analyze the role of each, in turn.

4.1.1 Mora count

One way to analyze the aspect of suppletion that depends on mora count could be to assume a general preference for /ŋka/ over /la/ (51). This preference for /ŋka/ is enforced by PRIORITY ((52); Mascaró 2007:726).

(51) Preferred ordering of allomorphs:
LOC = $\{$/ŋka/$_1 >$ /la/$_2\}$

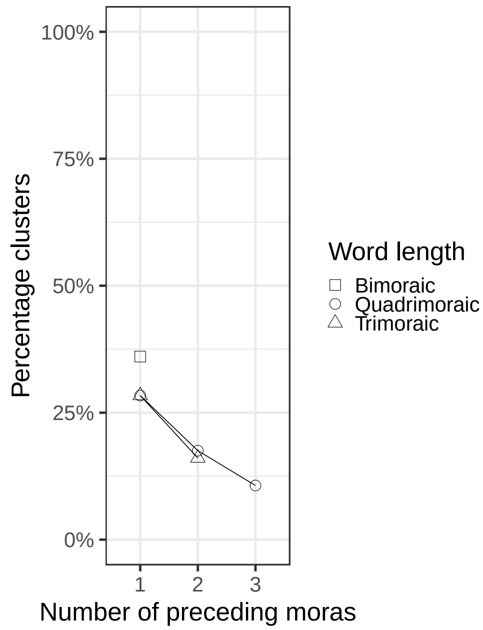
(52) **PRIORITY**:
Respect lexical priority (ordering) of allomorphs.

Given this preference for /ŋka/, why does /la/ attach to longer stems? One possible explanation could come from a language-wide dispreference for clusters that appear later, in longer words.[5] An

[4] One could also imagine an analysis in which all allomorphy is analyzed as suppletion. Vocabulary Insertion rules could require [ta] to be inserted after [n]-final words, [ca] to be inserted after [ɲ]-final stems, [a] to be inserted after [ɾ]-final, stop-final, and NC{i,a}-final words; and so on. I have no argument against this position, except to note that it would introduce something of a duplication into the grammar: the analyses of nasal cluster dissimilation, /k/ lenition, and cluster phonotactics are independently necessary to account for aspects of the language's regular phonology.

[5] Is it possible to characterize the distribution of suppletive allomorphs by appealing to stress or other prosodic factors? Probably not. As shown in (i), the division between two and three moras does not track any distinctions in stress or footing.

Figure 1: Distribution of clusters by word length and position



analysis of all bimoraic, trimoraic, and quadrimoraic stems in Wordick's lexicon (n=1951) reveals several trends regarding the distribution of clusters (Figure 1). First, word length matters: clusters are more common in bimoraic words. This means that words like (hypothetical) [ampa] are more common than words like (hypothetical) [ampala] or [ampalara]. Second, position in the word matters: in trimoraic and quadrimoraic words, clusters are more frequent after the first mora than they are after the second or third mora (so words like hypothetical [ampalarra] are more common than words like [alamparra]).

These trends suggest that attaching /la/ to trimoraic and longer stems may be a way to avoid placing /ŋk/, a cluster, in a dispreferred position. I formalize this preference as *LATECC (53).

(53) ***LATECC (*μ_2CC)**:
Assign a * for each consonant cluster preceded by two or more moras.

To take effect, *LATECC must dominate PRIORITY. It is also important to note that MAX, which played a central role in Sections 3.2-3.3, dominates PRIORITY; an alternative but unattested way to

(i) Stress, footing, and allomorphy in Yindjibarndi (based on Wordick pp. 41-42)

Moras	Form	Footing	Stress profile	Allomorph
2	CV:-CV	Basic: (ˈCV:-CV)	(1-0)	/ŋka/
		Variant: (ˈCV.V)(-ˌCV)	(10)-(2)	
	CVCV-CV	(ˈCV.CV)(-ˌCV)	(10)-(2)	
3	CV:CV-CV	Basic: (ˈCV:.CV)(-ˌCV)	(10)-(2)	/la/
		Variant: (ˈCV.V)(ˌCV-CV)	(10)(2-0)	
	CVCV:-CV	Basic: (CV.ˈCV:)(-ˌCV)	(01)-(2)	
		Variant: (ˈCV.CV)(ˌV-CV)	(10)(2-0)	
	CVCVCV-CV	(ˈCV.CV)(ˌCV-CV)	(10)(2-0)	

resolve the *LateCC violation would be to delete a consonant (e.g. /paɽkara+ŋka $\rightarrow$ *paɽkara-a). These ranking arguments are illustrated in (54).

