THE MĀORI PASSIVE AND GERUNDIVE: AN OT ANALYSIS AND CORPUS STUDY

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Conventions

Throughout this work, I will utilize conventions to present information in a consistent manner. Some of these conventions will be familiar to anyone with a background in Linguistics, and others are my own. They are as follows:

IPA underlying representations (UR): /fakaːɾa/, /–ia/
IPA surface representations (SR): [fakaːɾa], [–ia]
Orthographic representations: <whakāra>, <whakära>, <whakaara>, *etc.* (faithfully copying from the source either the macron, umlaut, or double letters indicating a long vowel)
Māori orthography in text: *whakāra* (with only the macron, out of preference)
Morphemes: /–ia/, /–aŋa/, /faka–/, *etc*.
Allomorphs in text: *–kia, –kanga, whaka–, etc*.
Incorrect SR: **hopu–ka*
Reconstructed word or phoneme: *ike, *k

1 Introduction

The Māori passive and gerundive alternations have been the cause of substantial debate since their first general description by Williams (1862)[1844]. Owing to a complicated state of affairs, competing proposals ad treatments have been advanced by Biggs 1961; Hohepa 1965[1967]; Hale 1968, 1973, 1991; Kiparsky 1971; Kenstowicz and Kissberth 1979:171–174; McCarthy 1981; Sanders 1990, 1991; Harlow 1991; Bauer 1993; Blevins 1994; Kibre 1998; and Jones 2008. Much of this literature directly or indirectly concerns the most appropriate framework in which to analyze the alternations: a morphological one, in which allomorphs are discrete representations of morphophonemic subclasses, or a phonological one, in which the distribution of allomorphs is regulated through abstract phonological rules or constraints. As such, these alternations have become a focal point in a wider discourse on the efficacy of generative phonology, its shortcomings, and whether it is suited to account for alternations that are difficult to derive through general and universal phonological principles.

There are sixteen regular allomorphs of the passive, most a combination of an initial 'thematic consonant'[1] followed by [-ia]. Among consonantal allomorphs, those formed with non-labial nasals are not entirely regular: those with the velar nasal are realized as *–ngia* and *–nga*, while those with the alveolar nasal are realized as *–ina* and *–na*. In addition to these, there are two alternants which are not formed with a thematic consonant at all, the allomorphs *–ia* and *–a*. There are four alternants which possess a *–Cina* shape, which I do not analyze here. The twelve passive allomorphs I analyze in this work are presented in (1).

(1) The passive alternants

	Active	*Passive*	*Active Def.*	*Source*[2]
1.	*mahue*	*mahue–**tia***	'to leave'	(Dict)
2.	*hopu*	*hopu–**kia***	'to catch'	(W:59)
3.	*ngaro*	*ngaro–**mia***	'to destroy'	(Dict)
4.	*whao*	*whao–**whia***	'to put into, fill'	(Dict)
5.	*(ti)tiro*	*tiro–**hia***	'to look'	(W:65)
6.	*tau*	*tau–**ria***	'to come to rest'	(Dict)
7.	*mahi*	*mahi–**ngia***	'to work'	(W:73)
8.	*kai*	*kai–**nga***	'to eat'	(W:61)
9.	*wera*	*wera–**ina***	'to love'	(Dict)
10.	*āki*	*āki–**na***	'to beat, pound'	(Dict)
11.	*hinga*	*hinga–**ia***	'to fall'	(W:61)
12.	*hoko*	*hoko–**a***	'to barter'	(W:58)

Though Māori makes significant use of zero-nominalization to form nouns from verbs and adjectives, the gerundive suffix has the distinction of being one of the most productive

[1] 'Thematic' like the stem-final vowels *a*, *o*, *u*, and *e* which characterize the first, second, third, and fourth declensions of Latin nouns, respectively. The use of 'thematic' to designate the initial consonants in passive and gerundive allomorphs is aligned closely with the notion of allomorphs as purely morphological entities, although it has become standard nomenclature regardless of analytical framework.

[2] For shorthand when presenting data, I use (Dict) to refer to the *Te Aka Māori Dictionary* online, and (W:pp) to refer to Williams (1862:pp).

suffixes in Māori, alongside the passive (Harlow 2007:121). Like the passive, the gerundive has a number of allomorphs, both those with initial thematic consonants and those without. In general, there is agreement between the thematic consonant of a stem's passive allomorph and that of its corresponding gerundive. Stems which form the passive with a vocalic allomorph or those including the non-labial nasals often take *–nga* in the gerundive. The gerundive alternations I analyze in this thesis are laid out in (2), alongside each stem's corresponding passive for comparison.

(2) The gerundive alternants alongside passives (sources are for gerundives)

	Active	*Passive*	*Gerundive*	*Gerundive Def.*	*Source*
1.	*mahue*	*mahue–**tia***	*mahue–**tanga***	'survivors'	(Dict)
2.	*hopu*	*hopu–**kia***	*hopu–**kanga***	'capture, arrest'	(Dict)
3.	*ngaro*	*ngaro–**mia***	*ngaro–**manga***	'destruction'	(Dict)
4.	*whao*	*whao–**whia***	*whao–**whanga***	'filling'	(K:7)[3]
5.	*(ti)tiro*	*tiro–**hia***	*tiro–**hanga***	'view, sight'	(Dict)
6.	*tau*	*tau–**ria***	*tau–**ranga***	'resting place'	(Dict)
7.	*mahi*	*mahi–**ngia***	*mahi–**nga***	'workplace'	(Dict)
8.	*kai*	*kai–**nga***	*kai–**nga***	'leftovers'	(Dict)
9.	*wera*	*wera–**ina***	*wera–**nga***	'burning'	(Dict)
10.	*āki*	*āki–**na***	*āki–**nga***	'beating'	(Dict)
11.	*hinga*	*hinga–**ia***	*hinga–**nga***	'fall, defeat'	(Dict)
12.	*hoko*	*hoko–**a***	*hoko–**nga***	'barter, exchange'	(Dict)

In addition to being numerous, the consonantal passive allomorphs have an extraordinarily uneven distribution that is often at odds with the initial consonants' overall distribution in the language. In a count by Sanders (1990:165), 25% of stems took the *–tia* allomorph, which is notable considering that [t]'s overall frequency in Māori is only 9.8%. In the same count, on the other hand, the *–kia* allomorph accounted for 1.9% of stems, whereas [k]'s overall frequency is much higher at 7.9%. The distribution of the allomorphs *–tia*, *–hia*, *–ngia*, and *–a*, in addition to other facts, have led researchers to argue these allomorphs have become unmarked and achieved 'default' status in the modern language (see Hale 1973, 1991; Sanders 1990, 1991; and Blevins 1994 for debate on these), while discrepancies between distributions of less productive allomorphs and the frequencies of their initial consonants (as is the case with *–kia*) is evidence that these allomorphs are gradually being overtaken by the more productive default forms. Great discrepancies between the frequencies of consonant-initial allomorphs and those consonants' frequencies in the language, as well as the prevalence of the default allomorphs *–tia*, *–hia*, *–ngia*, and *–a*, suggest that there are factors other than purely phonological ones which have some influence on the distribution of passive allomorphs.

A phenomenon first noted by Williams (1862), stems can form the passive with a single allomorph while others do so with several, as shown by examples such as *whao* 'to put into' → *whao–na*, *whao–ngia*, *whao–ria*, *whao–whia*, *whao–whina* (Dict). I call this phenomenon 'multiple allomorphy' and use this term throughout the rest of this work. All passive allomorphs participate in multiple allomorphy, yet there are some regularities. Many examples of multiple

[3] (K:7) = Kibre (1998:7)

allomorphy contrast a less productive passive allomorph with one that is much more productive, such as the stem *hopu* 'to catch' → *hopu–a*, *hopu–ngia*, *hopu–kia*, *hopu–kina* (W:59), where the uncommon *–kina* appears alongside much more productive forms. Other examples contrast a less common but nonetheless productive allomorph with one or several of the default allomorphs, as in the stem *timata* 'to begin' → *timata–ia*, *timata–ngia*, *timata–ria*, *timata–hia*, *timata–tia* (W:58), where the consonantal default allomorphs (*–tia*, *–hia*, and *–ngia*) are contrasted with two less frequent ones (*–ia* and *–ria*). The tendency for stems to form the passive with several allomorphs is further evidence that phonological influences alone are insufficient to account for the whole picture of passive allomorphy.

Additional factors beyond these present difficulties to a working analysis. Hale (1973) provided six pieces of evidence that *–tia* holds some default status in the language, and this evidence suggests that not only has *–tia* become increasingly productive among regular stems, but that is has also spread to a number of morphological environments and grammatical constructions as an innovation. Nominal stems used spontaneously in the passive regularly take the default allomorph *–tia*. Causative verbs derived from bare stems by means of the prefix *whaka–* also commonly take *–tia* in the passive, yet these verbs exhibit conflicting tendencies. Data show these can form the passive exclusively with the allomorph(s) of the uninflected stems, with the allomorph *–tia* in addition to the bare stem's passive allomorph(s), exclusively with *–tia* regardless of the bare stem's allomorph(s), or with a different and occasionally unproductive allomorph entirely. Postverbal adverbials agreeing with the governing verb take *–tia*, as do unassimilated loan words and passivized prepositional phrases, although counterexamples are plentiful. In addition to these innovative uses of *–tia*, the default allomorphs *–tia* and *–a* appear to have a weight-sensitive distribution. *–a* is a default for bimoraic stems, and *–tia* is a default for trimoraic stems and larger (Blevins 1994). *–hia* and *–ngia* have assumed the role of *–tia* in a separate dialect of Māori, and these allomorphs can be found in many of the same morphological environments as *–tia* (Blevins 1994). However, data show they do not have the same weight-sensitive distribution, showing there are discrepancies even among the default allomorphs.

When taken together, these phonological and morphological factors indicate an incredibly complicated state of affairs. Regarding which type of analysis—a phonological one or a morphological one—is best to account for these facts, many earlier works conclude that a morphological analysis is the most appropriate to answer questions like the distribution of allomorphs, multiple allomorphy, and the existence of default forms (see Biggs 1961; Hohepa 1965; Hale 1973, 1991; and Kenstowicz & Kissberth 1979:171–174). Proponents of a phonological analysis counter that to settle on a morphological analysis is to ignore obvious phonological contexts in which the allomorphs appear (see Hale 1968; Sanders 1990, 1991; Blevins 1994; and de Lacy 2003). Still more scholars have expressed their desire to break from this dichotomy by putting forth alternative analyses that are a combination of the phonological and the morphological or that belong to other analytical frameworks entirely.[4]

In this thesis, I provide a comprehensive account of passive and gerundive allomorphy, addressing such issues as allomorph shape, the uneven distribution of allomorphs, the existence of defaults, and multiple allomorphy in general. The primary aim of this thesis is to present an account of the Māori passive and gerundive alternations within the framework of parallel Optimality Theory (henceforth OT, Prince & Smolensky 1993/2004). It will be shown that coda

[4] See Kibre (1998) for an analysis utilizing lexical relatedness morphology (LRM), parallel distributed processing (PDP), and dual source inheritance (DSI) models. Also see Jones (2008) for a computational approach using artificial neural networks to predict which allomorphs appear with which stems.

deletion, cross-morpheme vowel deletion and gliding, nasal metathesis, and non-labial nasal haplology resulting in deletion successfully account for the attested alternations of the passive and gerundive. However, to propose an OT analysis with these repairs requires several highly specific constraints referencing both morphological boundaries and phonological features, casting doubt on claims that purely phonological analyses devoid of morphological conditions are preferable.

Kibre (1998) writes that 'Maori [h]aplology and [m]etathesis are difficult to motivate from universal principles and seem to require the arbitrary rewriting power of the traditional generative rule formalism. This phonological unnaturalness ultimately suggests that these alternations belong as much to morphology as phonology' (Kibre 1998:21). The findings of this thesis—specifically that more natural (i.e. general) constraints are incapable of deriving the attested alternations—corroborate Kibre's claim. To advocate for the specific constraints introduced in the analysis and to prove that more general constraints are unable to successfully derive the alternations, I present a number of alternatives and demonstrate how they fail to derive the attested outputs. While this 'phonological unnaturalness' suggests a working analysis cannot be formulated without some reference to the morphology, I do not believe this constitutes grounds that a morphological analysis is preferable. Rather, I advocate for a phonological origin of the alternations, and I argue that a phonological analysis is most suitable for deriving the alternations of the passive and gerundive, although this analysis is one in which the morphology plays an uncommonly central role, typologically speaking. Like other proponents of a phonological analysis, I argue that a morphological analysis fails to account for obvious phonological environments which condition allomorphy and misses key generalizations about the allomorphs.

However, as will be shown, a phonological analysis alone is insufficient to account for the entire picture of passive and gerundive allomorphy. With the analysis in place, I turn to other facts of the language deserving of consideration: allomorph distribution, the prevalence of default allomorphs, and multiple allomorphy in general. To account for these, I argue in favor of Hale's (1973, 1991) claim that a morphological resegmentation of the boundary separating stem and suffix occurred sometime after the loss of consonantal codas in the language. In effect, this created competing 'morphemes,' which have gradually spread to other stems through the effects of levelling, producing the complicated situation seen today in regards to allomorph distribution, the default allomorphs, and multiple allomorphy. It will be shown that these facts are difficult to account for under alternative proposals. Thus, I argue that while a phonological analysis is most appropriate to derive the shape of allomorphs, such an analysis is a model of a previous state of the language. This phonological origin and analysis of the past system accurately derive allomorph shape but cannot account for the current state of allomorphy, evidence that the representations of stems and suffixes have since changed.

With the intention of further analyzing the effects of resegmentation, the second goal of this thesis is to present a preliminary corpus study of Māori stems and the full range of their passive allomorphs. The focus of this corpus study is to provide a description of allomorph distribution, the default allomorphs, and multiple allomorphy, with the aim of lending support to the hypothesis that a morphological resegmentation has occurred. The corpus study shows that multiple allomorphy is much more complicated and widespread than has been previously thought. These data show that Hale's (1973, 1991) claims regarding the morphological contexts where *–tia* operates as a default allomorph and Blevins' (1994) claim regarding the weight-sensitive distribution of *–tia* and *–a* are indeed correct, though there are counterexamples

suggesting allomorphy is more nuanced than can be adequately summarized with such broad generalizations.

While allomorph shape, the uneven distribution of allomorphs, prevalence of default suffixes, and multiple allomorphy contribute to a complicated image of passive and gerundive allomorphy in modern Māori, I argue that a prior state of the language can be approximated by analyzing the distribution of passive allomorphs. Despite a morphological resegmentation, data show that phonological influences continue to regulate the distribution of allomorphs, consistent with the phonological origin hypothesis. Therefore, I argue that the most appropriate analysis in which to view the alternations consists of two parts: the first, a phonological origin in which the alternants were derived by means of phonological and morphological influences, and the second, a morphological resegmentation followed by leveling (after Hale 1973, 1991).

1.1 Methodology and data

The data in this thesis were compiled from a number of print and online sources. I first consulted Williams (1862) and gathered all verbs with passive endings from the lexicon. I checked these verbs against the *Te Aka Māori Dictionary* online (https://maoridictionary.co.nz/), which lists all the passive allomorphs of a queried verb stem in modern usage. To learn how the passive allomorphs for each verb had been compiled, I reached out to several people involved with the *Te Aka Māori Dictionary*. Unfortunately, the dictionary's compiler died several years ago. For this reason, I am not aware of how passive data were gathered for every stem.

If a verb in Williams (1862) was listed with a passive allomorph that did not appear in the *Te Aka Dictionary*, the allomorph in Williams was discarded in favor of the allomorph(s) in the online dictionary. Although concerned about losing or manipulating data, I found there were not many instances of this. Because Williams (1862) contained only 151 passivizeable stems, I sought additional print and online sources for stems and checked them against the dictionary. Since the inclusion of a given verb stem and those allomorphs was predicated upon their being found in the *Te Aka Dictionary*, these forms are cited as belonging to the dictionary, although they ultimately come from a number of sources.

Presented with a scarcity of data, I reached out to Dr. Ray Harlow for assistance. He provided me with two sources: collections of Māori-only newspapers from the 19th and 20th centuries (available at https://nzdl.org), and a Word file of *He Hokinga Mahara*, an all-Māori autobiography published by Longman Paul (1990) and written by Hēmi Pōtatau, a notable Māori soldier, writer, and minister. With the help of Dr. Stanton, this document was converted to a .txt file, and letters with umlauts were converted into ASCII letters that were non-Maori orthography (*ä*, *ë*, *ï*, *ö*, and *ü* were substituted for *b*, *x*, *q*, *z*, and *d*, respectively). After this had been done, all non-ASCII characters were removed. I decided searching for the passive allomorphs in string-final position was the best way to conduct the search, since there is no attribute shared by all Māori verbs which we could have searched for. We scanned the document for words containing the following strings in word-final position:

(3) Queried passive strings

a.	kia, hia, tia, ria, whia, mia, nia, ngia	← to find *–Cia* allomorphs
b.	iia, eia, aia, oia, uia	← to find vowel-only allomorphs
c.	ia, ea, aa, oa, ua	← to find reduced vowel-only allomorphs
d.	ina, inga	← to find metathesized nasal allomorphs
e.	na, nga	← to find reduced nasal allomorphs

This query returned 1,304 forms. After converting the non-Māori ASCII characters back into their respective vowels (this time with macrons: *b*, *x*, *q*, *z*, and *d* were replaced by *ā*, *ē*, *ī*, *ō*, and *ū*, respectively), I searched for the potential active stems in the *Te Aka Dictionary* in the same way as before. If for a given form the configuration of verbal root + passive morpheme could be analyzed in multiple ways (e.g., the form *hiahiatia* can be analyzed as *hiahia–tia* or *hiahiati–a*, the form *turumakina* as *turuma–kina* or *turumaki–na*, etc.), each of the possible active stems were searched for. If a form could not be found in the online dictionary, it was discarded for lack of an alternative way to identify the word. Once a verb stem and its passive allomorph(s) had been gathered, I searched for that stem's probable gerundive forms in the *Te Aka Dictionary*, since nouns formed from verb stems by means of the gerundive suffix are typically listed in dictionaries as their own entries.

Data in this thesis are not URs and SRs, but rather active, passive, and gerundive surface forms. For the purposes of presenting the data in IPA (which corresponds to the Māori phonemic inventory given by Harlow 2007), several substitutions have been made for the orthography: [ŋ] for <ng>, [ɾ] for <r>, and [f] for <wh>. Long vowels are indicated by the IPA symbol [:] as opposed to umlaut <ä>, macron <ā>, or double vowels <aa>. Acoustic analyses of Māori vowels show numerous distinctive diphthongs, each with falling sonority (Maclaghan et al. 2004). In the data, these are indicated with a diacritic, as in [ai̯], [ae̯], [ao̯], [au̯], [ei̯], and [ou̯], and adjacent vowels without diacritics should be viewed as separate vowels in hiatus. While Māori contains a number of long diphthongs, like [a:i̯], these are not present in the data.

I conclude this section with a note on citations. Most data in this work are cited as belonging to two sources only: *First Lessons in the Maori Language with a Short Vocabulary* by Williams (1862) and the *Te Aka Online Māori Dictionary*. As in the data in (1) and (2), these sources are given abbreviated citations when citing data. Citations from Williams (1862) appear as the initial 'W' followed by page number (i.e., *hopu* 'to catch' (W:59)). Citations from *Te Aka Dictionary* simply appear as (Dict) for every form, since there are no page numbers in the online source (instead, each verb stem must be searched for individually). If information other than data is cited from Williams (1862) or the *Te Aka Dictionary*, an abbreviated citation is used with a footnote clarifying the entire citation (i.e., (K:7) = Kibre (1998:7)).

1.2 Roadmap

§1 lays the groundwork for analysis and introduces the reader to the goals of this work and methodology for how the data were collected. The analysis of the passive and gerundive is taken up in §2.1, discussion of alternative constraints in §2.2, and conclusion along with a discussion of complications in §2.3. In §3, I argue that a syntagmatic reanalysis of the passive and gerundive must have occurred at some point after the loss of consonantal codas in Māori (following Hale 1968, 1973, 1991). This reanalysis is argued to be the cause of uneven distributions among passive forms, the origin of default suffixes *–tia*, *–hia*, *–ngia*, and *–a*, and the cause of multiple allomorphy in general. In §4, I discuss a larger corpus study of Māori passive alternations that supports both the OT analysis presented in §2 and the syntagmatic reanalysis discussed in §3. §5 concludes.

2 The Passive and Gerundive: an OT analysis

This section presents the proposed analysis of the passive and gerundive (§2.1). In the course of analysis, it will be shown that several specific constraints are required. These

constraints are treated to an examination of their own (§2.2), where I evaluate more general alternatives to these and demonstrate how they fail to achieve the desired results. I close this section with a complication of the analysis and concluding thoughts (§2.3).

2.1 The analysis: a previous state of Māori

What follows in this section is an OT analysis of twelve of the sixteen passive allomorphs and all the gerundive allomorphs. The following subsections are organized as follows. §2.1.1 provides an analysis of the thematic *–Cia* and *–Canga* allomorphs. §2.1.2 focuses on the vocalic passive alternants *–ia* and *–a* and the gerundive allomorphs *–anga* and *–nga* after stems ending in short vowels, diphthongs, and long vowels. The nasal passive alternations *–ngia*, *–nga*, *–ina*, and *–na* are examined in §2.1.3, and non-labial nasal gerundive haplology is examined in §2.1.4. To simplify the presentation of data in §2.1.1 and §2.1.2 for the reader, I present alternations of the passive first followed by alternations of the gerundive compared to those of the passive. In §2.1.3, I present nasal passive alternations, and in §2.1.4, I present nasal gerundive alternations.

It is important to remember that while this analysis is an attempt to derive the allomorphs, it is a model of a previous state of the language. In this previous state, underlying consonants were present stem-finally on a number of stems. While these consonants originally belonged to stems, data from the corpus study and claims made by Hale (1973, 1991) and Blevins (1994) suggest that the UR of stems and passive and gerundive suffixes has since changed. For the remainder of §2, I treat initial consonants as belonging to stems under the assumption that I am modeling an earlier state of the language. I hope to demonstrate in §4 that it can no longer be the case that consonants belong to stems (following Hale 1973, 1991), since the distribution of allomorphs, the default suffixes, and the full range of multiple allomorphy would be difficult to account for if this were not the case.

