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Ma Manda Phonology

Ryan Pennington

MA MANDA PHONOLOGY

By

Ryan Pennington

Presented to the Faculty of
the Graduate Institute of Applied Linguistics
in partial fulfillment of the requirements
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ABSTRACT

Ma Manda Phonology

Ryan Pennington
Master of Arts
with major in
Applied Linguistics
The Graduate Institute of Applied Linguistics, June 2013

Supervising Professor: Steve Parker

This thesis presents a phonological description of Ma Manda (ISO 639-3: skc), a Finisterre-Huon language of the Trans-New Guinea family. This is accomplished through a sketch of the segmental phonology, syllable structure and phonotactics, suprasegmental features, and morphophonemic alternations.

In addition to documenting the phonological domains listed above, particular emphasis is given to several unique and interesting processes. First, /i/ and /u/ tend to be reduced to the high central [ɨ] in unstressed environments. Related to this is a rule of epenthesis whereby the same segment ([ɨ]) is inserted between disallowed consonant clusters. These two processes are discussed from both a synchronic and a diachronic perspective. Next is a process of long distance nasal agreement, also known in the literature as nasal consonant harmony (Hansson 2010, Walker 2011). In Ma Manda, NV (nasal+vowel) sequences initiate the prenasalization of a following tautomorphemic voiced plosive. For example, the word /mədə/ ‘talk’ is pronounced as [məndə]. Furthermore, both voiceless and voiced heteromorphemic plosives undergo the same

alternation: /mo-qə/ → [moɴqə] ‘go down and...’ and /mo-bɐ/ → [mombɐ] ‘go down!’. Ma Manda is the only language known to exhibit this pattern. Finally, a number of complex and phonetically unmotivated alternations are triggered when consonants concatenate across morpheme boundaries. For example, the lateral /l/ is realized as a voiceless alveolar stop ([t]) when adjacent to any nasal (e.g., /l+m/→[tm] and /m+l/→ [mt]). Mappings such as /lm/→[tm] are quite unexpected from the perspective of sonority-based constraints like the Syllable Contact Law (Hooper 1976, Seo 2011). Nevertheless, in Ma Manda these processes are robust, productive, and regular. Consequently, several aspects of the sound patterns of this understudied language of Papua New Guinea are noteworthy for the contribution they make to linguistic typology in general, and to phonological theory in particular.

Dedicated to Crystal, my bride,
about whom I think and dream every hour of every day.

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12 April 2013

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ABBREVIATIONS

-	affix boundary	LW	loanword
*	ungrammatical	med	medial verb
/ /	phonemic representation	ms	milliseconds
[ ]	phonetic representation	MSC	morpheme structure constraint
~	free variation	n	noun
+	join morphemes	nom	nominative case
:	fused morpheme	nfut	near future tense
=	clitic boundary	npst	near past tense
→	becomes, surfaces as	NV	nasal + vowel sequence
Ø	null morpheme	o	bound object pronoun
1	1st person	OPD	Organised Phonology Data
2	2nd person	part	participle
3	3rd person	pfv	perfective aspect
adj	adjective	pl	plural
adv	adverb	PNG	Papua New Guinea
cat	cataphoric pronoun	poss	possessive
caus	causative	pres	present tense
compl	completive aspect	rpst	remote past tense
dat	dative pronoun	sbjv	subjunctive mood
ds	different subject medial verb	SCL	Syllable Contact Law
du	dual	sg	singular
emph	emphatic pronoun	sim	same subject simultaneous medial verb
H	heavy syllable		
hab	habitual aspect	ss	same subject medial verb
Hz	Hertz	SSP	Sonority Sequencing Principle
imp	imperative mood	TAM	tense, aspect, modality
iter	iterative aspect	v	verb
L	light syllable	VOT	voice onset time
LLG	Local Level Government	ynq	polar question
loc	locative case		

1 INTRODUCTION

This thesis is a phonological description of Ma Manda (ISO 639-3: skc), a Finisterre-Huon language of the Trans-New Guinea family. It is one of eleven languages that form the Erap subgroup, a subdivision of the broader Finisterre-Huon family that is spread across the Huon peninsula of northeastern Papua New Guinea (PNG).

The phonology of Ma Manda is particularly interesting in several ways. First of all, the high peripheral vowels /i u/ are prone to reduction to the high central [ɨ] in unstressed environments, as well as in words of three syllables or longer. This can be seen when the first person possessive suffix is attached to /nimin/ 'cousin'.

(1)	a. /nimin/	[ní.min][1]	'cousin'
	b. /nimin-nə/	[nɨ̀.mɨ.nə́]	'cousin-1sg.poss'

Related to this process of vowel reduction is the process of barred-i epenthesis, whereby [ɨ] is inserted between disallowed consonant clusters, as well as word-finally after voiced plosives /b d g/, the liquid /l/, and fricatives /f s/. Diachronically, epenthesis has arisen from the reanalysis of [ɨ] as an epenthetic segment rather than a reduction of the full high vowels. Ma Manda is in a state of transition with regard to this vowel: Often the full high peripheral vowels are recoverable in careful speech and thus reanalysis is shown not to have occurred, while in many other cases morphological evidence reveals

[1] All phonetic symbols used in this thesis follow the International Phonetic Alphabet.

that this vowel is not underlyingly present. As an example, the following pair of forms shows /nol/ ‘brother’ both in isolation and with the first person possessive suffix /-nə/:

(2)	a. /nol/	[nó.lu]	‘brother’
	b. /nol-nə/	[nót.nə]	‘brother-1sg.poss’

Word-finally in (2a), the epenthetic vowel is realized as [u] after /l/ (harmonized in roundness and backness with the [o] earlier in the word). When attached to the nasal-initial suffix, however, /l/ undergoes a predictable alternation: /l+n/→[tn]. This alternation shows that the high vowel is not phonemically present here.

A second unique characteristic of Ma Manda phonology is the phenomenon of long distance nasal agreement, whereby nasal+vowel sequences initiate the prenasalization of a following tautomorphemic voiced plosive. Interestingly, heteromorphemically both voiced *and* voiceless plosives are prenasalized in this environment. Ma Manda is the only language in the world known to exhibit such a pattern. Nasal agreement among both voiced and voiceless plosives is seen in the following verbal paradigm (where (3) shows a regular verb root and (4) shows a verb root composed of an NV sequence).

(3)	a. /lo/ ‘go.up’ + /-got/ ‘1sg:rpst’	→	[ló.got] ‘I went up’
	b. /lo/ ‘go.up’ + /-de/ ‘2du:imp’	→	[ló.de] ‘go up (2du)!’
	c. /lo/ ‘go.up’ + /-qə/ ‘ss’	→	[ló.qə] ‘go up and ...’
(4)	a. /mo/ ‘go.down’ + /-got/ ‘1sg:rpst’	→	[móŋ.got] ‘I went down’
	b. /mo/ ‘go.down’ + /-de/ ‘2du:imp’	→	[món.de] ‘go down (2du)!’
	c. /mo/ ‘go.down’ + /-qə/ ‘ss’	→	[móɴ.qə] ‘go down and ...’

A final unique characteristic of Ma Manda phonology is the complex morphophonemic alternations that are seen when consonants—especially sonorants—are

brought into contact with other consonants across morpheme boundaries. For example, the liquid changes to a voiceless stop when adjacent to any nasal (e.g., /l+m/→[tm] and /m+l/→[mt]/[mp]), and the liquid and labiovelar glide coalesce to form [g]. These alternations can be seen in (5).

(5)
a.	/lo/ ‘go.up’ + /-lət/ ‘1sg:pres’	→	[lo.lə́t] ‘I am going up’
b.	/blam/ ‘carry’ + /-lət/ ‘1sg:pres’	→	[blá**m.t**ət] ‘I am carrying it’
c.	/monə/ ‘secondborn.son’ + /=lɨ/ ‘nom’	→	[mó.nə.lɨ̀] ‘Secondborn son did...’
d.	/qaqon/ ‘uncle’ + /=lɨ/ ‘nom’	→	[qá.qo**n.t**ɨ̀] ‘Uncle did ...’
e.	/nam/ ‘brother-in-law’ + /=lɨ/ ‘nom’	→	[na**m.p**ɨ̀] ‘Brother-in-law did ...’
f.	/ul/ ‘hit’ + /-neŋ/ ‘2pl:imp’	→	[ú**t.n**eŋ] ‘hit him (2pl)!’
g.	/ul/ ‘hit’+/-wam/ ‘1pl:pres’	→	[u.**g**am] ‘we are hitting him’

The remaining portions of this chapter are structured as follows: First, in §1.1 I discuss the objective and structure of this thesis; in §1.2 I lay out my four primary motivations for this study; §1.3 addresses the scope of the thesis, including the limitations I am aware of; §1.4 provides a description of the methodology that has been undertaken; and §1.5 provides an overview of the informed consent protocol that was followed during the data collection phase of the research.

1.1 Objective

The objective of this thesis is to describe the phonology of the Ma Manda language. This is accomplished through analyses of the segmental phonology (Chapter 4), syllable structure and phonotactics (Chapter 5), suprasegmental features (Chapter 6), and morphophonemic alternations (Chapter 9). Particular focus is given to three phenomena: reduction of high vowels (§7.1), epenthesis of the high central (barred-i) vowel (§7.2),

and long distance nasal agreement (Chapter 8). I describe the behavior of these processes in detail and discuss their possible historical origins. Finally, the appendices provide lists of the words upon which the analysis in this thesis is based (including numbers that cross-reference the audio files on the attached disc). Appendix 1 is a general wordlist, composed primarily of monomorphemic nouns and adjectives. Appendix 2 provides frequency counts of all Ma Manda phonemes based on 1448 morphemes. Appendix 3 provides a list of ten nouns, each inflected in six separate possessive forms. These illustrate the variety of morphophonemic alternations that are seen in nominal suffixation. Appendix 4 provides a group of ten separate verbs in morphological paradigms. These are simple paradigms that fully illustrate the variety of morphophonemic behaviors that can occur when TAM (tense, aspect, mood) suffixes are attached to verb stems. Appendix 5 provides an interlinearization of a short story about planting yams. Finally, Appendix 6 is a supplement to §9.1 that provides a structured list of all interactions that occur when heteromorphemic consonants concatenate.

1.2 Motivations

The present study has four primary motivations. First, it serves as a building block upon which future analyses can take place. Out of necessity, a basic understanding of the phonology of a given language is required before an attempt can be made at wrestling with syntactic analysis. Often though, a finalized statement on the sound system can only be made after all other pieces of the puzzle have been put into place. This thesis is the starting point in my analysis of the Ma Manda language. Second, this study addresses

three particular phonological phenomena—reduction of high vowels, epenthesis of the high central vowel, and prenasalization of voiced plosives—which have been analyzed in various ways within the Erap subgroup and across the Trans-New Guinea family of languages as well. A thorough treatment of these processes in Ma Manda should shed light on identical or similar processes attested in several related languages. Third, a deeper analysis of these processes will be helpful for linguistic theorists and typologists. For example, to my knowledge, no other language is known to exhibit long distance nasal agreement among both voiced and voiceless plosives across morpheme boundaries, while only among voiced plosives tautomorphemically. Finally, a thorough phonological analysis is paramount in the development of an effective writing system. Without, at the very least, a basic grasp of the various phonological phenomena at work in a language, many of the decisions in the development of an orthography would be made blindly and might lead to unnecessary revisions and frustration.

1.3 Scope

The analysis throughout a majority of this thesis is presented in a purely descriptive light. This means that the description is divorced from theory wherever possible. It is my goal that this thesis be accessible to a variety of people doing basic linguistic research among PNG languages, many of whom may not be familiar with the latest theoretical advancements in the field of phonology. It is true though that linguistic analyses often betray one's allegiance to particular theories and models. In dealing with the various intricacies of Ma Manda phonology, I utilize concepts from Generative

Phonology (Chomsky & Halle 1968), Optimality Theory (Prince & Smolensky 2004), Metrical Phonology (Hayes 1995), Autosegmental Phonology (Goldsmith 1976), Evolutionary Phonology (Blevins 2004), and Phonetically Based Phonology (Hayes *et al.* 2004). It is important that the data be presented with clarity, in order that fieldworkers, typologists, and theorists can use it to substantiate, modify, and/or disqualify their own hypotheses.

Generally speaking, the syntax of Ma Manda is not addressed in this paper. That would lead to a much longer thesis, and would detract from the limited and focused scope of the present phonological study. Syntactic information is provided insofar as it may aid in the understanding of the processes described herein. Though morphology, likewise, is not a primary focus of this work, it is handled more than syntax due to its relevance in the various complex morphophonemic alternations. An overview of the morphological paradigms is necessary, though they are not dwelled upon, as their grammatical analysis is not germane to the present study (although two sets of paradigms are presented as appendices). For a brief overview of the morphosyntax, however, see §2.4.

Finally, it is important to note that, for the purpose of consistency, only one dialect is in focus throughout this thesis. The Erap family[2] is part of a complex dialect chain, where the language of each successive village gradually morphs into different dialects and, subsequently, different languages. The boundaries that are drawn are often

[2] This group is often referred to as a "family" in Papuan literature, even though it is a small group within the Finisterre-Huon family, which in turn belongs to the massive Trans-New Guinea family. I use "group" and "family" interchangeably throughout the thesis.

rather arbitrary. This means that the border villages within any particular “language” are fuzzy and often incorporate linguistic patterns and phenomena from neighboring languages. Ma Manda is no exception in this regard. The dialect under study is that which is spoken in and around the two Ma Manda villages of Saut and Lemang. This dialect was chosen because it is more distant from a main road, and therefore it is less affected by pidginization. Additionally, due to the increased isolation of Saut and Lemang, fewer outsiders are present, and therefore the effects of code-switching are reduced. Dialectical differences are observed, however, especially when they are relevant for potential differences of opinion regarding a particular analysis.

1.4 Methodology

This thesis is based upon research primarily conducted during six months of living in the village of Saut. This time was spread out over a period of three years, from 2009–2012. In addition, at several points speakers from Saut have joined me at Ukarumpa, SIL’s main center in Papua New Guinea. This has probably encompassed two additional months.

The data has been gathered from a number of sources. The primary method of collecting language data has been simply living and interacting with the Ma Manda people while carrying around a simple data notebook. Upon hearing something new, I would re-elicit the data and ask questions to unveil paradigmatic relationships, collocations, and disallowed utterances. The data in these data notebooks was always

confirmed at a later date with multiple people, and when deviations were discovered, these were noted alongside the originals. Finally, each finished data notebook has been scanned, electronically catalogued, and backed-up on the internal server of SIL PNG in Ukarumpa.[3]

In addition, many oral discourses of various genres have been recorded, including narratives, procedural discourses, expository discourses, prayers, and dialogues. A majority of these were recorded by audio recorder, while several were captured by video camera as well. A good portion of these have been re-collected in careful speech, and many of those have been orally translated.[4] These "careful speech" and "oral translation" recordings were recorded with the original speaker when possible. These stories have been elicited from both males and females, from twelve to seventy years old, from many education levels. The analysis undertaken in this thesis, however, is based on the wordlists and stories as spoken by only two men: Garambon Magu and Tuboin Bangam.

Finally, various paradigms and wordlists have been collected over the years. Most often these elicitation sessions have simply been confirmations of data that had previously presented itself in informal speech or in recorded stories. These were generally written into data notebooks as well. Recently, I undertook the project of recording a collection of wordlists and paradigms, both for posterity and to substantiate

[3] SIL PNG's internal server is not accessible to the public; it is used solely as a backup.
[4] Utilizing the BOLD (Basic Oral Language Documentation) method first espoused by Gary Simons (Simons 2008; Reiman 2009, 2010). This method involves an initial audio recording, followed by a careful re-speaking, and a subsequent oral translation.

my own analyses. This has resulted in a collection of over 300 monomorphemic words spoken both in isolation and in a carefully selected frame. These words were selected to illustrate every possible phonetic variant and phonotactic combination that I know to exist.[5] Additionally I previously collected approximately 850 words, all spoken in isolation and from a combination of speakers. I have also collected recordings of verb paradigm in frames, as well as nouns in possessive paradigms.

The recorded data upon which these descriptions are based are provided (in wav format) in a disc at the front of the thesis. The numbers alongside the examples throughout the paper cross-reference the media files (the absence of a number means that there is no recording for that word). An alphabetized wordlist is also provided in Appendix 1. This list contains every word used within this thesis, transcribed both phonemically and phonetically.

1.5 Informed consent

A few comments are in order regarding the informed consent protocol that has been followed. First of all, the collection of written and recorded data was discussed with the various village leaders of Saut. No one expressed any aversion to this process at any time. Unfortunately, no official record of that consent was made with these leaders. Instead, signatures have been obtained for all the people who have allowed themselves to

[5] These recordings are 16-bit/48 KHz PCM files recorded on an Olympus LS-20M recorder with a Shure SM10A headset microphone.

be recorded. Each form contains a statement of full disclosure about the ways that their language data may be used. This statement was written in Tok Pisin, the national language of Papua New Guinea.[6] This brief statement is provided below, followed by an English translation.

> *Mi laik harim tokples bilong yu. Mi bai putim toktok bilong yu long rikoda na bihain bai mi putim em i go insait long komputa. Mi bai no inap kisim moni bilong dispela. Mi bai givim em i go long wanpela ples we ol i save lukautim dispela kain samting long en (olsem universiti). Dispela toktok bai stap long ples klia (Internet) na husait lain laik harim nau o bihain taim, em ol i ken harim. Bihain, sapos ol tumbuna pikinini bilong yu o ol arapela manmeri i gat laik long kisim sampela save bilong tokples na kalsa bilong yu o pasin tumbuna bilong yu, orait ol i ken harim dispela toktok bilong yu. Em bai yu tok orait long dispela o nogat? Sapos yu tok orait, orait raitim nem bilong yu long dispela lain.*[7]
>
> I want to hear your language. I will put your speech on a recorder and later I will put it into a computer. I will not be able to get money for this. I will give it to a place where they look after this kind of thing (like a university). This speech will be freely accessible (Internet) and whatever group wants to hear it now or later can listen. Later, if your descendants or other people want to get some knowledge about your language and culture or your ancestral customs, they can hear your speech. Will you say "okay" to this or not? If you say "okay", write your name on the line.

I took great care to provide my informants with as much information as possible. For many Ma Manda people, however, the concepts of recorders, computers, the Internet, and archives are foreign. I searched to find the balance between overloading people with too much unhelpful information, and providing insufficient background for them to make

---

[6] Tok Pisin, or Melanesian Pidgin, is one of three national languages of PNG (the other two being English and Hiri Motu). It is the *lingua franca* for most people of Morobe Province. A vast majority of Ma Manda speakers are fluent in this language.

[7] I owe thanks to John Hatton and Malinda Ginmaule for their help in writing this statement in Tok Pisin. I based this on a consent statement that John had crafted, and it was refined through discussion with Malinda, a Papua New Guinean who is fluent in Tok Pisin.

an informed decision. It is an important ethical consideration to find an appropriate method of helping people to be adequately informed, and I feel that I have been faithful to the Ma Manda people in this endeavor.

It was never the case that the people were forced to read the form and sign without any discussion. Rather, I would spend a fair amount of time in discussion with the informants, helping them to understand the various issues involved. Generally, I would bring along someone who I had already informed, and they would help to translate into Ma Manda. This was often done not with a sole informant, but with a group of would-be informants.