(54) *LateCC, Max $\gg$ Priority: /paɽkara+Loc/ $\rightarrow$ [paɽkara-la] (*[paɽkara-(ŋk)a]

/paɽkara+Loc/ Loc = {/ŋka/$_1$ $>$ /la/$_2$}	*LateCC	Max	Priority
☞ a. [paɽkara-la$_2$]			*
b. [paɽkara-ŋka$_1$]	*!		
c. [paɽkara-a$_1$]		*!*	

4.1.2 Syllabicity of the final segment

The preference to attach /ŋka/ to vowel-final stems and /la/ to consonant-final stems is easy to understand: triconsonantal clusters are forbidden in Yindjibarndi. If /ŋka/ attached to a stem like /majtan/, the result would be illicit *[majtan-ŋka]. I formalize this dispreference as *CCC (55).

(55) ***CCC (*[-syllabic][-syllabic][-syllabic])**:
Assign one * for each triconsonantal cluster.

To take effect, *CCC must dominate Priority. As before, Max must also dominate Priority, as an alternative but unattested way to satisfy *CCC would be consonant deletion. (In (56), I do not analyze the hardening of suffix-initial /l/; see Section 3.2.2 for this aspect of the analysis.)

(56) *CCC, Max $\gg$ Priority: /majtan+Loc/ $\rightarrow$ [majtan-ta] (*[majtan-(ŋ)ka])

/majtan+Loc/ Loc = {/ŋka/$_1$ $>$ /la/$_2$}	*CCC	Max	Priority
☞ a. [majtan-ta$_2$]			*
b. [majtan-ŋka$_1$]	*!		
c. [majtan-ka$_1$]		*!*	

In light of the discussion that follows, it is worth asking if a ranking like M $\gg$ Priority $\gg$ Max could account for the results in (54, 56), where M stands for an as yet unidentified markedness constraint. For (54), this could be a constraint stipulating that /ŋka/ may not be attached to trimoraic or longer stems. For (56), however, an equivalent move is likely not feasible. One could appeal to a restriction on heterorganic nasal-stop clusters, but recall from (30) that such clusters are attested within roots (e.g. [kanka] 'height, top' (288)), and they can also be created across stem-suffix boundaries, as in [ɲin-ku] 'you-Obj' (219) and [purkuɳ-ku] 'close smoke-Obj' (215). In addition, such an analysis would not be able to rule out a further candidate (d), [majtan-a$_1$], which poses no obvious phonotactic problem.

In sum, suppletive allomorphy of the locative suffix can be analyzed as the interaction of phonological constraints with an allomorph preference constraint. A summary of the analysis follows.

(57) Summary of the integrated analysis

$$\begin{tikzcd}
\text{*CCC} \arrow[dr] & \text{Max} \arrow[d] & \text{*LateCC} \arrow[dl] \\
& \text{Priority} &
\end{tikzcd}$$

4.2 Where the analysis fails

Recall that, for the analysis of nasal cluster dissimilation in Section 3.2.1, *NCV(C)NC must dominate MAX. This is because, given an input like /waɳʈa+ŋka/, the language satisfies *NCV(C)NC by deletion. The problem arises when we integrate the analysis of nasal cluster dissimilation with that of suppletion. If we add the ranking MAX ≫ PRIORITY, as established in (54,56), the grammar incorrectly predicts that *NCV(C)NC should be satisfied through suppletion, not deletion (58).

(58) MAX ≫ PRIORITY makes the wrong prediction for /waɳʈa+ŋka/

/waɳʈa+LOC/ LOC = {/ŋka/$_1$ > /la/$_2$}	*NCV(C)NC	MAX	PRIORITY
a. [waɳʈa-ŋa$_1$]	*!		
☹ b. [waɳʈa-a$_1$]		*!*	
💣 c. [waɳʈa-la$_2$]			*

Fixing this problem with the analysis of predictable allomorphy would requires us to rank PRIORITY over MAX; this is in conflict with the ranking that is necessary for suppletive allomorphy.