2.1.1 *–Cia* and *–Canga* alternations

In (4), thematic consonants in passive allomorphs engage in consonant-zero alternation with the active stem. In addition, a reduplicated first syllable goes unexpressed whenever the passive is added (Williams 1862); I do not analyze this reduplicated dropping.

(4) Thematic *–Cia* passives

	Active	*Passive*	*Active Def.*	*Source*
1.	(pu)puɾi	puɾi**–tia**	‘to hold’	(W:63)
2.	hopu	hopu**–kia**	‘to catch’	(W:59)
3.	ŋaɾo	ŋaɾo**–mia**	‘to destroy’	(Dict)
4.	tau̯	tau̯**–ria**	‘to come to rest’	(Dict)
5.	fao̯	fao̯**–fia**	‘to put into, fill’	(Dict)
6.	(ti)tiɾo	tiɾo**–hia**	‘to look’	(W:65)

Six of Māori’s ten consonant phonemes are present in *–Cia* allomorphs: [t], [k], [m], [ɾ], [f], and [h]. As is evident from the lack of closed syllables in the data, Māori, like other Polynesian languages, possesses a ‘(C)V(V(V))’ syllable structure (Harlow 2007). A phonological analysis to these alternations was first proposed by Hale (1968), who argued that a diachronic change from closed to open syllables in Proto-Oceanic can account for the absence of consonants in uninflected forms, although the idea that the active stems once ended in these

consonants was not new (see Churchward 1928). Proponents of a phonological analysis have mostly followed Hale in the argumentation that these consonants belong to stems (Sanders 1990, Blevins 1994, de Lacy 2003, Kibre 2008, and others).[5] Without suffix material, stem-final consonants are lost in the course of derivation. The theory that these consonants once existed stem-finally entails that the UR for the passive is /–ia/,[6] and that these consonants appear when the passive is suffixed to the stem. The same is true for the gerundive (5).

(5) Thematic *–Canga* gerundives compared to *–Cia* passives (sources are for gerundives)

	Active	*Passive*	*Gerundive*	*Gerundive Def.*	*Source*
1.	(pu)puɾi	puɾi**–tia**	puɾi**–taŋa**	'retention'	(Dict)
2.	hopu	hopu**–kia**	hopu**–kaŋa**	'capture, arrest'	(Dict)
3.	ŋaɾo	ŋaɾo**–mia**	ŋaɾo**–maŋa**	'destruction'	(Dict)
4.	tau̯	tau̯**–ɾia**	tau̯**–ɾaŋa**	'resting place, mooring'	(Dict)
5.	fao	fao̯**–fia**	fao**–faŋa**	'filling'	(K:7)[7]
6.	(ti)tiɾo	tiɾo**–hia**	tiɾo**–haŋa**	'view, sight'	(Dict)

In (5), thematic consonants in *–Canga* gerundive alternations participate in consonant-zero alternation with the stem, like the *–Cia* passive alternations presented in (4). With /–ia/ established as the passive UR and thematic consonants being stem-final, the UR for the gerundive would appear to be /–aŋa/.

An analysis of the data should begin by proposing a constraint against codas (6).

(6) *CODA: assign one violation for every coda present in an output candidate.

The presence of consonants in passive and gerundive allomorphs and the consonant-zero alternations between inflected and uninflected forms is evidence that stem-final consonants undergo deletion to avoid incurring a violation of the highly-ranked *CODA. I propose the constraint MAX, which militates against deletion (7).

(7) MAX: assign one violation for every segment in the input that does not correspond to a segment in the output.

To ensure that stem-final consonants are deleted, *CODA must be ranked higher than MAX. The result of this constraint ranking can be seen below on bare, uninflected stems (8).

[5] Since my own treatment of thematic consonants is similar to most other phonological analyses, I decline to discuss other proposals in this section. For proposals with a slightly different take on thematic consonants, see Blevins (1994) for an analysis in an autosegmental framework, and see de Lacy (2003) for an analysis in which [-t-] epenthesizes to abide by prosodic restrictions on PrWd formation.

[6] de Lacy (1996:6) claims that '/i/ is the most common epenthetic vowel in Polynesian languages,' and so there is a possibility that the passive /i/ is epenthetic. However, I take issue with this theory on the basis of the alveolar nasal allomorph *–ina*. If /i/ were epenthetic, there would be no reason for this vowel to epenthesize within the stem following suffixation of /–a/. As such, I do not consider this possibility, although more on this in §2.1.3.

[7] (K:7) = Kibre (1998:7)

(8) Consonant deletion in (4.2) /hopuk/ ‘to catch’ (W:59)

/hopuk/	*CODA	MAX
a. hopuk	*! W	L
b. ☞ hopu_		*

The more faithful of the two, candidate (a) incurs a fatal violation of *CODA due to a stem-final /-k/. Candidate (b) deletes the marked coda and incurs a less-costly violation of MAX. Therefore, candidate (b) is optimal.

Stem-final consonants surface faithfully when the passive is suffixed to the stem (9).

(9) No consonant deletion in (4.2) /hopuk+ia/ ‘to catch’ (W:59)

/hopuk+ia/	*CODA	MAX
a. ☞ hopuk+ia		
b. hopu_+ia	e	*! W

In (9), candidate (a) is optimal compared to candidate (b), which has incurred a fatal violation of MAX for unnecessarily deleting the stem-final consonant. Underlying stem-final consonants also surface faithfully when the gerundive is suffixed to the stem (10).

(10) No consonant deletion in (5.2) /hopuk+aŋa/ ‘capture, arrest’ (Dict)

/hopuk+aŋa/	*CODA	MAX
a. ☞ hopuk+aŋa		
b. hopu_+aŋa	e	*! W

Candidate (a) is optimal since it has incurred no violations. Candidate (b), on the other hand, suffers an unnecessary and fatal violation of MAX for deleting the thematic consonant /k/.

Evidence from other Polynesian and Austronesian languages support the hypothesis that thematic consonants originally belonged to stems. First, there are languages such as Malay, Ilocano, and Tagalog which have not removed stem final consonants. Stems from these languages often show the same final consonant as the thematic consonant present in the etymologically-related Māori stem’s passive and gerundive forms. Second, in languages from this family which did delete final consonants, such as Samoan, the same passive alternations can be seen between stems from these languages and those from Māori. Data on both these points are presented below, with comparisons between Malay, Ilocano, Samoan, and Māori (11).

(11) Alternations in Austronesian languages (data from Krupa 1968, Samoan from Cook 1996)

Māori	*Gloss*	*Malay*	*Ilocano*	*Samoan*	*Reconstructed PAN*
inu**–mia**	‘drink–PASS’	minum	uminom	—	*inum
tanu**–mia**	‘plant, bury–PASS’	tanam	—	tanu**–mia**	*tanem
taŋi**–hia**	‘cry–PASS’	taŋiskan	agsaŋit	—	*taŋis

2.1.2 *–ia*/*a* passive and *–anga*/*nga* gerundive alternations

In the previous subsection, the constraint ranking *CODA » MAX was shown to account for the consonant-zero alternations exhibited by *–Cia* and *–Canga* allomorphs. This section continues the analysis by examining causes of allomorphy following vowel-final stems. This subsection finds that deletion is the main repair for markedness problems induced by suffixation to a vowel-final stem. Gliding occurs when the passive is suffixed to stems ending in /-a/.

Passive alternations following stems ending in long vowels are presented in (12).

(12) No deletion after /V:/-final stems in passives

	Active	*Passive*	*Active Definition*	*Source*
1.	pa:	pa:**–ia**	'to be connected'	(Dict)
2.	ta:	ta:**–ia**	'to dump, strike'	(Dict)
3.	hi:	hi:**–ia, –a**	'to raise up, fish'	(Dict)
4.	ki:	ki:**–ia, –a**	'to say, speak, express'	(Dict)
5.	he:	he:**–ia**	'to be wrong, mistake'	(Dict)
6.	to:	to:**–ia**	'to drag, haul'	(Dict)
7.	ɾu:	ɾu:**–ia**	'to shake, quiver'	(Dict)

In (12), the passive UR /–ia/ surfaces faithfully after most stem-final long vowels. There is reduction of the passive-initial /i/ in (12.3) and (12.4) following /-i:/, although data show this is optional. A number of /i:/-final stems from the corpus study have *–ia* as their only vocalic passive allomorph: *rī* 'to screen, protect' → *rī–ia* (Dict), and *pī* 'to slight, ignore' → *pī–ia* (Dict), suggesting either the default allomorph *–a* has spread to stems in (12.3) and (12.4) as an innovation (see §3 and §4.3 for the discussion of morphological reanalysis and *–a* default allomorphy, respectively), or that the passive /i/ is optionally lost to reduction after identical long vowels. Since /i:/-final stems seem to take the reduced *–a* with more regularity than is to be expected if *–a* were simply spreading, I propose optional reduction leads to the loss of /i/ after /-i:/, and that this change does not result from an OCP-like effect (see de Lacy 2003). If this were an obligatory OCP, we should expect to find only the *–a* allomorph with stems ending in /-i:/, as the *–ia* allomorph has not become unmarked or spread to other stems (see §4.3). Since this reduction appears to be optional, I do not analyze it further.

The gerundive suffix behaves like the passive following long vowels (13).

(13) No deletion after /V:/-final stems in gerundives

	Active	*Passive*	*Gerundive*	*Gerundive Definition*	*Source*
1.	pa:	pa:**–ia**	pa:**–aŋa, –ŋa**	'connections'	(Dict)
2.	ta:	ta:**–ia**	ta:**–aŋa, –ŋa**	'time/place of beating'	(Dict)
3.	hi:	hi:**–ia, –a**	hi:**–aŋa**	'fishing'	(Dict)
4.	ki:	ki:**–ia, –a**	ki:**–aŋa**	'act of speaking, saying'	(Dict)
5.	he:	he:**–ia**	he:**–aŋa**	'error, mistake'	(Dict)
6.	to:	to:**–ia**	to:**–aŋa**	'place something is hauled'	(Dict)
7.	ɾu:	ɾu:**–ia**	ɾu:**–aŋa**	'shaking'	(B:48)[8]

[8] (B:48) = Blevins (1994:48)

Likewise, there is no obligatory deletion for the gerundive.[9] For the gerundive, there is the same optional reduction of /a/ after /-aː/-final stems in (13.1) and (13.2) that was seen in the case of the passive /i/ after /-iː/ in (12.3) and (12.4). In *Te Aka Māori Dictionary*, these optionally reduced forms are orthographized as <pānga> and <tānga>, which I see as an orthographic convention and not as evidence of these vowels being obligatorily deleted. If deletion of /V$_i$/ following /-V$_i$ː/ were obligatory, then there should be no *–ia* allomorph following stems ending in /-iː/, but data show this is not the case; in fact, sometimes *–ia* is these stems' only allomorph. To answer whether it is truly the case that the gerundive /a/ optionally or obligatorily reduces after /-aː/-final stems or whether these spellings are due to orthographic convention alone, one would need access to native speakers; future work will have to be dedicated to answering this question.

When it comes to the passive and gerundive's behavior following short vowels and diphthongs, the attested repair strategies are slightly different depending on the nature of the stem-final and suffix-initial vowels. In the case of the passive, there is gliding after /-a/ (14).

(14) Gliding after /a/-final stems in passives

	Active	*Passive*	*Active Definition*	*Source*
1.	tiːmata	tiːmata–**i̯a**	'to begin'	(W:58)
2.	hiŋa	hiŋa–**i̯a**	'to fall'	(W:61)
3.	paŋa	paŋa–**i̯a**	'to throw, toss'	(Dict)
4.	tapa	tapa–**i̯a**	'to name'	(Dict)
5.	maka	maka–**i̯a**	'to throw'	(W:71)

As opposed to no change in the passive following long vowels (12), the passive surfaces as [–i̯a] following the [+low] vowel /-a/ in (14).[10] In these examples, [i̯] is a part of a diphthong with a stem-final [-a]. Of great importance to the analysis of the passive is the finding that /a+i/ is always a diphthong where /i/ is the first vowel of the passive (Harlow 2007:74).

However, after diphthongs and other short vowels, the passive-initial vowel deletes (15).

[9] Blevins (1994:48) notes that after long vowels the initial vowel of the gerundive is optionally deleted if the stem-final vowel is [–back], and obligatorily deleted after long /-aː/. The alternations she provides for stems ending in long [–back] vowels can be found in *Te Aka Dictionary* with both optionally-reduced and non-reduced forms: *kīnga ~ kīanga* 'act of speaking, saying' and *hēnga ~ hēanga* 'error, mistake' (Dict), supporting her claim. However, these are the only optionally-reduced gerundives I have been able to find, so I believe these reduced forms are the result of leveling (see §4) or perhaps another orthographic convention.

[10] One commonly-cited stem, *noho* 'to sit, stay' (Dict), forms the passive with *–ia*, in addition to several other irregular forms. This is the only /o/-final stem in Māori that I have found which takes *–ia*. Other Polynesian languages have /o/-final stems which take *–ia* in the passive, however, suggesting that /-a/ and /-o/ may have behaved similarly in Proto-Polynesian or Proto-Oceanic. However, the overwhelming evidence that /-o/ conditions deletion in Māori shows that an analysis without deletion following /-o/ is at odds with the language.

(15) Deletion after diphthong- and other vowel-final stems in passives

	Active	*Passive*	*Active Definition*	*Source*
1.	(ha)haɐ̯	haɐ̯**–a**	‘to appear, shine’	(Dict)
2.	taɐ̯	taɐ̯**–a**	‘to arrive’	(W:57)
3.	ŋauᵢ	ŋauᵢ**–a**	‘to bite’	(Dict)
4.	hi:koi̯	hi:koi̯**–a**	‘to step’	(Dict)
5.	(wa)wa:hi	wa:hi**–a**	‘to break open’	(Dict)
6.	piki	piki**–a**	‘to climb, ascend’	(W:59)
7.	afe	afe**–a**	‘to surround’	(Dict)
8.	kawe	kawe**–a**	‘to carry’	(Dict)
9.	ɾapu	ɾapu**–a**	‘to search for’	(Dict)
10.	hoko	hoko**–a**	‘to barter’	(W:58)

In (15), no stem accepts *–ia* as an allomorph, and there is no gliding. Instead, the /i/ of the passive deletes in all cases. Like the passive, deletion affects the first vowel of the gerundive following diphthongs and short vowels (16). Unlike the passive, however, the initial /a/ of the gerundive suffix cannot not glide to form a diphthong with the preceding vowel, as in (14).

(16) Deletion after vowel-final and diphthong-final stems in gerundives

	Active	*Passive*	*Gerundive*	*Gerundive Definition*	*Source*
1.	ti:mata	ti:mata**–i̯a**	ti:mata**–ŋa**	‘beginning’	(Dict)
2.	taɐ̯	taɐ̯**–a**	taɐ̯**–ŋa**	‘arrival’	(Dict)
3.	ŋauᵢ	ŋauᵢ**–a**	ŋauᵢ**–ŋa**	‘biting, gnawing’	(Dict)
4.	hi:koi̯	hi:koi̯**–a**	hi:koi̯**–ŋa**	‘stride’	(Dict)
5.	(wa)wa:hi	wa:hi**–a**	wa:hi**–ŋa**	‘prologue, prelude’	(Dict)
6.	afe	afe**–a**	afe**–ŋa**	‘serfs’	(Dict)
7.	ɾapu	ɾapu**–a**	ɾapu**–ŋa**	‘search, inquiry’	(Dict)
8.	hoko	hoko**–a**	hoko**–ŋa**	‘barter, exchange’	(Dict)

To recapitulate these data, suffixation following vowel-final stems in (12) and (13) shows that the first vowel of the passive and gerundive does not delete after stem-final long vowels. After short vowels and diphthongs, the case is different. For the passive, there is gliding following short [+low] vowels (14), and deletion following other short vowels and diphthongs (15). For the gerundive, there is deletion after all diphthongs and short vowels (16). However, both deletion and gliding must be conditioned by the length of the preceding vowel in addition to another factor, since not all hiatus is marked, as is seen in the *–Cia* allomorphs of the passive (4), or for example in the reduplicated form *tuitui* ‘to sew’ (W:68). Māori allows hiatus morpheme-internally, as well as across word boundaries (e.g., *karu ika* [kaɾu#ika] ‘fish eye lens’ (Dict)), suggesting the constraint against hiatus is demarcative, or sensitive to the presence of the morpheme boundary separating the active stem and suffix.

There are numerous languages which employ these same repairs to resolve hiatus across morpheme and word boundaries. For example, certain Greek prefixes ending in vowels lose said vowels when affixed to verb stems beginning in vowels or glides: /kata+éɾxome/ → [katéɾxome]

(see Philippaki-Warburton 1970:64–68). For another example, in Chicano Spanish (see Bakovič 2006), hiatus can also be resolved by deletion: *paga Evita* 'Evita plays' (/a#e/ → [e]), while gliding also occurs given a licit vowel combination: *me urge* 'it is urgent to me' (/eu/ → [ju]) (data from Bakovič 2006). Therefore, these repairs and the cross-morpheme nature of the relevant constraint are well attested cross-linguistically.

I call the markedness constraint that forbids hiatus across a morpheme boundary *[–long]+V$_1$. The definition for this constraint is given below (17).

(17) *[–long]+V$_1$: assign one violation for every instance of two vocalic segments juxtaposed across a morpheme boundary where the first is [–long] and the second is the first vowel of the following morpheme.

This constraint assigns one violation to an output candidate for every instance of the offending sequence the candidate possesses. For this to compel the deletion of a suffix-initial vowel following [–long] vowels and diphthongs, it must dominate MAX (18).

(18) Vowel deletion in (15.9) /ɾapu+ia/ 'to search' (W:72)

	/ɾapu+ia/	*[–long]+V$_1$	MAX
a.	ɾapu+ia	*! W	L
b.	☞ ɾapu+_a		*

In the tableau above, candidate (a) incurs a fatal violation of *[–long]+V$_1$ since it contains the sequence /u+i/. Candidate (b), which deletes the suffix-initial vowel instead, is optimal. This same suffix-initial deletion affects the gerundive (19).

(19) Vowel deletion in (15.7) /ɾapu+aŋa/ 'search, inquiry' (Dict)

	/ɾapu+aŋa/	*[–long]+V$_1$	MAX
a.	ɾapu+aŋa	*! W	L
b.	☞ ɾapu+_ŋa		*

In the tableau above, candidate (a) incurs a fatal violation of *[–long]+V$_1$. Candidate (b) is optimal since it deletes a vowel from the gerundive, incurring a less-costly violation of MAX.

Suffix-initial vowels are deleted not only following short vowels, but following diphthongs as well, as seen in (15.2–4) and (16.2–4). While the proposed markedness constraint *[–long]+V$_1$ would seemingly miss this, there is evidence to suggest that Māori diphthongs and long monophthongs are underlyingly composed of a sequence of two unlike vowels (see Bauer (1993:543–545) for a full account of the debate). Two analyses of Māori diphthongs and long vowels have been advanced by Biggs (1961), who argues that there could either be ten vowel phonemes in all—five short vowels and five long vowels—or that there are no diphthongs or long vowels at all, and what appear to be diphthongs and long vowels are in fact sequences of two short vowels in the UR. The second view has come to be favored by most experts on Māori.

Support for Bigg's first proposal comes from the finding that long vowels differ from short vowels in both length and quality, while the second proposal has support in gliding across morpheme and word boundaries (see Harlow 2007 for more information), as in the case of the passive following /a/-final stems. Although I dispute that long vowels are composed of two

identical vowels in the UR, assuming that diphthongs are underlyingly two separate vowels requires every one of Māori's short and long diphthongs to end in a short vowel. Therefore, the second segment in every surface diphthong is a [–long] vowel. In addition, since Māori requires diphthongs to fall in sonority, with examples like [ai̯], [ae̯], [ao̯], and [ei̯], the second vowel in a diphthong must also be [–low]. When taken together, assuming that diphthongs are two unlike vowels in the UR, there is no way the initial vowel of the passive could come into contact with a second segment of a surface diphthong that is not [–low, –long]. This is the same natural class that stem-final short vowels /e, i, o, u/ belong to, thus providing a basis for their shared phonological behavior. The tableau below shows the derivation of a passivized stem ending in a surface diphthong (20).

(20) Vowel deletion in (14.2) /tae+ia/ 'to arrive' (W:57)

	/tae+ia/	*[–long]+V$_1$	MAX
a.	tae+ia	*! W	L
b.	☞ tae+_a		*

Here, candidate (a) incurs a fatal violation of *[–long]+V$_1$ since it has cross-morpheme hiatus involving a short vowel and the first vowel of the suffix. Candidate (b) chooses instead to delete the suffix-initial vowel, so it is optimal.

As it stands, there is no formalized reason why the first vowel of the passive and gerundive should delete as opposed to the stem-final vowel. In a derivation, deletion of either of the two vowels would repair the marked /[–long]+V$_1$/ sequence (21).

(21) Variable vowel deletion in (14.9) /ɾapu+ia/ 'to search' (W:72)

	/ɾapu+ia/	*[–long]+V$_1$	MAX
a.	ɾapu+ia	*! W	L
b.	☞ ɾap_+ia		*
c.	☞ ɾapu+_a		*

Data show that the first vowel of the passive is always deleted. This would suggest a positional faithfulness (Beckman 1998)—possibly instantiated in a high-ranking IO-MAX(stem)—prevents deletion of stem material. However, data on the gerundive show sporadic instances of stem-final vowel deletion as opposed to suffix-initial vowel deletion, contradicting this hypothesis. A few of these examples are shown below in (22).

(22) Gerundive forms with stem-final vowel deletion

	Active	*Passive*	*Active Def.*	*Gerundive*	*Gerundive Def.*	*Source*
1.	(pu)puhi	puːhi–**a**	'to shoot'	puh–**aŋa**	'shooting'	(Dict)
2.	uhi	uːhi–**a**	'to cover'	uːh–**aŋa**	'covering'	(Dict)
3.	aːɾahi	aɾahi–**na**	'to lead, escort'	aɾah–**aŋa**	'leading'	(Dict)

Unless examples of suffixation such as these are shown to be irregular, or that there is a cause of these particular alternations (which I am unaware of; other 'irregular' stems showing lengthening or shortening in a first vowel delete the stem-final vowel, in line with the analysis),

then it would be undesirable to formulate a reason why stem vowels do not delete, since to do so would miss these alternations. Additionally, formalizing a preference for stem material by means of a positional faithfulness would complicate the analysis of gerundive haplology (§2.1.4). For the remainder of this work, with the explicit knowledge that the passive-initial vowel always deletes and that the gerundive-initial vowel deletes in a large majority of cases, I limit my constraint sets to exclude outputs where the stem-final vowel is deleted. Although not ideal, I argue there is no apparent way to formalize a choice in vowel deletion, and that it is questionable whether to do so is even desirable on the basis of the evidence in (22).