2 THE MA MANDA LANGUAGE

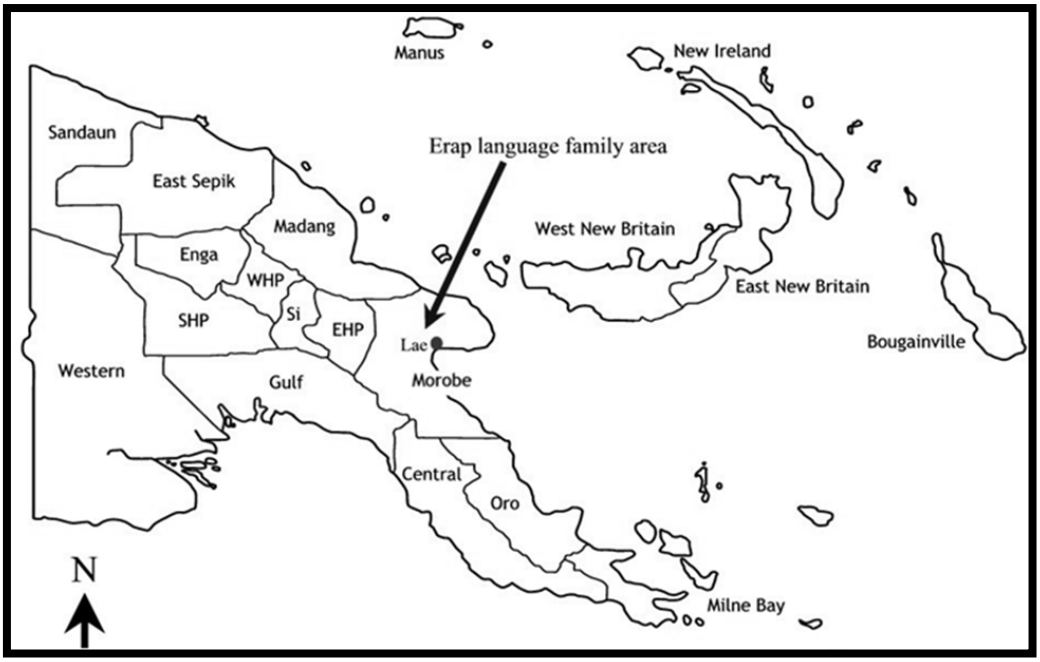
The Ma Manda language group is composed of four primary villages—Kesengen, Lemang, Maulak, and Saut—along with two hamlets—Gisapin and Mosa.[8] In addition, there are two outlying villages—Sawana and Yangaran—which blend characteristics of Ma Manda with the neighboring languages of Numanggang and Sama, respectively. Based on the 2000 census count (National Statistical Office 2002)—and accounting for population growth, as well as emigration to population centers for employment—I estimate the current population of Ma Manda to be approximately 1800 people. Several hundred are living elsewhere around the country, especially in squatter settlements around the city of Lae. The location and geography are addressed in §2.1, the genetic classification is provided in §2.2, Ma Manda's vitality is assessed in §2.3, and a brief overview of the morphosyntax is provided in §2.4

2.1 Location

The Erap family is located between the Irumu and Busu Rivers in the Finisterre Mountains and on the southern slopes of the Saruwaged Range, within Morobe Province. Map 1 shows the Erap family in reference to Lae, the capital of Morobe Province. The

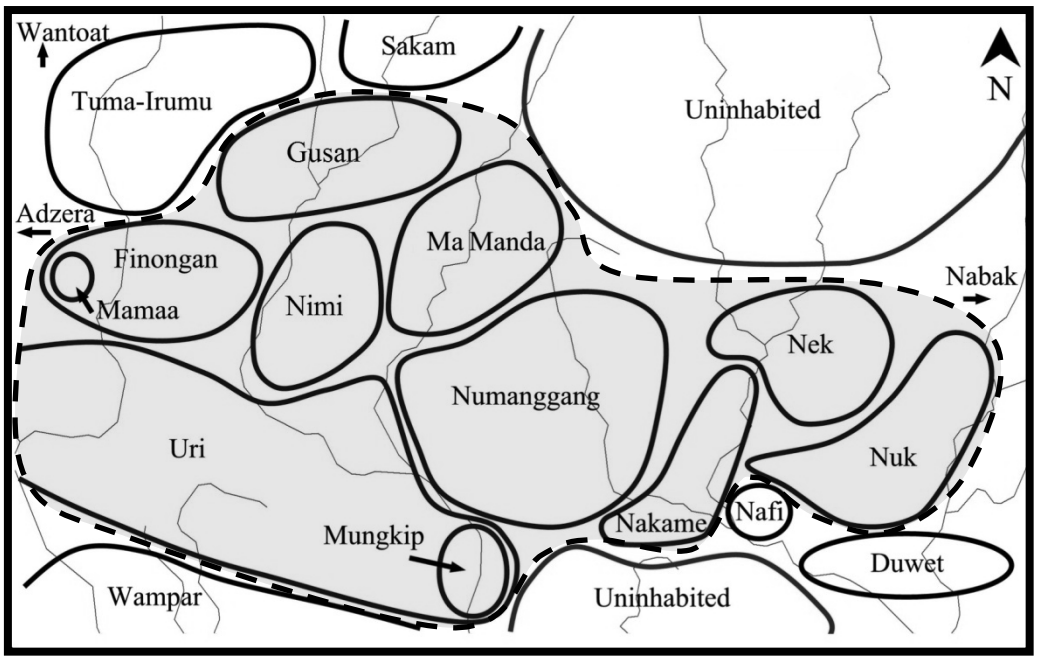
[8] In this area a typical village has a population of approximately 200 people in approximately 35 households. A hamlet is a small community located near a larger village, typically with a population of no more than 40 people. For census counts, the people from these hamlets are usually counted along with the villages from which they have originated.

Ma Manda language group is a part of the Wain-Erap Rural LLG (Local Level Government), which is in the Nawae District of Morobe Province. The Ma Manda language area is located in the north central portion of the Erap family along the headwaters of the Erap River. Specifically, the village of Saut is located at S06.320650 E146.709350, while the village of Kesengen is located at S06.359117 E146.702333.



Map 1: Erap location within PNG (Hiley *et al.* 2008:7)

Map 2 shows the relative locations of each Erap language. Kesengen, the southernmost Ma Manda village, is often accessible by road. This accessibility depends on many factors, most notably landslides and the height of rivers due to heavy rains. Kesengen is approximately 50 km (31 mi) northwest of the major city of Lae. The Ma Manda language area ranges in altitude from approximately 1077 meters (3500 feet) to 1587 meters (5200 feet).



Map 2: Erap group (adapted from Hiley *et al.* 2008:7)

2.2 Genetic classification

Ma Manda is classified as Trans-New Guinea, Finisterre-Huon, Finisterre, Erap (Ross 2005, Lewis *et al.* 2013). Though higher-level groupings have seen a few insignificant changes over the years, cohesion of the Erap subfamily has not seen any counter-arguments since its establishment in 1970 (McElhanon & Voorhoeve 1970, Hooley & McElhanon 1970, Claassen & McElhanon 1970). Figure 1 below illustrates the current accepted classification of the Finisterre-Huon family and Erap group.

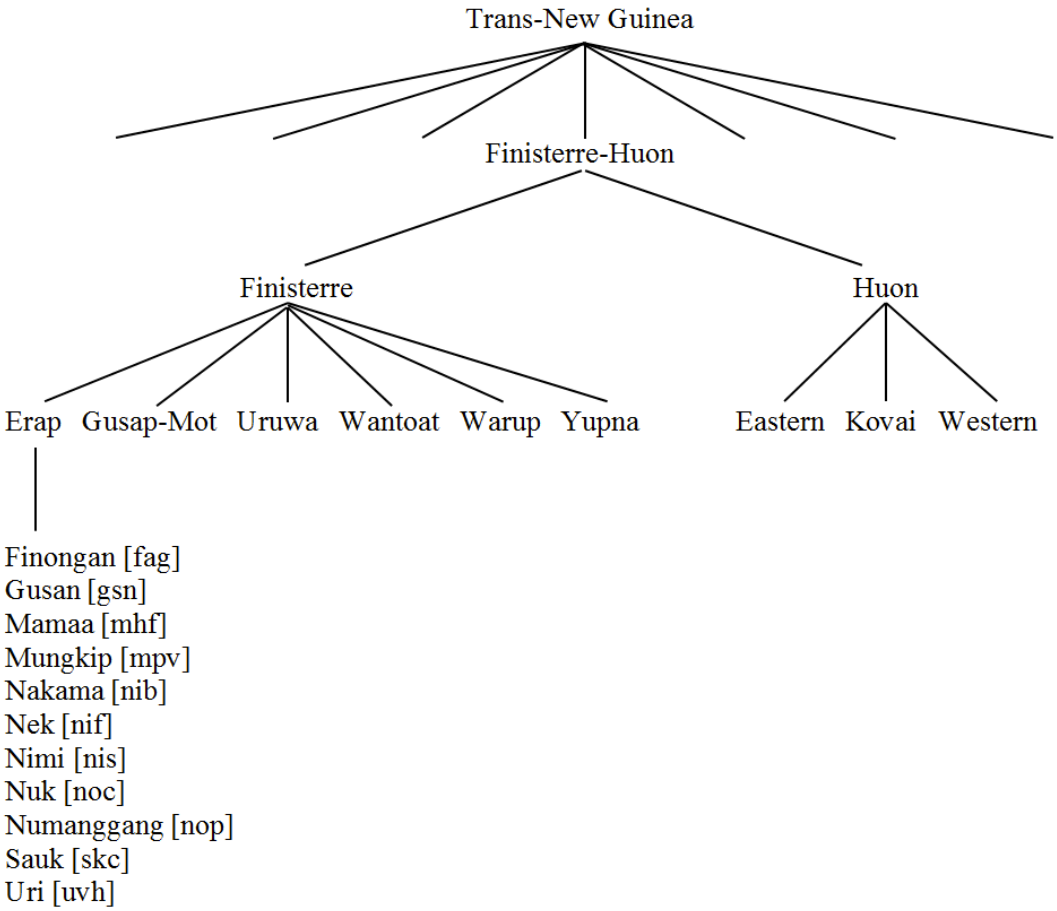


Figure 1: Erap group genetic classification (Ross 2005)

There are a few important notes to be made here. First, it is only recently that the name "Ma Manda" has been changed from "Sauk" in the Ethnologue (Lewis *et al.* 2013). During a sociolinguistic study in 2006, Hiley *et al.* (2008) discovered that the previously-established name was unknown to the speakers. It should be pointed out that names of language groups are not a strong value in this area, and therefore the names do not necessarily hold any particular significance to the people. After thoroughly discussing the issue, however, the community proferred "Ma Manda" as the new name. *Ma Manda* means "what talk?" and is related to a specific legend that describes how their people first

learned to hear, see, and speak. Second, Mamaa (also referred to as Mama) has been all but absorbed by the Finongan language, and now operates as a single-village dialect (Claassen & McElhanon 1970:56, Rice 2010), and Mungkip has been declared to be on the verge of extinction, having been absorbed by Uri (Retsema *et al.* 2009). Finally, the four eastern Erap languages surrounding the Boana government station are grouped together as a tighter unit (Claassen & McElhanon 1970:56, Hooley & McElhanon 1970)—"the Wain subfamily" (Hynum 1980:1). Based on these facts, I propose the revised organization shown in Figure 2.

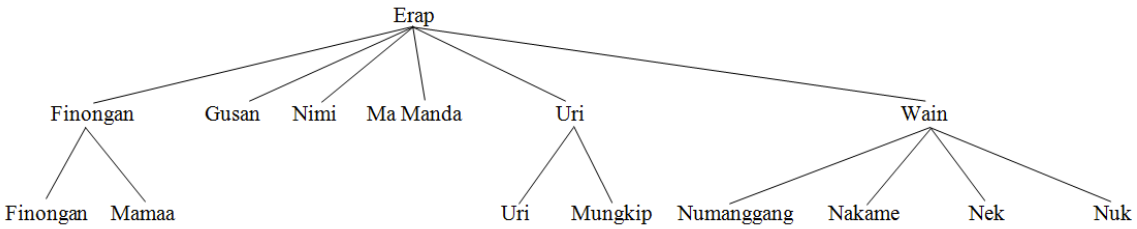


Figure 2: Proposed revision of Erap family

2.3 Language vitality

Ma Manda is spoken fluently by all people of the language group who are participants in village life. Those who have attained higher levels of education often leave the area in search for work, and these people sometimes do not teach Ma Manda to their children. Generally though, Ma Manda children are fluent in Ma Manda alone, and only learn outside languages once they begin attending school. A vast majority of the people are bilingual in Tok Pisin. The only demographic that is not typically bilingual is elderly

women, who have never spent much time outside of the language area. I am unaware of the patterns of language use in squatter settlements in and around the city of Lae.

Pidginization has been a pervasive feature of many languages of Morobe Province. In these situations, Tok Pisin has been adopted in increasingly greater degrees until the original language becomes extinct. Due to the relative isolation of the Ma Manda language area, however, people are still choosing to use Ma Manda in their homes, in community meetings, in village-level preschools, and in church. In gatherings that include other language groups, Tok Pisin is used instead.

These factors establish Ma Manda as a Level 6 on the GIDS scale (Fishman 1991:92–95). This means that the language is being used orally by all generations, and is being used by children as their first language. More precisely, Ma Manda is at Level 6a on the expanded (EGIDS) scale: “This is the level of ongoing oral use that constitutes sustainable orality. Intergenerational transmission of the language is intact and widespread in the community. The language use and transmission situation is stable or gaining strength” (Lewis & Simons 2010:112). A tentative orthography was only developed for the language group in 2011, and therefore literacy is not widespread. This is the criterion that separates Levels 5 and 6.

2.4 Morphosyntax overview

This section summarizes prominent characteristics of Ma Manda morphosyntax that bear on the phonological topics described herein—so that the phonology can be

properly understood within the broader linguistic situation. The only features which are addressed here are clause-chaining, switch-reference, bound portmanteau affixes for person/number of the subject and tense, and bound pronominal object affixes.

Ma Manda is a clause-chaining language with a basic word order of SOV. A clause-chaining language is one in which distinctive verbal morphology differentiates various dependent ("medial") clauses from the independent ("final") clause (Roberts 1997:104). A sentence, therefore, has one final, fully-inflected verb, along with a potentially large number of minimally-inflected medial verbs. Each medial verb is the head of a co-subordinate clause, and these clauses string together into a "chain". This structural makeup can be thought of as a train, where the independent verb is the engine at the end, and this is preceded by several cars (dependent verbs) hooked on and preceding it (Longacre 1972:2). In Ma Manda only the final verb is fully inflected for tense, aspect, and mood categories. In contrast, medial verbs can only be inflected with a same-subject or different-subject suffix. This is the essence of what is known as a switch-reference system. Each medial verb is inflected for whether the following clause has the same subject or a different subject. Switch-reference can be defined as follows: "Canonical switch reference is an inflectional category of the verb, which indicates whether or not its subject is identical with the subject of some other verb" (Haiman & Munro 1983:ix).

The sentences in (6) exemplify the clause-chaining and switch-reference systems as they operate in Ma Manda. The three examples are composed of three clauses each.

(6) a. /tamɨŋ bə-qə gebɨŋ mo-qə sɨbət se-ŋəq/
woman come-ss inside go.down-ss food cook-3sg:npst
'The woman came and went inside and cooked the food.'

b. /nə bə-qə gebɨŋ mo-ŋɨlɨ tamɨŋ sɨbət se-ŋəq/
man come-ss inside go.down-23.ds woman food cook-3sg:npst
'The man came and went inside and the woman cooked the food.'

c. /nəq bə-qə gebɨŋ mo-ŋələ tamɨŋ sɨbət se-ŋəq/
1sg come-ss inside go.down-1sg.ds woman food cook-3sg:npst
'I came and went inside and the woman cooked the food.'

The sentence in (6a) is composed of two medial verbs, each inflected for same subject (SS), followed by a final verb that is inflected for person/number, and tense. When a verb is marked with the suffix /-qə/ 'SS', this means that the subject of the following clause is the same as the current subject. Since the subject remains the same throughout the sentence, the only place where subject agreement morphology takes place is on the final verb. Finally, note that the successive clauses in (6a) are interpreted in a simple sequential order. Example (6b) is quite similar: the same three verbs are used, the first two verbs are marked as medial verbs, and the last verb is fully inflected for person/number and tense. In this example, however, a man comes and goes inside, and then a woman cooks the food. Since the subject of the second clause (i.e., man) is different from the subject of the final clause (i.e., woman), the different subject medial suffix (DS) is used. This suffix indicates (i) that the subject of the following clause is not coreferential with the current clause, and (ii) that the subject of the current clause is not first person (i.e., either second or third person). Once again, the clauses are interpreted as sequential, though the final clause is given prominence over the two cosubordinate clauses. The final sentence in (6c) is almost identical to (6b), except that the subject of

the first two clauses is '1SG', indicated by the pronoun /nəq/. In this case, the second verb (i.e., /mo/ 'go.down') is given a first person singular different subject suffix.

Like most Trans-New Guinea languages, Ma Manda is characterized by extensive pro-drop of both subject and object. Once an argument has been introduced, successive clauses and sentences typically utilize only the bound agreement morphemes on the verb, rather than overt noun phrases. Independent verbs in Ma Manda are minimally composed of a stem, followed by a portmanteau suffix indicating person and number of the subject, along with tense (seen with *se-ŋəq* 'cook-3SG:NPST' in (6) above). The person/number and tense categories can be distinguished in certain instances, but the overall pattern suggests that they are best treated as fused morphemes (Edgar Suter, p.c.). Foley (1986:137) points out the prevalence of this pattern in New Guinea: "Very common in Papuan languages are series of portmanteau suffixes expressing the person and number of the actor as well as tense." Additionally, a small closed class of approximately 25 transitive verbs take bound pronominal object prefixes. This is a feature of many Finisterre-Huon languages (Suter 2012:23).[9] This is exemplified in (7).

(7) a. /qep nə bən=tɨ nimin Ø-u-goq/
yesterday man a=nom cousin 3sg.o-hit-3sg:rpst
'Yesterday a man hit his cousin.'

b. /qep nə bən=tɨ (nəq) n-u-goq/
yesterday man a=nom 1sg 1sg.o-hit-3sg:rpst
'Yesterday a man hit me.'

c. /qep nə bən=tɨ (gəq) g-u-goq/
yesterday man a=nom 2sg 2sg.o-hit-3sg:rpst
'A man hit you.'

[9] The object prefixes of Ma Manda and other Finisterre-Huon languages have been reconstructed and found to be identical to the free pronouns of proto Trans-New Guinea (Suter 2012:23).

The verb in (7a) does not have an overt object agreement prefix. Many, though not all, verbs have a null prefix for the third person. In (7b–c), however, there are prefixes for 1SG and 2SG, respectively. Along with the bound pronominal affixes, separate free pronouns can be used as well, though these are optional.