The problem for an integrated analysis of suppletive and predictable allomorphy can be summarized as follows. The analysis of suppletion shows us that it is better to use the "wrong" allomorph than it is to delete a consonant, in order to satisfy *LATECC and *CCC (59).

(59) *CCC, *LATECC, $\boxed{\text{MAX} \gg \text{PRIORITY}}$

The analysis of predictable allomorphy, by contrast, shows us that it is better to delete a consonant than it is to use the "wrong" allomorph, in order to satisfy *NCV(C)NC (60).

(60) *NCV(C)NC, $\boxed{\text{PRIORITY} \gg \text{MAX}}$

The integrated analysis thus runs into a ranking paradox, a fatal problem for any analysis. There is no solution that I am aware of. (Possible solutions that involve indexation of faithfulness constraints to morphemes are useless here, as the problem arises within a single morphological paradigm.)

The insight: if we allow the grammar to treat suppletion as a potential repair to a phonotactic problem that can be prioritized over other repairs, like deletion, then we expect the hierarchy among these possible repairs to hold in all cases where both repairs are in principle available. But this is not what happens in the Yindjibarndi locative: the integrated analysis shows us that suppletion solves some phonotactic problems, while deletion solves others. The analysis proposed in Section 3 avoids this problem entirely by depriving phonology of the option to use suppletion as a repair to phonotactic problems.

5 A serial alternative

In this section I show that an analysis where phonological and morphological operations are serially interleaved (following Wolf 2008) can derive the locative facts but has trouble accounting for others. In Section 5.1 I develop a Harmonic Serialist analysis (McCarthy 2010 *et seq.*) of suppletive and predictable locative allomorphy.[6] In Section 5.2 I show how this analysis fails when we consider

[6]Note that, by virtue of using Harmonic Serialism, the analysis in Section 4.1 differs from one that would come from Wolf (2008), who uses Optimality Theory with Candidate Chains (OT-CC, McCarthy 2007). All analytical points raised

additional facts considering the behavior of the topicalization clitic /mpa/.

A brief introduction to Harmonic Serialism is necessary. Harmonic Serialism (McCarthy 2010 *et seq.*) is a serial version of Optimality Theory in which GEN is limited to making one change at a time. For present purposes, I assume that one change includes operations like morpheme insertion or deletion (Wolf 2008), segment insertion or deletion (*pace* McCarthy 2008), and lenition or hardening. Because GEN is limited to making one change at a time, derivations precede in steps, with the output of each step functioning as the input to the next one. The derivation converges when it is no longer possible to improve on the input, given the assumed constraints and their ranking.

5.1 Deriving the locative facts

To derive the locative facts, I import from Section 4 the assumption that /ŋka/ is the preferred allomorph. In addition, I assume the following constraints: *CCC, *NCV(C)NC, PRIORITY, MAX, and REALIZEMORPHEME ((61, Kurisu 2001:37). This analysis does not take into account the mora-counting aspect of suppletive allomorphy; the successes and failures of the serial analysis are clear enough from the aspect of allomorphy that depends on the type of stem-final segment.

(61) **REALIZEMORPHEME (REALIZEMORPH)**:
Every underlying morpheme must receive some phonological exponence.

In a serial analysis, we want the following order of operations to occur. First, the locative morpheme is inserted. Which morpheme is inserted depends on the constraint *CCC: if insertion of the preferred /ŋka/ would result in violation of *CCC, /la/ is inserted instead. Following insertion of the locative allomorph, predictable allomorphy occurs. The input /wuntu+ŋka/, for example, is realized as [wuntu-ka]. One ranking capable of deriving this order of operations follows in (62).

(62) REALIZEMORPH ≫ *CCC ≫ PRIORITY ≫ *NCV(C)NC ≫ MAX

This ranking ensures that morpheme insertion happens first, and that which morpheme is inserted depends on *CCC. As shown in (63), if insertion of the preferred allomorph /ŋka/ would result in a *CCC violation (*[majtan-ŋka]), /la/ is inserted instead.

(63) Step 1: REALIZEMORPH, *CC ≫ PRIORITY prefers insertion of /la/ for /majtan/

/majtan+LOC/ LOC = {$/\text{ŋka}/_1 > /\text{la}/_2$}	REALIZE MORPH	*CCC	PRIORITY	*NCV(C)NC	MAX
☞ a. [majtan-la_2]			*		
b. [majtan-ŋka_1]		*!			
c. [majtan]	*!				