Stem-final long vowels do not result in violations of *[–long]+V$_1$, as indicated by the absence of deletion in (12) and (13). The evidence is consistent with Biggs' first theory in which Māori has ten vowel phonemes: five short vowels and five long counterparts. Under this theory, it is still possible to analyze diphthongs as two unlike vowels in the UR. In this case, short diphthongs are the SR of two short unlike vowels, as in /a+i/, while long diphthongs are the SR of an initial long vowel and one short vowel, as in /a:+i/. Data on gliding is consistent with this hypothesis: there are cases of morpheme-internal hiatus where vowels which would be expected to form a diphthong according to the grammar's specifications fail to do so, leaving two separate vowels (Harlow 2007:69). That hiatus can fail to form a diphthong morpheme-internally but rarely fails to do so in a cross-morpheme context given a licit vowel combination is further evidence that diphthongs are sequences of short vowels.

This analysis adequately captures the fact that there is no deletion after long vowels (23).

(23) No vowel deletion in (12.7) /ɾu:+ia/ 'to scatter, sow' (Dict)

	/ɾu:+ia/	*[–long]+V$_1$	MAX
a.	☞ ɾu:+ia		
b.	ɾu:+_a	e	*! W

In the tableau above, candidate (a) is the more faithful of the two and incurs no violations. Therefore, it is optimal. Candidate (b), on the other hand, has deleted the initial vowel of the passive without motivation, incurring a fatal violation of MAX.

The view that there exist vowel phonemes with a [+long] feature is at odds with the prevailing theory (originating with Biggs 1961) that Māori has only five vowel phonemes—/a/, /e/, /i/, /o/, and /u/—and long vowels and diphthongs are a succession of these vowels in the UR. One of the undesirable outcomes of accepting this theory is that long vowels would have to be analyzed as two identical short vowels underlyingly. Following a short vowel is the same environment in which deletion occurs under the given analysis (24).

(24) Undue deletion with [V:] > /VV/ in (12.6) /to:+ia/ 'to drag, haul' (Dict)

	/too+ia/	*[–long]+V$_1$	MAX
a.	☹ too+ia	*! L	W
b.	💣 too+_a		*
c.	too+__	e	**! L

Assuming long vowels are two short vowels, candidate (b) is the preferred output in this derivation. However, the attested output is candidate (a), which does not delete /i/. This analysis is unable to derive the correct outputs for stems terminating in these 'long' vowels when

assuming they are two short vowels underlyingly. Such a theory would not be able to account for the shared behavior of short vowels and diphthongs to the exclusion of long vowels based on length or weight alone; therefore, I argue following Biggs (1961) that long vowels must exist in Māori and that the underlying [+long] feature belonging to these vowels is what differentiates them from short vowels and diphthongs. While discussing alternative constraints in §2.2, I argue that a formalization of *[–long]+V1 to make reference to two short vowels encounters problems that are easier solved by positing long vowels instead of making *[–long]+V1 more specific.

To continue with the analysis, while /i/ is deleted following the short vowels /-e/, /-i/, /-o/, /-u/ and diphthongs and surfaces faithfully following long vowels, there is gliding after stems ending in /-a/, seen in examples such as (14.3) /paŋa+ia/ 'to throw, toss' → [paŋa–i̯a] (Dict). This is evidence to suggest a violation of a general Ident constraint, one that militates against changes in syllabicity (25).

(25) Ident[±syllabic]: assign one violation for every [syllabic] value which has changed from input to output.

This constraint must be ranked lower than MAX or else deletion would be the less costly repair. The only reason gliding with a corresponding violation of Ident[±syllabic] is not the chosen repair for all sequences of /V+V/ is due to language-particular restrictions on syllabification and gliding. In Māori, syllabification depends on several factors, including vowel quality, rate of speech, and formality register (Harlow 2007:74), yet Māori also appears to have a gradient preference for syllabification, complicating the issue further. It appears that syllabification and gliding are more likely for sequences of /a+a/, /Vi+Vi/, and /a+V/, but less likely for other eligible sequences such as /o+i/, /e+i/, /e+u/, etc. In addition, for syllabification or gliding to occur, there are specifications which need to be met in regards to the nature of the morpheme boundary and the morphemes in question. The sequence /a+a/ appears as [a:] in the case of reduplication, when the causative prefix *whaka–* is prefixed to an /a/-initial stem, and for sequences of base+particle and particle+base. However, /a+a/ does not seem to form long vowels in the case of suffixes. This explains why—although /a+a/ is likely to form a long vowel—it does not do so for the /a/-initial gerundive and an /a/-final stem. Similarly, the sequence /Vi+Vi/ can appear as a long vowel in the case of reduplication, but not for suffixes, explaining why /i+i/ does not form a long vowel for the /i/-initial passive following /i/-final stems. The sequence /a+V/ is always a diphthong where Vi is the /i/ of the passive, and /a+V/ commonly forms diphthongs in the case of the causative prefix as well. Lastly, other /Vi+Vj/ combinations where Vi is not /a/ are entirely restricted to morpheme-internal contexts, and these cannot appear cross-morphemically (see Harlow (2007:74–75) for a comprehensive overview of syllabification and gliding). Since other candidates that are not as optimal as /a+i/—such as /e+i/, /i+i/, /o+i/, and /u+i/—cannot undergo gliding in this cross-morpheme context, deletion occurs instead: (15.6) /piki+ia/ 'to climb' → [piki–a] (W:59), cf. *[piki:a].

It is vital that gliding affects the first segment of the passive. Consider a verb stem terminating in a surface diphthong, such as the verb *ngau* [ŋau̯] 'to bite' (Dict). Although the second element in the diphthong surfaces as a [–syllabic] segment, stems ending in a diphthong always take *–a*, evidence that the vowel /i/ is always deleted here. Therefore it is crucial that gliding occurs *across* the morpheme boundary. If it does not, there is a violation of *[–long]+V1 regardless if the preceding segment is [–syllabic] in the output. In the case of stem-final /-a/, this analysis adequately captures cross-morpheme gliding.

(26) Gliding in (14.2) /hiŋa+ia/ ‘to fall’ (W:61)

	/hiŋa+ia/	*[–long]+V1	MAX	Ident[±syllabic]
a.	hiŋaia	*! W	e	L
b.	hiŋa_a	e	*! W	L
c.	☞ hiŋaia			*

Candidate (a) earns a fatal violation of *[–long]+V1 on account of hiatus across the morpheme boundary. As a result, this candidate is eliminated. Candidate (b), which deletes the initial /i/ of the passive, suffers a fatal violation of MAX since there exists a less-costly repair. Gliding of /i/ is chosen by candidate (c), incurring a less-costly violation of Ident[±syllabic], and for this reason candidate (c) is selected by the grammar.

The constraint raking *[–long]+V1 » MAX » Ident[±syllabic] presented in this subsection successfully accounts for the passive alternations following vowel-final stems. Before closing this subsection, I wish to mention two morphemes which appear to be superficially contradictory to the analysis. These are reduplicants and the causative prefix *whaka–*. Both these morphemes show hiatus in cross-morpheme contexts, suggesting *[–long]+V1 is at odds with the grammar of Māori. However, I argue the data show these comply with the proposed analysis. For reduplicants like *ua–ua* ‘to be difficult, demanding’ (Dict), I argue a high-ranking BR-MAX constraint prevents deletion in spite of hiatus. While Harlow (1991) has argued that a pattern of first vowel lengthening in some reduplicated forms, as in /RED+taweke/ ‘linger’ → [ta:–we–weke] ‘slow, dilatory’ (Harlow 1991:127), should be analyzed as reduplication of the first syllable followed by deletion of the repeated consonant (/RED+taweke/ → ta–tawe–weke → [ta–Øawe–weke]), I argue this lengthening must be caused by another sound change based on differences in consonant deletion among cases of haplology in Māori (see the analysis of gerundive haplology in §2.1.4 for an argument why it is doubtful this lengthening can be attributed to same-consonant deletion). Other than these cases of lengthening, there are no other alternations suggesting a high-ranking BR-MAX is violated for reduplicants.

For the causative prefix, the prefix-final vowel /-a/ often forms diphthongs and long vowels with stem-initial vowels just like the passive following stem-final /-a/, yet data show that the causative sometimes fails to do so. The causative also does not take part in stress assignment. While Māori words typically assign stress according to complicated weight-to-stress rules (see Harlow 2007 for more information), data show the causative does not receive stress at all unless the final /a-/ forms a diphthong or long vowel with a stem-initial vowel, in which case the resulting heavy syllable is stressed (Harlow 2007:82–84). Therefore, examples like *whakairo* ‘carved pattern’ [fa.ˈkaj̯.ɾo] coexist with examples like *whakairi* ‘to hang up’ [fa.ka.ˈi.ɾi] (data from Harlow 2007:74). On the basis of this evidence, I propose two things for the causative. First, the causative behaves similar to the passive following /a/-final stems in that a diphthong or the long vowel [a:] is often created with a stem-initial vowel (although long vowels are not formed for the passive). When this happens, the resulting heavy syllable receives stress. This is evidence that gliding is a preferred repair for cross-morpheme /a+V/ sequences, which is predicted by the analysis.

Second, I propose the causative is extrametrical on the grounds that it does not partake in stress assignment, it often fails to form cross-morpheme diphthongs and long vowels, and that prefixation of the causative to /a/-initial stems forms long vowels across the morpheme boundary

(albeit irregularly). When the causative fails to syllabify or glide, the extrametricality of the prefix shields the prefix-final /a/ from deletion, explaining why hiatus can remain in the cross-morpheme derived environment for the causative. This would also explain why 'long' vowels are formed across the morpheme boundary: instead of deleting the prefix-final /a/ in /a+a/ cross-morpheme hiatus (which is the case for gerundive /a+a/ hiatus, as seen in (16.1)), the prefix-final vowel remains and the sequence is pronounced as the long vowel [aː]. That this 'long' vowel is formed from two short vowels does not constitute evidence that *all* long vowels in Māori are composed of two short identical vowels, but that this sequence is merely pronounced as a long vowel. Lastly, this extrametricality explains why hiatus for the causative sometimes fails to form a diphthong despite the cross-morpheme derived environment: the pressures felt by the passive and gerundive to delete a vowel simply are not shared by the causative, and so causative /a+V/ hiatus may form a diphthong, but, unlike the passive, it is not impelled to do so. The passive and gerundive suffixes, which do condition stress and are not extrametrical, do not have recourse to this extrametricality, and therefore their initial vowels must delete or glide.

2.1.3 Non-labial nasal passive alternations

I turn now to alternations involving non-labial nasals. I present data on passive allomorphy after velar nasal-final stems first in (27) and (28).

(27) Deletion after /aiŋ/-final stems in passives

	Active	*Passive*	*Active Definition*	*Source*
1.	hapai	hapai**–ŋa**	'to lift'	(W:64)
2.	kai	kai**–ŋa**	'to eat'	(W:61)
3.	faːŋai	faːŋai**–ŋa**	'to feed, nourish'	(Dict)

In (27), the allomorph *–nga* appears after the diphthong [-ai], suggesting the /i/ of the passive has been deleted.

(28) No deletion after other /Vŋ/-final stems in passives

	Active	*Passive*	*Active Definition*	*Source*
1.	taː	taː**–ŋia**	'to dump, strike'	(Dict)
2.	kuɾa	kuɾa**–ŋia**	'to be educated'	(Dict)
3.	mahi	mahi**–ŋia**	'to work'	(W:73)
4.	heː	heː**–ŋia**	'to be wrong'	(Dict)
5.	heɾe	heɾe**–ŋia**	'to tie'	(W:71)
6.	uː	uː**–ŋia**	'to land (a vessel)'	(Dict)
7.	tohu	tohu**–ŋia**	'to instruct'	(Dict)
8.	poː	poː**–ŋia**	'to set (of the sun)'	(Dict)
9.	tao	tao**–ŋia**	'to cook'	(Dict)
10.	kino	kino**–ŋia**	'to dislike, hate'	(Dict)

The allomorph *–ngia* can be found after long and short monophthongs as well as other diphthongs (28). I was only able to find *–ngia* after one other diphthong, [-ao], shown in (28.9).

I propose that the markedness constraint forbidding [aiŋia] sequences does not have to do with marked segments or sequences *per se* but is actually one against rapid, repetitive, and 'inverted' articulations. *–ngia* surfaces faithfully in a majority of cases—including after other diphthongs—but not in the case of /aiŋia/ (/$V_iV_jNV_jV_i$/). The orthographic string <aingia> does not appear in Potatau's *He Hokinga Mahara* (1990), suggesting that sequences of this type are marked in the language more generally. A prolonged search through Harlow (2007) and the *Te Aka Māori Dictionary* online uncovered no instances of <aingia> that were not (uncommonly) formed through irregular passive suffixation. To determine if the phonological string [aiŋia] was forbidden specifically, I also searched Potatau (1990) for strings with other seemingly licit $V_iV_jNV_jV_i$ combinations: <aonoa>, <aongoa>, <aomoa>, <aenea>, <aengea>, <aemea>, <ainia>, <aimia>, <aunua>, <aungua>, <aumua>, <einie>, <eingie>, <eimie>, <eunue>, <eungue>, <eumue>, <ounuo>, <ounguo>, <oumuo>, <oinio>, <oingio>, and <oimio>. None of these returned any results. I believe this is further support for an articulatory explanation, since the fact that none of the possible strings appear in the language is evidence these sequences are marked for some shared characteristic, such as the articulations necessary to produce them.

The difficulty with the string [aiŋia] specifically may lie in accurately pronouncing a sequence which begins with a [–high, +low] vowel and transitions to one that is [+high, –low], which then requires a lowering of the velum to pronounce the nasal consonant, and then reverses the order of vowels by first pronouncing a vowel that is [+high, –low] followed by one that is [–high, +low]. The lack of other $V_iV_jNV_jV_i$ sequences is evidence that repetitive or 'inverted' articulations similar to those required for the string [aiŋia] may be banned on the basis that they are too difficult to accurately produce. I call the constraint forbidding these sequences *aiŋia for short, though this is meant to be shorthand for a more general constraint against difficult repetitive articulations required to pronounce the above strings, and this constraint does not only penalize [aiŋia] sequences. In this way, this constraint is different from, say, *[–low]+V_1, which penalizes exactly that marked sequence.

(29) *aiŋia: A candidate receives one violation for every sequence of $V_iV_jNV_jV_i$ that it contains.

This constraint dominates MAX. Deletion serves as the repair for this markedness problem, and the /i/ of the passive is deleted (30).

(30) Deletion in the case of (27.1) /hapaiŋ+ia/ 'to lift' (W:64)

	/hapaiŋ+ia/	*aiŋia	MAX
a.	hapaiŋ+ia	*! W	L
b.	☞ hapaiŋ+_a		*

Candidate (a) incurs a fatal violation of *aiŋia, while candidate (b) deletes a segment from the offending string, receiving a less costly violation of MAX. Hence, candidate (b) is optimal.

Having provided an account of velar nasal passive allomorphy, I move on to consider passive alternations involving an alveolar nasal. Data on these are shown in (31) and (33).

(31) Metathesis and gliding after /an/-final stems in passives

	Active	*Passive*	*Active definition*	*Source*
1.	aɾoha	aɾoha–**i̯na**	'to love'	(Dict)
2.	kata	kata–**i̯na**	'to laugh'	(W:64)
3.	huɾa	huɾa–**i̯na**	'to uncover (cards)'	(Dict)
4.	weɾa	weɾa–**i̯na**	'to burn'	(Dict)
5.	hua	hua–**i̯na**	'to call, name'	(Dict)

In the data above, assuming /n/ is present stem-finally like other consonants, there appears to be metathesis which reverses the order of segments from /n+i/ to [in] if the preceding vowel is /a/. The passive-initial /i/ also glides to form a diphthong with the preceding /a/, paralleling gliding after /a/-final stems.

Metathesis is well-attested in Māori, and there are examples of vowels, consonants, syllables, and even features undergoing metathesis (32). Therefore, this sound change has considerable supporting evidence language-internally, although consonant-vowel metathesis in the case of passive allomorphy is different from the metathesis of identical constituents in (32).

(32) Examples of identical-constituent metathesis in Māori (from Harlow 2007:21)

a. Vowels in adjacent syllables:
   i. *ikeike ~ ekieki* 'high, lofty'
   ii. *mahine ~ maheni* 'smooth'
   iii. *pape ~ pepa* 'make a slip in reciting a *karakia* (a charm/prayer)'
   iv. *hangehange ~ hengahenga* 'a shrub'
   v. *hukinga ~ hikunga* 'head of a valley'

b. Consonants in adjacent syllables:
   i. *honuhonu ~ nohunohu* 'nauseous'
   ii. *kāheru ~ kārehu* 'spade'
   iii. *paewhenua ~ paenehua* 'dock (the weed)'
   iv. *ngaro ~ rango* 'fly (n.)'
   v. *erangi ~ engari* 'but'
   vi. *pūrokuroku ~ pūkorukoru* 'gather up, of garments'

c. Adjacent whole syllables:
   i. *rewha ~ whare* 'eyelid'
   ii. *ngahere ~ ngarehe* 'forest'
   iii. *pūtangitangi ~ pūngitangita* 'prickle'
   iv. *kōmuramura ~ kōramuramu* 'eat at odd times'

d. Phonological features:
   i. *tenga ~ kenakena* 'Adam's apple'
   ii. *ngatu*[11] *~ nakunaku* 'crushed'
   iii. *inohi ~ unahi* 'scale of fish'

As opposed to metathesis, deletion appears to be the preferred repair if the vowel preceding the alveolar nasal is [–low] (33).

[11] This form is unattested in Māori, yet it has cognates in Rapanui and Hawai'ian.

(33) Deletion after other /Vn/-final stems in passives

	Active	*Passive*	*Active Definition*	*Source*
1.	tuku	tuku–**na**	‘to allow’	(W:57)
2.	toɾo	toɾo–**na**	‘to burn, blaze’	(Dict)
3.	huɾipoki	huɾipoki–**na**	‘to turn upside down’	(Dict)
4.	tuhituhi	tuhituhi–**na**	‘to write’	(Dict)
5.	a:ki	a:ki–**na**	‘to beat, pound’	(Dict)

The context for deletion here parallels that vowel-only allomorphy. In the data above, there is deletion of /i/ if the vowel preceding the alveolar nasal is [–low]. I was not able to find any examples of this after long vowels or diphthongs, although presumably deletion would be the same following these segments as well.[12]

In (31), the *–ina* allomorph suggests that the passive’s /i/ metathesizes with a stem-final alveolar nasal when the preceding vowel is /a/, and that the resulting /a+i/ sequence glides to form the diphthong [aɪ̯]. On the other hand, the *–na* allomorphs presented in (33) suggest that /i/ is deleted when a non-low vowel precedes the alveolar nasal in the stem. This parallels the pattern of passive gliding or deletion seen after [+low] and [–low] vowel-final stems in (14) and (15), respectively. There are two ways to analyze these alternations. The first is to hypothesize that metathesis occurs obligatorily following all vowels for /-n/-final verb stems and after the diphthong [aɪ̯] for /-ŋ/-final verb stems. Metathesized nasals would land to the right of the morpheme boundary, as in (33.1) /tukun+ia/ ‘to allow’ → /tuku–ina → [tuku–na] (Dict) and (27.1) /hapaiŋ+ia/ ‘to lift’ → /hapai–iŋa/ → [hapaɪ̯–ŋa] (W:64), resulting in vowel deletion across the morpheme boundary as specified by the constraint ranking *[–long]+V$_1$ » MAX. A derivational strategy similar to this was proposed within serial rule-based approaches to the non-labial nasal alternants (see Hale 1968 and Sanders 1990, among others), where nasal-vowel metathesis is ordered before vowel deletion so that metathesis feeds the following rule. Although there are of course differences between analyses, this represents the general proposal (see Kibre 1998:16 for a succinct yet thorough overview of rule-based approaches).

Within the framework of parallel OT, however, this succession of repairs incurs two violations—first of a linearity constraint banning the reordering of segments, and second of MAX, which bans deletion—and therefore it represents a more costly repair strategy than deletion only. This brings us to the second way to analyze non-labial nasal alternations, which is to make a distinction between two distinct repair strategies. For one strategy (which is particular to /an/-final stems), metathesis only happens if the preceding vowel would not cause the /i/ of the passive to delete. In the case of this strategy, there is metathesis followed by gliding. Under this analysis, then, metathesis only occurs for /-an/-final stems because Ident[+syllabic] is ranked low enough that the grammar will tolerate an additional violation of a linearity constraint. For the second strategy, there is only deletion since metathesis in addition to deletion is too costly. Following all [–low] vowels, as seen in (33), there is only deletion since the higher-ranked MAX would be violated regardless of whether metathesis occurs or not. I advocate for the dual repair strategy option, which is more parsimonious than a single repair strategy with obligatory metathesis followed by deletion.

[12] Though nasal-vowel metathesis and vowel preservation following [+long] vowels is not attested in Māori (or is difficult to find), there appears to be an instance of this in Pukapukan: *pō* ‘benighted’ → *pō–ina* (data from Salisbury 2002), which, if confirmed, would provide direct support for this hypothesis.

To account for these facts, I propose a constraint on sequences of underlying alveolar nasals followed by the vowel /i/ across the morpheme boundary. A more recent analysis by de Lacy (2003) holds that there is a general constraint against [ni] in the language, and while this would successfully account for the passive alternations, evidence in words such as *pani* 'to smear' (W:69) and *mania* 'slippery' (W:69), among many others, suggest that [ni] sequences may not be marked generally. Therefore, it must be the case that [ni] is only marked in a cross-morpheme context. I propose amending the markedness constraint to be demarcative, sensitive to the presence of a morpheme boundary (34).

(34) *n+i: A candidate receives one violation for every sequence of [n+i] it possesses, where [n] and [i] are juxtaposed across a morpheme boundary.