3 LITERATURE REVIEW

3.1 Related languages

This thesis is the first thorough description of Ma Manda phonology. Three previous manuscripts are as follows. Pennington (2012a) provides a brief overview of the segmental phonology, stress placement, and syllable structure. Pennington (2012b) describes two phonological processes—epenthesis of the high central vowel and "nasal spreading"—and relates them to similar processes in various Papua New Guinean languages and recent literature. This article also addresses how the two processes of epenthesis and nasal spreading have affected the development of the Ma Manda orthography. Pennington (2012c) discusses the numerous alternations that occur among consonants at morpheme boundaries in light of the Syllable Contact Law and various perceptual factors.

In the following subsections I summarize the contributions that are most significant to the present study of Ma Manda phonology. In §3.1.1 I present a brief history concerning the Erap and wider Finisterre-Huon families, focusing on phonological patterns and phenomena. In §3.1.2 I discuss the relevant information gleaned from William Foley's important 1986 survey, *The Papuan languages of New Guinea*. In §3.1.3 I provide a summation of the phonological data available for the Erap languages. Finally, in §3.1.4 I provide a summary table of the relevant surveys of the

Finisterre-Huon and greater Trans-New Guinea families. I also provide a table showing all manuscripts and publications available on the individual Erap languages.

3.1.1 Finisterre-Huon family

As stated in §2.2, Ma Manda belongs to the Finisterre-Huon family, a group of approximately 70 languages within the broader Trans-New Guinea phylum (Pawley 2005:94; McElhanon 1975, 1977). More specifically, Ma Manda is one of eleven languages of the Erap group. It appears that the Erap area languages were first noted to exist by Wurm (1964). The cohesion of the Erap languages as a family within the broader Finisterre-Huon family, however, was established through a series of publications in 1970. McElhanon & Voorhoeve (1970) reported on a wordlist survey conducted across the Finisterre-Huon family, including every Erap language. Hooley & McElhanon (1970) added to this knowledge base with a summary of census information regarding the various villages known to exist in the Erap area, and even grouped the eastern four Erap languages together as a tighter-knit linguistic group within the Erap group. Claassen & McElhanon (1970) is the first publication to provide a synthesis of the phonological patterns being described by fieldworkers throughout the Finisterre-Huon family. Some of the more relevant and notable phonological patterns that were said to characterize Finisterre-Huon languages are as follows:

- widespread occurrence of voiced prenasalized stops, especially intervocalically (and occasionally in word-initial position as well);
- occurrence of prenasalized voiced affricates and/or fricatives in some languages;

- velar nasals in word-initial position in a few languages;
- lack of contrast between laterals and alveolar flaps;
- variation in dialects and/or languages between the *s* and *h* phonemes;
- voiceless stops often have unaspirated and aspirated allophones depending on word or syllable position;
- voiceless stops are often unreleased word-finally;
- backed location of velar stops, especially the *k*;
- phonemic vowel length in a few languages, though usually with a restricted set of vowels;
- *f* exists in some languages, though sometimes claimed to alternate with *p*;
- word-final glottal stops in many languages, which correspond with *k* in many others;
- many languages have labiovelar stops *kp* and *gb*, or labialized stops *kw* and *gw*;
- many 5- and 6-vowel systems, all with *i*, *u*, *e*, *o*, and *a*; the extra vowel tends to be *ɔ* or *ə*;
- generally simple syllable structure, with consonant clusters being disallowed within the syllable;
- most languages only allow *p*, *t*, *k*, *m*, *n*, and *ŋ* to occur syllable-finally, and a few languages allow laterals in this position;
- generally simple syllable nuclei.

Throughout the years since then, the picture has continued to be refined. McElhanon (1973, 1975) provided a table of phonemes of ten representative languages across the Finisterre-Huon family, including Uri, an Erap language to the southwest of Ma Manda. McElhanon noted several additional patterns for Finisterre-Huon phonologies:

- when a language allows vowel clusters, there are usually restrictions on their sequence;
- each language has peculiarities regarding which consonants may occur contiguously at syllable boundaries;
- morphophonemic processes vary from the very simple to the very complex; Wantoat (the family bordering Erap on the west) is known to be an example of a particularly complex morphophonology.

He also provided a large amount of data regarding morphological and syntactic patterns and phenomena, although these are largely outside the scope of this thesis.

An assortment of Finisterre-Huon languages are valuable in supporting the present study, including Awara (Quigley 2003, Quigley & Quigley 2011), Nankina (Spaulding & Spaulding 1992, 1994), Tuma-Irumu (Webb & Webb 1992, Webb 1997), Wantoat (Davis 1964a, 1964b, 1969), and Nabak (Fabian *et al.* 1971, McElhanon 1979, Fabian *et al.* 1998).

3.1.2 Papuan languages

In his seminal work on Papuan languages, Foley (1986) discussed the most salient patterns of phonology, morphology, and syntax throughout the non-Austronesian languages of Papua New Guinea. The following are the aspects of his summary that are most relevant to this discussion of Ma Manda:

- the typical Papuan vowel system contains five vowels *i, e, a, o, u*; this is extended to form a six-vowel system in two primary ways: either with the addition of a low back rounded vowel *ɔ* (common on the Huon peninsula) or, more commonly, with the addition of a second (higher) central vowel—which can vary from *ɨ* to *ʌ*, with *ə* being the most common;
- seven-vowel systems are not uncommon, and are formed by the addition of an extra front and back vowel—either *ɪ*/*ʊ* or *ɛ*/*ɔ*—or, more commonly, by the addition of two central vowels *ə* and *ɨ* (common in the Sepik);
- consonantal systems typically contain three places of articulation—labial, dental/alveolar and velar—but often include a palatal as well;
- many phonemes have a wide array of allophonic variation, especially stops, which have a tendency for weakening and voicing intervocalically;
- Papuan languages generally have only a single liquid phoneme: an *r*/*l* contrast is uncommon;

- all Papuan languages have the semivowels *w* and *j*, though their phonemic status varies according to phonetic features of the language and the analyst's preference; *j* usually occurs in languages that lack a palatal distinction for other manners of articulation, and therefore is typically best analyzed as an apical semivowel in the same basic series as *t*;
- many languages are analyzed as having prenasalized voiced stops, while many other languages are analyzed in which nasalized stops are considered separate segments (N + C);
- typically characterized by complex morphologies—especially in the verb—in an agglutinative pattern.

3.1.3 Erap languages

Linguistic description and analysis of the Erap group of languages has thus far only been carried out by members of SIL, at least with regard to published and known works. There are phonological descriptions available for Nek, Numanggang, and Uri, although they are all unpublished manuscripts. In addition, there are Organised Phonology Data (OPD) descriptions available for each of these languages and for Finongan as well. OPDs are normally created by SIL for each New Guinea language in which fieldwork is carried out. They are brief overviews of the segmental phonology, stress placement, syllable structure, and miscellaneous pertinent facts regarding the phonology and orthography. Finally, SIL-internal surveys have been conducted on all the Erap languages. These surveys provide prospective fieldworkers with relevant data regarding language vitality, linguistic relatedness, and much more. These surveys are the only information that I am aware of for Nema, Mungkip, Nakame, Sama, and Nuk. The following list provides my extraction of the most recurrent and relevant phonological patterns exhibited by these eleven languages:

- every Erap language has sets of voiceless, voiced, and nasal stops which contrast at the labial, alveolar, and velar points of articulation;
- sometimes voiceless plosives have nasal releases in utterance-final position;
- often voiceless plosives are aspirated in onset position and unreleased word-finally;
- velar plosives are prone to spirantization intervocalically;
- the velar nasal is very rare word-initially;
- the glottal stop occasionally occurs word-finally as an allophone of *t* or *k*;
- phonemic k^w and g^w in some languages;
- prenasalization of plosives is predominant, especially intervocalically;
- two or three (voiceless) fricative phonemes exist in each language: *f, s, h*; voiced fricatives are common allophones of plosives and *w*;
- an alveolar flap *ɾ* alternates with the liquid phoneme *l* in every language;
- *w* and *j* are analyzed to be phonemic in all of these languages;
- vowel length is observed in several languages, though analyzed in various ways: phonemic length, sequences of vowel nuclei, or reduced versions of full vowels;
- a short unstressed central vowel is noted for several of the languages; it is claimed to be epenthetic in certain instances;
- vowels are sometimes nasalized when adjacent to nasal stops;
- a CVC maximal syllable template is common, while a couple of languages allow the liquid to occur as a second onset consonant;
- often the voiced plosives, fricatives, and liquids are barred from coda position;
- stress is analyzed in various ways in various languages: quantity-sensitive, quality-sensitive, word-initial, contrastive, and unpredictable.

3.1.4 Summary of sources

Table 1 and Table 2 provide an overview of the works which are most important for the study of Ma Manda. Table 1 provides a summary of the works that are especially relevant to the Erap group, the Finisterre-Huon family, and the greater Trans-New Guinea family. A majority of these sources are broad surveys that help to form the foundation of the current ongoing linguistic work in Finisterre-Huon languages.

Table 1: Summary of important sources

Reference	Title
Claassen & McElhanon 1970	Languages of the Finisterre Range—New Guinea
Foley 1986	*The Papuan languages of New Guinea*
Hooley & McElhanon 1970	Languages of the Morobe District—New Guinea
McElhanon 1973	Towards a typology of the Finisterre-Huon languages, New Guinea
McElhanon 1975[10]	New Guinea area languages and language study
McElhanon 1977	The north-eastern Trans-New Guinea Phylum languages
McElhanon 1984	A linguistic field guide to the Morobe Province, Papua New Guinea
McElhanon & Voorhoeve 1970	The Trans-New Guinea Phylum: Explorations in deep-level genetic relationships
Pawley 2005	The chequered career of the Trans New Guinea hypothesis: Recent research and its implications
Ross 2005	Pronouns as a preliminary diagnostic for grouping Papuan languages
Wurm 1964	Recent developments in linguistic studies on the Australian New Guinea mainland
Wurm & Dutton 1981	Morobe Province [map]

Table 2 lists all the works that deal specifically with the Erap languages, including wordlists, sociolinguistic surveys, dialect surveys, anthropological papers, and grammatical and phonological descriptions.

Table 2: Summary of Erap sources

Language	Reference	Description
Finongan	Troolin & VanderWal 1998a	sociolinguistic survey report
	Troolin & VanderWal 1998b	wordlist of 170 words
	Rice & Rice 2006	sociolinguistics and literacy study
	Rice 2010	dialect study
	Rice & Rice 2010	informal overview of phonology and orthography
	Rice *et al.* 2010	social organization study

[10] This work is exactly the same as McElhanon (1977).

Language	Reference	Description
Ma Manda	Hiley *et al.* 2008[11]	sociolinguistic survey report & wordlist
	Pennington 2012a	informal overview of phonology and orthography
	Pennington 2012b	paper on barred-i epenthesis and "nasal spreading"
	Pennington 2012c	paper on alternations arising from heteromorphemic consonant clusters
	Pennington 2012d	preliminary observations on grammatical aspect
Mungkip	Retsema *et al.* 2009	sociolinguistic survey report (includes wordlist of 170 words)
Nakame	Hynum & Hynum 1988	mainly a Numanggang dialect survey but includes a wordlist from a Nakame village
	Potter *et al.* 2006	sociolinguistic survey report (includes wordlist of 170 words for each of 7 villages)
Nek	Linnasalo 1991	phonology paper
	Linnasalo 1993	grammar paper
	Linnasalo 1995	social organization paper
	Linnasalo 1997	dialect study
	Linnasalo 2003a	informal overview of phonology and orthography
	Linnasalo 2003b	phonological description
	Linnasalo 2008	worldview paper
Nema	Hiley *et al.* 2008	sociolinguistic survey report & wordlist
Nuk	Potter *et al.* 2007	sociolinguistic survey report (includes wordlist of 170 words for 2 separate villages)
Numanggang	Hynum 1980	phonological description
	Hynum & Hynum 1988	dialect survey and wordlists from 3 villages (2 Numanggang & 1 Nakame)
	Hynum 1995	grammar description
	B. Hynum 2001	marriage paper
	Hynum 2001	informal overview of phonology and orthography
	Hynum 2010	paper describing an ergative marker
Sama	Hiley *et al.* 2008	sociolinguistic survey report & wordlist

[11] Hiley *et al.* (2008) is a large sociolinguistic survey report of three languages: Ma Manda, Nema, and Sama. This includes phonological and dialect observations, as well as a plethora of other information regarding education, religion, and social organization. The appendices include wordlists of 170 words for the following: three separate Ma Manda villages, three separate Nema villages, and five separate Sama villages. In addition to these, previously gathered wordlists are reproduced for Finongan (including the dialect of Mamaa), Mungkip, Nakame, Nek, Nuk, Numanggang, and Uri. This is done for the purpose of lexicostatistical analysis. The original sources for these wordlists are listed separately in this table.

Language	Reference	Description
Uri	McElhanon 1968a	wordlist recordings corresponding with McElhanon (1968b)
	McElhanon 1968b	wordlist of 180 words for each of 7 villages
	Webb 1974a	phonological description
	Webb 1974b	translation of 4 Uri legends
	Webb 1980	grammar description
	Webb 1981	supplement to Webb (1974a), dialect survey, & wordlist of 180 words for each of 3 dialects
	Webb 1995	informal overview of phonology and orthography

3.2 Epenthesis and nasal agreement

A significant amount of research has been undertaken regarding both epenthesis of the barred-i vowel and nasal agreement. These two phonological phenomena merit special attention. This section provides an overview of the descriptive, theoretical, and typological works which are relevant to my study of "barred-i" epenthesis (§3.2.1)—along with the related process of high vowel reduction—and long distance nasal agreement (§3.2.2).

3.2.1 Barred-i epenthesis

Foley (1986) discusses at length the status of the high central ("barred-i") vowel in various Papuan languages, particularly in the Sepik. These comments, and the languages upon which he based his hypotheses, are discussed in Chapter 7. These special vowels are discussed from a diachronic perspective in Blevins & Pawley (2010), which is a response to the typology of vowel intrusion presented in Hall (2006). Some other languages which provide additional examples of the special status of the barred-i vowel are: Yimas (Foley 1991), Kalam (Pawley 1966), Alamblak (Bruce 1984), and sundry

others in the Sepik; Menya (Whitehead 2004), Nankina (Spaulding & Spaulding 1992, 1994), Haruai (Comrie 1991) and several Erap languages; and Selau (Blust 2003) from the Austronesian family.

3.2.2 Long distance nasal agreement

Several works are particularly helpful in my analysis of long distance nasal agreement in Ma Manda. Outside of the Erap group, some other Trans-New Guinea languages exhibit similar patterns. Particularly relevant are some Binanderean languages, especially Korafe (Farr & Farr 1974) and Binandere (Wilson 1992). Smallhorn (2009/2011) discusses these languages in her historical reconstruction of the Binanderean languages.

The prenasalization patterns exhibited in Ma Manda are an example of what has been called in recent literature "long distance consonant agreement." The following works, among a vast literature, are particularly important for developing and refining this concept over the years: Piggott (1996), Gafos (1996/1999), Gafos (1998), Walker (2000a), Hansson (2001/2010), Piggott (2003), Rose & Walker (2004), and Walker (2011). Hansson (2001/2010), Rose & Walker (2004), and Walker (2011) have begun to draw a more defined boundary between, on the one hand, general patterns of nasal spreading and harmony, and on the other, long distance agreement (which is evidenced by Ma Manda). These works, and some of the languages upon which their theories are based, are relevant to the analysis and are discussed in Chapter 8.

3.3 Sonority and perceptibility

Ma Manda exhibits a complex system of morphophonemic alternations, which is the topic of Chapter 9. Many of these alternations can be explained by an appeal to one of two contrasting phonological theories: (i) sonority and (ii) perception-based phonology. In order to understand some of the complexities involved, it is beneficial to be somewhat acquainted with the overarching themes involved in these different enterprises. This is an admittedly lengthy section, but its inclusion is necessary for a full understanding of the forces at work behind the morphophonemic alternations in Ma Manda.

3.3.1 Sonority and the Syllable Contact Law

The notion of sonority has been notoriously difficult to define and measure. As for a formal definition, Parker (2011:1160) describes it as "a unique type of n-ary (non-binary) feature-like phonological element that potentially categorizes all speech sounds into a hierarchical scale." As for measurement, this "sonority scale" or "sonority hierarchy" has proven more elusive until recently. Many varieties have been suggested in the literature (see Parker (2002, 2008, 2011) for discussion). The following reflects a noteworthy justification:

> We should not be overly concerned about the difficulty of finding well-defined phonetic definitions of sonority, however ... the notion of sonority is justified in terms of its ability to account for cross-linguistic generalizations involving phoneme patterning, and need not have a direct, invariant expression at the level of physical phonetics. (Clements 1990:291)

Nonetheless, Parker (2008:61) poses the question: “What is the articulatory, acoustic, and/or perceptual source of sonority in the speech signal?” In answer, it is determined that “phonological sonority, as derived from cross-linguistic syllable phonotactics, does indeed have a reliable physical basis” (2008:82). It turns out that, with minor exceptions, acoustic intensity values are a strong physical correlate of sonority. This is a valuable step forward in the affirmation of sonority in current phonological theory.

The most commonly cited version of the sonority hierarchy, which organizes sounds into five natural classes in order of decreasing sonority, is as follows: vowels > glides > liquids > nasals > obstruents (Clements 1990, Kenstowicz 1994). Due to cross-linguistic variation, it is exceedingly difficult to make many definitive statements regarding further delimitations within the sonority scale, especially due to the various conceptions of the feature in the first place. See Parker (2008, 2011), however, for an expansion of the sonority scale to include seventeen relative sonority indices correlated with acoustic intensity values.

The basic hierarchy shown above is motivated by extensive cross-linguistic evidence, and its simplicity allows it to be a practical tool in phonotactic descriptions and theoretical observations. It is especially useful with regard to the Sonority Sequencing Principle (SSP) (Hooper 1976, Selkirk 1984, Clements 1990, Blevins 1995, *inter alia*). The SSP states that within a syllable a string of segments will rise in sonority to the

nucleus and fall in sonority thereafter. In other words, every syllable has only one peak of sonority, which is coextensive with the nucleus.

Of the several weaknesses of the SSP commonly mentioned in the literature, perhaps the most damaging is its typological over- and under-generation (Henke *et al.* 2012). As for under-generation, a typical complaint is that it does not account for the commonly-occurring sibilant + stop sequence. Of course, one might say that the SSP does address this fact, since this cluster type reverses the SSP *minimally*. As for over-generation, a typical complaint is that it fails to prohibit commonly attested sequences like [tl] and [dl] clusters. In other words, it has nothing to say about place of articulation.

Another important sonority-based generalization is that of the Syllable Contact Law (SCL) (Hooper 1976, Murray & Vennemann 1983, Vennemann 1988, Clements 1990). This principle restricts the sonority of segments from rising across a syllable boundary. Hooper's (1976) original proposition for Spanish was categorical in nature, whereby the sonority of syllable-final consonants must exceed the sonority of a following syllable-initial consonant. Subsequent variations and extensions of the SCL (Murray & Vennemann 1983, Vennemann 1988, Clements 1990) have been more gradient in nature, whereby heterosyllabic segments are preferred when the first segment is higher in sonority than the second (Seo 2011). This is in line with Optimality Theoretic accounts of these phonological facts as well (Davis 1998, Davis & Shin 1999, Rose 2000, Gouskova 2004, *inter alia*).