In Step 2 of this derivation, [majtan-la_2] maps to [majtan-ta_2], in accordance with high-ranked *CL (31). I do not show this step of the analysis here.

This same ranking predicts that a word like /wuntu/ should take the allomorph /ŋka/, and that nasal cluster dissimilation should follow allomorph selection. In Step 1 of the derivation (64), PRIORITY prefers the insertion of /ŋka/. Although insertion of /ŋka/ results in a *NCV(C)NC violation, PRIORITY outranks *NCV(C)NC, so this violation is tolerated.

in this section also apply to an OT-CC-based analysis.

(64) Step 1: PRIORITY prefers insertion of /ŋka/ for /wuntu/

/wuntu+LOC/ LOC = {/ŋka/$_1$ > /la/$_2$}	REALIZE MORPH	*CCC	PRIORITY	*NCV(C)NC	MAX
a. [wuntu-la$_2$]			*!		
☞ b. [wuntu-ŋka$_1$]				*	
c. [wuntu]	*!				

In Step 2, the ranking *NCV(C)NC ≫ MAX compels nasal cluster dissimilation. Deletion of the second nasal (65a) is preferable to leaving it intact (65b).

(65) Step 2: *NCV(C)NC ≫ MAX compels nasal cluster dissimilation

/wuntu-ŋka/	REALIZE MORPH	*CCC	PRIORITY	*NCV(C)NC	MAX
a. [wuntu-ŋka]				*!	
☞ b. [wuntu-ka]					*

Step 3 of this analysis involves lenition of /k/ to [w], resulting in [wuntu-wa].

An analysis like this one, in which the analysis is serial, succeeds because it allows different markedness constraints to be satisfied in different ways, according to where in the derivation they become relevant. The ranking *CCC ≫ PRIORITY comes into effect first, and ensures that potential violations of *CCC are averted by using the "wrong" allomorph. The ranking *NCV(C)NC ≫ MAX comes into effect after allomorph selection and ensures that potential violations of *NCV(C)NC are resolved through deletion.

5.2 The topicalization clitic /mpa/

As shown in Section 3.2.1, the topicalization clitic /mpa/ participates in nasal cluster dissimilation. Examples demonstrating deletion of the suffix-initial nasal (66a,b), as well as its retention when the stem does not contain a nasal-stop sequence (66c,d), are repeated from (9) below.

(66) Nasal cluster dissimilation with the topicalization clitic /mpa/

a.	/munti+mpa/	→	[munti-pa]	'really-TOP'	(34)
b.	/t̪aŋkaɽ+mpa/	→	[t̪aŋkaɽ-pa]	'enough-TOP'	(34)
c.	/n̪ula+mpa/	→	[n̪ula-mpa]	'at this-TOP'	(240)
d.	/paɽaː+mpa/	→	[paɽaː-mpa]	'long time-TOP'	(273)

The ranking in (62) easily accounts for this data. In Step 1 of the derivation (67), /mpa/ is affixed to the stem. The fact that affixation is permitted in forms like (66b) shows that REALIZEMORPHEME dominates *CCC: it is better to realize the topicalization morpheme, even though this results in a marked triconsonantal cluster. (PRIORITY is no longer relevant, as the topicalization morpheme has only one basic allomorph, so I omit it from the tableaux that follow.)

(67) Step 1: REALIZEMORPHEME ≫ *CCC compels insertion of /mpa/ in /t̪aŋkaɽ+mpa/

/t̪aŋkaɽ+mpa/ TOP = /mpa/$_1$	REALIZE MORPH	*CCC	*NCV(C)NC	MAX
☞ a. [t̪aŋkaɽ-mpa$_1$]		*	*	
b. [t̪aŋkaɽ]	*!			

In Step 2 of the derivation (68), the rankings *CCC ≫ MAX and *NCV(C)NC ≫ MAX compel deletion of the suffix-initial consonant.