*n+i must dominate a new, low-ranked faithfulness constraint forbidding metathesis of segments across the morpheme boundary. Although it would be desirable to unify nasal-vowel metathesis in (31) and the examples of same-constituent metathesis in (32) under the same markedness constraint, metathesis of different *versus* identical constituents as well as the cross-morpheme *versus* morpheme-internal metathesis (which is seen in most of the examples in (32)) suggest these are two separate processes. As for which segments metathesize in instances of nasal-vowel metathesis, if vowels were metathesizing segments, then vowel metathesis would occur for all markedness problems involving vowels, which is not the case. I argue that metathesis here is specific to nasals, and that these metathesized nasals must land to the right of /i/, placing /i/ next to the morpheme boundary. Otherwise, there would be no cross-morpheme context for deletion or gliding. With these facts in mind, I name the linearity constraint against this metathesis MORPHLINNASAL, a precise definition for which is given in (35).

(35) MORPHLINNASAL: A candidate receives one violation if S_1 is any nasal segment and S_2 is any following segment, and S_1 and S_2 are separated from each other by a morpheme boundary, and S_1 precedes S_2 in the input but not in the output, and the transposition of S_1 and S_2 occurs outside of a stem across the morpheme boundary.

MORPHLINNASAL (MLN for short) permits the metathesis of any nasal segment out of the active stem, but since metathesis must occur across a morpheme boundary, MLN does not allow nasal metathesis morpheme-internally. *n+i dominates MLN, resolving markedness problems through nasal-vowel metathesis (36).

(36) Nasal-vowel metathesis in (31.2) /katan+ia/ 'to laugh' (W:64)

	/katan+ia/	*n+i	MLN
a.	katan+ia	*! W	L
b.	☞ kata+ina		*

MORPHLINNASAL is ranked lower than MAX but higher than Ident[±syllabic]. When metathesis of /Vn+i/ into /V+in/ creates the right context for vowel deletion across morpheme boundaries, a violation of higher-ranked MAX knocks the candidate out of the running on the grounds that a single violation of MAX is preferable to a violation of MAX as well as one of MLN. On the other hand, when /an+i/ metathesis creates the environment /a+in/, the sequence

/a+i/ forms the diphthong [aɪ̯]. The tableaux below in (37) and (38) provide examples for each of these outcomes.

(37) Deletion only in (33.1) /tukun+ia/ 'to allow' (W:57)

	/tukun+ia/	*[–long]+V1	*n+i	MAX	MLN	Ident[±syllabic]
a.	tukun+ia	e	*! W	L	e	e
b.	tuku_+ia	*! W	e	* e	e	e
c.	tuku_+_a	e	e	**! W	e	e
d.	☞ tukun+_a			*		
e.	tuku+ina	*! W	e	L	* W	e
f.	tuku+_na	e	e	* e	*! W	e

Above in (37), candidate (a) incurs a fatal violation of *n+i. Candidate (b) deletes the nasal segment from the stem and receives a violation from MAX; since there is a resulting /u+i/ sequence, this candidate receives a fatal violation from *[–long]+V1. Candidate (c) chooses to delete two segments, the stem-final nasal and the first vowel of the passive, and in doing so receives and two violations from MAX. Although this does not result in a violation of *[–long]+V1 since /a/ is not the first vowel of the passive, one violation of MAX is preferable to two, and so this candidate is not as optimal. Candidate (d) is optimal, since it only deletes the vowel from the passive suffix, incurring only a single violation of MAX. Candidate (e) metathesizes the /n+i/ sequence, incurring a violation of the higher-ranked *[–long]+V1 as well as one from MORPHLINNASAL, and candidate (f) metathesizes and deletes the vowel once it has metathesized with /n/, receiving a violation of MAX and a fatal violation of MLN. This tableau shows fatal violations in these cases sometimes do not come from higher-ranked constraints or from MLN alone, but rather from violations of MLN in addition to a violation of MAX.

As opposed to the tableau above, which exhibited a case of deletion only following /Vn/-final stems, there is metathesis and gliding following /an/-final stems, seen in (38).

(38) Metathesis and gliding in (31.3) /huɾan+ia/ 'to uncover (cards)' (Dict)

	/huɾan+ia/	*[–long]+V1	*n+i	MAX	MLN	Ident[±syllabic]
a.	huɾan+ia	e	*! W	e	L	L
b.	huɾa_+ia	*! W	e	* W	L	L
c.	huɾa_+i̯a	e	e	*! W	L	* e
d.	huɾa_+_a	e	e	*!* W	* e	L
e.	huɾan+_a	e	e	*! W	L	L
f.	huɾa+ina	*! W	e	e	* e	L
g.	huɾa+_na	e	e	*! W	* e	L
h.	☞ huɾa+i̯na				*	*

In the tableau in (38), candidate (a) receives a fatal violation of *n+i. Candidate (b) receives violations of *[–long]+V1 and MAX for deleting the nasal segment from the stem and placing two vowels in hiatus across the morpheme boundary. Candidate (c) is slightly different:

having deleted the stem-final nasal and glided the resulting /a+i/ sequence into a diphthong, this candidate receives violations of MAX and Ident[±syllabic]. Although violations of Ident[±syllabic] are the least costly, deletion results in the candidate being struck from the running. Candidate (d) deletes both /n/ and /i/, and so it receives three violations in total, including a fatal violation of MAX. Candidate (e) undergoes the same repair as other /Vn/-final stems, choosing to delete the initial vowel of the passive as opposed to metathesis. However, since this is more costly than other valid repairs, the candidate is struck from the running. Both candidate (f) and (g) metathesize /an+i/ to /a+in/, but candidate (f) keeps two vowels in apposition across the morpheme boundary, incurring a fatal violation of *[–long]+V1. Candidate (g) deletes /i/, incurring a fatal violation of MAX. The candidate that makes the fewest and least costly repairs is the only one that remains. Candidate (h) metathesizes segments and glides /a+i/ into a diphthong, only receiving two violations, one from MORPHLINNASAL and the other from Ident[±syllabic]. This tableau shows that it is less costly to metathesize and glide than to simply delete if the former repair strategy is a viable one.

This constraint ranking does not affect the derivation of /aiŋ/-final stems, as shown in the tableau below. Given the choice to delete or metathesize and delete, the grammar would prefer to delete /i/ following the diphthong [ai̯] (39).

(39) Deletion in (27.3) /faːŋaiŋ+ia/ ‘to feed, nourish’ (Dict)

	/faːŋaiŋ+ia/	*[–long]+V1	*ai̯ŋia	MAX	MLN	Ident[±syllabic]
a.	faːŋaiŋ+ia	e	*! W	L	e	e
b.	faːŋai_+ia	*! W	e	* e	e	e
c.	faːŋai_+_a		e	**! W	e	e
d.	☞ faːŋaiŋ+_a			*		
e.	faːŋai+iŋa	*! W	e	L	* W	e
f.	faːŋai+_ŋa	e	e	* e	*! W	e

Candidate (a) receives a fatal violation of *ai̯ŋia for possessing a /ViVjNVjVi/ sequence, and candidate (b) deletes the stem-final nasal and incurs a fatal violation of *[–long]+V1 as well as a violation of MAX. Candidate (c) deletes two segments, receiving a secondary and fatal violation of MAX. Candidate (d) is the most optimal candidate, since it only deletes one segment: the suffix-initial vowel. Candidates (e) and (d) both metathesize, but candidate (e) receives a fatal violation from *[–long]+V1, and candidate (f) receives a fatal violation of MORPHLINNASAL for metathesizing /ŋ+i/ and deleting /i/ when deletion alone would suffice.

In closing, the choice between nasal metathesis and /i/ deletion versus /i/ deletion alone can be formalized by allowing MAX to dominate MORPHLINNASAL. A constraint ranking of MAX » MORPHLINNASAL » Ident[±syllabic] ensures that not all nasal markedness problems are solved by deletion. Instead, any high-ranked markedness problems involving nasals will be satisfied through metathesis of the nasal when one violation of MLN and one violation of Ident[±syllabic] would be the only violations incurred. When metathesis would result in deletion, however, there is only deletion and no metathesis. This accurately produces the dual repair strategy for passivized alveolar nasal-final stems I argued for above.

2.1.4 Non-labial nasal gerundive haplology

With most of the passive and gerundive analysis in place, what remains to be accounted for is a complicated pattern of gerundive haplology following stems that terminate in non-labial nasals. Data below provide examples where the strings /ŋ+aŋa/ and /n+aŋa/ surface as [ŋa] (40).

(40) Haplology in the case of /ŋ+aŋ/ and /n+aŋ/ strings in the gerundive

	Active	*Passive*	*Gerundive*	*Gerundive Definition*	*Source*
1.	kai̯	kai̯**–ŋa**	kai̯**–ŋa**	'leftovers'	(Dict)
2.	kuɾa	kuɾa**–ŋia**	kuɾa**–ŋa**	'schooling, education'	(Dict)
3.	mahi	mahi**–ŋia**	mahi**–ŋa**	'place where work is done'	(Dict)
4.	he:	he:**–ŋia**	he:**–ŋa**	'error, mistake'	(Dict)
5.	tohu	tohu**–ŋia**	tohu**–ŋa**	'expert'	(Dict)
6.	po:	po:**–ŋia**	po:**–ŋa**	'nightfall'	(Dict)
7.	weɾa	weɾa**–ina**	weɾa**–ŋa**	'burning'	(Dict)
8.	toɾo	toɾo**–na**	toro**–ŋa**	'burning, fire'	(Dict)
9.	tuhituhi	tuhituhi**–na**	tuhituhi**–ŋa**	'writing'	(Dict)

However, haplology must be conditioned by a specific morphological environment, since [nVŋ] and [ŋVŋ] strings appear morpheme-internally and in derived environments (41).

(41) No haplology in the case of [ŋV+ŋ] and [nV+ŋ] strings in the gerundive or passive

	Active	*Passive*	*Active Definition*	*Gerundive*	*Gerundive Definition*	*Source*
1.	faŋa	faŋa**–ia**	'to measure'	faŋa**–ŋa**	'span, measurement'	(Dict)
2.	hiŋa	hiŋa**–ia**	'to fall, lose'	hiŋa**–ŋa**	'fall, defeat'	(Dict)
3.	haŋa	haŋa**–ia**	'to make, build'	haŋa**–ŋa**	'build'	(Dict)
4.	ɾuna	ɾuna**–ia**	'to draw together'	ɾuna**–ŋa**	'drawing together'	(K:8)
5.	kino	kino**–ŋia**	'to dislike'	kino**–ŋa**	'offence, sin'	(Dict)
6.	hono	hono**–a**	'to join, connect'	hono**–ŋa**	'union, connection'	(Dict)
7.	tono	tono**–a**	'to request'	tono**–ŋa**	'application'	(Dict)

Haplology across morpheme and word boundaries occurs elsewhere in Māori, so there is good evidence for this sound change. In all cases, the target of the sound change is the first of the two identical consonants (42).

(42) Haplology and consonant deletion in Māori (data from Harlow 2007:21–22)

	Example	*Gram. category*	*Definition*	*Alternations*
a.	*Ngāti ~ Ngāi*	prefix	'descendants of'	*Ngāti Porou* *Ngāti Ruanui* *Ngāi Tahu* (cf. **Ngāti Tahu*) *Ngāi Tūhoe* (cf. **Ngāti Tūhoe*) *Ngāti Tūwharetoa*
b.	*Motu ~ Mou*	compound	'island'	*moutere* (cf. *motutere*) *Moutohorā* (cf. **Motutohorā*)
c.	*whaka– ~ whā–*	prefix	CAUS	*whaka–horo* *whā–kino* (cf. *whaka–kino*)
d.	*–n/ng+anga ~ –nga*	suffix	NOM	*hopuk–anga* *tohu–nga* (cf. **tohun–anga*) *hapai–nga* (cf. **hapaing–anga*)
e.	*Matatau ~ Mātau*	lexical item	'know'[13]	
f.	*Pararaki ~ Pāraki*	lexical item	'land wind'	

In all above cases, the target of deletion is the first of two identical consonants, whether it belongs to an affix, the stem, or other.[14] The difference between the first consonant deleting in all of these examples as opposed to the second consonant deleting in the analysis of vowel lengthening in reduplicants as being caused by same-consonant deletion is evidence that reduplicant lengthening is caused by a different process (e.g., /RED+taweke/ 'linger' → /ta–tawe–weke/ → [ta–Øawe–weke] 'slow, dilatory,' [Øa–tawe–weke] (data from Harlow 1991:127)). If it were more apparent how to achieve deletion of the second consonant in reduplicants while preserving cross-morpheme hiatus and explaining why other instances of C_iVC_i resulting from reduplication do not result in deletion, then it would be more plausible that same-consonant deletion is effecting this lengthening, and an attempt should be made to unify these processes; however, to do so is not the focus of this work.

[13] For the individual lexical items, the lack of evidence of systematic haplology morpheme-internally in other morphologically simple words suggests these are irregular. However, for the gerundive, deletion always occurs in this context.

[14] Deletion is irregular in a number of these cases, as in the *Ngāti ~ Ngāi* prefix in (42.a), the causative prefix in (42.c), and the individual lexical items in (42.e) and (42.f). For these, I propose lexicalization and how aware speakers are of the morpheme boundary plays a large role in whether consonants are deleted. A similar proposal was made by Blevins (1994) for why the causative regularly takes *–tia* in the passive.

Kibre (1998:20), mentioning that haplology in the case of the gerundive could be motivated by an OCP against series of consonants with the features [+nasal, –labial], notes that it is not clear how to satisfy a constraint against haplology through deletion of an entire syllable. de Lacy (1999), on the other hand, argues that all cases of morphological haplology involve coalescence as opposed to deletion, which would explain how an entire syllable 'disappears' in the case of /ŋ+aŋa/ and /n+aŋa/ strings for the gerundive (e.g., /n$_1$+a$_2$ŋ$_3$a$_4$/ → [ŋ$_{1,3}$a$_{2,4}$]). However, I argue the loss of the whole syllable is just as easily captured by cross-morpheme vowel deletion: in none of the cases in (42) except for the gerundive does hiatus result across the morpheme boundary following consonant deletion, meaning none of the other cases have motivation to also delete a vowel to avoid cross-morpheme hiatus. If the first consonant in gerundive haplology is to be deleted, as all of the first consonants in (42) are, then the suffix-initial vowel must also then be deleted to satisfy the higher-ranked constraint *[–long]+V$_1$.

On the basis of this evidence, I argue that all of the above instances of cross-boundary deletion are motivated by the same constraint dominating MAX. Harlow (2007) notes that (42.a) *Ngāti ~ Ngāi* is a prefix and (41.b) *Motu ~ Mou* is used to form compounds. Thus, I argue the fact that *Ngāti ~ Ngāi* appears as its own word in writing is the result of an orthographic convention and is not a true representation of this morpheme. For this reason, the above examples in (42.a–d) can be unified under a single demarcative markedness constraint. To account for haplology, I propose a specific markedness constraint against identical consonants in adjacent syllables in derived environments such as those seen above (43).

(43) *C$_{i]stem}$+//VC$_i$: assign one violation for every instance of two identical consonants in adjacent syllables separated by a morpheme boundary where the consonant bordering the morpheme boundary belongs to the stem.

*C$_{i]stem}$+//VC$_i$ penalizes both /C$_{i]stem}$+VC$_i$/ and /C$_i$V+C$_{i]stem}$/ sequences. While *C$_{i]stem}$+//VC$_i$ specifies that only identical consonants incur a violation, I argue that /n/ and /ŋ/, in sharing [–labial, +nasal] features, are treated as similar enough to receive the same treatment. As stated previously, *C$_{i]stem}$+//VC$_i$ must dominate MAX for deletion to occur (44).

(44) Haplology and deletion in (40.5) /tohuŋ+aŋa/ 'expert' (Dict)

	/tohuŋ+aŋa/	*CODA	*[–long]+V$_1$	*C$_{i]stem}$+//VC$_i$	MAX	MLN
a.	tohuŋ+aŋa	e	e	*! W	L	e
b.	tohuŋ+_ŋa	*! W	e	e	* L	e
c.	tohu_+aŋa	e	*! W	e	* L	e
d.	☞ tohu_+_ŋa				**	
e.	tohu+aŋŋa	*! W	* W	e	L	* W
f.	tohu+a_ŋa	e	*! W	e	* L	* W
g.	tohu+__ŋa	e	e	e	** e	*! W

Candidate (a) fatally violates *C$_{i]stem}$+//VC$_i$ by having a /ŋ+aŋa/ sequence, and so it is dropped. Candidate (b) deletes the suffix-initial vowel, incurring a violation of MAX as well as a fatal violation of *CODA since this places two consonants next to each other. Candidate (c) deletes the stem-final nasal, receiving a violation of MAX and a fatal violation of *[–long]+V$_1$ since there are two vowels juxtaposed across the morpheme boundary. Candidate (d) deletes the

stem-final nasal as well as the suffix-initial vowel, and so it is the most optimal since it only has two violations of MAX. While metathesis without deletion in candidate (e) leads to a fatal violation of *CODA and additional violations of *[–long]+V_1 and MORPHLINNASAL, metathesis and deletion is just as bad. Candidate (f) metathesizes /n/ and incurs a fatal violation of *[–long]+V_1 as well as a violation of MLN. Candidate (g) is different from candidate (d) (the most optimal) in one respect: whereas candidate (d) only deletes the two segments, candidate (g) deleted both segments following /n/ metathesis, incurring an unnecessary and fatal violation of MLN. In this way, similar to how deletion only was preferable in the case of /Vn+i/ and /aiŋia/, so too is deletion only the more optimal repair strategy for gerundive haplology, even though MLN is ranked lower than MAX.

The tableau in (44) is slightly misleading in that I have excluded a candidate which would be the most optimal if included: one where deletion removes the second of the two identical consonants, as in *[tohun+a_a]. This candidate would resolve all markedness problems through only one violation of MAX, meaning it is more optimal than the attested output (44.d) [tohu_+_ŋa]. While it would be preferable to delete the second of the two identical consonants in this case, data from (42) show that it is always the first of the two consonants which is deleted, hence why I have excluded candidates which delete the second nasal. While this is undesirable, there is not an apparent reason as for why the first of two consonants deletes, since, as discussed in §2.1.2 in the analysis of allomorphy after vowel-final stems, to propose an analysis protecting suffix material from deletion would not capture why the suffix-initial vowel commonly deletes after a stem-final vowel, while proposing a positional faithfulness (Beckman 1998) to prevent deletion of stem segments would obviously complicate the analysis of gerundive haplology, where the consonant from the stem is deleted instead of the suffix consonant. Despite this limitation, there is evidence that the first consonant is deleted always, so only presenting candidates which delete the first consonant, while arbitrary, has justification elsewhere in Māori.

Unlike the example above, there is no violation of *$C_{i]stem}$+//VC_i when an alveolar or velar nasal is separated from the gerundive suffix by a vowel belonging to the stem.

(45) No nasal deletion in (41.5) /kino+aŋa/ ‘offence, sin’ (Dict)

	/kino+aŋa/	*CODA	*[–long]+V_1	*$C_{i]stem}$+//VC_i	MAX	MLN
a.	kino+aŋa	e	*! W	e	L	e
b.	☞ kino+_ŋa				*	

Candidate (a) incurs a fatal violation from *[–long]+V_1 since it contains two vowels separated by the morpheme boundary. Candidate (b) deletes the vowel from the suffix, and so it is the more optimal candidate. When the suffix-initial vowel is deleted, there is no violation from *$C_{i]stem}$+//VC_i since the particular derived environment is not present here.

2.2 Alternative Constraints

In the OT analysis presented in the previous section, I argued that to account for the attested patterns of cross-morpheme vowel deletion and gliding, nasal metathesis, and gerundive haplology, the constraints *[–long]+V_1, *n+i, MORPHLINNASAL, and *$C_{i]stem}$+//VC_i must be demarcative, must specify certain phonological features, and in the case of three of the constraints, must reference segments in prominent positions such as directly adjacent to the morpheme boundary or belonging to the stem. In addition, the attested outputs for vowel

deletion and gerundive non-labial nasal haplology could only be selected by arbitrarily stating which segment(s) was/were to be deleted. While *SPE*-style rules possess an arbitrary rewrite power capable of deriving the alternations with comparative ease (Hale's original 1968 analysis requires only a handful of rules), phonologists working in an OT framework strive to derive outputs through a variable ranking of very general constraints grounded in phonological universals. The 'phonological unnaturalness' (to use Kibre's (1998) term) of these specific constraints and of the alternations themselves would therefore seem to support a morphological analysis rather than a phonological one on the grounds that more general constraints cannot achieve the same outputs, or that in trying to formulate an analysis using general constraints, one inevitably encounters complications that cannot be easily overcome.[15]

However, I argue that a phonological analysis is possible, and certainly preferable to a morphological analysis, yet that such a phonological analysis requires more input from the morphology than is perhaps typologically standard. This subsection is dedicated to demonstrating how more general alternatives to *[–long]+V_1, MORPHLINNASAL, and *$C_{i]stem}$+//VC_i fail to achieve the same outputs (*n+i has already been found to be necessary since a constraint such as *ni incorrectly penalizes morpheme-internal [ni], so I decline to explore other alternatives to this constraint in this subsection). In showing how general alternatives to these constraints are inadequate, I hope to advocate for these specific constraints and to show that they are the most appropriate to derive the alternations of passive and gerundive.

2.2.1 Alternatives to *[–long]+V_1

In this subsection, I demonstrate that the constraint *[–long]+V_1 cannot account for the alternations if it were formalized in a different way. To this end, I consider several alternative constraints ranging from most general to least general. These are: *VV, *VV_1, *V+V, *V+V_1, *$V_i(V_j)$+V, *[–long]+V, and *$V_i(V_j)$+V_1. While it will be shown that a constraint such as *$V_i(V_j)$+V_1—if formalized in a particular way—can account for the alternations when assuming long vowels are two vowels in the UR, to do so would be similar to positing the constraint *[–long]+V_1. I close with an argument that *[–long]+V_1 as it is instantiated now is the most suitable constraint against cross-morpheme hiatus.

A constraint which does not reference a morpheme boundary, *VV is a constraint against hiatus in general. This means all morpheme-internal hiatus would be marked, resulting in vowel deletion in forms like *tuitui* 'to sew' (Dict), deletion of one of the passive's segments following consonant-final stems, deletion following stem-final long vowels, and deletion of the entire passive following vowel-final stems. The tableaux below in (46) and (47) show the result of having such a general constraint by looking at passivization of consonant-final and vowel-final stems.