There are two primary weaknesses of the SCL (Seo 2003:12ff.). First, it simply cannot explain why certain types of clusters are often repressed across syllable boundaries *as well as* tautosyllabically. In other words, phonological processes often target certain sequences no matter where they occur. For example, in Leti (Seo 2003:12–14) the /nl/ cluster surfaces as [ll] whether it occurs word-initially or intervocalically. In intervocalic position, it can be assumed that the /nl/→[ll] alternation arises to cure the syllable boundary from having rising sonority. However, in word-initial position no such explanation presents itself. Since the SCL crucially refers to the syllable boundary, it can have nothing to say about other locations in the syllable. This is unfortunate, because such alternations deserve a unified account.

Second, the SCL cannot provide a unified account of identical alternations found in both liquid + nasal sequences as well as nasal + liquid sequences, like those in Korean (Seo 2003:15–16, Henke *et al.* 2012:82–88). Long assumed to be evidence for the SCL, the Korean liquid/nasal alternation has turned out to be evidence against it. The process in Korean targets both nasal + liquid and liquid + nasal sequences equally (i.e., /nl/→[ll]; /ln/→[ll]). Even though the denasalization in nasal + liquid sequences does seem to show support for the SCL, the denasalization in liquid + nasal sequences shows a sonority movement in the opposite direction from what is predicted. When one takes into account the fact that /lm/ sequences are not targeted by alternations at all in Korean, it becomes obvious that sonority is not a factor here. Rather, these types of phonological

modifications can be better treated by appealing to the notion of speech perception, an area to which I now turn.

3.3.2 Perception-based phonology

Many works in the literature thoroughly describe such concepts as cues, recoverability, robustness, precision, and modulation (Ohala 1990; Wright 1996, 2001, 2004; Benkí 2003; Henke *et al.* 2012). The following summary simply defines the most relevant and salient notions of the perception-based enterprise.

Following Wright (2001, 2004), a cue can be defined as "information in the acoustic signal that allows the listener to comprehend the existence of a phonological contrast" (2004:36). The acoustic signal is supplied by continuous and overlapping articulations that vary in their perceptibility. The degree to which these articulations (and thus the presence of segments) are likely to be comprehended is the notion of cue robustness (Henke *et al.* 2012:72). The greater the robustness of a cue, the greater the likelihood that a listener will perceive it in a normal speaking environment. Similarly, cue precision is the degree to which a particular cue *narrows down the field* of segmental contenders (Benkí 2003, Henke *et al.* 2012). So, for instance, the presence of an anti-formant restricts the choices to that of liquids and nasals only.

The robustness of a cue is affected by several factors, including audibility, temporal distribution, and modulation. Audibility simply refers to the loudness of the cue: The louder the portion of the signal that bears the cue, the more robust it is. Temporal

distribution refers to the fact that some cues occur rapidly (e.g., a tongue flap), while others are distributed over a longer portion of the speech signal (e.g., frication noise). The longer the duration, the more robust the cue is. Modulation refers to the amplitude and spectral change between a pair of successive segments. Ohala (1990:325) emphasizes the differences in the intrinsic parameters of successive segments as well: “Rather than focus on some alleged intrinsic value that individual speech sounds or sound types are supposed to have we should concentrate on the modulations in the relevant parameters created by concatenating one speech sound with another.” Basically, the greater the degree of change between two segments, the greater the modulation, and thus the greater the robustness of each segment involved.

The concepts of cue robustness, cue precision, and modulation come together to explain why certain sounds are better suited in particular positions, while others are less so. In other words, these factors contribute to *cue recoverability*. One final factor involved in the robustness of a cue is its redundancy. When articulatory gestures are caused to overlap in natural speech, this often results in a superfluity of information regarding a particular contrast. For instance, in an /fl/ cluster the cues to the presence of the liquid are not only found in the following formant transition of the vowel, but also in the formant structure overlapping with the fricative. “Even though increased overlap may result in perceptual benefits given the proper segmental sequence, too great a degree of overlap can result in information loss and a degradation of the signal” (Wright 2004:47). Cue redundancy, then, refers to the availability of excess cues that can help to retain a

contrast in spite of background noise or significant overlap. When there is a paucity of cues it is less likely for a segment to be recoverable, and more likely that over time it will be assimilated, dissimilated, metathesized, or handled in some other manner in order to force lexical contrast to remain.

There has been a significant amount of phonetic research done on the various cues for manner of articulation, voicing, place of articulation, etc. These cues are found in the following areas, among others: formant transition frequencies, release burst spectrums, closure silence, pitch perturbations in vowel onsets, durations of closures, durations of VOTs, the presence of periodicity, etc. Table 3, reproduced in its entirety from Henke *et al.* (2012:78), provides a helpful summary "about the internal cues of various speech sounds, about their best position in a string of segments, and about their suitability as carriers of cues to the identity of their neighboring segments, in terms of manner, of place, and of voicing" (Henke *et al.* 2012:78).[12]

[12] Reproduced with personal permission from Richard Wright.

Table 3: Summary of natural class cues

class	manner cues		voicing cues		place cues		optimal
	internal	carrier	internal	carrier	internal	carrier	position
vowels	robust	good	robust	good	robust	good	C_, _C, C_C, _
glides	poor	good	robust	good	medium	medium	_V, V_
liquids	poor	good	robust	good	medium	medium	_V, V_
nasals	robust	poor	robust	poor	poor	poor	_V, V_
sibilants	robust	medium	medium	poor	robust	poor	_V, V_, _CV, VC_
fricatives	medium	poor	poor	poor	medium	poor	_V, V_
plosives	poor	poor	poor	poor	poor	poor	_V, V_

Therefore, for instance, vowels are exceptional in their ability to internally carry cues to their manner, voicing, and place. They are also able to carry cues from neighboring segments. Plosives, on the other hand, are unable to carry internal cues to their manner, voicing, and place. Instead, these cues are found on neighboring segments, particularly vowels. Only the vowels, glides, and liquids are fairly capable of serving to carry cues from neighboring segments.

These overviews of sonority, especially the Syllable Contact Law, as well as the major perception-based notions—cues, recoverability, robustness, precision, and modulation—are important in the discussion of morphophonemic alternations provided in Chapter 9. With these things in mind, I now turn to a description of the segmental phonology of Ma Manda.

4 SEGMENTAL PHONOLOGY

Ma Manda has 21 distinct phonemes, which are described and illustrated in the following sections. Consonant phonemes are discussed in §4.1, followed by vowel phonemes in §4.2; finally, the most critical aspects of this chapter are summarized in §4.3.

4.1 Consonant phonemes

There are fourteen consonant phonemes in the Ma Manda sound system. These phonemes can be divided into six natural classes: voiceless plosives, voiced plosives, nasals, fricatives, liquids, and glides. All three series of stops—voiceless plosives, voiced plosives, and nasals—consist of labial, alveolar, and velar/uvular places of articulation. Due to the frequency of the voiceless uvular plosive, this has been analyzed to be the underlying form. Recall §3.1.1, where I point out Claassen & McElhanon's (1970:63–66) acknowledgement of the frequency of (voiceless) backed velar plosives in Finisterre-Huon languages. There are only two fricatives in Ma Manda, both of them voiceless, and they are produced at the labial and alveolar places of articulation. There is a single liquid phoneme, and two glide phonemes.

The inventory of consonant phonemes, along with each phoneme's phonetic variants, is shown in Table 4. Two preliminary comments are in order. First, the phonetic alternants that are listed are the ones that occur in monomorphemic wordforms.

Variations that take place across morpheme boundaries are handled separately, in Chapter 9. Also, phonetic symbols used in this thesis follow the IPA, except that primary stress is marked with an acute accent (V́), while secondary stress is marked with a grave accent (V̀). The superscript symbol (V̆) indicates particularly short duration. In the remaining sections after Chapter 4, a broader phonetic transcription is used, in which aspiration, unrelease, lenition, and vowel laxing are not transcribed unless necessary for a particular discussion.

Table 4: Consonant phoneme inventory

	labial	alveolar	palatal	velar	uvular
vl. plosive	p [p] [pʰ] [p̀] [pᵐ]	t [t] [tʰ] [t̀] [tⁿ] [t̪] [t̪ʰ] [t̪̀] [t̪ⁿ]			q [q] [qʰ] [q̀] [qᴺ] [k] [kʰ] [k̀] [kᵑ] [ʁ] [χ]
vd. plosive	b [b] [ᵐb] [mb] [β]	d [d] [ⁿd] [nd] [d̪] [ⁿd̪] [nd̪]		g [g] [ᵑg] [ŋg] [ɣ]	
nasal	m [m]	n [n] [n̪]		ŋ [ŋ] [ɴ]	
fricative	f [f]	s [s] [ʃ] [h]			
liquid		l [l] [ɾ]			
glide	w [w]		j [j]		

Each natural class is discussed in more detail in the sections that follow. Each individual consonant is substantiated with various examples that illustrate its presence in three separate environments: word-initially, intervocalically, and word-finally. Where possible, two examples are provided for each environment. Consonant clusters are not discussed here, as this is the topic of §5.2.

Within each environment, the phonetic variants are listed in decreasing order of frequency. Therefore, the most common and likely surface form is listed first, and the least common, last. Also, only the segment in focus is shown with alternant forms. It would be far too cumbersome to provide a list of every possible realization of each word.

Finally, the numbers listed next to each underlying wordform cross-reference the audio recordings on the disc at the front of this thesis, as well as the wordlist in Appendix 1.

4.1.1 Voiceless plosives

Ma Manda has three voiceless plosives /p t q/, which are shown in Table 5, Table 6, and Table 7, respectively. Additionally, a glottal stop occasionally surfaces in loanwords. This phone is briefly discussed at the end of this section.

Table 5: Allophones of /p/

/p/ [p] [pʰ] [p̚] [pᵐ]		
Word-initial		
/pit/ 0215	[pít̚] [pʰít̚]	‘lightning’
/pusoŋ/ 0216	[pu.sóŋ] [pʰu.sóŋ]	‘calf’
Intervocalic		
/məjəpun/ 0164	[mə́.jə.pùn] [mə́.jə.pʰùn]	‘banana sp.’
/sendapoq/ 0231	[sɛ́n.da.pòq̚] [sɛ́n.da.pʰòq̚]	‘cocoon’
Word-final		
/tequp/ 0259	[té.ʁup̚] [té.ʁupᵐ]	‘hat’
/səp/ 0228	[sə́p̚] [sə́pᵐ]	‘dog’

Table 6: Allophones of /t/

/t/	[t] [tʰ] [t̚] [tⁿ] [t̪] [t̪ʰ] [t̪̚] [t̪ⁿ]	
Word-initial		
/taweŋ/ 0252	[tá.weŋ] [tʰá.weŋ] [t̪á.weŋ] [t̪ʰá.weŋ]	‘taro’
/tisəŋ/ 0265	[ti.sə́ŋ] [tʰi.sə́ŋ] [t̪i.sə́ŋ] [t̪ʰi.sə́ŋ]	‘sneeze’
Intervocalic		
/qətəp/ 0126	[qə.tə́p̚] [qə.tʰə́p̚] [qə.t̪ə́p̚] [qə.t̪ʰə́p̚]	‘twins’
/sateu/ 0219	[sa.tʰɛ́ᵘ] [sa.tɛ́ᵘ] [sa.t̪ʰɛ́ᵘ] [sa.t̪ɛ́ᵘ]	‘rat sp.’
Word-final		
/sibət/ 0233	[sɨ̌.bə́t̚] [sɨ̌.bə́tⁿ] [sɨ̌.bə́t̪̚] [sɨ̌.bə́t̪ⁿ]	‘food’
/jot/ 0305	[jó̰t̚] [jó̰tⁿ] [jó̰t̪̚] [jó̰t̪ⁿ]	‘house’

Table 7: Allophones of /q/

/q/	[q] [qʰ] [q̚] [qᴺ] [k] [kʰ] [k̚] [kᵑ] [ʁ] [χ]	
Word-initial		
/qədəŋ/ 0120	[qə́.dəŋ] [qʰə́.dəŋ] [kə́.dəŋ] [kʰə́.dəŋ]	‘bamboo’
/qas/ 0117	[qás] [qʰás] [kás] [kʰás]	‘ground trap’
Intervocalic		
/muqujə/ 0185	[mù.qu.jə́] [mù.ʁu.jə́] [mù.χu.jə́] [mù.qʰu.jə́] [mù.ku.jə́] [mù.kʰu.jə́]	‘pig’
/fuqunəp/ 0060	[fú.qu.nə̀p̚] [fú.ʁu.nə̀p̚] [fú.χu.nə̀p̚] [fú.qʰu.nə̀p̚] [fú.ku.nə̀p̚] [fú.kʰu.nə̀p̚]	‘spirit’
Word-final		
/nənəq/ 0195	[nə.nə́q̚] [nə.nə́qᴺ] [nə.nə́k̚] [nə.nə́kᵑ]	‘child’
/gonteq/ 0089	[gón.tɛᵊq̚] [gón.tɛᵊqᴺ] [gón.tek̚] [gón.tekᵑ]	‘grasshopper’

To generalize, the voiceless plosives /p t q/ may be aspirated in onset position of the syllable. Word-finally they are almost always unreleased. Aspirated and unreleased allophones of voiceless plosives behave identically throughout the Erap group (see (Webb 1974a:53ff., Hynum 2001:3, Rice & Rice 2010:9, Linnasalo 2003b:6). In utterance-final position they often surface with a nasal release (this also occurs in other Erap languages; see Webb (1974a:53ff.) *inter alia*). All the alveolar stops /t d n/ are in free variation with dental counterparts. The labial /p/ and alveolar /t/ voiceless plosives are quite straightforward, while the uvular plosive /q/ has many more allophones. The dorsal consonants are much more often lenited than their coronal and labial counterparts,

and this is most evident with /q/. Intervocalically, this phoneme often lenites to a voiced uvular fricative [ʁ], or (less often) a voiceless uvular fricative [χ]. Foley (1986:55) comments that "a pervasive feature of Papuan languages is the tendency to weakening and voicing of the stops between vowels." The phoneme /q/ can also be pronounced at the velum [k], though the uvular pronunciation is more natural and preferred. A transition vowel is sometimes inserted between a front vowel /i e/ and /q/, as seen in *gonteq* 0089 in Table 7. Similarly, schwa lowers to [a] (§4.2.2), and /u/ lowers to [ʊ] (§7.1) before /q/. The non-high location of the uvular stop causes a preceding non-low vowel to be lowered. See Weber (1989) for comparable behavior of Quechua vowels.

In addition to these three voiceless plosive phonemes, the glottal stop [ʔ] is occasionally present, though it is analyzed not to be present underlyingly. This phone primarily presents itself in borrowed names and words from Kâte, a language on the Morobe coast which was used by the Lutheran church to missionize language groups across the Huon peninsula (Wagner & Reiner 1986). Some speakers insert it predictably before word-initial vowels, and one small dialect inserts glottal stops predictably after all word-final vowels. It is especially common in borrowed names from the Kâte language, such as *Bazakiec* 0017 [ba.d͡zà.ʁi.jéʔ].

4.1.2 Voiced plosives

As with the voiceless plosives, the voiced set /b d ɡ/ contrasts at three places of articulation: labial, alveolar, and velar. Their environments are displayed in Table 8, Table 9, and Table 10, respectively.

Table 8: Allophones of /b/

/b/	[b] [ᵐb] [mb] [β]	
Word-initial		
/bəsəm/ 0014	[bə́.səm] [ᵐbə́.səm]	‘spear’
/bot/ 0030	[bó̰t̰] [ᵐbó̰t̰]	‘gathering’
Intervocalic		
/qulibi/ 0147	[qú.ɾi.βì] [qú.ɾi.bì]	‘navel’
/mombə/ 0178	[mɔ́m.bə]	‘leech’
Word-final		
–		

Table 9: Allophones of /d/

/d/	[d] [ⁿd] [nd] [d̪] [ⁿ̪d̪] [nd̪]		
Word-initial			
/dabu/ 0032	[dá.bɯ] [ⁿdá.bɯ] [d̪á.bɯ] [ⁿ̪d̪á.bɯ]	‘fourthborn daughter’	
/dunom/ 0043	[du.nóm] [ⁿdu.nóm] [d̪u.nóm] [ⁿ̪d̪u.nóm]	‘lip’	
Intervocalic			
/səduwəm/ 0221	[sə́.du.wə̀m] [sə́.d̪u.wə̀m]	‘spider sp.’	
/məndə/ 0160	[mə́n.də] [mə́n̪.d̪ə]	‘talk’	
Word-final			
–			

Table 10: Allophones of /ɡ/

/ɡ/	[g] [ᵑg] [ŋg] [ɣ]	
Word-initial		
/gəmət/ 0069	[gə.mə́t̰] [ᵑgə.mə́t̰]	‘snake’
/geq/ 0075	[gɛ́ᵊq̰] [ᵑgɛ́ᵊq̰]	‘animal’
Intervocalic		
/ləgəmandɨ/ 0151	[lə̀.ɣə.mán.dɨ] [lə̀.gə.mán.dɨ]	‘dream’
/nəŋgət/ 0197	[nə́ŋ.gə̰t̰]	‘blood’
Word-final		
–		

Word-initially, all voiced plosives are optionally prenasalized. Intervocalically, the labial /b/ and velar /g/ voiced plosives are generally lenited to form their voiced fricative counterparts [β ɣ]. The alveolar plosive /d/ does not undergo lenition (this appears to be a property of many Finisterre-Huon languages); it can surface from the dental point of articulation. All voiced plosives are prenasalized when preceded by a nasal+vowel (NV) sequence. The inserted nasal is pronounced with the full length and robustness of a nasal phoneme, and it operates as the coda of the preceding syllable. This process of "long distance nasal agreement" is the focus of Chapter 8. Voiced plosives are unequivocally disallowed in word-final position. As seen in Chapter 7, this rule is met through epenthesis of [ɨ] rather through word-final elision.

4.1.3 Labialized velar plosives

Though labialized uvular or velar plosives [qʷ] and [gʷ] are not phonemic in Ma Manda, it is important to discuss them because they are claimed to be phonemic in numerous Finisterre-Huon languages (Claassen & McElhanon 1970:63–66), including Awara (Quigley 2003:26–28) and the Erap languages of Finongan (Rice & Rice 2010:1) and Numanggang (Hynum 2001:1). In Ma Manda, [qʷ] and [gʷ] occur word-initially (or at least morpheme-initially in reduplicated forms) in a few cases. I have analyzed these labialized plosives as *g+u* sequences (e.g., [gʷə́ŋ.gʷə̀ŋ] from /guwəŋ-guwəŋ/ 0095 'round' and [gʷám] from /guwam/ 0093 'ginger sp.'). When these words are spoken carefully, the full /u/ quality returns. The issue regarding the competing analyses of vowels and glides is addressed in §5.3.

4.1.4 Nasals

Ma Manda has three nasals /m n ŋ/, which are illustrated in Table 11, Table 12, and Table 13, respectively.