(68) Step 2: *CCC ≫ *NCV(C)NC ≫ MAX compels nasal cluster dissimilation

/t̪aŋkaɻ-mpa/	REALIZE MORPH	*CCC	*NCV(C)NC	MAX
a. [t̪aŋkaɻ-mpa]		*!	*	
☞ b. [t̪aŋkaɻ-pa]				*

The problem for this analysis comes from the observation that /mpa/ does not attach to a consonant-final root if that consonant-final root does not contain a preceding nasal-stop cluster. Wordick's description is extremely clear on this point. Apropos of the data point in (66b) (analyzed in (67-68), he writes the following (p. 34):

> "The reader should understand that this is not simply a reduction of an impossible tri-consonantal cluster to a disyllabic [sic] one: the topic clitic will just not fit on words ending in a consonant with no immediately preceding nasal plus stop cluster [...] Gilbert Bobby [a native speaker] tells me that the only thing you can do in this case is to use the emphatic clitic in its place."[7]

I take Wordick's statement to mean that deletion is a possible way to satisfy *NCV(C)NC, but that it is not a possible way to satisfy *CCC. This is parallel to the facts for the locative suffix: suppletion, rather than deletion, is the attested response to *CCC. The difference here is that the topicalization clitic /mpa/ has no other allomorphs. If affixing /mpa/ would violate *CCC (and not *NCV(C)NC), the word is impossible, and speakers resort to other strategies.

The present analysis fails to make the necessary distinction between these two types of consonant-final word. Given hypothetical /maʈaɻ+TOP/, the current ranking predicts Step 1 of the derivation to involve morpheme insertion (69) and Step 2 to involve reduction of the triconsonantal cluster through deletion (70). But this, according to Wordick, is not what happens.

(69) REALIZEMORPHEME ≫ *CCC compels insertion of /mpa/ in /maʈaɻ+LOC/

/maʈaɻ+LOC/ TOP = /mpa/$_1$	REALIZE MORPH	*CCC	*NCV(C)NC	MAX
a. [maʈaɻ-mpa$_1$]		*		
☞ b. [maʈaɻ]	*!			

(70) Step 2: *CCC ≫ MAX compels reduction of the triconsonantal cluster

/maʈaɻ-mpa	REALIZE MORPH	*CCC	*NCV(C)NC	MAX
a. [maʈaɻ-mpa]		*!		
💣 b. [maʈaɻ-pa]				*

[7]The emphatic clitic is /pa/. How can we tell that it really is a different morpheme? Because the /p/ of emphatic /pa/ lenites, but the /p/ of topicalization /mpa/ does not (compare /munti+mpa/ → [munti-pa] 'truly-TOP' to /munti+pa/ → [munti-wa] 'truly-EMP' (225)). In rule-based terms, /p/ lenition counterfeeds nasal cluster dissimilation (which in turn feeds /k/ lenition). I have not been able to find an example of the emphatic attaching to a [ɾ]-final word to confirm that the morpheme-initial /p/ lenites there too, but this is what's expected given Wordick's description.

One way to account for the non-realization of forms like /maʈaɾ+mpa/ could be to introduce MPARSE ((71), Prince & Smolensky 2004) and rank it beneath MAX.

(71) **MPARSE**:
Assign one * to the null output.

This analysis correctly predicts that the null output is optimal, given the input /maʈaɾ+LOC/ (72). But it also incorrectly predicts that the null output is optimal given input /t̪aŋkaɾ+mpa/ (73): non-realization has now become the preferred realization for all C-final words.

(72) Step 1: MPARSE, *CCC ≫ MAX results in the null output for /maʈaɾ+LOC/

	/maʈaɾ+LOC/ TOP = /mpa/$_1$	REALIZE MORPH	*CCC	*NCV(C)NC	MAX	MPARSE
	a. [maʈaɾ-mpa$_1$]		*!			
	b. [maʈaɾ]	*!				
☞	c. ⊙					*

(73) Step 1: MPARSE, *CCC ≫ MAX results in the null output for /t̪aŋkaɾ+mpa/

	/t̪aŋkaɾ+LOC/ TOP = /mpa/$_1$	REALIZE MORPH	*CCC	*NCV(C)NC	MAX	MPARSE
☹	a. [t̪aŋkaɾ-mpa$_1$]		*!	*		
	b. [t̪aŋkaɾ]	*!				
💣	c. ⊙					*

The problem here is the ranking *CCC ≫ MAX. This analysis makes the prediction that CCC clusters, when not avoidable through suppletion, should be resolved through deletion (or through the null parse, if MAX ≫ MPARSE). While *CCC ≫ MAX is necessary to account for the behavior of the locative forms, it is problematic for the topicalized forms. With *CCC ≫ MAX in place, there is no way to account for the behavior of /mpa/. Thus while a serialist analysis is capable of deriving the locative facts, it fails when we consider other cases of phonologically-conditioned morphology in the language (see Embick 2010: Ch. 5 on the importance of whole-language analysis). The related phenomena in the locative and the topicalization paradigms show us that no respectable phonological analysis of suppletive allomorphy is workable.