[15] One example of these 'complications' was seen in the previous section in the constraint IO-MAX(stem). One would argue that such a constraint is necessary to naturally account for the fact that deletion does not often affect a stem-final vowel, yet stem-final vowels do (uncommonly) get deleted in the case of the gerundive, and, in the case of gerundive haplology, deletion does appear to affect stem-internal nasals as opposed to suffix-internal nasals, which is the opposite of what is to be expected under a high-ranking IO-MAX(stem). Complications such as these produce a minefield which is difficult to traverse successfully using general constraints.

(46) Undue deletion after /C/-final stems for alternative constraint *VV

	/atafait+ia/	*VV	MAX	Ident[±syllabic]
a.	☹ atafait+ia	*!* W	L	L
b.	atafait+_a	*! W	* e	L
c.	atafa_t+_a	e	**! W	L
d.	💣 atafai̯t+_a		*	*

In (46) above, a segment is deleted from the passive morpheme following a thematic consonant since the passive /–ia/ has hiatus. The constraint *VV also leads to the deletion of the entire passive morpheme following vowel-final stems (47).

(47) Over-deletion after V-final stems for alternative constraint *VV

	/fatu+ia/	*VV	MAX	Ident[±syllabic]
a.	fatu+ia	*!* W	L	e
b.	☹ fatu+_a	*! W	* L	e
c.	💣 fatu+__		**	

In the tableau above, the entire passive morpheme is deleted. With the markedness constraint *VV over-deleting segments, the analysis cannot be restored through a high-ranking constraint like REALIZEMORPH (Kurisu 2001). Assumed to be undominated, REALIZEMORPH should ensure that the entire passive is not deleted following vowel-final stems. While this prevents over-deletion after vowel-final stems, there would still be undue deletion following consonant-final stems as well as morpheme-internally since at least one exponent of the passive morpheme would be preserved. Instead, a more specific markedness constraint is required.

The constraint *VV could be amended to reference the first vowel of a following morpheme so that deletion does not affect the entire passive. This alternative constraint could look like *VV$_1$. However, this constraint might as well be called *V+V, since it would *de facto* have to reference a morpheme boundary if the second vowel is the first vowel of a following morpheme, yet neither of these constraints achieve the correct output.

A slightly more specific constraint like *VV$_1$ or *V+V is also unable to adequately capture the nuances of passive allomorphy. While this constraint limits hiatus to a cross-morpheme context, deletion would incorrectly occur after stem-final long vowels. Without positing other constraints to prevent this from happening, an incorrect candidate is selected (48).

(48) Undue deletion after long vowel-final stems in the case of alternative constraint *V+V

	/ɾu:+ia/	*V+V	MAX	Ident[±syllabic]
a.	☹ ɾu:+ia	*! W	L	e
b.	💣 ɾu:+_a		*	

The constraint *V+V would also predict deletion of the entire passive following vowels. Changing the constraint to *V+V$_1$ to reference the first vowel of the suffix in addition to being

morphologically sensitive does not resolve the issue, as the passive's /i/ would still delete following stem-final long vowels. As will be shown below in the discussion of the alternative constraint *[–long]+V, positing a constraint to prevent over-deletion has the opposite effect: under-deletion. Therefore, there is no way either *VV$_1$, *V+V or *V+V$_1$ would be able to capture the nuances of passive allomorphy following vowel-final stems.

So far in this subsection, none of the proposed markedness constraints reference the length of the preceding vowel. While this has caused less specific constraints to fail, even constraints referencing this feature must reference more features if a constraint referencing the length of the preceding vowel is to successfully capture allomorphy. For example, *[–long]+V—another slightly more specific alternative constraint—is also incapable of accounting for the alternations. While it would appear to lack several problems associated with the previous alternative constraints, this constraint also deletes the entire passive following short vowels and diphthongs, as the tableau below shows (49).

(49) Over-deletion after vowel-final stems in the case of alternative constraint *[–long]+V

/ɾapu+ia/	*[–long]+V	MAX	Ident[±syllabic]
a. ɾapu+ia	*! W	L	e
b. ☹ ɾapu+_a	*! W	* L	e
c. 💣 ɾapu+__		**	

If an undominated REALIZEMORPH (Kurisu 2001) were used to prevent over-deletion in the case of the passive following short vowels assuming the constraint *[–long]+V, then what follows is not over-deletion following vowel-final stems, but under-deletion (50). The same would happen for the alternative constraints *VV$_1$, *V+V, and *V+V$_1$ discussed above.

(50) Under-deletion in the case of alternative constraint *[–long]+V with REALIZEMORPH

/ɾapu+ia/	REALIZEMORPH	*[–long]+V	MAX	Ident[±syllabic]
a. 💣 ɾapu+ia		*		
b. ☹ ɾapu+_a	e	* e	*! W	e
c. ɾapu+__	*! W	L	** W	e

Assuming long vowels are two short vowels underlyingly, a constraint such as *V$_i$(V$_j$)+V or *V$_i$(V$_j$)+V$_1$ could in theory account for the attested alternations without arguing that there are phonemically [+long] vowels in Māori. While *V$_i$(V$_j$)+V encounters the same problems with over-deletion and under-deletion as *[–long]+V was shown to have in (49) and (50), *V$_i$(V$_j$)+V$_1$ may successfully capture the alternations. Such a constraint would be formalized like so:

(51) *V$_i$(V$_j$)+V$_1$: assign one violation if an output candidate contains a short monophthong or diphthong followed by the first vowel of a following morpheme.

If the constraint were not formalized in this way, the /V$_i$V$_i$+V$_1$/ sequence resulting from passive suffixation to a stem ending in two underlying identical short vowels would still condition deletion, since a /[–long]+V$_1$/ sequence is present. By formalizing the constraint to be sensitive to short vowels and diphthongs but not long vowels, the same effects as *[–long]+V$_1$

can be achieved. However, this is not as preferable as *[–long]+V1. First, the formalization of *Vi(Vj)+V1 misses a key generalization about the underlying representations of diphthongs as two short vowels and the natural class these segments share with short monophthongs. Second, by missing this generalization, *Vi(Vj)+V1 must arbitrarily state which segments count towards a marked sequence, or else it would incorrectly motivate /i/-deletion following long vowels, since a /Vi+V1/ sequence is present if long vowels are two identical short vowels in the UR. Therefore, I believe this constraint, while capable of achieving the same result, is more arbitrary and more specific than *[–long]+V1, and therefore it is not preferable on the grounds that the most general constraint possible should be employed to account for these alternations.

I conclude this discussion of alternatives to the constraint *[–long]+V1 with a reiteration that more general constraints are unable to properly account for the vocalic alternations of the passive, even with help from high-ranking faithfulness constraints like REALIZEMORPH (Kurisu 2001). *[–long]+V1 as it is instantiated now is the most suitable to overcome the challenges of *–ia* and *–a* allomorphy presented in this section, and the constraint ranking *[–long]+V1 » MAX » Ident[±syllabic] successfully accounts for the attested alternations.

2.2.2 Alternatives to MORPHLINNASAL

This subsection will be devoted to explaining the MORPHLINNASAL constraint and why it must be formalized as such. In the same way as I advocated for the constraint *[–long]+V1 in §2.2.1, I will consider a number of alternatives to this constraint—LINEARITY, MORPHLINEARITY, and LINEARITYNAS—proceeding from most general to least general. This subsection will show that MORPHLINNASAL is the best constraint to account for metathesis in the case of alveolar nasal-final stems.

Since MORPHLINNASAL, like *[–long]+V1, is questionable on the grounds that it is highly specific, I first turn to the most general constraint which could prevent metathesis: LINEARITY. Whatever the constraint that militates against metathesis, it must be ranked either above or below MAX. However, there are difficulties which arise when either LINEARITY dominates MAX or, *vice versa*, when MAX dominates LINEARITY, as shown by the tableaux in (52) and (53) below.

When LINEARITY dominates MAX, one of the unfortunate outcomes is that markedness problems involving the alveolar nasal are resolved though vowel deletion instead of metathesis and gliding, since metathesis is too costly of a repair (52).

(52) Undue vowel deletion when the alternative LINEARITY » MAX

	/huan+ia/	*[–long]+V1	*n+i	LINEARITY	MAX	Ident[±syllabic]
a.	huan+ia	e	*! W	e	L	L
b.	hua_+ia	*! W	e	e	* e	L
c.	hua_+i̯a	e	e	e	* e	*! W
d.	💣 huan+_a				*	
e.	hua+ina	*! W	e	* W	L	L
f.	☹ hua+i̯na	e	e	*! W	L	* e

Conversely, when MAX dominates LINEARITY, markedness problems involving vowel segments are resolved through metathesis and not deletion, since MAX is ranked too highly and LINEARITY does not specify which type of segment is allowed to metathesize (53).

(53) Undue vowel-vowel metathesis when MAX » alternative LINEARITY

	/fatu+ia/	*[–long]+V$_1$	MAX	LINEARITY	Ident[±syllabic]
a.	fatu+ia	*! W	e	L	e
b.	☹ fatu+_a	e	*! W	L	e
c.	💣 fat+iua			*	
d.	fat+_ua	e	*! W	* e	e
e.	fat+i_a	e	*! W	* e	e

If the constraint ranking MAX » LINEARITY were correct and the linearity constraint were more general, then marked stem-final consonants would also metathesize *into* the stem rather that delete and incur a violation of the higher-ranked MAX, under the right conditions (54).

(54) Undue stem-internal metathesis when MAX » alternative LINEARITY

	/huan/	*CODA	MAX	LINEARITY
a.	huan	*! W	e	L
b.	☹ hua_	e	*! W	L
c.	💣 huna			*

It could be argued in the case of a general linearity constraint that some sort of positional faithfulness (Beckman 1998) requires the linear order of segments within the stem to remain the same. If this were the case, then problems encountered by the alternative LINEARITY in (53) would be resolved, since it would not be possible to reorder stem-internal segments: the alveolar nasal would be free to metathesize out of the stem, only changing the order of a segment from the stem with respect to segments in the suffix, like so: /h$_1$u$_2$a$_3$n$_4$+i$_5$a$_6$/ → [h$_1$u$_2$a$_3$+i$_5$n$_4$a$_6$]. However, the data on metathesis in Māori (32) (see §2.1.3), where vowels, consonants, features, and even whole syllables are reordered within morphemes forces me to conclude that no linear positional faithfulness of this sort exists in Māori.

While an entirely general constraint like LINEARITY is unable to capture the nuances of the passive alternations, more specific constraints also run into problems. A constraint like MORPHLINEARITY—which would penalize metathesis across morphemes—would encounter the same problem of vowel-vowel metathesis seen in (53), as seen in (55).

(54) Undue vowel-vowel metathesis for alternative MORPHLINEARITY

	/fatu+ia/	*[–long]+V$_1$	MAX	MORPHLINEARITY	Ident[±syllabic]
a.	fatu+ia	*! W	e	L	e
b.	☹ fatu+_a	e	*! W	L	e
c.	💣 fat+iua			*	
d.	fat+_ua	e	*! W	* e	e
e.	fat+i_a	e	*! W	* e	e

Similarly, a constraint like LINEARITYNAS—which permits only the metathesis of nasal segments—would still encounter the problem in (54) where a segment metathesizes further into the stem, as seen in (56).

(56) Undue stem-internal metathesis for alternative LINEARITYNAS

	/huan/	*CODA	MAX	LINEARITYNAS
a.	huan	*! W	e	L
b.	☹ hua_	e	*! W	L
c.	💣 huna			*

Only MORPHLINNASAL, making reference to both morphological structure and to a nasal feature, is capable of giving rise to the alternations seen in the data. It is not possible that the /i/ of the passive metathesizes instead, as this predicts vowel metathesis should occur in almost all cases of /[–long]+V1/. Thus, it cannot be vowel metathesis which derives alveolar nasal passive allomorphs. Instead, a highly-specific linearity constraint referencing both morpheme boundaries and nasal features is required to capture the nuances of alveolar passive allomorphy, similar to how the highly-specific markedness constraint *[–long]+V1, referencing a [–long] feature in the stem-final vowel, a morpheme boundary, and suffix-initial vowels was required to induce the correct pattern of cross-morpheme vowel deletion and gliding.

2.2.3 Alternatives to *Ci]stem+//VCi

The constraint *Ci]stem+//VCi, like other constraints discussed in this work, is highly specific. This subsection is dedicated to discussing alternative and more general constraints and to showing the ways they fail to derive the correct outputs. I introduce four more general alternative constraints—*CiVCi, *Ci+VCi, *CiV+Ci, and *Ci+//VCi—and will illustrate with tableaux how these are insufficient to account for haplology. It will be shown that *Ci]stem+//VCi as it is formalized now is the most appropriate constraint against cross-morpheme consonant haplology.

Without reference to morphological structure, *CiVCi is a constraint against haplology in general, whether morpheme-internally or cross-morphemic. This constraint, assigning violations for all sequences of identical consonants, would incorrectly assign violations to all instances of haplology. Although hiatus in reduplicants would be spared owing to a high-ranking BR-MAX (discussed previously), this should predict words such as the name (*Hemi*) *Potatau* would remove an internal consonant (57).

(57) Undue deletion for alternative constraint *CiVCi in *Potatau*

	/potatau/	*CODA	*[–long]+V1	*CiVCi	MAX
a.	💣 po_atau				*
b.	☹ potatau	e	e	*! W	L

In addition, this constraint predicts all instances of haplology formed by the gerundive should result in deletion of the first consonant. With the rest of the analysis remaining the same,

the incorrect output candidate is selected when the gerundive is suffixed to a stem with an internal non-labial nasal (58).

(58) Undue deletion for alternative constraint *CiVCi

	/kino+aŋa/	*CODA	*[–long]+V1	*CiVCi	MAX
a.	kino+aŋa	e	*! W	* W	L
b.	kin_+_ŋa	*! W	e	e	** e
c.	💣 ki_o+_ŋa				**
d.	☹ kino+_ŋa	e	e	*! W	* L

Therefore to arrive at the correct derivations, this constraint must reference morphological structure. However, slightly more specific constraints like *Ci+VCi or *CiV+Ci also fail to select the correct output. The first of these would accurately reproduce the alternations of the gerundive, but it would not compel deletion in other instances of haplology like in *whaka–kino* 'to speak badly of' (Harlow 2007:22), as seen in (59).

(59) Under-deletion for alternative constraint *Ci+VCi

	/faka+kino/	*CODA	*[–long]+V1	*Ci+VCi	MAX
a.	💣 faka+kino				
b.	☹ fa_a+kino	e	e	e	*! W

Conversely, the constraint *CiV+Ci would capture other cases of haplology, including the causative examples, but it would cause undue deletion in stems with internal non-labial nasals when suffixed with the gerundive prefix (60), just as in (58) above.

(60) Undue deletion for alternative constraint *CiV+Ci

	/kino+aŋa/	*CODA	*[–long]+V1	*CiV+Ci	MAX
a.	kino+aŋa	e	*! W	* W	L
b.	kin_+_ŋa	*! W	e	e	** e
c.	💣 ki_o+_ŋa				**
d.	☹ kino+_ŋa	e	e	*! W	* L

To subsume both *Ci+VCi and *CiV+Ci into the same constraint, *Ci+//VCi can be used to assign violations for haplology in different directions, but the same problems which plagued *Ci+VCi and *CiV+Ci affect this constraint as well, since there is no reference to which of the two consonants is the stem-internal consonant, which was shown to be the trigger in the previous subsection. Without such formalization, *Ci+//VCi performs the same as *Ci+VCi and *CiV+Ci and in fact causes all instances of haplology in derived environments to be marked. I show only one example where *Ci+//VCi fails, the gerundive (41.5) /kino+aŋa/ 'offence, sin' (Dict), in (61).

(61) Undue deletion for alternative constraint *C_i+//VC_i

	/kino+aŋa/	*CODA	*[–long]+V_1	*C_i+//VC_i	MAX
a.	kino+aŋa	e	*! W	* W	L
b.	kin_+_ŋa	*! W	e	e	** e
c.	💣 ki_o+_ŋa				**
d.	☹ kino+_ŋa	e	e	*! W	* L

In the tableau above in (61), the constraint *C_i+//VC_i incorrectly penalizes sequences of *C_iV+C_i, leading to undue deletion of a first consonant.

Since a consonant from the stem bordering the morpheme boundary was found to be the trigger necessary to induce deletion for haplology, the markedness constraint penalizing these sequences must reference the additional characteristic of which segment belongs to the stem, which the constraint *$C_{i]stem}$+//VC_i does. Only this constraint accurately assigns violations for the marked structures /$C_{i]stem}$+VC_i/ and /C_iV+$C_{i]stem}$/ seen in (42), and (importantly) it does not assign violations to morpheme-internal haplology. The correct outputs are selected for the gerundive cases (see near the end of §2.1.4 for working tableaux), and tableaux below in (62), (63), and (64) show this constraint also accurately derives the correct outputs for other cases of haplology (or lack thereof) seen in (42).

(62) Deletion for *$C_{i]stem}$+//VC_i in (42.b) /motu+teɾe/ (Harlow 2007:22)

	/motu+teɾe/	*CODA	*[–long]+V_1	*$C_{i]stem}$+//VC_i	MAX
a.	motu+teɾe	e	e	*! W	L
b.	☞ mo_u+teɾe				*

Above, the same constraint ranking used to derive the alternations of the passive and gerundive accurately derive the alternations of the compound prefix /motu–/. The necessary constraint ranking here of course is *$C_{i]stem}$+//VC_i » MAX, which motivates deletion. The correct output candidate is selected for alternations involving the causative prefix as well (63).

(63) Deletion for *$C_{i]stem}$+//VC_i in (42.c) /faka+kino/ 'to speak badly of' (H:22)

	/faka+kino/	*CODA	*[–long]+V_1	*$C_{i]stem}$+//VC_i	MAX
a.	faka+kino	e	e	*! W	L
b.	☞ fa_a+kino				*

Lastly, this constraint is not affected by problems associated with assigning violations to morpheme-internal haplology, since there is no internal morphological structure. Under this analysis, the individual lexical items in (42.e) and (42.f) in the previous section are analyzed as irregular (see footnote 13 on pp. 28). If these forms were regular, there should be a great deal more morpheme-internal hiatus resolved through deletion, yet this is not attested. Morpheme-internal hiatus does not result in violations of *$C_{i]stem}$+//VC_i, as seen in (64).

(64) No deletion for *$C_{i]stem}$+//VC_i in *Potatau*

	/potatau/	*CODA	*[–long]+V_1	*$C_{i]stem}$+//VC_i	MAX
a.	po_atau	e	e	e	*! W
b.	☞ potatau				

Just as with *[–long]+V_1, *n+i, and MORPHLINNASAL, the specificity of the constraint *$C_{i]stem}$+//VC_i arises from both morphological and phonological influences on the grammar. This is curious considering that morphological structure should have so much sway over the grammar and that these constraints should all be as specific as they are, without much basis in universal phonological principles. However, as was demonstrated for each of these constraints, more general alternatives fail to derive accurate outputs without referencing morphological and phonological characteristics.

2.3 Conclusion and issues

This concludes the OT analysis of the passive and the gerundive. A final constraint ranking of *CODA, *[–long]+V_1, *n+i, *a i̯ŋia, *$C_{i]stem}$+//VC_i » MAX » MORPHLINNASAL » Ident[±syllabic] has been shown to correctly derive the attested output candidates in this prior state of Māori through processes such as coda deletion, cross-morpheme vowel deletion and gliding, nasal metathesis, and non-labial nasal haplology.

Before continuing, I want to point to one complication of the analysis which cannot be easily overcome. If it is to be argued that diphthongs are underlyingly two short vowels, then an analysis that posits gliding as repair for cross-morpheme hiatus while morpheme-internal hiatus is not marked must contend with output candidates incurring violations for unnecessarily gliding /V_i+V_j/ sequences morpheme-internally. The tableau below in (65) shows that a candidate which contains morpheme-internal hiatus may not accurately form a diphthong under this analysis.

(65) Deletion without stem-internal gliding in (15.3) /ŋau+ia/ ‘to bite’ (Dict)

	/ŋau+ia/	*[–long]+V_1	MAX	Ident[±syllabic]
a.	ŋau+ia	*! W	L	e
b.	ŋau̯+ia	*! W	L	* W
c.	💣 ŋau+_a		*	
d.	☹ ŋau̯+_a	e	* e	*! W

As the tableau makes clear, the attested output candidate is preferably one that makes as few changes as possible from input to output. The crucial problem here is that the most optimal candidate (c) does not form a diphthong since doing so would result in a non-essential violation of Ident[±syllabic]. However, the attested output is candidate (d), which does have a diphthong.

This is problematic, since surface forms contain diphthongs which—like the diphthong in *ngau*—are presumably unmotivated. However, this may more accurately describe Māori syllabification and gliding than detract from this analysis. As mentioned previously, Harlow notes that all combinations of vowels appear in hiatus in Māori morpheme-internally, yet while

there are examples where /V_i+V_j/ sequences that would be predicted to form diphthongs according to Māori's complicated gradient preferences fail to do so, leaving two short vowels in hiatus (Harlow 2007:69). I propose that the issue of variable gliding is indicative of Māori as a whole and not an issue with this analysis specifically, although the issue is reflected in the analysis sometimes selecting an incorrect output form, as in (65) above. However, this never prevents the first segment of the passive from gliding to avoid a violation of *[–long]+V_1 since the passive is motivated to do so by a highly-ranked markedness constraint, so the analysis still derives correct outputs for vocalic alternations of the passive and gerundive.

That outputs must be derived by means of such specific constraints as *[–long]+V_1, *n+i, MORPHLINNASAL, and *$C_{i]stem}$+//VC_i is evidence that these alternations, as Kibre (1998:21) wrote, 'belong as much to morphology as phonology.' In demonstrating how more general constraints fail to achieve the same results, this has been confirmed: four of the eight constraints in this analysis must reference morphological boundaries as well as phonological features with seemingly no basis in universal phonological principles. In addition to these specific constraints, the correct candidates for alternations arising through vowel hiatus and nasal haplology could only be selected after arbitrarily stating which segment(s) was/were to be deleted, although there is evidence to support these arbitrary selections. While the individual sound changes attested for the alternations of the Māori passive and gerundive—coda deletion, cross-morpheme vowel deletion ad gliding, nasal metathesis, and non-labial nasal haplology—are not uncommon cross-linguistically, these being motivated by such highly-specific constraints as opposed to more general ones certainly sets Māori apart from other languages, typologically speaking. Therefore, there is no surprise as to how the Māori passive and gerundive have become a battleground in the wider debate on generative phonology.