Table 11: Allophones of /m/

/m/	[m]	
Word-initial		
/monə/ 0179	[mó.nə]	‘secondborn son’
/mafu/ 0155	[má.fu]	‘pandanus nut’
Intervocalic		
/guma/ 0091	[gu.má]	‘smooth’
/imet/ 0103	[i.mét̚]	‘banana sp.’
Word-final		
/bɨdəm/ 0019	[bɨ̌.də́m]	‘possessions’
/lofem/ 0153	[lo.fém]	‘gecko’

Table 12: Allophones of /n/

/n/	[n] [n̪]	
Word-initial		
/nai/ 0190	[náⁱ] [n̪áⁱ]	‘time’
/noŋ/ 0207	[nóŋ] [n̪óŋ]	‘knife’
Intervocalic		
/tənəpmoŋ/ 0254	[tə.nə́p.mɔŋ] [tə.n̪ə́p.mɔŋ]	‘ring-tailed possum’
/wenə/ 0290	[wé.nə]	‘secondborn daughter’
Word-final		
/moin/ 0175	[móⁱn] [móⁱn̪]	‘wrong’
/squn/ 0239	[sqún] [sqún̪]	‘bump’

Table 13: Allophones of /ŋ/

/ŋ/	[ŋ] [ɴ]	
Word-initial		
/əl/	[əl] ~ [ŋəl]	‘to be (at)’
/awe/	[á.we] ~ [ŋá.we]	‘to finish’
Intervocalic		
/səŋem/ 0226	[sə́.ŋɛm]	‘door’
/ijəŋen/ 0107	[i.jə́.ŋɛn]	‘thin’
Word-final		
/eŋ/ 0048	[éŋ]	‘yes’
/gələŋ/ 0068	[gə.lə́ŋ]	‘game’

Nasals have few allophonic variations. The labial /m/ and alveolar /n/ nasals do not undergo any variation (except for /n/ being in free variation with its dental counterpart), while the velar nasal /ŋ/ can be pronounced at the uvular point of articulation [ɴ] before or after the voiceless uvular plosive /q/. The nasals can occur in all three of the provided environments, with the exception that the velar nasal does not usually occur in word-initial position. This is a common pattern in Finisterre-Huon languages (Claassen & McElhanon 1970:63–66, Quigley 2003:19–20, Linnasalo 2003b:10, Hynum 2001:3). Nasals are the most frequently occurring class of consonant phonemes, with /m/ being the most common consonant phoneme overall (see Appendix 2).

Interestingly, many /a/- and /ə/-initial words surface with a velar nasal morpheme-initially in utterance medial position:

(8)	/awe-awe/ 0312	[a.wè.ŋá.we]	'eternity' (lit. 'finish-finish')
(9)	/qaup əle/	[qáᵘp.mə.lè]	'be quiet!

As seen in (9) this velar nasal even assimilates to the place of a preceding voiceless plosive.[13] This can be seen clearly in certain cognate forms among neighboring Erap languages, shown in (10).

(10) Cognates for 'nose' in neighboring languages (Hiley *et al.* 2008:73ff., McElhanon & Voorhoeve 1970:20ff.):

a. Ma Manda:	[amdə] ~ [ŋamdə]
b. Nema:	[ŋam], [ŋandon]
c. Sama	[ŋamda]

[13] A different analysis is that this is an unspecified nasal, which is then given the velar place as a default. This analysis is considered for /ŋ/-final verbs as well in §9.1.4.

It is plausible that many of these words begin with an underlying velar nasal, which then elides in utterance-initial position. More research is needed in order to appropriately address this hypothesis.

Nasals—especially the velar nasal—tend to be ambisyllabic: They operate both as the coda of one syllable and the onset of the next. When spoken slowly, people struggle to break up nasals because they cannot decide where to place the nasal segment. In these early stages of orthography development many people tend to write intervocalic /ŋ/ two times:

(11) /səŋem/ 0226 [sáŋɛm] ~ [sáŋ.ŋɛm] <sañem> ~ <sañ̃ñem>[14] 'door'

This is true of all intervocalic velar nasals, and thus it does not seem appropriate to posit that geminate /ŋ/s are underlying here. The only situation in which geminate consonants *may* occur in Ma Manda is across morpheme boundaries, as seen in §9.1. This observation of ambisyllabic nasals has been made for the related languages of Awara (Quigley & Quigley 2011:18) and Irumu (Webb & Webb 1992) as well.

4.1.5 Fricatives

Ma Manda has two voiceless fricatives /f s/, which are shown with examples in Table 14 and Table 15, respectively.

[14] The angled brackets (i.e., < >) indicate orthographical representation.

Table 14: Allophones of /f/

/f/	[f]	
Word-initial		
/fətnaŋ/ 0054	[fə́t.naŋ]	‘white’
/fi/ 0059	[fí]	‘work’
Intervocalic		
/ifit/ 0101	[i.fḭ́t̚]	‘banana sp.’
/təfələ/ 0253	[tə.fə́.lə]	‘afternoon’
Word-final		
/daf/ 0033	[dáf]	‘mountain protrusion’
–		

Table 15: Allophones of /s/

/s/	[s] [ʃ] [h]	
Word-initial		
/səŋgotə/ 0227	[sə́ŋ.go.tə̀]	‘quoll sp.’
/sidə/ 0242	[sí.də] [ʃí.də]	‘sweet potato’
Intervocalic		
/qusəmbə/ 0148	[qu.sə́m.bə] [qu.hə́m.bə]	‘big’
/isit/ 0105	[í.ʃḭt̚] [í.sḭt̚] [í.hḭt̚]	‘kunai grass’
Word-final		
/tas/ 0250	[tás]	‘rattan’
/pas/ 0211	[pás]	‘rope’

The dearth of fricative phonemes is common cross-linguistically, and this is true of Papuan languages as well. In most Papuan languages, fricatives are frequently allophones of other phonemes (such as [β ɣ ʁ χ] in Ma Manda) (Foley 1986:56). The labial fricative /f/ does not undergo any variation. It occurs word-initially, intervocalically, and only once word-finally. Regarding Nek, Linnasalo (2003b:6) remarks that there are only four known [f]s, and those are all in onomatopoeic or descriptive words; she therefore claims that it is not a phoneme in Nek. I do analyze it to be phonemic in Ma Manda, though it is certainly rarer than the other consonants. The sibilant /s/ occurs in all environments, though it is fairly rare for it to occur word-finally

(see Appendix 2 for phoneme frequency counts; see Quigley (2003:21, 24) for similar comments regarding Awara). When preceding or following a high vowel—[i ɨ u]—it can surface at the palatal point of articulation [ʃ]. Between two high vowels, it is almost exclusively pronounced as [ʃ]. Furthermore, [ʃ] is always in free variation with [h] intervocalically. For many speakers, though, [s] and [h] are freely interchangeable in all word-medial environments. The phoneme /s/ in Ma Manda seems to be coextensive with the /h/ phoneme of Numanggang. For instance, 'fourthborn son' in Numanggang is *hawa* (Hynum 2001:3), while it is *sawə* 0220 in Ma Manda. This same correspondence is seen among several Wantoat dialects as well (Claassen & McElhanon 1970:65).

4.1.6 Liquid

The liquid /l/ is shown Table 16 with its flap allophone [ɾ].

Table 16: Allophones of /l/

/l/	[l] [ɾ]	
Word-initial		
/lamut/ 0150	[lá.mut̚]	'poison'
/lem/ 0152	[lém]	'plateau'
Intervocalic		
/məlom/ 0159	[mə.lóm] [mə.ɾóm]	'owner'
/mulin/ 0186	[mu.ɾín] [mu.lín]	'dried out'
Word-final		
/soŋgal/ 0243	[sóŋ.gal]	'bird sp.'
–		

The liquid is in free variation with its flap allophone intervocalically (the same is said for Awara (Quigley 2003:20), as well as most of the Erap and Finisterre-Huon languages). The flap [ɾ] is preferred before front vowels ([i, e]), as well as post-

consonantally. Word-initially only [l] surfaces. Just as with the fricatives, /l/ rarely occurs word-finally—a common prohibition, especially in the Erap languages (Linnasalo 2003b:10). *Soŋgal* 0243 'bird sp.' is the only word that surfaces with a word-final /l/ that is not an obvious loanword.

4.1.7 Glides

Ma Manda has two glides /w j/, as shown in Table 17 and Table 18, respectively.

Table 17: Allophones of /w/

/w/	[w]	
Word-initial		
/wəmsəŋ/ 0285	[wə́m.səŋ]	'fireplace'
/wegɨ/ 0287	[wé.gɨ]	'mushroom'
Intervocalic		
/təwa/ 0251	[tə́.wa]	'ridge'
/qowəŋgɨt/ 0145	[q^{h}o.wə́ŋ.gɨ̌t̚]	'mushroom sp.'
Word-final		
–		

Table 18: Allophones of /j/

/j/	[j]	
Word-initial		
/jalɨ/ 0295	[já.lɨ]	'two'
/joŋ/ 0304	[jóŋ]	'shade'
Intervocalic		
/ujaŋ/ 0279	[u.jáŋ]	'tail'
/əju/ 0006	[ə.jú]	'banana sp.'
Word-final		
–		

A certain ambiguity arises in interpreting glides and high peripheral vowels (whether to analyze them as underlying vowels or glides). This stems in part from examples like those in (12), which can be pronounced as either [u.j] or [wi].

(12)	a. /ujaŋ/ 0279	[u.jáŋ] ~ [wi.jáŋ]	‘tail’
	b. /qu-ləŋ/ 0396	[qu.jəŋ] ~ [q^{w}i.jəŋ]	‘go-2sg:pres’[15]

Regarding /w/ and /j/, Foley (1986:56) claims that “these semivowels are present in all Papuan languages, but their phonemic status varies widely according to the phonetic features of the individual languages and, to some extent, according to the analyst’s preferences in analysing diphthongs and other complex vocalic nuclei.” It is widely known that decisions between competing glide and vowel analyses often have to be made arbitrarily (Parker 2012:120–27). It is not always possible to defend a particular analysis, and linguists must maintain consistency throughout their description of a particular language, all the while holding the analysis with an open hand. Every linguist who has worked on an Erap language has claimed there to be both a /w/ and a /j/ phoneme, though often with rather limited distribution.

A word like *qowəŋgɨt* 0145 ‘mushroom sp.’ exhibits a definite rapid glide-like transition between the vowels /o/ and /ə/. The same goes for [j] in words like *əju* 0006 ‘banana sp.’. Further evidence for the existence of (surface) semivowels is seen in the minimal pair in (13)–(14), where one word begins with /j/ and the other with /ij/.

(13)	/jəŋen/ 0300	[jə́.ŋɛn]	‘much later’
(14)	/ijəŋen/ 0107	[i.jə́.ŋɛn]	‘thin’

The /ij/ in *ijəŋen* has a longer vocalic sound than the /j/ in *jəŋen*. In (13) there is a glide onset; in (14) there is a vowel, followed by a glide onset to the next syllable. These examples do not prove that semivowels exist underlyingly, but at least that semivowels

[15] See §9.1.6 for a discussion of the /l/→[j] alternation.

surface during syllabification. The following graphs support these findings. In Figure 3 the duration up to the nasal segment is 201ms, while in Figure 4 the duration to the nasal is 287ms.[16] However, since the overall duration of the first word (472ms) is significantly shorter than the second (640ms), a proportional measurement is more helpful. In Figure 3 the duration to the first nasal is 42.6% of the total duration of the word, while in Figure 4 the duration to the same nasal is 45% of the total word. This suggests that another full segment is present in *ijəŋen*. The spots where the duration measurements are taken are marked with arrows. These graphs were created using Praat (Boersma & Weenink 2012).

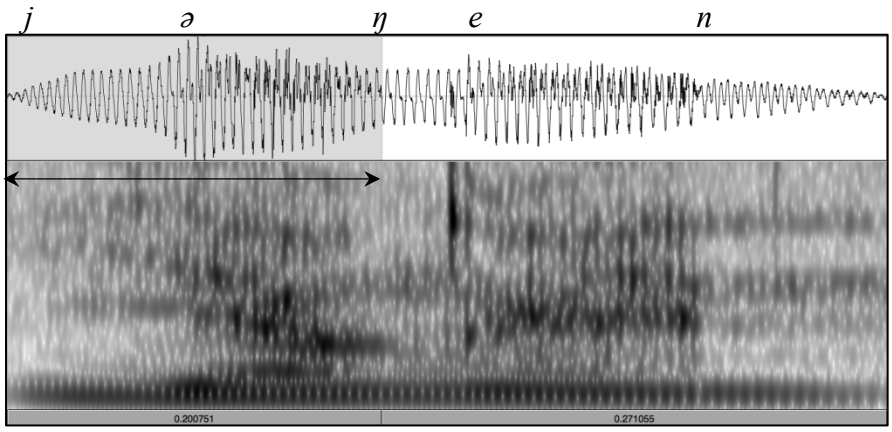


Figure 3: Spectrogram and waveform of /jəŋen/

[16] The duration is measured through to the nasal because this is a much easier place to find a boundary. Nasal segments are indicated by a solid first formant and little else, as can be seen here. Additionally, the accompanying waveforms show the drop in intensity when the /ə/ vowel transitions to /ŋ/.

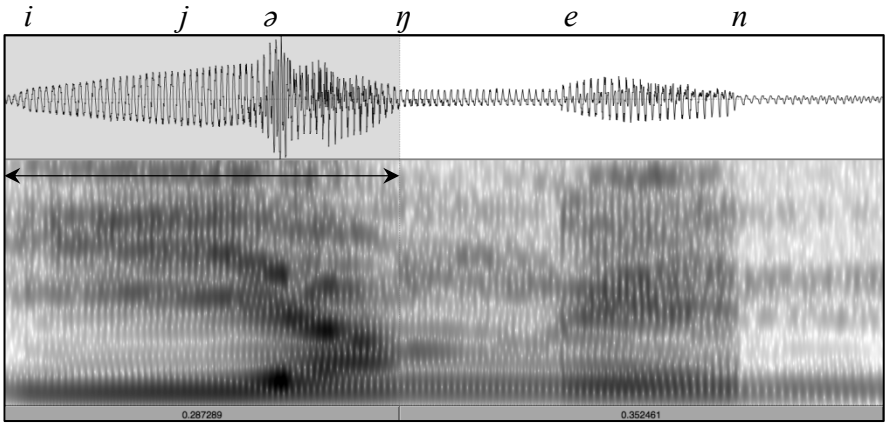


Figure 4: Spectrogram and waveform of /ijəŋen/

Based on the analyses undertaken in related languages, along with my own impression regarding these vocalic segments, I have made the analytical decision to treat vocalic onsets as underlying glides, and all others as underlying vowels. This has at least two advantages. First, it easily explains morphophonemic epenthesis such as the following (see §9.1.5):

(15) /nol-je/ [nó.lɨ.jè] 'brother-pl'

As discussed throughout §9.1, sonorants do not concatenate without alternations ensuing. If /-je/ began with a vowel (i.e., *[-ie]), epenthesis should not occur here, since epenthesis only occurs interconsonantally.

A second advantage comes from the observation that a lack of word-final semivowels is consistent with the phonotactic restrictions of Ma Manda. The only consonants that are freely permitted in coda position are voiceless plosives and nasals. This certainly suggests that glides outside of onset position should be treated as vowels rather than semivowels (see §5.3 for more discussion on this topic).

Furthermore, cross-linguistically it is known that syllables prefer to have onsets. It is logical, then, that vocalic segments in onset position are taken to be semivowels. This facilitates the clumping of segments into syllables to aid in speech production and perception.

4.2 Vowel phonemes

Ma Manda has seven phonemic vowels. They can be divided into high /i ɨ u/, mid /e ə o/, and low /a/ on the vertical axis. This organization is the most common seven-vowel system of Papua New Guinea, especially prevalent in the Sepik region (Foley 1986:54). The most intriguing aspect of this inventory is that the high central vowel is a recent phonologization of reduced high vowels. The vowels are presented in Table 19, along with their various allophones, in order of decreasing frequency.

Table 19: Vowel phoneme inventory

	front	central	back
high	i [i] [ɪ] [ɨ]	ɨ [ɨ] [ɪ] [ɯ] [ʊ] [ə]	u [u] [ʊ] [ɯ] [ɨ]
mid	e [e] [ɛ]	ə [ə] [a]	o [o] [ɔ]
low		a [a] [ə]	

The following sections serve to illustrate each vowel's occurrence in three separate environments: word-initially, interconsonantally, and word-finally. Complex vocalic nuclei are addressed separately in §5.3.

The vowels are grouped based on height, and each vowel is shown with its various allophones. Just as in §4.1, only the segments in focus are shown with phonetic

alternants. Additionally, the nasalization of vowels is left out for simplicity. Regarding nasal vowels, it is sufficient to point out that vowels are often nasalized when preceding or following nasal consonants. When in between two nasal consonants, vowels are almost exclusively nasalized, though in careful speech the nasalization is removed. Nasalization of vowels is not phonemic and does not garner any further discussion here (see Chapter 8 for discussion of nasalization).

4.2.1 High vowels

Ma Manda has three high vowels /i ɨ u/, illustrated in Table 20, Table 21, and Table 22, respectively.

Table 20: Allophones of /i/

/i/	[i] [ɪ] [ɨ]	
Word-initial		
/imbən/ 0102	[im.bə́n] [ɪm.bə́n]	‘yam sp.’
/isopmijaŋ/ 0106	[i.sòp.mi.já̰ŋ]	‘prayer’
Interconsonantal		
/nindɨ/ 0203	[nɨ́n.dɨ] [nín.dɨ] [nín.dɨ]	‘1pl’
/gisibə/ 0080	[gɨ́.sɨ.bə̀] [gí.sɨ.bə̀] [gí.si.bə̀]	‘bat’
Word-final		
/gi/ 0085	[gí]	‘rain’
/badi/ 0007	[ba.dí] [ba.dí]	‘grass skirt’

Table 21: Allophones of /ɨ/

/ɨ/	[ɨ] [ɪ] [ɯ] [ʊ] [ə]	
Word-initial		
–		
Interconsonantal		
/tɨq/ 0260	[tɨ̌q̀] [tʊ̌q̀] [tʊ̌q̀]	‘clothing’
/qadɨp/ 0110	[qá.də̌p̀] [qá.dɨ̌p̀] [qá.dʊ̌p̀] [qá.dɪ̌p̀]	‘wood, fire’
Word-final		
/qadɨgɨ/ 0109	[qá.dɨ̌.gɨ]	‘smoke’
/mondagɨ/ 0180	[mɔn.dá.gɨ]	‘banana sp.’

Table 22: Allophones of /u/

/u/	[u] [ʊ] [ɯ] [ɨ]	
Word-initial		
/ut/ 0277	[út̄]	'stinging nettle'
/ugem/ 0275	[u.gém]	'sharp'
Interconsonantal		
/guməq/ 0092	[gu.máq] [gʊ.máq] [gɯ.máq] [gɨ.máq]	'spider'
/gulət/ 0090	[gú.lət̄]	'year'
Word-final		
/flu/ 0061	[flú] [flʊ́] [flɯ́]	'wing'
/jəlobu/ 0298	[jə́.lo.bù] [jə́.lo.bʊ̀] [jə́.lo.bɯ̀] [jə́.lo.bɨ̀]	'banana (generic)'

The high peripheral vowels /i u/ occur in all environments. They are particularly susceptible to reduction to more central location, in varying degrees, in unstressed environments (e.g., /u/→[ʊ ɯ ɨ]). In certain instances, this reduction has occurred consistently over a long enough period of time that the original vowel quality has been lost. This has led to the phonologization of the high central vowel. A thorough discussion of the status of the high central vowel, high vowel reduction, and the related epenthesis process is presented in Chapter 7. The barred-i vowel does not occur in word-initial position, a fact that is consistent with the preference for word-initial stress in Ma Manda (see §6.1), as well as a general rarity of word-initial vocalic segments. This also aligns with the hypothesis that this vowel has been reanalyzed as the epenthetic vowel used to break up consonant clusters. Barred-i is the second most frequently-occurring vowel phoneme, outnumbered only by schwa (see Appendix 2).