5.3 A morphological analysis

What, then, should be the analysis of the topicalization clitic? One option is that the distribution of this topicalization clitic could be governed by a Vocabulary Insertion rule. A possibility for how this rule could be written follows in (74): /mpa/ can be inserted given a vowel-final stem or a stem with an immediately preceding nasal-stop cluster (regardless of whether or not it's consonant-final).

(74) Vocabulary insertion rule for topicalization clitic
[TOP] ↔ / {V __ , NCV(C) __}

Under this analysis, nasal cluster dissimilation remains a part of regular phonology, and does not play a role in determining whether or not /mpa/ is inserted. This analysis succeeds because it divorces regular phonology from the considerations that govern morpheme insertion.

6 Some other cases of PCSA in Yindjibarndi

While the locative suffix constitutes one major and interesting case of PCSA in Yindjibarndi, there are several other suffixes that exhibit PCSA. All cases of PCSA in Yindjibarndi reference two phonological factors: length of the stem (monosyllabic vs. bimoraic vs. longer), and syllabicity of the final segment. We can represent the phonological space used for PCSA as a table, with two cross-cutting factors; an example for the locative morpheme, attached to common nouns, is in (75).

(75) Visualization of suppletive allomorphy in the locative

	Final segment	
Length	C	V
σ	/la/	/ŋka/
$\sigma_\mu\sigma_\mu$	/la/	/ŋka/
Longer	/la/	/la/

In what follows, I expand the scope of the paper by discussing two additional cases of PCSA: the objective case clitic when attached to common nouns, and the vocative. (A third case of PCSA in the inchoative verbalizer is discussed by Wordick pp. 86-89; due to its complexity, I do not discuss it here.) I show that allomorphy in the objective and vocative depends on the same factors as in (75), but neither case can be construed as fully optimizing. These facts lend further support to morphological analyses of PCSA.

6.1 The objective case clitic

The objective case clitic, when affixed to a common noun, can be realized as either /ji/ or /ku/. The preferred allomorph is /ji/ when the stem contains two syllables, each with a short vowel, and ends with /i/ or /a/ (76a,b). The preferred allomorph is /ku/ in all other cases: when the stem is consonant-final, monosyllabic or trimoraic and longer, or ends with /u/ (76c-f). Note that in many of these cases, lenition processes obscure the form of the morpheme. The lenition process affecting /ku/ (76d-f) is familiar from the discussion in Section 3.2.2. The alternation in (76a) is reflective of a further lenition process affecting intervocalic /j/: it deletes when the preceding vowel is high (/i/ or /u/) and the following vowel is /i/.

(76) Examples of the objective case clitic

a.	/pari+ji/	→	[pari-i]	'devil-OBJ'	(27)
b.	/muɭa+ji/	→	[muɭa-ji]	'meat-OBJ'	(56)
c.	/puɽkuɳ+ku/	→	[puɽkuɳ-ku]	'close smoke-OBJ'	(66)
d.	/t̪aː+ku/	→	[t̪aː-u]	'mouth-OBJ'	(18)
e.	/warapa+ku/	→	[warapa-u]	'grass-OBJ'	(31)
f.	/waɽu+ku/	→	[waɽu-u]	'night-OBJ'	(32)

This distribution is visualized in (77); note that breaking down the category of V into [+back] and [-back], while not necessary to characterize suppletion in the locative, is necessary for the objective.

(77) Distribution of the objective case allomorphs, for common nouns

	Final segment		
Length	C	V	
		[+back]	[-back]
σ	/ku/	/ku/	/ku/
$\sigma_\mu\sigma_\mu$	/ku/	/ku/	/ji/
Longer	/ku/	/ku/	/ku/

Is this distribution optimizing? Along the mora-counting dimension, the answer is pretty clearly no: there is no phonotactic reason why insertion of /ji/ should be preferred to /ku/ for a subset of bimoraic stems (see Embick 2010: Ch. 5 for discussion of similar cases). Along the segmental dimension, however, the answer is potentially yes.