Though this section has proven the attested alternations can be achieved by a parallel OT account, there are numerous additional factors which have yet to be taken into consideration. First, the greatly disproportionate distribution of the default allomorphs *–tia, –hia, –ngia,* and *–a*; second, the pervasiveness of multiple allomorphy; and third, the uneven distribution of allomorphs. These suggest that a phonological analysis alone is insufficient to account for the entire picture of passive and gerundive allomorphy. To answer these questions, a more-than-phonological explanation is required. Hale (1973, 1991) proposed that a reanalysis of the morpheme boundary may have occurred sometime following the loss of consonantal codas. The next section will discuss this possibility, ultimately siding in favor of it. Therefore, the OT analysis presented is an analysis of a past system, one in which coda consonants were present stem-finally in the URs of a number of stems. Data on allomorphy in the modern language, however, suggest that stem-final consonants have been reanalyzed as belonging to the passive and gerundive, which has in effect created numerous competing 'morphemes,' whereas the past system contained only one passive UR and one gerundive UR.

3 Syntagmatic reanalysis

A phonological analysis like the one postulated in the previous section is appealing in that it accounts for the obvious phonological contexts and derived environments which gave rise to passive and gerundive alternants. Although this phonological analysis accurately derives alternants, there is ample evidence that such an analysis is only useful in deriving a previous state of the language. Facts like the widely uneven distribution of allomorphs, the overwhelming prevalence of *–tia* and *–a*, the existence of other default suffixes, and multiple allomorphy in general suggest that a phonological analysis is insufficient, and that the phonologically-conditioned alternants have become reanalyzed into competing paradigms.

Since a comprehensive analysis of the passive and gerundive would not be complete without addressing these facts about the Māori passive, it is vital that these are accounted for. In this section, I advance an argument in favor of a syntagmatic reanalysis of the morpheme boundary—that is, a resegmentation of the passive and gerundive suffixes (following Hale 1973, 1991, and Blevins 1994). I reason that the distribution of default passives and gerundives could not have reached its current state had reanalysis not occurred. Lastly, I argue that affix leveling following reanalysis is capable of giving rise to the present state of allomorphy in Māori, and in addition to answering questions about the distribution of the default suffixes, this resegmentation is uniquely suited to account for multiple allomorphy in general.

Morpheme resegmentation is not particularly rare among the world's languages, and can occur whether it is unmotivated or as a result of some sound change. A commonly cited instance of this occurred in English, where words lost or gained an initial [n] through interaction with the indefinite article *a* ~ *an* (66). Several examples from Diertani (2011) are below.

(66) Morphological resegmentation in English (from Diertani 2011:212–213)
- a. a nadder → an adder (cf. Old English *nœddre*; Old Irish *nathir* 'water snake')
  a napron → an apron (cf. French *napperon*)
  a noumpere → an umpire (from Middle French *nonpeer* 'peerless')
- b. an ekename → a nickname
  an ewt → a newt (cf. Old English *efeta*)
  an otch → a notch (cf. French *hoche*)

Like the unmotivated English example, another instance of resegmentation without motivation occurred in Greek, where the suffix *–thē–* (–θη–) came about through a 'recutting' of the segmental string following roots ending in *-th* (67). The original suffix *–ē–* (–η–) (67.a), which derived intransitive aorists and evolved into a passive suffix by Classical Greek, was gradually ousted by the novel suffix (67.b); in some cases, both alternants are attested with a root (67.c), outwardly resembling the situation of Māori multiple allomorphy.

(67) Greek *–ē–* and *–thē–* (from Diertani 2011:216)

a.	*khar–ē–*	(χαρ–η–)	'rejoice'
	hrag–ē–	(ῥαγ–η–)	'get broken'
b.	*kiln–thē–*	(κλιν–θη–)	'get bent, swerve'
	do–thē–	(δο–θη–)	'be given'
c.	*ēggél–ē–, –thē–*	(ἠγγέλ–η–, –θη–)	'be announced'

Hale (1973) was first to propose that a reanalysis of the morpheme boundary—similar to the ones that occurred in English and Greek—had occurred in the history of Māori sometime between the loss of stem-final consonants and the present day. Unlike English and Greek, the resegmentation in Māori appears to have been induced by the sound change removing codas from the stem. In his reasoning as to why Māori underwent this resegmentation, Hale writes:

> There is a tendency in the acquisition of a language for linguistic forms to be analyzed in a way which minimizes the necessity to postulate underlying phonological representations of morphemes which violate the universal surface canonical patterns of the language (Hale 1973:420).

A situation in which a UR is reanalyzed to conform to the SR with greater accuracy would decrease violations incurred in the course of derivation. Blevins, in agreement with Hale, concludes that a reanalysis of the morpheme boundary would represent a less-costly alternative to the derivations necessary to arrive at the correct output (Blevins 1994). Under the OT analysis in this thesis, if stems were underlyingly consonant-final, words with underlying final consonants would *de facto* incur at least one violation of MAX to conform to Māori's open-syllable surface pattern.

Cases like this would be the norm for stems with final consonants, where the critical ranking of *CODA » MAX ensures no learner could encounter a closed syllable or even encounter alternations suggestive of closed syllables which did not arise through suffixation. As a result, subsequent generations of speakers may not have had sufficient evidence to posit stem-final consonants. Over the course of several generations, consonant-zero alternations between passive and gerundive forms and uninflected stems were likely reanalyzed by speakers as belonging to the suffixes. See (68) for a demonstration.

(68) Reanalysis over the generations

	Active	*Passive*	*Gerundive*
Gen 1	*hopuk*	*hopuk–ia*	*hopuk–anga*
Gen 2	*hopu_*	*hopuk–ia*	*hopuk–anga*
…			
Gen n	*hopu*	*hopu–kia*	*hopu–kanga*

A hypothetical Generation 1 preceding the shift from closed to open syllables believes thematic consonants belong to their active stems since these consonants surface in uninflected forms. The shift to open syllables takes place in Generation 2, and formerly final consonants now appear only in the suffixed cases. The surface evidence suggesting thematic consonants appear alongside suffixes prompts a later Generation n to reanalyze the morpheme boundary, causing thematic consonants to change their affiliation from stems to suffixes. However, this change did not affect only the thematic consonants, but all active/passive alternations: passive alternations involving the alveolar nasal with original URs such as /katan+ia/ 'to laugh'→ [kata–n̪a] (W:64) have been reanalyzed to contain the metathesized nasal, as in *kata–ina*. This resegmentation ultimately gave rise to numerous morphologically-conditioned alternants, the more productive of which have spread to other stems through the effects of leveling, explaining the enlarged distributions of the default allomorphs.

What this goes to show is that learners will reanalyze URs to conform to surface patterns in the absence of contradictory evidence, even if this places considerable strain on learnability (Diertani 2011:225). A simple coda deletion rule was substituted for sixteen morphologically-conditioned alternants: the process of learning which alternants appear with which stems must represent a formidable task on the part of learners. It is no wonder, therefore, why Māori passive alternants engage in the degree of multiple allomorphy that they do, and it is also no wonder why speakers of other Polynesian languages have taken leveling to a much greater extent than Māori.

This theory of reanalysis is consistent with variation seen in passive and gerundive allomorphy and with variation across passives in Polynesian languages, and the theory explains the rise of default allomorphs, multiple allomorphy, and the uneven distribution of allomorphs. These would be difficult to account for under an analysis in which there was no morphological

resegmentation. For one, if consonants had remained a part of the stem, then one allomorph only should appear with each stem. It would not be possible to derive a range of consonantal and vocalic allomorphs as in the case of *wawata* 'to desire earnestly' → *wawata–ngia*, *wawata–hia*, *wawata–tia* (Dict) or *awhe* 'to hem in' → *awhe–a*, *awhe–hia*, *awhe–tia* (Dict) if there were only one UR for the passive and one stem-final consonant (or lack thereof). Moreover, this would also not be possible to achieve under the stem leveling theory proposed by Sanders (1990) or the [t]-epenthesis theory proposed by de Lacy (2003). While these are able to capture leveling of *–tia* forms, they cannot account for leveling of several affixes which are each motivated by a root-leveling default principle specific to a different stem-final consonant. For example, in the case of multiple allomorphy of *awhe*, there would need to be at least two stem-leveling rules as posited by Sanders (1990) to account for the innovative forms, and then we would have to ask if it could be possible that the stem-final segment could be /e/, /h/, and /t/ *all at once*.

One of the pieces of evidence used to argue for a purely phonological analysis and against the morphological resegmentation postulated and argued for by Hale (1973, 1991) is that a stem's passives and gerundives in large part share the same thematic consonants, suggesting these consonants remain with the stem. The data do show that in a vast number of cases, this is true. However, variation can be seen. As with the passive, the [t]- and [h]-based allomorphs of the gerundive have become defaults (see Harlow 2007:121–122), and for this reason, examples exist where the consonant in the passive form is not the same as that of the gerundive form, and words which would not normally be passivized form nouns with the addition of the default gerundive alternants, further evidence that these consonants do not belong to the stem. I argue it is Māori's conservative nature which has in large part determined that identical consonants appear in the passive and gerundive of a given stem.

Second, that Polynesian languages have regularized different passive forms—as in *–tia* for Māori, *–'ia* for Hawai'ian (> PPN /k/), *–a* for Rarotongan, and *–hia* for Tahitian—is evidence of variability in default forms and lack of correspondence across the regularized passives in different languages (Hale 1991:100–101). Sanders (1990) objects to Hale's (1973, 1991) reanalysis and affix-leveling scenario on the grounds that under this theory, there is no reason to favor the *–tia* alternant over any other arbitrary morphologically-conditioned alternants. That different Polynesian languages have regularized different consonantal forms and that two dialects of Māori itself are in the process of leveling different forms confirms that there is no reason to favor any consonantal forms at all. The choice to regularize an arbitrary alternant is just that: purely arbitrary.

We are left with this scenario: alternations arising through phonological and morphological influences (§2) have been reanalyzed into morphologically-conditioned entities through the absence of evidence that codas exist (§3). This reanalysis turned the alternants into competing paradigms which have undergone leveling, thus explaining multiple allomorphy, the rise of default allomorphs, variation between a stem's passive and gerundive suffixes, and different Polynesian languages regularizing different suffixes. In the following section, I present a corpus study of Māori passives. I hope to show that the extent of variation among passive alternants is consistent with this theory, and consistent with an analysis in which alternants are in more or less free variation, although the phonological processes presented in (§2) continue to regulate allomorphy to some extent.

4 A corpus study

The tendency for verbs to accept multiple passive forms was argued to be evidence that the URs of active stems and their suffixes have changed (§3), on the grounds that, among other

things, the range of multiple allomorphy seen in Māori passives, allomorph distribution, and the rise of default suffixes *–tia*, *–hia*, *–ngia*, and *–a* would be difficult to account for if thematic consonants remained with stems and had not been reanalyzed into competing paradigms. This section presents a preliminary corpus study of Māori passive allomorphs and explores multiple allomorphy among these passives, analyzing the distribution and percent occurrence of passive alternations as a means of gaining a clear picture on the true extent of leveling.[16] A discussion of the default suffixes follows, offering support for Hale's claims on the default status of *–tia*. Another goal of this section is to reinforce assertions made during the OT analysis regarding the vocalic alternations *–ia* and *–a*, the alveolar nasal alternations *–ina* and *–na*, and the velar nasal alternations *–ngia* and *–nga*. It will be shown that despite a morphological resegmentation and leveling of default forms, there are continued effects of phonological factors on the morphophonology of passive alternations.

The corpus is organized as follows. There are five pages, into which forms were separated by the effect(s) suffixation has on the stem. The first page includes examples where suffixation takes place without any effect on the stem, as in *hopu ~ hopu–kia* 'to catch' (W:59); the vast majority of stems undergo no change when the passive or gerundive morphemes are added, and as a result this page contains the majority of forms in the corpus. There are 401 stems, ten of which are loan words adapted from English, and 62 are derived causatives. The remainder of stems in this page are morphologically simple or are reduplicated forms. I use data from the first page of the corpus to advance arguments for the remainder of §4.

The second through fourth pages of the corpus are dedicated to the two sub-patterns mentioned in the introduction: vowel lengthening and reduplicated first syllable dropping. The second page of the corpus includes fourteen examples where suffixation causes the vowel in the stem's first syllable to lengthen, as in *tiki ~ tīki–na* 'to fetch' (W:62). The third page includes nine examples where suffixation causes a reduplicated first syllable to be dropped, as in *(pu)puri ~ puri–tia* 'to hold' (W:63). The fourth page includes eight examples where suffixation causes an initial reduplicated vowel to be dropped in addition to the lengthening of a vowel in the resulting first syllable, as in *(hu)huti ~ hū–tia* 'to pluck up' (W:65). As I have not provided an analysis of these sub-patterns, I decline to analyze them in the corpus study. Future work will have to be dedicated to analyzing these sub-patterns in depth.

The fifth and final page in the corpus includes only three examples, and these are of suffixation which causes a change in the quality of a vowel in the stem. The three verbs in this page are *rongo ~ rangona* 'to hear' (W:63), the derived causative *whakarongo ~ whakarangona* 'to listen, hear' (Dict), and *mea ~ meinga, meingatia, meatingia, meatia* 'to say, speak' (Dict). Since there are only three verbs which fall under this category, I do not discuss them further.

4.1 Multiple allomorphy

A phonological analysis successfully accounts for the alternations seen in the passive and gerundive, but this alone is insufficient to account for the range of multiple allomorphy exhibited by passivized stems. Williams (1862) was the first to note that some stems form the passive with one allomorph and other stems with several, and the extent of this variation suggests that the UR of stem and passive suffix has changed. This section analyzes the extent of multiple allomorphy, especially with regard to the number of allomorphs taken by different types of stems.

[16] Nominalized stems formed by means of the gerundive suffix are normally presented in dictionaries as their own entry and do not list other gerundive allomorph(s) which may appear with the stem, and so I do not analyze gerundive forms in this corpus study since the corpus centers around questions of multiple allomorphy.

In the first page of the corpus there are 401 stems, which altogether take 768 passive allomorphs. Out of these 401 stems, each stem has an average of 1.915 allomorphs (768/401), with a range from one to six allomorphs (the verb stem *whao* 'to put into, fill' forms the passive with six allomorphs, more than any other stem in the corpus: *whao–ngia*, *whao–na*, *whao–whia*, *whao–ria*, *whao–hia*, and *whao–whina* (Dict)). There is a fairly strong divide among the number of allomorphs taken by bimoraic stems versus the number taken by stems which are trimoraic or larger. On average, bimoraic stems have 1.751 allomorphs per stem (303/173), while trimoraic and larger stems have 2.039 allomorphs per stem (465/228). The reason for this discrepancy may be due to the consonantal default allomorphs *–tia*, *–hia*, and *–ngia*. While bimoraic stems have been found to consistently take the *–a* allomorph as their chosen default, trimoraic and larger stems take *–tia* (Blevins 1994). In one dialect, *–hia* and *–ngia* take the place of *–tia* as defaults, meaning trimoraic and larger stems could take all three default consonantal forms in addition to other passives, whereas bimoraic stems take only *–a* in addition to other passives.

The data in this corpus does not include just one allomorph per stem but rather all the cited allomorphs of a given stem. Therefore, there is a major difference between the nature of this data and that of the independent counts given by Sanders (1990). As can be expected, these findings are markedly different. The data are shown below in (69), compared to the consonant frequencies given by Harlow (2007). Curly brackets indicate the sum of the numbers or *per cents* to the right. While the data are for the most part organized from most number of instances per allomorph to least, the vowel-only and alveolar and velar nasal allomorphs are presented side-by-side for comparison, and the four *–Cina* allomorphs are presented last in the chart.

(69) Multiple allomorphy of 401 verb stems (C frequencies from Harlow 2007:68)

Allomorph	*# of instances*		*% of stems*		*C Frequency*
–tia	180		44.888%		[t], 9.8%
–a	155	208	38.653%	51.870%	
–ia	53		13.217%		
–hia	127		31.671%		[h], 4.5%
–ngia	108	111	26.933%	27.681%	[ŋ], 2.0%
–nga	3		0.748%		
–ria	25		6.234%		[ɾ], 5.7%
–na	21	40	5.237%	9.975%	[n], 3.4%
–ina	19		4.738%		
–kia	14		3.491%		[k], 7.9%
–mia	6		1.496%		[m], 3.7%
–whia	2		0.499%		[f], 1.0%
–kina	3		0.748%		
–hina	2		0.499%		
–whina	1		0.249%		
–rina	1		0.249%		

The data from this corpus study show that the most common allomorphs are *–tia* (44.888%), *–a* (38.653%), *–hia* (31.671%), and *–ngia* (26.933%). These greatly outnumber even the next most common allomorph, *–ia* (13.217%). Since a majority of Proto-Oceanic stems presumably ended in vowels, the prevalence of *–a* is unsurprising (Hale 1990). What is surprising, however, is the extent to which [t]-, [h]-, and [ŋ]-based varieties are out of proportion with those consonants' presence in the language. When taken with the distribution of less-productive forms compared to those consonants' frequency, this suggests that the default allomorphs are spreading to the environments once occupied by the less-common allomorphs.

The results of the corpus study show that the extent of allomorphy in Māori is much greater than has been previously known. The most recent to work on the allomorphs was Jones (2008), who organized stems into 28 categories based on the allomorphs taken by each stem, producing categories such as {ia}, {tia, a}, {tia, hia}, etc. (see Jones 2008:43). However, this corpus shows that allomorphy is much more complex. Not only do the results show that many stems can take more than three allomorphs (Jones' work features a single category of stems which can take three allomorphs, and this category contained a single stem), the results also confirm that it is not particularly uncommon for stems to take four or even five allomorphs, although there are far fewer stems which take four or five allomorphs compared to those which take one, two, or three. The data on allomorphs per stem is summarized in (70).

(70) Number of allomorphs per all stems

Allomorphs per stem	*# of stems*	*% of 401 stems*
1	171	42.643%
2	131	32.668%
3	71	17.706%
4	19	4.738%
5	8	1.995%
6	1	0.249%

Just as there was shown to be a divide between average allomorphs per bimoraic stem versus average per trimoraic and larger stems, this data show a difference between the number of allomorphs accepted by bimoraic stems and those accepted by trimoraic and larger stems. Bimoraic stems usually take only one or two allomorphs (71).

(71) Number of allomorphs per bimoraic stem

Allomorphs per stem	*# of stems*	*% of 173 bimoraic stems*
1	85	49.133%
2	56	32.370%
3	26	15.029%
4	3	1.734%
5	2	1.156%
6	1	0.578%

On the other hand, trimoraic and larger stems tend to take more allomorphs than bimoraic stems do, as seen in (72).

(72) Number of allomorphs per trimoraic stem

Allomorphs per stem	*# of stems*	*% of 228 trimoraic and larger stems*
1	86	37.719%
2	75	32.895%
3	45	19.737%
4	16	7.018%
5	6	2.632%

For derived causatives versus bare stems, there is an even greater divide in number of allomorphs accepted by these stems. I argue this is due to the tendency for causatives to accept the default allomorph *–tia* in addition to the allomorph(s) of the bare stem (see §4.2.2 for discussion). Data show a slim majority of derived causatives take three allomorphs per stem, with the next closest number being two allomorphs per stem, followed by one (73).

(73) Number of allomorphs per derived causative

Allomorphs per stem	*# of stems*	*% of 62 causatives*
1	15	24.194%
2	17	27.419%
3	18	29.032%
4	9	14.516%
5	3	4.839%

A majority of bare stems take only one allomorph, with the next closest number being two per stem (74). Bare stems which take one or two allomorphs per stem account for 79.636% of all bare stems, whereas derived causatives which take one or two allomorphs per stem account for only 51.613% of causatives, a difference of 28.023%. The data for bare stems below does not include the ten loan words present in the corpus.

(74) Number of allomorphs per bare stem

Allomorphs per stem	*# of stems*	*% of 329 bare stems*
1	150	45.593%
2	112	34.043%
3	52	15.805%
4	9	2.736%
5	5	1.520%
6	1	0.304%

These results show that multiple allomorphy is more extensive than has been argued previously. They also show that there are differences between the number of allomorphs taken by bimoraic stems versus trimoraic and larger stems, suggesting allomorph distribution is in some way quantity-sensitive. Further evidence of quantity-sensitive allomorphy is discussed in §4.2.5 regarding the allomorphs *–tia* and *–a*. The data for derived causatives and bare stems show there is a much greater chance that a derived causative takes more allomorphs than a bare stem. §4.2.2 further explores the differences between derived causatives and bare stems.

Many stems can be found which take the allomorphs *–tia*, *–hia*, *–ngia*, and *–a*, in addition to less-productive allomorphs, providing a justification for the treatment of *–tia*, *–hia*, *–ngia*, and *–a* as default allomorphs. The next subsection analyzes default allomorphy in detail, with an in-depth discussion of the default status of *–tia* and *–a*. Specifically, I address the six pieces of evidence that Hale (1973) provided for the default status of *–tia* and will provide support for a number of these claims. In addition, the results confirm Blevins' (1994) claim regarding the weight-sensitive nature of *–tia* and *–a.*

4.2 Default allomorphy

It has been argued that several allomorphs have risen to default status in modern Māori (see Hale 1973, 1991; Sanders 1990, 1991; Blevins 1994 for discussion). These default allomorphs drive multiple allomorphy to a great extent, and as these have spread beyond their original distribution, they have gradually overtaken less productive allomorphs. This subsection is dedicated to exploring the default allomorphs *–tia*, *–hia*, *–ngia*, and *–a*. The most common allomorph in the corpus is *–tia*, which appears with 44.888% of stems. Following this allomorph are *–a* (38.653%), *–hia* (31.671%), and *–ngia* (26.933%). This shows that while the *–hia* and *–ngia* consonantal forms are indeed more productive than other allomorphs, the *–tia* alternant is by far the most productive consonantal form. According to Hale (1973), there are six pieces of evidence supporting the idea that *–tia* is Māori's default passive allomorph. These are (paraphrased from the original source):

(75) Hale's six pieces of evidence for default *–tia* (from Hale 1973)

1. Nominal stems used verbally in spontaneous discourse take *–tia* in the passive.
2. Causatives derived by means of the causative prefix *whaka–* form the passive with *–tia*, even if the bare verb selects a different allomorph.
3. Certain adverbials agree in voice with the verbs they modify, and these take *–tia* even if the verb takes a different allomorph.
4. English loanwords take the *–tia* allomorph even if they are unassimilated and do not follow the normal phonological rules of Māori.
5. Compound verbs formed by incorporation of the adverbial phrase commonly take *–tia.*
6. *–tia* can be used when the conventional passive is forgotten or otherwise lost.