4.2.2 Mid vowels

There are three mid vowels /e ə o/, shown in Table 23, Table 24, and Table 25, respectively.

Table 23: Allophones of /e/

/e/ [e] [ɛ]		
Word-initial		
/eməq/ 0047	[é.məḳ]	‘moon’
/eləŋ/ 0046	[e.láŋ]	‘lie’
Interconsonantal		
/gətneŋ/ 0073	[gə́t.neŋ]	‘frog’
/men/ 0167	[mɛ́n] [mén]	‘mouth’
Word-final		
/bɨse/ 0024	[bɨ́.sé]	‘jungle’
/gəbe/ 0063	[gə.bé]	‘tail feathers’

Table 24: Allophones of /ə/

/ə/ [ə] [a]		
Word-initial		
/əmbun/ 0004	[əm.bún]	‘hair’
/əŋgon/ 0005	[əŋ.gón]	‘ray of light’
Interconsonantal		
/bəm/ 0013	[bə́m]	‘woven bamboo’
/səlefəqa/ 0224	[sə.lé.fə.χà] [sə.lé.fa.χà]	‘gust’
Word-final		
/səwə/ 0230	[sə́.wə]	‘duck sp.’
/qepmə/ 0135	[qép.mə]	‘day’

Table 25: Allophones of /o/

/o/ [o] [ɔ]		
Word-initial		
/ofən/ 0208	[ó.fən]	‘pig rope’
/omin/ 0209	[ó.min] [ɔ́.min]	‘rat hole’
Interconsonantal		
/dəpmon/ 0038	[də́p.mon] [də́p.mɔn]	‘sleep’
/moq/ 0176	[mɔ́ḳ] [móḳ]	‘firstborn daughter’
Word-final		
/go/ 0087	[gó]	‘sun’
/ibəbo/ 0098	[í.bə.bò] [í.bə.bɔ̀]	‘unstable’

The three mid vowels occur freely in all environments. The lax allophones of /e/ and /o/, [ɛ, ɔ], occur in free variation with their tense counterparts, particularly around sonorants. Similarly, Quigley (2003:35) remarks that the lax vowels in Awara are prevalent before, and to a lesser degree, after, the sonorants /l/ and /m/, as well as before prenasalized voiced plosives. The mid central schwa vowel [ə] does not undergo much

variation, except that it has a tendency to be lowered in anticipation of a following low central vowel /a/ (e.g., /səlefəqa/ 0224 →[sə.lé.fa.χà] ‘gust’). It also invariably surfaces as [a] before the uvular plosive (see §4.1.1 for a discussion of this process). Schwa is the most frequently-occurring phoneme in the Ma Manda language (see Appendix 2).

4.2.3 Low vowels

Ma Manda has one low vowel /a/, which is shown in Table 26.

Table 26: Allophones of /a/

/a/ [a] [ə]		
Word-initial		
/alaməq/ 0001	[à.la.máq̀]	‘cloud’
/aŋgəm/ 0002	[aŋ.gə́m]	‘banana sp.’
Interconsonantal		
/bam/ 0010	[bám]	‘cold’
/sawə/ 0220	[sá.wə] [sə́.wə]	‘fourthborn son’
Word-final		
/fa/ 0049	[fá]	‘cicada’
/bəja/ 0345	[bə.já]	‘armpit’

The low central vowel occurs freely in all three environments, though it is rarer than other vowels word-initially. Just like the mid central vowel, this vowel has a tendency to harmonize with the height of a following non-high central vowel (seen with *sawə* in Table 26).

The contrast between this low central vowel and the mid central vowel /ə/ is quite clear in minimal pairs and in short monosyllabic and bisyllabic wordforms. However, in trisyllabic words and in utterances where context clarifies the word choice, the height of this vowel loses its importance. Outside of minimal pairs, these two vowels are almost

completely interchangeable. Native speakers are often unable to tell me which pronunciation is preferable for any particular word. By and large, though, the pattern is that the low central vowel simply reduces to schwa when contrast between the non-high central vowels is unimportant. See §9.1.6 for a discussion on what happens when two schwa vowels concatenate. Examples (16)–(18) show some of the myriad minimal pairs between the two vowels. In these instances, there is no free variation between /ə/ and /a/.

(16)	a. /bəm/ 0013	[bə́m]	'woven bamboo'
	b. /bam/ 0010	[bám]	'cold'
(17)	a. /səwə/ 0230	[sə́.wə]	'duck sp.'
	b. /sawə/ 0220	[sá.wə]	'fourthborn son'
(18)	a. /tlən/ 0267	[tɾə́n]	'ringworm'
	b. /tlan/ 0266	[tɾán]	'snakeskin'

4.3 Summary

There are 21 phonemic segments in the Ma Manda sound system, including fourteen consonants and seven vowels. The consonants can be divided into six natural classes: voiceless plosives /p t q/, voiced plosives /b d ɡ/, nasals /m n ŋ/, voiceless fricatives /f s/, a liquid /l/, and glides /w j/. Only the voiceless plosives and nasals may occur freely in coda position (and thus word-finally as well). Additionally, the fricatives and the liquid rarely occur word-finally. All consonants occur freely in word-initial position except for the velar nasal, which does not usually occur in this position.

The back voiceless plosive /q/ occurs at the uvular, rather than the velar, point of articulation in its default realization. The labial and velar voiced plosives /b ɡ/ often lenite intervocalically; of the voiceless plosives, the /q/ is also susceptible to lenition—

surfacing as a voiced or voiceless uvular fricative [ʁ χ]. The sibilant /s/ is in free variation with [ʃ] when adjacent to high vowels. It can also freely surface as [h] word-medially. The liquid has a flap [ɾ] allophone which optionally occurs intervocalically, and is preferred post-consonantally.

The vowels can be divided into high /i ɨ u/, mid /e ə o/, and low /a/. Many of the high vowels are in the midst of being reduced to a short high central vowel, while many others have already lost their original full vowel quality. This has led to the phonologization of the high central vowel. All vowels occur freely in all environments, with the exception that the barred-i does not occur word-initially.

5 THE SYLLABLE AND PHONOTACTICS

A study of Ma Manda phonotactics reveals several important patterns which shed light on the syllabification process. The most readily-apparent pattern is that tautosyllabic consonant clusters are almost exclusively disallowed. Though reduced vowels may be elided altogether—and in this way produce certain consonant clusters—the majority of syllables do not have such a pattern. This disallowance of consonant sequences is seen in loanword adaptations, where the barred-i vowel is inserted to break up underlying clusters from English. The freely occurring consonant clusters take place across syllable boundaries. This implies an active syllable template which regulates the syllabification of the language.

This chapter is structured as follows: §5.1 discusses Ma Manda syllable patterns; §5.2 looks at the occurrence of consonant sequences; §5.3 examines vowel sequences, including the process of diphthongization; and §5.4 provides a chapter summary.

5.1 Syllable template

The maximal syllable template is CLVVC,[17] which allows for the production of nine syllable types: CV, CVV, CVC, CVVC, CLV, CLVV, CLVC, V, and VC. CLVVC is predicted to be possible, but the data set does not contain any examples. This would be

[17] Where L stands for the liquid /l/.

the maximal projection of the syllable template, and therefore it is expected to be the most limited in distribution. Similarly, only one example of CLVV is found in the data. CV is considerably more common than the others. The CVC and CLVC types are drastically limited since only voiceless plosives and nasals can freely occur in the coda. The V and VC types only occur word-initially in monomorphemic words. The CVV and CVVC types require the first vowel to be non-high and the second vowel to be high. Additionally, with a mid vowel the backness specification of the two vowels must be different (i.e., /eu/, /oi/). The separate vowel segments are spoken as a single complex nucleus. These complex vocalic nuclei are discussed further in §5.3.

The dialect under investigation does allow liquids to surface as the second element in an onset cluster, when the first segment is an obstruent. The CL pattern is in free variation with syllables containing the epenthetic high central vowel (i.e., CɨLV). For instance, a CLVC word such as *floŋ* 0056 'to' may surface as either [flóŋ] or [fɨ.lóŋ].[18] Ma Manda also occasionally allows nasals to occur as a syllable nucleus when preceded by a homorganic voiceless plosive. This pattern stems from the complete elision of a remnant high vowel. For example, a word such as *muqɨŋ* 0183 'sprout' can be pronounced as either [mú.qɨŋ] or [mú.qɴ]. These matters are dealt with more fully in Chapter 7. What is important to note is that, for the discussion of syllable types, only the liquid is allowed as

[18] Throughout the remaining portions of this thesis, a broad phonetic transcription is utilized. Stress is indicated, but lenition, laxing, nasal assimilation, unrelease, and aspiration are not shown. This means that the barred-i vowel, which varies from [ɪ]–[ɨ]–[ɯ]–[ʊ]–[ə] is written exclusively as [ɨ] unless its particular quality is relevant to the discussion. See the appendices for narrower transcriptions.

the second member of an onset cluster. Syllabic nasals, on the other hand, are not included as a syllable type because they arise from an optional process of elision.

The following tables illustrate the nine syllable types, each in four environments: as a whole word, word-initially, word-medially, and word-finally. All examples are based on monomorphemic wordforms.

Table 27: CV syllables

Whole word		
/gi/ 0085	[gí]	‘rain (n)’
/bo/ 0028	[bó]	‘club’
Word-initial		
/gəbet/ 0064	[gə.bét]	‘melon sp.’
/pilup/ 0217	[pí.lup]	‘arrowhead’
Word-medial		
/təqəsep/ 0249	[tə́.qə.sèp]	‘closed’
/fentəgɨt/ 0057	[fén.tə.gɨ̀t]	‘all’
Word-final		
/jəgu/ 0296	[jə́.gu]	‘imperial pigeon’
/fetne/ 0058	[fét.ne]	‘bundle’

Table 28: CVV syllables

Whole word		
/nai/ 0190	[ná^{i}]	‘time’
/bai/ 0009	[bá^{i}]	‘flute’
Word-initial		
/nəulə/ 0201	[nə^{u}.lə]	‘bamboo sp.’
/qaudə/	[qá^{u}.də]	‘stone’
Word-medial		
–		
Word-final		
/sateu/ 0219	[sa.té^{u}]	‘rat sp.’
/boŋgai/	[boŋ.gá^{i}]	‘fly sp.’

Table 29: CVC syllables

Whole word		
/mut/ 0189	[mút]	‘grub’
/faq/ 0050	[fáq]	‘hero’
Word-initial		
/fətnaŋ/ 0054	[fə́t.naŋ]	‘white’
/gəmbom/ 0070	[gəm.bóm]	‘bean’
Word-medial		
/tameŋslə/ 0247	[ta.méŋ.sɨ.lə̀]	‘morning’
/tupmuŋqə/ 0270	[túp.muɴ.qə̀]	‘short’
Word-final		
/gufut/ 0076	[gú.fut]	‘wind’
/gɨtnəq/ 0083	[gɨt.nə́q]	‘hiccup (n)’

Table 30: CVVC syllables

Whole word		
/nain/ 0191	[náⁱn]	‘egg’
/goin/ 0088	[góⁱn]	‘black’
Word-initial		
–		
Word-medial		
–		
Word-final		
/dədaum/ 0036	[də.dáᵘm]	‘dragonfly’
/qalaut/ 0111	[qa.láᵘt]	‘cabbage’

Table 31: CLV syllables

Whole word		
/flu/ 0061	[flú] ~ [fɨ.lú]	‘wing’
/glu/ 0079	[gɾú] ~ [gɨ.ɾú]	‘scar’
Word-initial		
/blagɨt/	[blá.gɨt] ~ [bɨ.lá.gɨt]	‘sorry’
/flolə/	[fló.lə] ~ [fɨ.ló.lə]	‘hard work’
Word-medial		
–		
Word-final		
/qafle/	[qá.fle] ~ [qá.fɨ.lè]	‘carry on head’
/dable/	[dá.ble] ~ [dá.bɨ.lè]	‘share’

Table 32: CLVV syllables

Whole word		
–		
Word-initial		
/qləudu/	[qlə́ᵘ.du]	‘weak, limp (v)’
Word-medial		
–		
Word-final		
–		

Table 33: CLVC syllables

Whole word		
/floŋ/ 0056	[flóŋ] ~ [fɨ.lóŋ]	‘to’
/tlən/ 0267	[tɾə́n] ~ [tɨ.ɾə́n]	‘ringworm’
Word-initial		
/fləŋgon/ 0055	[flə́ŋ.gon] ~ [fɨ.lə́ŋ.gon]	‘axe’
/qloŋginəŋ/ 0133	[qlóŋ.gɨ.nə̀ŋ] ~ [qɨ.lóŋ.gɨ.nə̀ŋ]	‘lory sp.’
Word-medial		
–		
Word-final		
/qləqlen/ 0137	[qlə́.qlèn] ~ [qɨ.lə́.qɨ.lèn]	‘soft’
/qoblep/ 0138	[qó.blep] ~ [qó.bɨ.lèp]	‘anger’

Table 34: V syllables

Whole word[19]		
/i/ 0097	[í]	‘this’
/u/ 0273	[ú]	‘that’
Word-initial		
/usuŋ/ 0276	[ú.suŋ]	‘above’
/ələlum/ 0003	[ə̀.lu.lúm]	‘tickle’
Word-medial		
–		
Word-final		
–		

[19] There are no content words composed of a single vowel in Ma Manda. In fact, these two examples (/i/ and /u/) are shortened forms of /idi/ and /udu/, respectively.

Table 35: VC syllables

Whole word		
/eŋ/ 0048	[éŋ]	‘yes’
/ip/ 0104	[íp]	‘bird (generic)’
Word-initial		
/imbən/ 0102	[im.bə́n]	‘yam sp.’
/upmuŋ/	[úp.muŋ]	‘bamboo sp.’
Word-medial		
–		
Word-final		
–		

5.2 Consonant sequences

Only a few types of consonant clusters are allowed in tautomorphemic wordforms. To be precise, eleven unambiguous consonant clusters are allowed tautomorphemically, as seen in Table 36. The initial column provides the first segment of each sequence, while the initial row provides the second segment.

Table 36: Tautomorphemic consonant phoneme sequences

	p	t	q	b	d	g	m	n	ŋ	f	s	l	w	j
p_							✓					*		
t_								✓				*		
q_									✓			*		
b_												*		
d_												*		
g_												*		
m_	✓			✓	✓	✓								
_														
n_		✓			✓									
ŋ_			✓			✓								
f_												*		
s_												*		
l_														
w_														
_														
j_														

✓ Allowed

* Allowed, but often broken up with epenthesis

It is obvious from Table 36 that few consonant sequences are allowed. Additionally, the sequences that are freely allowed always involve a nasal and a plosive. Further still, the involved nasal is homorganic with the adjacent plosive in all cases except for /md/ and /mg/ (which are infrequent). The sequences involving /l/ as the second onset segment are often broken up by epenthesis. It appears this type of cluster is becoming less preferred (see Chapter 7).

Table 37 provides an example of each of these consonant sequences:

Table 37: Tautomorphemic consonant phoneme sequence examples

pm	/dəpmon/ 0038	[də́p.mon]	‘sleep’
tn	/fetne/ 0058	[fét.ne]	‘bundle’
qŋ	/bɨqŋan/ 0022	[bɨ́q.ŋan]	‘neck’
mp	/pempəŋ/ 0214	[pém.pəŋ]	‘shoulder’
mb	/wembi/ 0288	[wém.bi]	‘frog sp.’
md	/memdɨ/ 0166	[mém.dɨ]	‘sweat’
mg	/bomgə/	[bóm.gə]	‘rat sp.’
nt	/gonteq/ 0089	[gón.teq]	‘grasshopper’
nd	/qondinəm/ 0143	[qón.di.nə̀m]	‘bird sp.’
ŋq	/tupmuŋqə/ 0270	[túp.muɴ.qə̀]	‘short’
ŋg	/təŋgə/ 0257	[tə́ŋ.gə]	‘bird sp.’

Table 38 shows the types of sequences that occur across morpheme boundaries.

Table 38: Heteromorphemic consonant phoneme sequences

	p	t	ɋ	b	d	g	m	n	ŋ	f	s	l	w	j
p_	*	*	*	*	*	✓	✓	✓			✓	*	*	*
t_	*		*	*	*	✓	*	✓		*	✓	*	*	*
ɋ_						✓		✓	✓		✓	*	*	*
b_														
d_														
g_														
m_	✓	✓	*	✓	✓	✓		✓	✓		✓	*	*	*
n_	*	✓	*	*	*	✓	*	✓			✓	*	*	*
ŋ_	*	*	✓	*	*	✓				*	✓	*	*	*
f_														
s_														
l_														
w_														
j_														

✓ Allowed

* Allowed only in reduplication and compounds

With the exception of compounds and reduplicated forms, there is a paucity of consonant sequences allowed even across morpheme boundaries. Immediately noticeable is the absence of clusters involving voiced plosives, fricatives, and the liquid as the first segment. Additionally, the liquid never surfaces as the second element. This is due in large part to the susceptibility of /l/ to morphophonemic alternations, which is discussed in Chapter 9. It is the nasals and voiceless plosives that tend to occur in clusters, as these are the only consonants that are freely allowed in root- and word-final position.

5.3 Vowel sequences

Ma Manda allows only five tautomorphemic vowel sequences, where V_1 is always non-high, and V_2 is always high. Also, V_1 and V_2 cannot have the same

specification for backness: The front vowel /e/ and central vowel /ə/ can only be followed by the back vowel /u/, while the back vowel /o/ can only be followed by the front vowel /i/. These patterns are illustrated in Table 39.

Table 39: Tautomorphemic vowel phoneme sequences

	i	ɨ	u	e	ə	o	a
i_							
ɨ_							
u_							
e_			✓				
ə_			✓				
o_	✓						
a_	✓		✓				

✓ Allowed

The diphthongs /oi/, /ai/, and /au/ are frequently-occurring, while /eu/ and /əu/ only occur in a few wordforms. Examples are shown in Table 40.

Table 40: Tautomorphemic vowel phoneme sequence examples

eu	/sateu/ 0219	[sa.té^{u}]	'rat sp.'
əu	/nəulə/ 0201	[né^{u}.lə]	'bamboo sp.'
oi	/goin/ 0088	[gó^{i}n]	'black'
ai	/bai/ 0009	[bá^{i}]	'flute'
au	/dədaum/ 0036	[də.dá^{u}m]	'dragonfly'

Vowel sequences in which a high vowel is followed by a non-high vowel are analyzed as V.GV sequences. As discussed in §4.1.7, these types of sequences always exhibit an onset glide between the two vowels. Examples of these are shown in Table 41.