Consider what would happen if /ku/, clearly the default allomorph, were affixed to a bimoraic, disyllabic word that ends with /i/ or /a/. The prediction, given /k/ lenition, is that /k/ should delete in these cases; recall that the only environment in which /k/ lenites to [w] is between [u] and [a]. Thus we predict that hypothetical /pari+ku/ would be realized as [paɾi-u], and hypothetical /muɭa+ku/ would be realized as [muɭa-u]. Is there any a priori reason to believe that these vowel sequences are dispreferred? No: Wordick notes (p. 19) that both [au] and [iu] are licit vowel sequences, and that both occur within morphemes, as in [mau-] 'cut' and [ciuɾa] 'bony bream'.

But is there any quantitative evidence that [iː] is preferred to [iu], and [aji] to [au]? On this point, the data are more interesting. Counts for vowel sequences from Wordick's lexicon are in (78): it is clear that long vowels (in black) are more frequent than sequences of short vowels. Based on this, we might conclude that /ji/ attaches to /i/-final words because doing so allows for the creation of a long vowel (as in [paɾi-i]) rather than an [iu] sequence (as in hypothetical [paɾi-u]).

(78) Frequency of long vowels and short vowel sequences in Yindjibarndi

		V_2			
		/a/	/i/	/u/	
	/a/	276	5	39	
V_1	/i/	9	32	7	
	/u/	1	4	53	(/oː/: 2)

In addition to this, [aji] is more common in Wordick's lexicon (n=78) than is [au] (n=39). Based on this, we might hypothesize that /ji/ attaches to /i/-final words because doing so allows an [aji] sequence to surface, instead of the less frequent [au].

With the variation according to [±back] accounted for, we need to ask why /ji/ can only attach to vowel-final stems. The likely answer is that /j/ appears only rarely after another consonant (there are six instances of [lj] in Wordick's lexicon), while /k/ appears more frequently and after a diverse set of segments (n=310; consonants that can precede [k] include [l ɾ ɻ j ɲ ɳ n ŋ t ʈ c]). It thus makes phonotactic sense that /ku/ attaches to consonant-final roots, as consonant clusters with [k] as the second member are generally more acceptable than are clusters with [j] as the second member.

The objective case provides us with an example in which the distribution of allomorphs is partially optimizing. While the mora-counting aspect of suppletion receives makes no obvious sense from a phonological standpoint, the aspect related to segmental factors could potentially be explained through reference to constraints on segment sequencing.

6.2 The vocative

The two suppletive allomorphs for the vocative suffix are /ji/ and /u/. The /ji/ allomorph attaches to stems that are bimoraic or longer (79a,b), the /u/ allomorph attaches to monomoraic stems (79c), and both /ji/ and /u/ are both licit for stems that are trimoraic or longer (79d,e).

(79) Examples of the vocative case marker

a.	/kuwa+ji/	→	[kuwa-ji]	'come here-VOC'	(111)
b.	/kaku+ji/	→	[kaku-i]	'Norman-VOC'	(111)
c.	/pa+u/	→	[pa-u]	'hey-VOC'	(111)
d.	/jinpiɾpa+ji/	→	[jinpiɾpa-i]	'Long Mack-VOC'	(111)
e.	/jinpiɾpa+u/	→	[jinpiɾpa-u]	'Long Mack-VOC'	(111)

One limitation on the vocative's distribution is that it only attaches to vowel-final stems. Given a consonant-final root, the vocative meaning is expressed only by intonation (Wordick p. 111). I summarize the distribution of the vocative morphemes in (80).

(80) Distribution of vocative allomorphs

	Final segment	
Length	C	V
σ_μ	(intonation)	/u/
$\sigma_\mu\sigma_\mu$	(intonation)	/ji/
Longer	(intonation)	/ji/, /u/

Some aspects of this distribution can be explained through reference to phonotactic restrictions. The failure of /ji/ to appear after consonant-final roots is not surprising; this same generalization was observed for the objective clitic and can be attributed to the general inability of /j/ to appear as the second member of a consonant cluster. But the distribution of /u/ and /ji/, and the failure of [u] to appear as an allomorph of the vocative following consonant-final roots, is more surprising.