In addition to these six pieces of evidence, *–tia* was found to predominate among a 'prosodically defined' subclass of verbs three or more morae in length (Blevins 1994). Thus there is some basis to treat *–tia* as Māori's default allomorph, although counterexamples to this trend exist. While all four of these allomorphs are common, I dedicate a majority of this subsection to discussing Hale's six pieces of evidence that *–tia* is the true default in Māori. The findings of this corpus confirm a number of Hale's claims, in addition to other facts about default allomorphs. While it would be greatly beneficial to discuss *–hia* and *–ngia* in the same way, it

appears that these allomorphs appear in many of the same environments as *–tia*, and so I do not treat these to their own discussion, rather incorporating them into discussion of *–tia* and *–a* when appropriate. Blevins' (1994) finding that the distribution of *–tia* and *–a* is weight-sensitive is confirmed by the results of this corpus as well. Lastly, while the allomorphs *–hia* and *–ngia* are still defaults in that they appear with a large number of stems, these do not have the same weight-sensitive distribution as *–tia* and *–a*, an indication that there are differences even among default allomorphs.

4.2.1 Passivized nominals

Regarding Hale's first piece of evidence, Sanders (1990) finds issue with the claim that nominal stems take *–tia* in the passive on the grounds that this claim is too general. Sanders cites two non-verbal roots from Hohepa's grammar—*pū* 'gun' and *pai* 'good'—which form the passive with *–hia* and *–ngia*, respectively, suggesting that Hale's first piece of evidence concerning passivized nominals is not as general as would seem. Sanders also references the nominalization of *mate* 'dead,' which is *matenga* 'death,' rather than **matetanga*, which is to be expected Hale's claims were 'entirely' general (Sanders 1990).

While queried nouns in *Te Aka Dictionary* online are not listed with their passive allomorph(s), there are examples of passivized nouns and even names (proper nouns) in Harlow (2007) which are cited with allomorphs other than *–tia*: *kōhatu–ngia* 'become a stone' from *kōhatu* 'stone' (Harlow 2007:119) and *Ngā–Pōtiki–hia* 'become Ngā Pōtiki's' from *Ngā Pōtiki*, a proper noun (Harlow 2007:120). However, the counterexamples from Harlow (2007) and Hohepa (1965) involve the default alternants *–hia* and *–ngia*, which may suggest that these default forms have been substituted for the default *–tia* or that the data were collected from informants belonging to the *–hia* and *–ngia* dialect, where these suffixes take the place of *–tia.* Despite these counterexamples, there is one example in Harlow (2007) of a phrase incorporating a noun which is cited with the *–tia* alternant, in line with Hale's claim: *whetū–rangi–tia* (star–heaven–PASS) 'star of the heaven' (Harlow 2007:120).

While Hale's claim may have been too general to account for the realities of *–tia* allomorphy, the evidence does point to default allomorphs being used to passivize nominals, especially consonantal default allomorphs, which would be in line with Hale's claim that the default variety has spread to this context. Another piece of evidence in favor of this claim has to do with passivized prepositional phrases. The head of a verb phrase itself may be a prepositional phrase, a vestigial construction from an earlier state of the language (Harlow 2007:120). The three examples of this from Harlow (2007) appear with *–tia*, which may provide evidence that passivized prepositional phrases behave similarly to passivized nouns in spontaneous discourse:

(76) *–tia* used in passivized phrases (from Harlow 2007:120)

1. [*Mā* *te* *matapihi*]***–tia*** *mai*
   [P Det above]–PASS Dir
   'Pass (it) in through the window.'
2. *Kei* [*rā* *runga*]***–tia*** *mai* *tatou* *e* *Hātana*:
   TA [P above]–PASS Dir 1Pl.Incl Agt Satan
   'Lest Satan should get an advantage of us:'
3. *Ko* *te* *waka* *i* [*na* *ruinga*]***–tia*** *mai* *ai* *ko* *Aotea*.
   Top Det canoe TA [P above]–PASS Dir Aph Pred A
   'The canoe on which he (Turi, the captain of Aotea canoe) came here was Aotea.'

The data show the *–tia* alternant indeed predominates, as Hale claims, but that that there is variation. These findings suggest *–tia* may be the preferred means of passivizing nouns and prepositional phrases, although it is not the only way.

4.2.2 Derived causatives

Second, Hale argues there is a tendency for derived causatives to form the passive with *–tia*. Sanders argues that this piece of evidence is incorrect due to 1) many counterexamples in which the derived causative forms the passive with the same allomorph as its non-causative bare stem and 2) causatives that form the passive with another allomorph other than the default *–tia*. However, derived causatives do indeed show a greater tendency to take the *–tia* allomorph, as found by Blevins (1994), who argues in addition to this that causatives formed from verb stems could be lexicalized, while those derived from noun and adjective stems—which cannot normally be passivized in isolation—are not. Lexicalized causatives would be free to take an allomorph different from the non-causative form, while those that are non-lexicalized would be forced to choose *–tia* or the same allomorph as that chosen by the non-verbal stem. The above would be consistent with Hale's generalization that causative forms in general take the alternant *–tia* as a default (1994:36). While addressing the issue of lexicalization among causative forms is beyond the scope of this work, it may be possible that the claims made by Hale, Blevins, and Sanders with regard to default *–tia* and causative verbs are each correct to some degree.

There are 62 causative verbs in the first page of corpus. Of these, *–tia* appears alongside 45 of them, or 72.581%. *–tia* is vastly more common alongside causatives than the other allomorphs. In order of prevalence, the data show that *–ngia* appears with 29 stems (46.774%), *–a* with 27 (43.548%), *–hia* with 27 (43.548%), *–ria* with ten (16.129%), *–ia* with four (6.452%), *–ina* with three (4.839%), *–kia* with two (3.226%), and *–na* with two (3.226%). The difference between percent occurrence of *–tia* and that of *–ngia*, the next most common allomorph, is 25.807%. Allomorph counts for causative verbs and bare stems are vastly out of proportion with each other. There are 329 bare stems on the first page of the corpus. Looking only at default varieties, *–tia* appeared with 149 stems (45.289%), *–a* with 132 (40.122%), *–hia* with 105 (31.915%), and *–ngia* with 83 (25.228%). This shows that *–tia* is by far more common amongst derived causatives than it is amongst bare stems, which directly supports Hale's second piece of evidence.

However, there may be cause to not regard causatives as noteworthy with regard to *–tia* allomorphy. Blevins found that *–tia* was common amongst stems which were three or more morae in length (I discuss this proposal in §4.2.5). Of the 157 bare stems in the corpus which are three morae or greater, 119 of them form the passive with *–tia*, or 75.796%. This is not much greater than the 72.581% of causatives that formed the passive with *–tia*. I propose *–tia* is common amongst derived causatives because of their greater length as compared to their underived bare stems. The causative prefix *whaka–* adds an additional two morae to a stem, which itself must *de facto* be bimoraic or larger. This means the fewest number of morae a derived causative could possess is four, already beyond the trimoraic window for selecting *–tia* as default of choice. This would lead to larger-than-trimoraic causatives forming the passive with *–tia* while their bare stems select different allomorphs. Under this hypothesis, the tendency for causatives to also form the passive with the allomorphs of their bare stems would simply be a result of speakers faithfully using the allomorphs of the bare stems.

To assess claims made by Hale and Blevins on one hand and Sanders on the other regarding whether causatives form the passive with the same or different allomorphs as their underived stems, I selected ten causative verbs and their non-causative stems from the corpus study at random. This was to investigate 1) if derived causatives formed the passive with *–tia* as the default if the non-causative stem could not be passivized (evidence supporting Hale and Blevins' findings), 2) if there was a tendency to take the *–tia* allomorph if the non-causative stem could be passivized (which would also support Hale and Blevins), and/or 3) if such a tendency had counterexamples where the causative's passive allomorph(s) were identical to those in the simple stem or where a causative derived from a stem that could not be passivized took an allomorph other than *–tia* (supporting Sanders). These causatives and their active stems are presented below with their passive allomorph(s) arranged beside them (data from *Māori Dictionary Online*). '0' indicates the allomorph's absence, while '+' indicates the allomorph is found alongside the verb in modern speech. If a verb possessed more than one definition, I selected only one out of considerations for space.

(77) Survey of passivized causative forms and their non-causative counterparts (data from Dict)

	Definition	*Verb*	*–ia*	*–a*	*–ngia*	*–ina*	*–ria*	*–hia*	*–tia*
1.a.	'to make run'	*whaka–omaoma*	0	0	0	0	0	0	+
b.	'to run'	*omaoma*	0	0	0	0	0	0	0
2.a.	'to drop frequently'	*whaka–takataka*	0	0	0	+	0	0	0
b.	'to fall frequently'	*takataka*	0	0	0	0	0	0	0
3.a.	'to denigrate'	*whaka–tūtūa*	0	0	0	0	0	0	+
b.	'to be low-born'	*tūtūa*	0	0	0	0	0	0	0
4.a.	'to illuminate'	*whaka–mārama*	0	0	+	0	0	+	+
b.	'to be clear'	*mārama*	0	0	0	0	0	0	0
5.a.	'to clear, free'	*whaka–wātea*	0	0	+	0	0	0	+
b.	'to be free'	*wātea*	0	0	0	0	0	0	0
6.a.	'to organize'	*whaka–haere*	0	+	+	0	0	+	+
b.	'to go, depart'	*haere*	0	+	0	0	0	+	+
7.a.	'to set down'	*whaka–takoto*	0	0	+	0	+	+	+
b.	'to lie down'	*takoto*	0	0	0	0	+	0	0
8.a.	'to set in motion'	*whaka–rewa*	+	0	+	+	0	0	0
b.	'to melt'	*rewa*	0	0	0	0	0	0	0
9.a.	'to save, rescue'	*whaka–ora*	0	0	+	0	0	+	+
b.	'to be alive, well'	*ora*	0	0	0	0	0	0	0
10.a.	'to make stand'	*whaka–tū*	0	0	+	0	+	+	+
b.	'to stand'	*tū*	0	0	0	0	+	0	0

The table above makes several things clear. First, corroborating Hale and Blevins' claims, the causatives (77.1.a) and (77.3.a) take *–tia* even if their non-causative verb stems cannot be passivized and thus have no preference for an allomorph. This must not be the case

generally, however (in line with Sanders' finding), as (77.2.a) takes the much less common *–ina* when, exactly like (77.1.a) and (77.3.a), its active stem has no passive at all. This finding is doubly surprising considering the general rarity of *–ina* compared to *–tia* (recall that in the corpus study, *–ina* appeared with only 4.738% of verbs, whereas *–tia* with 44.888%), or the two other default suffixes *–ŋia* and *–hia* (appearing with 26.933% and 31.671% of verbs, respectively).

Since the *–ŋia* and *–hia* allomorphs take the place of the default *–tia* in other dialects, it would not be as surprising to find a causative taking one or even multiple of these defaults given the non-causative stem has no passive at all. In fact, this is the case with causatives (77.4.a), (77.5.a), and (77.9.a) above. But that *–ina* should appear in (77.2.a) as well as appearing as one of the allomorphs of (8.a), as opposed to a default suffix in this case, is surprising since it suggests the 'default' status of passive allomorphs for the causative is in fact much more nuanced than would appear at face value. If it were not, then there would be no reason for an allomorph as uncommon as *–ina* to be the sole passive allomorph for any causative derived from a stem without preference.

The causatives in (77.6.a), (77.7.a), and (77.10.a) suggest that there is a tendency among causatives to retain the passive alternants of their stems. This can be done while also selecting one or more of the default alternants. However, this random selection shows no causative that takes the allomorphs of the non-derived form and those allomorphs only. What the data show is both the retention of the allomorphs of non-causative stems in the derived causative as well as the tendency to select *–tia* (or the other default allomorphs) as a default. The above selection is not a comprehensive overview of passive allomorphy for causative verbs, and it does not refute the claims made by Hale (1973, 1991), Sanders (1990), 1991), or Blevins (1994). Instead, it demonstrates the reality that it is possible for each of the arguments presented by these researchers to be correct to some extent. The resulting picture of passive allomorphy and derived causatives is more complicated and unwieldy than previously argued by either side.

While the data show that neither argument is fully general, the finding that 72.581% of causatives take *–tia* is evidence that Hale's claim that causatives select this allomorph as a default has some weight. However, considering the extent of variation seen in (77), I would argue that there is no unique pressure for causatives to select *–tia*, or else the presence of *–tia* would be greater following these causatives. In particular, that some causatives form the passive with a highly unproductive passive form, even when their bare stem cannot be passivized, is evidence that while *–tia* is common among causatives, it is not a default for them. I propose that the prevalence of *–tia* among causatives is instead due to these causatives being larger than three morae in length. 119 of the 157 trimoraic and larger bare stems in the corpus form the passive with *–tia*, which comes out to be 75.796%. The difference between percent of bare trimoraic and longer stems which take *–tia* and causatives which take *–tia* is only 3.215%. This is far from any meaningful statistical difference between trimoraic and larger stems and causatives. In fact, the data show these behave quite similarly with regards to selecting *–tia*. Since derived causatives are always larger than three morae, the apparent pressure for causatives to form the passive with *–tia* could be on account of them being larger than the size necessary to select *–tia*. If this were the case, then it is not that causatives by default form the passive with *–tia*, but rather that causatives are participating in the migration to a quantity-sensitive pattern of allomorphy. I discuss this quantity-sensitivity in further detail in §4.2.5.

4.2.3 Passivized adverbials

Regarding Hale's evidence that adverbials agreeing with the passive head and compound verbs incorporating a noun from an adverbial phrase take *–tia*, there is some evidence in favor of this. Bauer (1981), echoing Hale's claim, noted that adverbials take a passive ending in agreement with the verb they modify, and these tend to take the *–tia* allomorph regardless of the passive allomorph the verb stem takes. Also in support of this, there are numerous examples of postverbal adverbs agreeing with the passive verb using *–tia*.

While I do not have data in the corpus study to confirm this, I have pulled examples from various sources to present in favor of *–tia* as the chosen allomorph for agreeing adverbials. The examples below contain definitions or translations given by the original source, and to make the data more transparent, I have added glosses for each of the words. Since glosses are not given in the original sources, there are occasional discrepancies between the exact semantics of these words as given by the *Te Aka Online Dictionary* and the semantics given by the original source. When such a discrepancy occurred, I erred on the side of caution and defaulted to the translation given by the cited source. The unmarked glosses come from searching these words in the *Te Aka Dictionary* and finding a definition that was the same or nearly the same as that given by the original source. The dagger '†' appearing next to a gloss is meant to indicate that I was not able to find the exact definition for that word in the dictionary, and that the given definition is one approximated from the original source.

(78) Postverbal adverbs and quantifiers with /t/-based passive allomorphs

1. *patu**–a*** *maori**–tia***
   hit–PASS unintentionally†–PASS
   'struck unintentionally' (Hale 1991:99)
2. *pei**–a*** *maori**–tia***
   banish–PASS without ceremony–PASS
   'banished without ceremony' (Hale 1991:99)
3. *kai**–nga*** *katoa**–tia***
   eat–PASS wholly†–PASS
   'eaten wholly' (Hale 1991:99–100)
4. *ako**–na*** *tonu**–tia***
   learn–PASS still–PASS
   '(being) learned still' (Hale 1991:100)
5. *kai**–nga*** *ota**–tia***
   eat–PASS uncooked–PASS
   'eaten raw' (Hale 1991:100)
6. *patu**–a*** *rawa**–tia***
   kill–PASS outright†–PASS
   'killed outright' (Hale 1991:100)
7. *mahi**–a*** *kē**–tia***
   make–PASS otherwise†–PASS
   'made otherwise' (Hale 1991:100)
8. *kite**–a*** *noa**–tia***
   see–PASS just–PASS
   'just seen' (Kibre 1998:11)

9. *aroha–**tia*** *nui–**tia***
   love–PASS dearly†–PASS
   'dearly loved' (Kibre 1998:11)
10. *patu–**a*** *pokerehū–**tia*** *noa–**tia***
    hit–PASS without cause–PASS without conditions–PASS
    'was hit without rhyme or reason' (Kibre 1998:11)

Additionally, the [t]-based allomorph of the gerundive supposedly appears with considerable frequency when postverbal adverbs are nominalized, as in these two examples from Kibre 1998. As before, these glosses are my own.

(79) Postverbal adverbs with /t/-based gerundive allomorphs
1. *whiu–**nga*** *pākaha–**tanga***
   punish–NOM severe–NOM
   'severe punishing' (Kibre 1998:11)
2. *tangi–**hanga*** *hotuhotu–**tanga***
   cry–NOM sob–NOM
   'sobbingly crying' (Kibre 1998:11)

The facts presented above support the claim that [t]-based varieties of the passive and gerundive have become the most common allomorphs for adverbials agreeing with a passive verb. As for counterevidence, while I am certain such exists, I have not been able to find any. Future research will have to investigate the claims addressed in this subsection using native speakers for data, which sadly is beyond the scope of this work.

4.2.4 Unassimilated borrowings

As for Hale's claim that unassimilated borrowings from English take the *–tia* ending, there is solid evidence that *–tia* is the preferred default for these stems. Sanders asserts there is evidence to suggest Hale's fifth claim is also not as general as stated by Hale, since the unassimilated word *kihi* 'to kiss' is *kihi–a* in the passive and not *kihi–tia*, which is to be expected under Hale's claim. However, like the other pieces of evidence for *–tia* as a default, while this is not as general as the original claim, it is nonetheless true that loan verbs take *–tia* in the passive.

In the corpus study, there are ten stems borrowed from English. In this count of unassimilated English borrowings, what I found is largely in line with Hale's claim despite the fact that there are only ten borrowed stems. These ten English borrowings are presented below in (80).

(80) Multiple allomorphy in ten English borrowings (data from Dict)

	Definition	*Verb*	*–ia*	*–a*	*–ngia*	*–ina*	*–ria*	*–hia*	*–tia*
1.	'to report'	*rīpoata*	0	0	+	0	0	0	+
2.	'to receive a pension'	*penihana*	0	0	0	0	0	0	+
3.	'to register'	*rēhita*	0	0	0	0	0	0	+
4.	'to monitor'	*monita*	0	0	0	0	0	0	+
5.	'to play'	*perei*	0	0	0	0	0	0	+
6.	'to wheel'	*wīra*	0	0	0	0	0	+	+
7.	'to lease, rent'	*rīhi*	0	0	0	0	0	0	+
8.	'to telephone'	*rīngi*	0	0	0	0	0	+	0
9.	'to vote, elect'	*pōti*	0	0	+	0	+	+	+
10.	'to will, bequeath'	*wira*	+	0	+	0	0	0	+

As the above shows, *–tia* is the only allomorph regularly selected by borrowed verbs. Of the ten borrowed verbs in the corpus, *–tia* appears alongside nine. In addition to this data, Blevins (1994:38) provides twelve borrowings which also form the passive with *–tia*. Of these, only one is present in this data as well, *rīngi*. These findings suggest Hale was indeed correct in his claim that *–tia* is the preferred allomorph for unassimilated loan words. When loan words form the passive with an allomorph other than *–tia*, usually this is done by means of one of the other default suffixes, and instances of a loan word forming the passive with neither of the defaults, while definitely present, are rare (for example, (80.9) is the only borrowed verb stem in the corpus which forms the passive with a non-default allomorph).

4.2.5 Quantity-sensitive allomorphy

Blevins (1994) found that *–tia* is used as a default for verbs longer than two morae, while *–a* is a default for words that were two morae in size. This finding is also confirmed by the corpus. The *–tia* allomorph is vastly more common among stems which are three morae and larger than it is among bimoraic stems. In the corpus, *–tia* appears alongside 75.439% of trimoraic and larger stems (172/228), including causatives and borrowings, while *–a* only appears with 34.649% of these stems (79/228). Conversely, the *–a* allomorph appears with 46.243% of bimoraic stems (80/173), while *–tia* appears with only 17.919% (31/173). These findings are represented below (81).

(81) Counts of *–tia* and *–a* for ≥ trimoraic and bimoraic stems

	≥ 3 morae (228)	= 2 morae (173)
–tia	172 (75.439%)	31 (17.919%)
–a	79 (34.649%)	80 (46.243%)

This supports Blevins' (1994) finding and suggests that *–tia* and *–a* are migrating into a weight-sensitive paradigm. At the same time, however, the other consonantal default forms are not following this same route, at least not as quickly as *–tia* and *–a*. *–hia* is more common for trimoraic and larger stems than it is for bimoraic stems. *–hia* appears with 38.158% of trimoraic

and larger stems (87/228), while it appears with only 27.746% of bimoraic stems (48/173). While a large difference, this is only a difference of 10.412%, as opposed to a difference of 57.52% for the *–tia* allomorph on trimoraic and larger versus bimoraic stems. For *–ngia*, there is almost no difference between the number of instances this allomorph appears with bimoraic stems as opposed to the instances it appears with trimoraic and larger stems. The chart below illustrates these facts (82).

(82) Counts of *–hia* and *–ngia* for ≥ trimoraic and bimoraic stems

	≥ 3 morae (228)	= 2 morae (173)
–hia	87 (38.158%)	48 (27.746%)
–ngia	66 (28.947%)	49 (28.324%)

These findings suggest that *–tia* and *–a* are notable among default passives on account of their migrating into a weight-sensitive paradigm. *–tia* is common among trimoraic and larger stems and *–a* is common among bimoraic stems, yet the other default allomorphs *–hia* and *–ngia* have not followed these in becoming as common among stems of a particular size/weight. Sensitivity to weight, in addition to *–tia* and *–a* being the most common default allomorphs, may suggest that *–tia* and *–a* are distinguished from other allomorphs in Māori and that these are true default allomorphs.