Table 41: Tautomorphemic V.GV sequence examples

ijə	/bijət/ 0027	[bi.jə́t]	'bird sp.'
ijo	/dijo/ 0333	[di.jó]	'chest'
ija	/tibijam/ 0263	[tì.bi.já́m]	'frog sp.'
uwə	/muquwəŋ/ 0184	[mú.qu.wə̀ŋ]	'fog'
uwa	/guwam/ 0093	[gwám] ~ [gu.wám]	'ginger sp.'

Table 42 shows the comparatively frequent *heteromorphemic* vowel sequences.

Table 42: Heteromorphemic vowel phoneme sequences

	i	ɨ	u	e	ə	o	a
i_			*				
ɨ_	✓		✓				
u_	*						
e_	✓		✓				*
ə_	✓		*				
o_	✓						
a_	✓			*			

✓ Allowed
* Allowed only in reduplication and compounds

Heteromorphemic vowel sequences are somewhat rare, since there are no vowel-initial suffixes or enclitics. A majority of the allowable sequences seem to arise in names for species of flora and fauna, which often involve a base form compounded to a fossilized form (see §9.3.2).

All tautosyllabic vowel sequences involve a non-high vowel followed by a high vowel off-glide. These vowel sequences are not analyzed as belonging to separate syllables, or as being phonemic diphthongs. Instead, they are composed of separate phonemic segments that have come together to form derived diphthongs (i.e., complex nuclei). This is supported by the data in several ways.

First, stress is never contrastive between the first and second vowels of a vowel sequence. The first vowel, which is always non-high, is always stressed, while the second vowel is shorter, thus behaving more like a glide. Second, the second vowel does not appear to be a *phonemic* glide either. Evidence against treating these high vowels as

phonemic glides (/w j/) is found in heteromorphemic patterns. In Ma Manda, sonorants are prone to alternate when they are brought into contact with other consonants across morpheme boundaries. However, words like *bai* ‘flute’ and *sateu* ‘rat sp.’ do not undergo any alternations when suffixed with the nasal-initial first person possessive affix /-nə/ or the liquid-initial nominative enclitic /=li/. If these were analyzed as glides, they would be the only examples of sonorants that fail to undergo alternations in this environment (in fact, the labiovelar glide is particularly susceptible to such changes). This is discussed further in §9.1.5. Finally, it is simply not advantageous to posit these five diphthongs as separate phonemic units. Since there are no examples of phonemic vowel length, and the phonetic diphthongs are limited to just a few particular types, it is simplest to assume that these complex nuclei are in fact composed of two vowel phonemes.

5.4 Summary

The syllable template is CLVVC, though its full projection is not found in the data. The vowel-initial syllable types (V and VC) only occur word-initially, while CV and CVC occur everywhere. CVV and CVVC syllables are composed of a phonemic non-high vowel, followed by a phonemic high vowel. These vowel sequences are analyzed as complex vocalic nuclei and not phonemic diphthongs. The liquid can occur as a second onset consonant, although this is often broken up with optional epenthesis. A small group of consonant clusters are allowed across syllable boundaries, and these all involve a nasal and either a voiced or voiceless (typically homorganic) plosive. A greater variety of consonant clusters are allowed across morpheme boundaries, though they are

still greatly restricted. Across morpheme boundaries, vowel hiatus sometimes occurs as well, especially in compounding and reduplication.

6 SUPRASEGMENTAL FEATURES

This chapter describes the suprasegmental features of Ma Manda. This includes an analysis of the stress system (§6.1) and a synopsis of the primary intonation contours (§6.2), followed by a summary (§6.3). Unlike several Erap languages, vowel length is not contrastive. Also, though Ma Manda uses pitch—among other indicators—to manifest stress, as well as phrase-, clause-, and utterance-level information, it is not a tonal language. None of the Erap languages have been analyzed as tonal.

6.1 Stress

The accent system has been difficult to "pin down" due to a lack of convergence of the prototypical indicators of stress such as pitch, intensity, and duration. The presence of the short barred-i vowel has led to a great deal of confusion (on my part) as well. In his grammar of a Sepik language which also possesses both a phonemic and an epenthetic barred-i vowel, Bruce (1984:59) comments: "The syllable is not easy to define in many cases for Alamblak." This issue arises for most linguists who struggle to describe languages that have this particular vowel. With this in mind, I turn to an overview of the Ma Manda stress-accent system, including definitions and references to the broader body of relevant literature.

Ma Manda has a quantity- and quality-sensitive, left-headed stress system. Stress is not contrastive, but it is not entirely predictable either. The preference is for word-initial stress, though stress can occur on any syllable, depending on syllable weight. The phonological foot is a moraic trochee. This means that it is composed of a sequence of two light syllables, the first of which is stressed (ĹL), or one heavy syllable (Ĥ). The words in (19) all have two light syllables with the same quality of nuclei.

(19)	a. /qəwə/ 0127	[qə́.wə]	'in-law'
	b. /musu/ 0188	[mú.su]	'yam sp.'
	c. /səwə/ 0230	[sə́.wə]	'duck sp.'
	d. /qeqe/ 0132	[qé.qe]	'roots'

This is one of the few reliable patterns in the Ma Manda stress system. Things become much more complicated because vowels have different weights. Various types of open and closed syllables interact with the qualities of their nuclei to produce surprising and complex results.

Stress is defined as "prominence", meaning that one syllable of each word is felt to be stronger than all of the others. This prominence is realized by a number of phonetic properties, including syllable duration, vowel quality, intensity, aspiration of voiceless plosives, and alignment with phrasal stress. To be more precise, a syllable that receives primary stress in Ma Manda may surface in the following manner:

(20) Gradient properties of stressed syllables in Ma Manda

- lengthened vowel duration;
- vowel articulated close to its target value;
- syllable is pronounced with greater overall intensity;
- higher pitch than surrounding syllables;
- fortification or lengthening of onset consonants;
- increased aspiration of onset voiceless plosives;
- attracts phrasal stress.

Stress often involves "a rather heterogeneous collection of phonetic properties" (Hulst 2010:12). It is true, however, that there are often one or two primary cues to stress placement. Unfortunately, these properties seldom align with one another in Ma Manda. For instance, it is often the case that one syllable seems to be marked for primary stress in terms of pitch, while another seems marked for stress in terms of intensity. It does not seem to be the case that any indicator can be relied upon more than the others. This is the primary difficulty in disentangling the phonological system of stress from the phonetic properties of the language.

(21) There is no convergence of the prototypical indicators of stress in Ma Manda.[20]

Gordon (2011:926) refers to such systems as "split-cue" stress systems. In this type of language, "potential phonetic markers of stress do not converge on a single syllable but rather are shared between multiple, often, though not always, adjacent syllables." For instance, Gordon points to Estonian, "where the primary stressed initial syllable, if it contains a phonemic short vowel, will be shorter than the immediately

[20] Unfortunately, acoustic measurements showing these properties of stress are left out of this thesis. A more technical approach to the stress system is left for future research.

following syllable and often have less intensity and lower fundamental frequency." Therefore lengthening of the consonant in the onset of the stressed syllable serves as the most reliable cue to stress in Estonian. Likewise in Ma Manda, a stressed word-initial barred-i vowel is still shorter (by up to 50ms) than a following unstressed vowel, and a word-final unstressed vowel tends to be longer than preceding stressed vowels.

In his typology of word-prosodic systems, Hyman provides a definition of stress-accent:

(22) Definition of stress-accent (Hyman 2006:231): "A language with stress accent is one in which there is an indication of word-level metrical structure meeting the following two central criteria:

- obligatoriness: every lexical word has at least one syllable marked for the highest degree of metrical prominence (primary stress);
- culminativity: every lexical word has at most one syllable marked for the highest degree of metrical prominence.

These properties, especially culminativity, are seen throughout the literature on metrical stress theory. The property of culminativity means that a word can have no more than one primary stress, while the property of obligatoriness means that a word can have no less than one primary stress. Thus, it is claimed that in a stress-accent language every word must have one and only one syllable marked for primary stress. These notions have proven to be too strong for a few "barred-i" languages of Papua New Guinea. Kalam, for instance, is said to have primary stress on the final syllable of each word as well as all

full vowels throughout the word (Blevins & Pawley 2010:17–18).[21] One of the issues seems to arise from the lack of distinction between primary and secondary stresses.[22] This appears to be part of the problem in Ma Manda as well. For instance, in a three syllable word there is often no apparent way of determining whether the first or the third syllable has primary stress. This confusion is attested by native speakers as well. It does seem that, generally, Ma Manda words have secondary stresses. Whether this hypothesis can be supported with acoustic measurements is left for future research.

Ma Manda is an unbounded stress-accent language. Rhythmic systems can be roughly divided into bounded and unbounded types. In a bounded stress system, the stresses fall within a particular distance of a boundary or other stress. In an unbounded system, stress can fall an unlimited distance from a boundary or another stress, provided the appropriate conditions are met (Hayes 1995:32). In Ma Manda, stress is attracted to the first syllable. This makes it appear to be a bounded system. However, if a "heavier" syllable is further to the right, then stress is often attracted to that syllable instead. The following statement is apropos:

> From a functional point of view, unbounded systems are curious because the location of accents provides no information about word edges. It must be concluded that in systems of this sort the 'greed' of heavy syllables in snatching the word accent has overtaken the edge-based preference of the accents that have fallen victim to their attraction. (Hulst 2010:41)

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[21] Some Trans-New Guinea languages are claimed not to possess a word-prosodic system at all (e.g., Hatam and Iatmul (Zanten & Dol 2010:16)).

[22] Regarding neighboring Uri, Webb (1974a:87) suggests that all "long vowels" attract equal stresses.

Since heavy syllables can pull stress away from the initial syllable, the question must be asked, “How are words demarcated?” In many other languages, stress is often seen to serve a demarcative function in utterances. It seems that words are simply not demarcated in this way in Ma Manda, at least not entirely. It is still true that most words are stressed on or near their initial syllables. Recall also that Ma Manda only allows vowels, voiceless plosives, and nasals to occur word-finally. It appears to be the case that positional restrictions on segments, along with stress placement, serve to demarcate phonological words from one another.

As previously mentioned, Ma Manda stress is attracted to “heaviness”. Hulst (2010:47) points out that, “In systems that use prominence to determine whether syllables are heavy or light, certain *properties* of the segments in the syllable count towards weight, not their mere presence.” It turns out that the most important property for determining the weight of syllables in Ma Manda is vowel aperture. Typically, when vowel quality is relevant in stress placement, the more open (low) the vowel is, the more prone it is to attract stress, and this is exactly the case in Ma Manda. According to Kenstowicz (1997:183), two properties contribute to the determination of prominence in “quality-sensitive” systems: vowel height and vowel peripherality. Thus, “lower vowels are more prominent than higher vowels, and peripheral vowels are more prominent than central vowels” (1997:157).

Both vowel quality (quality-sensitivity) *and* coda consonants (quantity-sensitivity) contribute to a syllable's weight in Ma Manda. Though there are tendencies, the system is complicated and somewhat unreliable. A few examples are provided in (23).

(23)	a. /qətəp/ 0126	[qə.tə́p]	'twins'
	b. /gəbe/ 0063	[gə.bé]	'tail feathers'
	c. /guma/ 0091	[gu.má]	'smooth'
	d. /qɨdə/ 0136	[qɨ.də́]	'greens'
	e. /bagɨt/ 0008	[ba.gɨ́t]	'slowly'
	f. /lamut/ 0150	[lá.mut]	'poison'

In (23a–e) the second syllable attracts stress away from the first syllable. In (23a) a coda consonant in the second syllable causes it to be heavy and thus pulls stress away from the first light syllable. The vowels are of equal quality and therefore play no role in stress placement. In (23b–d) both syllables are light, and yet stress is still pulled onto the second syllable. In each of these cases, the second vowel is decidedly heavier than the first. In (23e) the first vowel is much more open than the second, but the coda of the second syllable still pulls the stress away. However, in (23f) the closed second syllable does not attract stress, which contradicts the pattern.

Related Erap languages Nek, Finongan, and Uri have also been analyzed as having versions of word-initial quality-sensitive stress systems (Linnasalo 2003b:32, Rice & Rice 2010:7, Webb 1974a:87), as well as nearby Nankina (Spaulding & Spaulding 1994:17–19). Regarding closely-related Numanggang, Hynum (2001:3) claims that stress is contrastive. However, the examples provided suggest a similar behavior to that of Ma Manda. For instance, a pair is given: *túo* 'firstborn son' and *tuót* 'enough'. It is quite clear

that a heavy second syllable is attracting the stress. This is seen in the comparable Ma Manda pair: *túwə* 0271 'firstborn son' and *tuwóŋ* 'firstborn son.3SG:POSS'.

In the default case, Ma Manda has word-initial stress. However, a heavy second syllable pulls the stress away from a light initial syllable. In addition to coda consonants, vowel aperture directly affects stress placement. This establishes the prosodic system as "quality-sensitive" in addition to "quantity-sensitive." The hierarchy of vowel heaviness—and thus the likelihood for attracting stress—is shown in (24).

(24) Hierarchy of vowel heaviness (weight) in Ma Manda
/a/ > /e o/ > /ə/ > /i u/ > /ɨ/

This hierarchy is coextensive with the relative openness of the vocal tract. Note that this hierarchy is *almost* in-line with Kenstowicz's dual stress-attracting properties—height and peripherality. Put another way: *The more sonorous a vowel is, the more likely it is to attract stress*.

It is important that the Ma Manda vowel hierarchy is analyzed to be different than Kenstowicz's prediction. In analyzing Kobon's (Davies 1981) quality-sensitive system (i.e., /a/ > /e o/ > /i u/ > /ə/ > /ɨ/), Kenstowicz hypothesizes that "the Kobon vowel system is first sorted in terms of peripheral vs. central and then in terms of height" (1997:164). Thus, in the first step the central vowels (i.e., /ə ɨ/) are outranked by all the others, and in the second step height determines the rest of the hierarchy. One way to handle the Ma Manda hierarchy is to hypothesize that height is ranked above peripherality. By dividing the vowel system first by height, we get the following: /a/ > /e ə o/ > /i ɨ u/. Then, by

applying the peripherality condition we get: /a/ > /e o/ > /ə/ > /i u/ > /ɨ/. This correctly predicts the hierarchy, but, importantly, implies a reversal of the sonority ranking proposed by Kenstowicz, de Lacy (2004), and Parker (2002, 2008, 2011). These proposals all rank schwa as less sonorous then the high peripheral vowels, and thus less likely to attract stress in a quality-sensitive system. Therefore, this analysis is theoretically unexpected. Another potential hypothesis is to analyze the schwa vowel as a caret ([ʌ]) instead. This has the added benefit of explaining its stressability, as well as relating it to other Finisterre-Huon languages that have the more-similar /ɔ/ vowel. A detailed acoustic study is needed to verify the quality of this mid vowel.

This relationship between vowel quality and stress attraction has been claimed for other "barred-i" languages as well, including Alamblak (Bruce 1984), Kamasau (Sanders & Sanders 1980), and Abelam (Laycock 1965) (Zanten & Dol 2010:119–20).

The words in (25) further illustrate Ma Manda stress patterns, showing the interaction between vowel quality and coda consonants in tri- and quadri-syllabic words.

(25)	a. /qobɨse/ 0139	[qó.bɨ.sè]	'chicken'
	b. /dəbugum/ 0035	[də́.bu.gùm]	'star'
	c. /gisibə/ 0080	[gí.si.bə̀]	'bat'
	d. /sendapoq/ 0231	[sén.da.pòq]	'cocoon'
	e. /miŋgəfəŋ/ 0174	[míŋ.gə.fə̀ŋ]	'lake'
	f. /gɨgɨlɨq/ 0077	[gɨ́.gɨ.lɨ̀q]	'gums'
	g. /qəfedəp/ 0121	[qə.fé.dəp]	'claw upwards'
	h. /qusuwət/ 0149	[qù.su.wə́t]	'tree sp.'
	i. /ləgəmandɨ/ 0151	[lə̀.gə.mán.dɨ]	'dream'

In (25a–f) stress behaves as expected in a language with moraic trochees assigned left-to-right. The first syllable has primary stress, while the third syllable has secondary

stress—though it is debatable whether there is any reliable distinction between primary and secondary stresses. Example (25g) has a word with the following foot structure: (LĹ)(H).[23] Here the /e/ of the second syllable pulls stress from /ə/ of the first syllable, and then the closed final syllable is not stressed, probably due to stress conflation. Example (25h) has a (L̀L)(Ĥ) structure, where the final heavy syllable attracts the primary stress, and the first foot is left-headed and given secondary stress. This is common with words involving high vowels, since they seldom attract stress. Example (25i) behaves in the same manner, except there is an additional unstressed syllable word-finally.

The interaction between codas and vowel aperture is a major complicating issue with regard to stress placement. Another complication results from a general variability of stress placement when a word is spoken in isolation. Many clear-cut examples always seem to be spoken the same, while others (e.g., /təndon/ 0255 'night') vary. This variability suggests that the language may be in a state of change in this area, perhaps moving toward—or perhaps away from—a pitch-accent system.

Finally, the stress system appears to be consistent across different word classes. The only exception to this is postpositional enclitics which tend not to attract stress. Nominal and verbal suffixes do not cause stress to move unless they have a heavier syllable than the noun or verb root onto which they are attached, as seen in (26c) and (27b).

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[23] Or perhaps (L)(Ĺ)(H) with clash removal, or L(Ĺ)H.

(26)	a. /qelɨ/ 0363	[qé.lɨ]	‘hand’
	b. /qelɨ-nə/ 0364	[qé.lɨ.nə̀]	‘hand-1sg.poss’
	c. /qelɨ-neq/ 0365	[qè.lɨ.néq]	‘hand-1pl.poss’
(27)	a. /tə-qə/ 0440	[tə́.qə]	‘do-ss’
	b. /tə-got/ 0434	[tə.gót]	‘do-1sg:rpst’

6.2 Intonation

This section on intonation briefly describes the Ma Manda intonational contours in prose. There is no focus on formal concepts such as alignment, association, and the scaling of targets (Ladd 2008:169ff.). A deeper analysis of the suprasegmental features would no doubt include these elements.

Ma Manda intonational contours are straightforward and behave similarly to a majority of Trans-New Guinea languages. Ma Manda has three primary intonational contours, corresponding with three speech acts: statements, polar questions, and commands. The following related languages reveal near-identical intonational patterns: Nek (Linnasalo 2003b:36–38), Numanggang (Hynum 1980:25–29), Awara (Quigley 2003:58–59), and Nankina (Spaulding & Spaulding 1994:19–20).

Statements have a general falling of the pitch toward the end of each clause, with a steep fall on the last syllable or two. Ma Manda is a clause-chaining language, whereby every sentence includes only one verb that is fully inflected for person, number, and tense. This verb comes at (or very near) the end of the sentence. Intermediate clauses each end in “medial” verbs which are minimally inflected—for person and number only. When a medial clause comes to an end—culminating in a medial verb—the pitch is reset,

though generally at a lower point than the beginning of the sentence. A typical sentence, therefore, consists of a series of falling pitches, each beginning at a slightly lower point than the beginning of the previous clause. This can be clearly seen in (28).[24] Each medial clause is marked by falling pitch,[25] followed by a slight readjustment of pitch at the beginning of the next clause. The pitch trace created by Praat (Boersma & Weenink 2012) is a faint gray line. I include a dark black line to show the general pitch contour.