First, there is no obvious phonotactic reason for /u/ to be the preferred allomorph for monosyllabic interjections and /ji/ to be the preferred allomorph for bimoraic, disyllabic forms. Second, there is no obvious reason why suffixing /u/ to a consonant-final root should be prohibited. Counts from the lexicon show that there are 417 [u]-final words and 197 consonant-final words; if anything, realizing the vocative as [u] following a consonant-final stem would improve the phonotactic profile of that word. Third and finally, if the distribution of /u/ and /ji/ were truly optimizing, we might expect to see their distribution depend on the [±back] value of the word-final vowel, as is the case for the objective case clitic.

Allomorphy in the vocative, like the objective, has both optimizing and non-optimizing aspects. The failure to realize /ji/ on consonant-final stems makes phonotactic sense, but the variation between the two allomorphs, and the failure to realize /u/ on consonant-final stems, does not.

6.3 Local summary

By considering more cases of PCSA in Yindjibarndi, we see the same phonological factors (stem length and identity of the final segment) recur as conditioning factors in the distribution of suppletive allomorphs. It is not the case, however, that the distribution of suppletive allomorphs is always optimizing: while some aspects of suppletive allomorphy in the objective and vocative make phonotactic sense, others do not. One possible conclusion to draw from this is that the fully optimizing distribution of allomorphs in the locative may be no more than a coincidence.

7 Conclusion

In summary, Yindjibarndi locative allomorphy supports analyses of phonologically conditioned suppletion as a morphological process (Paster 2006, Embick 2010, *a.o.*). The distribution of allomorphs receives a simple analysis if we treat suppletive allomorphy and predictable allomorphy as separate processes, one implemented in the morphological component of the grammar and the other implemented in the phonological component of the grammar. The argument for this analysis is not based on analytic principles or the fit of a theory to the typology. It is based on the fact that reasonable phonological analyses of locative suppletion fail. The broader point this paper makes is that even apparently optimizing cases of PCSA ought to receive morphological analyses (following authors such as Paster 2006, Embick 2010, Gouskova et al. 2015).

A secondary point coming out of this paper, echoing a point raised by Embick (2010: Ch. 5), is that it is necessary to consider cases of PCSA as part of an overall system of suppletive allomorphy, and to not analyze them in isolation. This is particularly important in Yindjibarndi, where all cases of suppletive allomorphy depend on the same two phonological factors: length of the stem and identity of the final segment. While the majority of this paper focused on locative suppletion, consideration of the topicalization clitic /mpa/ led to rejection of the serial analysis, and consideration of the objective and vocative paradigms allowed us to see that while all cases of PCSA refer to the same two phonological factors, the distribution of suppletive allomorphs does not always have a phonotactic motivation, and thus cannot always receive a reasonable phonological analysis.

Even given this conclusion, it is worth asking why, if PCSA in Yindjibarndi is not governed by the phonological grammar, so many aspects of suppletion appear to occur in response to (and in turn satisfy) phonotactic constraints. Across the three suffixes discussed here, for example – the locative, the vocative, and the objective – the suppletive allomorphs are distributed in such a way so as to minimize the size of consonant clusters and to respect constraints on cluster distribution. I follow Embick (2010:21) here in assuming that these generalizations arise as the result of factors like diachrony and acquisition. Concretely, I hypothesize that optimizing distributions of suppletive allomorphs are easier for the learner to acquire than non-optimizing distributions. One possible reason for this could have to do with the timeline of phonological acquisition. It is widely believed that phonotactic learning is the first stage of phonological acquisition (Mehler et al. 1988, Jusczyk et al. 1994, Jusczyk et al. 1999, a.o.), meaning that the learner must acquire its phonotactic grammar based on morphologically simplex as well as complex forms. If the distribution of suppletive allomorphs is in line with the language's regular phonology, then the learner has a more internally consistent input to learn from; a non-optimizing distribution of allomorphs would mean that, in the early stages of acquisition, the learner would have to contend with many more exceptional forms. The hypothesis then is that an internally consistent input is easier for the learner to generalize across, and that over time, this learning bias causes patterns of suppletive allomorphy to fall in line with generalizations observed in the regular phonology. Verifying that this hypothesis is plausible will, however, have to await further work.

Abbreviations

LOC	locative case marker
EMP	emphatic clitic
ABL	ablative case marker
OBJ	objective case clitic
TOP	topicalization clitic
DIR.ALL	direct allative case marker

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