4.2.6 Additional considerations

So far, the discussion of default forms has been mostly limited to the passive. As for the gerundive, *–tanga* and *–hanga* have followed their corresponding passive in becoming increasingly productive (Harlow 2007:121). While neuter verbs and adjectives commonly form the gerundive by taking *–nga* (Harlow 2007:121), as in the example *oti–nga* 'completion' from *oti* 'be complete' (Harlow 2007:121), a number of abstract nouns with the meaning 'the property of being an X' are derived through the suffixation of the *–tanga* default: *Māori–tanga* 'Māori culture, Māoriness,' *rangatira–tanga* 'chiefliness' (examples from Harlow 2007:121). In addition, there is a non-obligatory rule whereby a word modifying a derived gerundive shows agreement with the noun, and these commonly take *–tanga* regardless of the allomorph of the derived gerundive. Two examples of this come from Harlow (2007:122).

(83) *–tanga* in agreement with a modified gerundive

1. *taku* *hinga–**nga*** *tīraha–**tanga***
   Sg.of.1sg fall–nom lie–nom
   'my falling prostrate'
2. *taku* *tae–**nga*** *tuatahi–**tanga***
   Sg.of.1sg arrive–nom first–nom
   'my first arrival', 'the first time I went (to …)'

When taken together with the prevalence of the *–tia* allomorph, that the *–tanga* and *–hanga* gerundive allomorphs have followed their corresponding passives in becoming more productive, in addition to the nominal agreement in (83) which is commonly done by means of the addition of the *–tanga* allomorph, provides further evidence of default allomorphs in Māori.

4.2.7 Concluding thoughts

To conclude, it appears as though Hale's claims are not as general as they appear upon first glance, as argued by Sanders (1990). However, *–tia* is indeed the more common alternant following passivized nouns, prepositional phrases, causative verbs, passivized adverbials, unassimilated loan verbs, and trimoraic and larger stems. Where *–tia* is not present, the other defaults *–hia*, *–ngia*, or *–a* can be found, although there is data showing that other less-productive allomorphs can still be found in cases where *–tia* is to be expected. Nonetheless, the evidence strongly suggests that *–tia* is at least productive to the point that it has spread to a number of contexts beyond its original distribution.

The rise of one or several default forms is to be expected following morphological reanalysis, since, as was argued in §3, the existence of a large number of arbitrary morphologically-conditioned alternants would have placed a considerable strain on learnability. As a consequence, out of these arbitrary morphologically-conditioned alternants, one or a few of them should come to be the more productive as speakers forget less-common allomorphs for other stems or the more common ones are substituted for a stem's traditional allomorph(s). Sanders (1990), however, rightfully finds fault with this line of thinking, on the grounds that out of numerous arbitrary alternants, such an analysis does not explain how the default suffix *–tia* rose to prominence. While Sanders is correct to raise this point, I do not agree that these arbitrary alternants had no backing to become defaults.

I propose default suffixes may have achieved their status as a consequence of those consonants' being more prevalent, either in the language generally or word-finally. /t/ is the most frequent consonant in Māori, accounting for 9.8% of all phonemes in the language, with /k/ coming in second among consonants at 7.9%, /r/ in third at 5.7%, and /h/ in fourth at 4.5% (Harlow 2007:68). For Māori's consonant-less default allomorph *–a*, the short vowels—/i/ (accounting for 11.3% of all phonemes), /e/ (8.7%), /o/ (5.7%), and /u/ (6.1%)—simply outnumber /a/ (18%) and the long vowels /a:/ (4.6%), /e:/ (0.8%), /i:/ (0.3%), /o:/ (1.5%), and /u:/ (0.4%). Such a frequency asymmetry would provide motivation for the newly-resegmented *–tia* and *–a* to be more frequently encountered in daily speech, more likely to spread to other verbs, and thus more likely than other alternants to become a default. However, to conclude with a point made by Hale (1973, 1991), the fact that numerous Polynesian languages have each regularized a different default passive form is evidence that the choice of default alternant is a purely arbitrary one. For that reason, there would not even need to be a 'reason,' so to speak, as to why *–tia* or *–a* have become the favored allomorphs.

4.3 Vocalic and nasal allomorphy and continued phonological effects

While I have advanced an argument in favor of a reanalysis of the morpheme boundary and allomorph leveling, there is evidence of phonological processes which continue to regulate the distribution of vocalic and nasal alternants. This evidence ultimately supports the phonological origin of these alternants and provides support for the phonological analysis presented in §2. This subsection will detail variation between allomorphs *–ia/a*, *–ina/na*, and *–ngia/nga*. Two things will be shown in this subsection: first, that the default allomorphs *–a* and *–ngia* have spread to novel contexts as an innovation, while *–ia* and *–nga* have not done the same; second, that alveolar nasal allomorphs *–ina* and *–na* remain in essentially the same contexts as they were present in before. This confirms the presence of continued phonological effects, since if the allomorphs had been reanalyzed into competing paradigms without further

influence from the phonology, we should expect that they would not continue to be constrained to their original phonological contexts.

To recapitulate the account of vocalic and nasal passive allomorphs (§2.1.2 and §2.1.3, respectively), it was argued that the suffix-initial vowels—/i/ for the passive and /a/ for the gerundive—undergo deletion, incurring a violation of MAX, in order to avoid a violation of the highly-ranked constraint *[–low]+V$_1$, which hiatus across a morpheme boundary. This constraint was found to be necessary to account for significant hiatus morpheme-internally as opposed to vowels being deleted in a cross-morpheme derived environment. However, following the stem-final vowel /-a/, what occurs is not deletion of the passive-initial vowel, as in all other cases, but gliding and the formation of the diphthong [aɪ̯]. To account for this, I proposed the constraint Ident[±syllabic], which is ranked lower than MAX. /a+V/ diphthongs are regularly formed across the morpheme boundary in the case of suffixation, as evidenced by the passive and causative, but other /V$_i$+V$_j$/ diphthongs where V$_i$ is not /a/ are restricted to morpheme-internal contexts (Harlow 2007:75), explaining why sequences such as /e+i/, /o+i/, *etc*., cannot form diphthongs here. The account of velar nasal alternations began by positing the constraint *aɪ̯ŋia. *aɪ̯ŋia dominates MAX, resulting in deletion. For the alveolar nasal alternations, the constraint *n+i motivates deletion of a passive-initial /i/ if the preceding vowel is not /a/, but if the preceding vowel is /a/, there is instead metathesis followed by the formation of a cross-morpheme diphthong to avoid vowels in hiatus. The constraint MORPHLINNASAL successfully accounts for metathesis of nasal segments while limiting this metathesis to a cross-morpheme environment.

The data in this corpus study confirm the analysis of these allomorphs. The data below in (84) was selected from the corpus to exemplify the effects of vocalic and nasal allomorph leveling. The passive morphemes *–ia*, *–a*, *–ina*, *–na*, *–ngia*, and *–nga*, are laid out above the data with an additional column for other *–Cia* allomorphs not represented by their own column.

(84) Phonological factors regulating vocalic and nasal allomorphs (data from Dict)

	Stem	*–ia*	*–a*	*–ina*	*–na*	*–ngia*	*–nga*	*other*
1.	*tā*	+	0	0	0	+	0	0
2.	*hī*	+	+	0	0	0	0	*–hia*
3.	*kōkō*	+	0	0	0	0	0	*–tia*
4.	*koko*	0	+	0	0	0	0	*–tia*
5.	*hinga*	+	0	0	0	0	0	0
6.	*huna*	+	+	0	0	0	0	0
7.	*hanga*	+	+	0	0	0	0	0
8.	*pana*	+	+	+	0	0	0	0
9.	*muku*	0	+	0	0	0	0	0
10.	*hoko*	0	+	0	+	0	0	0
11.	*eke*	0	+	0	0	+	0	*–tia*
12.	*hapai*	0	+	0	+	+	+	*–tia*
13.	*whiri*	0	+	0	0	+	0	*–hia*

The leveling of default varieties is evidenced by the many verbs which accept multiple—sometimes formerly exclusive—passive allomorphs. The OT analysis in this work predicted the reduced passive alternant *–a* should appear following [–low] vowels and diphthongs while *–ia* appears following /a/ and long vowels. In the first column in (84), *–ia* is only present on stems

ending in long vowels or /a/. However, as can be seen by the second column, *–a* has spread to stems which formerly did not take that allomorph, such as the /a/-final stems in (84.6–8). The situation is the same with regards to the alveolar nasal allomorphs is slightly different. Neither of these allomorphs have become more productive, and these can still be found in their original phonological environments. For the velar nasal allomorphs, while *–nga* has not become more productive and still is present only after stems ending in /ai/, *–ngia* has spread to other stems, including the /ai/-final stem in (84.12), evidence that this allomorph has become unmarked.

Of the 53 stems in the corpus which take *–ia* in the passive, only two do not end in /-V:/ or /-a/: *whatiwhati* 'to break' and *whakanoho* 'to place' (Dict). There are 35 stems which take *–ia* to the exclusion of *–a*. 15 of these end in /-a/, none end in a different short vowel, and 20 end in /-V:/. These data contrast with the allomorph *–a* in the second column in (84). This allomorph appears alongside verbs ending in any vowel. Of the 159 verbs which take *–a*, four end in /-V:/, 13 end in /-a/, and the rest end in other short vowels or diphthongs. However, none of the 141 verbs which take *–a* to the *exclusion* of *–ia* end in /-a/, and only one ends in a long vowel: *tā* 'to net' (Dict). This shows there is a discrepancy among the vocalic allomorphs: whereas *–a* can appear with stems ending in any vowel, *–ia* only appears following /-a/ or /-V:/, and if a stem ends in either of these vowels, it may take both *–ia* and *–a*. This is reflected in the chart above: *–a* can apply to many stems, including ones where it was not previously licensed, whereas *–ia* has remained in the same environments. This confirms that *–a* has become unmarked and spread to novel environments. However, the allomorph *–ia* has not become unmarked, or else it would be more prevalent following stems ending in vowels other than /-a/ or /-V:/.

While almost all [a]-final stems form the passive with *–ia* and syllabify the initial [i], as predicted by the analysis, several also form the passive with *–a* (as can be seen in (84.6–8)). The examples below in (85) consist of bimoraic /a/-final stems, and these show the spread of *–a* to /a/-final stems as an innovation.

(85) Multiple allomorphy of bimoraic [a]-final verbs

	Definition	*Verb*	*–ia*	*–a*	*–ngia*	*–ina*	*–na*	*–hia*	*–tia*	*Source*
1.	'to build, make'	*hanga*	+	+	0	0	0	0	0	(W:59)
2.	'to prepare (food)'	*taka*	+	+	+	0	0	0	0	(Dict)
3.	'to fall'	*hinga*	+	0	0	0	0	0	0	(W:61)
4.	'to hide, conceal'	*huna*	+	+	0	0	0	0	0	(W:63)
5.	'to spread out'	*hora*	+	0	0	+	0	+	0	(Dict)
6.	'to carry on the back'	*waha*	+	+	+	+	0	0	+	(Dict)

In addition to *–ia* and *–a*, the distribution of alveolar and velar nasals confirms that phonological factors still partially determine allomorph selection. Like the vocalic alternants, *–ina* appears following /-a/, while *–na* appears after all other short vowels and diphthongs (recall I could not find an instance of this allomorph following long vowels). There are 20 stems in the corpus which take *–ina*, and all end in /-a/ except for one: *tohu* 'to instruct' (Dict). For *–na*, 22 stems take this allomorph and all end in short [–low] vowels, as predicted by the analysis. There are a number of stems which take both a nasal and a vocalic allomorph, such as (84.8) *pana* and (84.10) *hoko* above. Stems of this type also conform to the predictions of the analysis despite

leveling: seven stems in the corpus take *–ia* and *–ina* both, and all end in /-a/, like (84.8). On the other hand, six stems take *–a* and *–na* both, and all end in short vowels other than /-a/, like (84.10). There is no stem which takes *–ia* and *–na*, confirming that the context for /i/ deletion is the same between vocalic and alveolar nasal stems. Lastly, there is one stem which takes the default allomorph *–a* as well as the less frequent allomorph *–ina*. This is *tohu* 'to instruct' (Dict), which has already been mentioned. That *–ina* and *–na* still appear in their original environments suggest these allomorphs have not become unmarked and still conform to the original analysis. The same is true for *–ia*: even when a stem takes multiple allomorphs, *–ia* is mostly restricted to stems ending in /-a/ or /-V:/. However, these results show *–a* has become unmarked and spread to

For allomorphs involving velar nasals, the OT analysis predicts *–nga* should appear following the diphthong [ai̯]. While this is at least mostly the case (in that all stems which end in [ai̯] are found with *–nga*), in two of the three examples where the stem accepts *–nga,* the stems also form the passive with *–ngia*. There are only three verbs in the corpus which take the *–nga* allomorph. These all end in /ai/. Two of these stems take both *–nga* and *–ngia*, evidence that, like *–a*, the unmarked allomorph has spread as an innovation to a previously exclusive environment. Lastly, there are 121 stems which take *–ngia*, and of all of these, only the two previously discussed cases end in /ai/. /ai/-final stems which take *–nga* are shown in (86).

(86) Multiple allomorphy of [ai̯]-final verbs

	Definition	*Verb*	*–ia*	*–a*	*–ngia*	*–nga*	*–na*	*–hia*	*–tia*	*Source*
1.	'to feed, nourish'	*whāngai*	0	+	0	+	0	+	+	(Dict)
2.	'to eat'	*hapai*	0	+	+	+	+	0	+	(W:61)
3.	'to eat'	*kai*	0	0	+	+	0	0	0	(W:61)

The spread of *–a* and *–ngia* is evidence of previously phonologically conditioned alternants becoming unmarked. However, the same has not happened for other vocalic and nasal alternations, suggesting the constraint ranking *[–long]+V, *n+i, *ai̯ŋia, *C_i+//VC_iV » MAX » MORPHLINNASAL » Ident[+syllabic] still has linguistic relevance despite resegmentation. As the most conservative Polynesian language, the continued effects of this constraint ranking have justification in Māori. I argue that the less conservative nature of other Polynesian languages led to them abandoning a majority of alternants, in favor of just one regularized form, along with the constraint ranking which gave rise to said alternations. I would also argue the opposite is true for Māori. Many alternants have been retained despite the leveling effects seen for *–tia* and *–a*, something which makes sense given Māori's conservative nature; at the same time, this conservative nature means the original constraint ranking continues to regulate the distribution of allomorphs.

Unlike the purely morphological subclasses posited by Biggs (1961) and Hohepa (1965), and unlike a solely phonological analysis, the data is captured best by an analysis which blends both phonological and morphological influences. Positing a phonological origin to the alternants accurately captures the obvious phonological contexts for allomorphy, while morphological reanalysis such as the one posited by Hale (1973, 1991) is best for describing the current extent of leveling and the regularization of default allomorphs. Previously phonological alternants became morphologically-conditioned competing paradigms, and *–tia*, *–hia*, *–ngia*, and *–a* have beaten out other arbitrary competitors to become unmarked and reach default status. These have since become productive far beyond their original distribution, providing key evidence that a

morphological resegmentation has occurred. At the same time, allomorphy continues to be regulated by the phonological constraints which gave rise to the alternants, as evidenced by vocalic and nasal allomorphy.

5 Conclusion

In this thesis, I have analyzed the Māori passive and gerundive alternations from both a phonological and morphological perspective in order to present a comprehensive account of the allomorphs. I proposed an OT analysis in §2 that derives the correct SRs of allomorphs through coda deletion, suffix-initial vowel deletion and gliding, nasal metathesis, and non-labial nasal haplology. While this phonological analysis successfully derives the attested alternations and is superior to a purely morphological analysis in that it accounts for the obvious phonological environments which condition allomorphy, it was found that several highly-specific constraints were necessary to achieve these results, casting doubt on claims that a purely phonological analysis is preferable. Instead of such a purely phonological analysis, I argue that a phonological analysis in which the morphology plays an uncommonly central role is best equipped to account for the alternations. While this sets Māori apart from other languages, typologically speaking, in that it appears that the alternations have little to no basis in universal phonological principles, I have shown that more general alternatives to the specific constraints employed in the analysis fail to achieve the same results or are at odds with the greater phonology of the language.

While this phonological analysis originated the allomorphs, this analysis is ultimately deriving an earlier state of the language. Other facts, such as a widely uneven allomorph distribution, default allomorphy, and multiple allomorphy in general, suggest that a phonological analysis on its own is insufficient. To account for these facts, in §3, I argued that a syntagmatic reanalysis—or resegmentation—of the morpheme boundary separating the stem and passive and gerundive suffixes must have occurred following the loss of codas in an earlier state of the language (following Hale 1973, 1991). Without surface evidence of codas, subsequent generations of speakers came to the conclusion that the consonant-zero alternations between inflected and uninflected stems were evidence of competing alternants instead of underlying stem-final consonants.

This reanalysis paved the way for more frequent consonant-initial forms to spread to other stems as an innovation, with leveling giving rise to the default suffixes *–tia*, *–hia*, *–ngia*, and *–a*. These have spread at the expense of less productive forms. The uneven distribution of allomorphs follows from the rise of these default alternants. Lastly, multiple allomorphy among passive allomorphs is further evidence of the effects of leveling. With numerous arbitrary morphologically-conditioned alternants, it is probable that speakers either became confused regarding a stem's 'correct' passive form and associated another allomorph with that stem, or that they simply substituted one allomorph for another if a stem's 'correct' allomorph was forgotten. In all, these facts can be satisfactorily accounted for under Hale's (1973, 1991) proposal of a morphological resegmentation, and this resegmentation is the most appropriate way to account for these facts. In addition, by comparing examples of morphological resegmentations in English and Greek, this shows that such a language change is common cross-linguistically, and that Māori is certainly not alone among the world's languages in that morphological boundaries have come to be reanalyzed.

Data from the corpus study in §4 confirmed the predictions of the OT analysis and lent support to the argumentation that default suffixes are unmarked and have become productive far beyond their etymological origin. At the same time, the corpus study showed that affix leveling must still contend with active phonological constraints and that there are still restrictions on the

leveling of the marked passives *–ia*, *–ina*, and *–na*. In the case of the defaults *–ngia* and *–a*, on the other hand, these have spread to verb stems terminating in vowels which originally did not accept these allomorphs, evidence that the default suffixes have since become unmarked.

The analysis herein successfully derives all the examined alternants, though difficult questions remain. First, it is not yet clear why the robust pattern of cross-morpheme vowel deletion should commonly affect the first vowel of the passive or gerundive suffix when deletion of a stem-final vowel would also remove the offending sequence. I suggested a high-ranking positional faithfulness (Beckman 1998) could perhaps account for this, although examples of stem-final vowel deletion contradict this hypothesis. At the same time, the robust pattern of same-consonant deletion in the gerundive shows the stem-final consonant being deleted and not the suffix-internal consonant, contrary to what would be expected given a high-ranking positional faithfulness. It may be possible that suffix-initial vowel deletion can still be accounted for in a formalized manner, and future work should address whether this is possible.

Second, it is also not clear why haplology results in the deletion of the first of two identical consonants or why the extremely specific derived environment in which haplology arises must involve the stem-internal consonant being directly adjacent to the morpheme boundary. It was shown that for stems with underlying final non-labial nasals, suffixation of the gerundive formed the marked strings /-n]$_{stem}$+aŋa/ and /-ŋ]$_{stem}$+aŋa/, which are repaired through deletion of both the first nasal as well as the suffix-initial vowel. However, when the first nasal does not border the stem, such as in /-nV]$_{stem}$+aŋa/ and /-ŋV]$_{stem}$+aŋa/, then the only segment to delete is the suffix-initial vowel, leaving the sequences [-nV]$_{stem}$+ŋa] and [-ŋV]$_{stem}$+ŋa] intact. These peculiar alternations warrant future consideration, and, in particular, research should be conducted into whether alternations such as the ones seen in Māori can be found in other languages.

The analysis of Māori's passive and gerundive alternants is uniquely relevant to discussions regarding the nature of URs, the fitness of generative phonology, and the nature of diachronic change. In addition, since Māori is the most conservative of the Polynesian languages in regards to its phonemic inventory and its preservation of a large number of passive and gerundive allomorphs, an analysis of these alternations can potentially be extended to alternations in languages with which Māori shares close ancestry, reshaping the way we view not only the evolution of Māori, but the evolution of the Polynesian language family more generally. As an example, in Elbert & Pukui's grammar of Hawai'ian (1979:84), 50 of the 51 stems which take *–a* as their passive allomorph end in a stem-final vowel other than /-a/, showing that the same patterns of cross-morpheme hiatus and deletion which hold in Māori hold in Hawai'ian as well. Other Polynesian languages exhibit the same alternations as Māori in the same derived environments, suggesting these sound changes occurred at a much earlier state (87).

(87) Passive alternations in other Polynesian languages

1. Samoan (data and glosses from Cook 1996)

	Active	*Passive*	*Passive Gloss/Definition*
a.	*nanā*	*nanā**–ina***	hide–PASS
b.	*(vi)vi'i*	*vi'i**–a***	praise–PASS
c.	*opo*	*opo**–ina***	hug–PASS
d.	*faapologa*	*faapologa**–ina***	repress–PASS
e.	*tanu*	*tanu**–mia***	bury–PASS
f.	*tago*	*tago**–fia***	touch–PASS

2. Rarotongan (data and glosses from Buse 1963)
   a. *'oko* *'oko–**na*** buy–PASS
   b. *pāpā* *pāpā–**ia*** thrash–PASS
   c. *pūreku* *pūreku–**na*** rip apart–PASS
3. Pukapukan (data and definitions from Salisbury 2002)
   a. *miti* *miti–**a*** 'sucked'
   b. *kite* *kite–**a*** 'seen'
   c. *liko* *liko–**a*** 'held'
   d. *tui* *tui–**na*** 'have caught a disease'
   e. *ulu* *ulu–**na*** 'search for'
   f. *mea* *mea–**ina*** 'called'
   g. *pō* *pō–**ina*** 'benighted'
   h. *vela* *vela–**ina***, ***–ngia*** 'get hot'

Due to the striking resemblance between these alternations and those of Māori, I believe that reconstructive analyses of Polynesian languages may be able to uncover new insights into the evolution of the *–Cia* passive and *–Canga* gerundive suffixes within the Polynesian language family, and this in turn has the potential to shed light on the analysis of the Māori alternations. Since Māori has retained the most number of allomorphs out of its sister languages, the Māori alternations are uniquely suited to offer a key insight into alternations in other Polynesian languages and are vital for addressing questions related to suffixation in the Polynesian language family. For this reason and others, the Māori passive and gerundive alternations are deserving of much greater attention.

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