(28) Statements: Falling contour throughout utterance

[nə́lɨ	qənéq	sópmɨɴqə̀	bə́ŋətə̀	wápmɨŋgàm]
/nə=lɨ	qəneq	isopm-qə	bə-(ŋ)əl-qə	wapm-wam/
man=nom	stick	hold.pl-ss	come-be.at-ss	plant.yams-1pl:pres

'(We) men grab the (marking) sticks and come and plant the yams.'

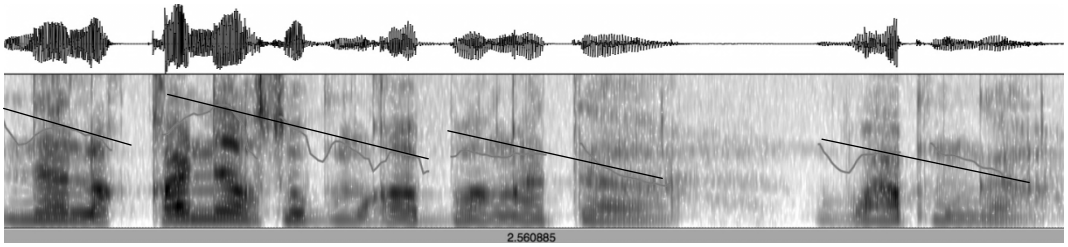


Figure 5: Falling pitch contour of a statement

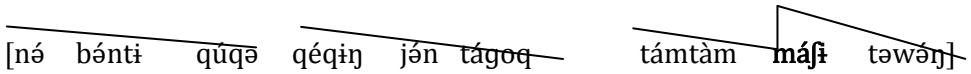
The sentence begins at a pitch of 236.3 Hz and then gradually falls toward the end of the clause. The phrasal stress in /qəneq/ causes the pitch to rise to 255 Hz before falling to 143.4 Hz at the end of the sentence.

[24] This example is taken from a story about planting yams, spoken by Garambon Magu, a 33-year-old male. The entire 1 minute 8 second story is included on the disc as number 0466: 0466a is an HD video file, recorded on an Olympus LS-20M recorder with a Shure SM10A headset microphone (.mov; 123.3 MB); 0466b is a reduced version of this video file (.m4v; 62 MB); 0466c is the extracted audio file only (.wav; 13.1 MB). This example can be found 54.5 seconds into the recording, lasting until second 57.1. This story is interlinearized in Appendix 5.

[25] In this example, each medial clause ends in a verb, minimally inflected with the same subject medial suffix (SS). See §2.4 for a discussion of the clause chaining system.

Phrasal stresses are characterized by sharp rises in pitch, and then followed by a continued lowering of the pitch contour as before. For example, see the spectrogram above, where the second syllable of /qəneq/ is given phrasal stress, accompanied by the highest intonation of the entire sentence. Content questions are treated in this manner as well. The content question word, which typically occurs immediately prior to the verb, is spoken with a higher pitch than the rest of the clause. As mentioned in the previous section, phrasal stress aligns with the primary stress of a word. Therefore, the word *masɨ* 0157 'what?', which is stressed word-initially, attracts phrasal stress on its first syllable, as seen in (29). All word-level stresses are subordinated to the primary phrasal stress. Quotations are also indicated by a rising of pitch.[26]

(29) Content questions: Sharp rising contour on question word



[nə́	bə́ntɨ	qúqə	qéqɨŋ	jən	tágoq	támtàm	**máʃɨ**	təwə́ŋ]
/nə	bən=lɨ	qu-qə	qeqɨŋ	jən	ta-goq	tam-tam	**masɨ**	tə-wəŋ/
man	a=nom	go-ss	call.out	cat	say-3sg:rpst	woman-pl	**what?**	do-23pl:pres

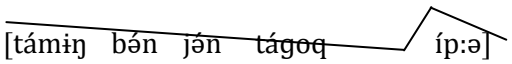
'A man went and yelled out, "What are you girls doing?"'

Polar questions also involve a sharp rise in pitch on the word which is being questioned, aligning with whatever syllable of that word is generally stressed. This rise typically co-occurs with the polar question morpheme /=wə/ 'YNQ', as seen in (30). Note that clitics do not generally receive stress, and therefore the polar question enclitic does not align with the rise in intonation; instead, the noun (onto which the clitic is attached) receives primary stress and is aligned with the rise in intonation. Therefore, the pitch rise can be anywhere in the word as long as it is aligned with the questioned constituent. In

[26] Unfortunately, the remaining examples in this section do not have associated audio files.

(30) the final noun *ip* ‘bird’ is aligned with the rise in pitch, since this is the word which is being questioned.

(30) Polar questions: Sharp rising contour on questioned word



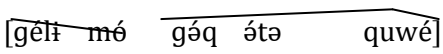
[támɨŋ	bə́n	jə̋n	tágoq	íp:ə]
/tamɨŋ	bən	jən	ta-goq	ip=wə/
woman	a	cat	say-3sg:rpst	bird=ynq

‘A girl asked, “Is it a bird”’

Occasionally, the polar question enclitic can be left out. In this case, the pitch rises throughout the clause, typically ending in a sharp rise on the last couple of syllables.

In contrast, commands are indicated by—in addition to verbal morphology—a high and steady, or slightly rising, pitch. Though the pitch sometimes may drop on the last couple of syllables, the general tendency is to maintain the high pitch throughout the utterance. This is seen in (31).

(31) Commands: High and steady contour



[gə́lɨ	mó	gə́q	ə́tə	quwé]
/gelɨ	mo	gəq	əl-qə	qu-be/
okay	finish	2sg	be.at-ss	go-2sg:imp

‘Okay now, you can go.’

All of these contours are consistent with universal tendencies (see Ladd (1996:114), among many others) and thus the generalities mentioned here have no serious controversy. Their value lies in how these patterns are aligned with intonation-units as part of the system of prosody. These issues are left for future study.

6.3 Summary

Ma Manda is not a prototypical stress-accent language. Stress is indicated primarily by pitch and intensity, but these two archetypal indicators do not necessarily coincide with one another. This lack of convergence of classic indicators for stress accent makes it difficult to be certain of any single analysis of some words. Additionally, the presence of the reduced high central vowel as both a phoneme and an epenthetic segment complicates the matter exponentially. In spite of these factors, a few definitive statements can be made. Ma Manda has both a quantity-sensitive and a quality-sensitive stress system, with a preference for word-initial placement. This analysis leads to the claim that the default foot is a moraic trochee. The relative weight of each syllable is determined by the presence of a coda consonant (quantity-sensitivity), as well as a hierarchy of vowel aperture which aligns closely with the sonority hierarchy (quality-sensitivity). The lack of an exact correlation between this vowel hierarchy and the sonority hierarchy proposed throughout the literature is theoretically relevant, and future acoustic analysis is needed to substantiate such a hypothesis. Secondary stress is assigned in alternate syllables outward from the primary stress, though it is debatable whether the notion of secondary stress is applicable to Ma Manda. Iterativity cannot as yet be proven due to the rarity of words long enough to carry multiple secondary stresses on one side of the primary stress. Clitics are typically unstressed, while suffixes only affect stress placement when they contain a heavier syllable than the root onto which they are attached.

Intonational contours are consistent with a majority of related languages. Statements exhibit a slow falling of pitch, and each successive medial clause starts with a slightly lower pitch than the beginning of its predecessor. Content question words and other points of phrasal stress are accompanied by a sharp rise in intonation. Polar questions are likewise indicated by a rise in pitch on the questioned word, while commands are indicated by a high steady or slowly rising pitch throughout.

7 HIGH VOWEL REDUCTION AND EPENTHESIS

Throughout this thesis I have alluded to the special qualities of the high central ("barred-i") vowel. Before addressing this vowel from the Ma Manda context, it is important to be familiar with its prevalence in the literature on Papua New Guinea languages.

Foley (1986:50) suggests that the /ɨ/ phoneme "has certain functions not shared by the other vowels" in many Papuan languages. "In these languages it functions as a linking vowel breaking up non-permissible consonant clusters." Referring to Yimas (Foley 1991) and other Sepik languages, he asks the following question: "What is the status of [ɨ] in such languages? Are all [ɨ]s to be analysed simply as transition vowels, inserted to break up certain consonant clusters, or are some [ɨ]s really phonemically present and others transition elements?" Foley proceeds to refer to Pawley (1966), who argues for the former with regard to Kalam. Pawley contends that in Kalam all [ɨ]s are transition vowels between consonants. Phonetically there are no consonant clusters, while at the phonemic level there are extensive consonant clusters. Though this discussion centers around languages that are located across the country in and around Sepik Province, it sheds light on the same issue in Ma Manda. Located within southern Morobe province, the Menya language provides yet another clear example of this phenomenon. Whitehead (2004:9) discusses "a short, high vowel being inserted between consonant clusters that are not

allowed in the phonetic realization." He then mentions that the quality of that epenthetic vowel varies, especially when the nearest phonemic vowel is /i/ or /u/.

Numanggang, Nek, and Uri, fellow Erap languages, contribute to the discussion. Regarding Numanggang, Hynum (1980:6 and pers. comm.) discusses what he terms a "voiceless vocoid [ɪ]". He points out its relative shortness in duration, and its existence in-between word-initial consonant clusters (particularly between /s/ and voiceless plosives). That Hynum notices this vowel in sC sequences is not surprising. Peterson & Lehiste (1960) point out that vowel durations are known to be influenced by the type of the following consonant, and that vowels are shorter when they are followed by a voiceless consonant. More precisely, the shortest vowel durations occur prior to voiceless plosives and fricatives. It is my contention that the voicelessness is solely due to its shortness. Occurring between two voiceless consonants, this short vowel just does not have the time to develop any periodicity through the vibrations of the vocal folds.[27]

Regarding Nek, Linnasalo (2003b:12) remarks that "in slow speech a transitional (epenthetic) schwa is at times in evidence in consonant clusters. The three voiced stops /b/, /d/, and /g/, and the voiced grooved fricative /z/ occur only syllable-initially, and never in consonant sequences in monomorphemic words." These statements about two related languages give credence to a similar analysis in Ma Manda. Numanggang exhibits a high front vowel occurring in the midst of word-initial consonant clusters. Nek exhibits

[27] This is just conjecture, however, since I do not have any audio recordings of the Numanggang language.

a mid central vowel occurring as a transitional element. Additionally, Linnasalo claims that this “schwa” vowel is particularly short, and never occurs word-initially.

Regarding Uri, Webb (1974a:87) mentions that the long high vowels /i: u:/ do not contrast with their short counterparts in word-initial position (reminiscent of the pattern that the barred-i vowel does not occur word-initially in Ma Manda). The statement below regarding the development of the Uri orthography is also pertinent:

> The problem in any one village of determining the value in unstressed syllables of mid or central vowels, whether to spell them with a representing schwa or i or u was not resolved by examining the survey results. No consistent pattern emerged, the vowel appearing to be conditioned in some speakers by adjoining vowels or consonants, and not in other speakers. A policy of spelling according to phonetic sound is to be adopted. (Webb 1981:11–12)

In the following sections the issues surrounding the phonemic status of this vowel are explained in full. First, in §7.1 the process of vowel reduction is explained. Then in §7.2 epenthesis is discussed, in which the barred-i vowel is reanalyzed as an epenthetic segment used to resolve syllable template violations. Finally, §7.3 summarizes the chapter.

7.1 High vowel reduction

In Ma Manda the two high peripheral vowels /i u/ are susceptible to reduction in certain environments, especially those that are typically unstressed. This reduction involves the centralization and shortening of /i/ and /u/, so that over time they arrive at

the shortest and most central spot in the high vowel space—the high central vowel [ɨ]. This is a form of "centripetal reduction" (Harris 2005).

High vowel reduction is not an uncommon phenomenon in Papua New Guinea. Many languages of the Sepik and Madang Provinces, as well as some Austronesian languages, are known to have some form of vowel reduction (Blevins & Pawley 2010:36–38). In many of these PNG languages there is a short high-to-mid central vowel [ə→ɨ] that wreaks havoc on phonological descriptions. This vowel tends to be highly variable, quite short in duration, and often found in place of high vowels in the cognate forms of neighboring languages. Additionally, it is often analyzed as epenthetic—inserted in order to break up disallowed consonant clusters. Some linguists consider the barred-i vowel to be a phoneme, while others consider it to simply be a "linking vowel". It may even be the case that the vowel length distinction claimed in a number of Erap languages actually stems from this issue: Full vowels are considered long, while reduced vowels are considered short.

Now I relate the process of high vowel reduction as it occurs in the Ma Manda language. First of all, full high vowels are rare in words of three syllables or more. In words of this length, the high vowels (even when stressed) are reduced. This is seen quite clearly in (32).

(32)	a. /nimin/ 0375	[ní.min]	'cousin'
	b. /nimin-nə/ 0376	[nɨ̀.mɨ.nə́]	'cousin-1sg.poss'

In (32a) *nimin* surfaces with full [i] vowels, while in (32b) the 1SG.POSS suffix *-nə* is added, causing the word to become three syllables long, and causing the [i]s to be reduced to [ɨ]. This is a fairly regular process.

(33) Generalization: The greater the number of syllables in a word, the more likely that the high vowels will be pronounced from a centralized location.

High vowels are also reduced in words with fewer than three syllables. This occurs primarily in unstressed syllables, as seen in (34).

(34)	a. /sibət/ 0233	[sɨ.bə́t] ~ [si.bə́t]	'food'
	b. /qabuŋ/ 0108	[qá.bɨŋ] ~ [qá.buŋ]	'smell'

Recall the rules of stress placement from §6.1. In (34a) the first syllable contains a low-ranked high vowel, and is therefore left unstressed. In (34b) the first syllable is stressed as expected, while the final syllable has a high vowel and does not attract stress. These unstressed high vowels then have a propensity for reduction. The stress rules also explain the fact that in (34b) the first vowel is reduced and yet still it attracts secondary stress. Ma Manda prefers to have one of the first two syllables stressed. If both of the first two syllables are reduced, then the first one is still given some prominence, even though its nucleus is still pronounced with shorter duration than a full high vowel.

The high central vowel, then, is primarily a phonetic reduction of the phonemic high vowels. This is especially true of the high back vowel /u/. It seems that there is a particular pull in Ma Manda to reduce this vowel as much as possible, or at the least to remove the rounding, thus producing a high back unrounded vowel [ɯ].

There are several minimal pairs between [i] and [ɨ], as seen in (35).

(35)	a. /bim/	[bím]	‘tobacco’
	b. /bɨm/ 0023	[bɨ́m]	‘corpse’

There are no such minimal pairs between [u] and [ɨ]. This is due to the higher proportion of reduced /u/ vowels to reduced /i/ vowels. Generally though, there are very few examples of minimal pairs between [i] and [u] at all. One example is seen in (36).

(36)	a. /min/	[mín]	‘pus’
	b. /mun/	[mún]	‘roundness’

This perhaps shows a relation to the barred-i languages of the Sepik, like the Ndu language family (Laycock 1965), which are analyzed as having three-vowel systems. Interestingly, in these languages the barred-i vowel is analyzed as phonemic, while /i/ and /u/ are allophones of this one phoneme.

The high back rounded vowel /u/ is particularly resistant to remaining a full vowel in Ma Manda. In monosyllabic words, for instance, one would expect that the full high vowels would remain. However, /u/ is not typically found before a /q/ in a mono- or bisyllabic word. Instead, [ɯ] occurs in its place, which is unrounded and slightly more central than [u].

(37)	/muq/ 0182	[mɯ́q]	‘enemy’

In monosyllabic words that do not end in /q/, the full /u/ vowel remains.

(38)	/mut/ 0189	[mút]	‘grub’

In (39) the full vowel quality has been completely lost, but it is obvious that these remnants have arisen from reduced /u/s when spoken slowly.

(39)	a. /tlɨq/ 0268	[tɾʊ́q] ~ [tɨ.ɾʊ́q]	‘mosquito’
	b. /səɨtɨq/ 0229	[sə́.tɯq] ~ [sə́.tʊq]	‘termite’

In summary, the Ma Manda language has a general tendency for the high peripheral vowels to be reduced in long words and in unstressed syllables. The reduction also occurs when /u/ is followed by /q/ (see §4.2.2 for a discussion of vowel lowering before the uvular stop).

So far in this discussion it has been assumed that [ɨ] is purely a phonetic reduction. However, this is certainly not the whole picture. In some instances the barred-i vowel is phonemic. In these cases, [ɨ] is not in a relationship of free variation or complementary distribution with [i] or [u]. Unlike reduced high vowels, even when these vowels are spoken slowly and carefully, the full vowel quality does not return; instead, the high central vowel is just drawn out awkwardly. Some examples are provided in (40).

(40)	a. /bɨm/ 0023	[bɨ́m]	‘corpse’
	b. /blagɨt/	[blá.gɨt]	‘sorry’
	c. /qɨdə/ 0136	[qɨ.də́]	‘greens’
	d. /qɨtɨlɨ/ 0351	[qɨ.tɨ́.lɨ]	‘bone’

I contend that, in these instances, the reduction has occurred for long enough that the original full vowel quality has been completely lost. In this case, the barred-i vowel has become phonemic. Consistent reduction has led to “remnant vowels”. This hypothesis is supported by a similar treatment for the Kalam barred-i vowel. Blevins & Pawley (2010:29) argue that in Kalam, a Trans-New Guinea language of Madang Province,

“remnant vowels evolve from reduced vowels, [and] they share many of the properties of reduced vowels: they are typically unstressed, very short and greatly influenced by coarticulatory effects.”

Remnant vowels develop from repeated and consistent reduction over a long period of time. Long words provide a perfect environment for this to occur; however, this is not the only impetus for the permanent reduction of these high vowels. Recall that lexical stress placement is subordinate to phrasal stress. This means that only the final stress of a phrase may remain, while the other stresses are reduced or eliminated altogether (see Blevins & Pawley (2010:31) for the same treatment of Kalam phrasal stress). Therefore in compounds and other types of frequently-occurring combinations of lexemes, the reduced vowels are heard with greater frequency than elsewhere. Over time, the new reduced quality becomes phonologized.

This concludes the discussion on vowel reduction. Next, the related process of epenthesis is explained from both synchronic and diachronic perspectives.

7.2 Epenthesis

As an introduction, it is helpful to look at a couple of loanword adaptations. Clues to the syllable structure of a language are commonly found in the incorporation of borrowed words into the vernacular lexicon. In (41), borrowed words from English illustrate the epenthetic barred-i vowel.

(41)	a. /qal/ 0112	[qá.lɨ]	‘car’
	b. /squl/ 0238	[sɨ.qú.lu][28]	‘school’

Central vowels are used here to resolve phonotactic and syllable template violations. Since the liquid cannot occur word-finally, the high central vowel (or an environmentally-conditioned variant) is inserted. This is known as “paragoge” (word-final epenthesis). Additionally, since sC clusters are dispreferred, the same vowel is inserted there as well in (41b). Blevins & Pawley (2010:15) use the same test: “Further evidence for the non-lexical status of Kalam predictable vowels can be found in loanword phonology and orthographic practice. Only a process of synchronic vowel insertion can account for the appearance of predictable vowels in loans.”

These barred-i vowels are alluded to in descriptions of loanword adaptations in both Numanggang and Uri as well. Hynum (1980:7) gives [sɪpak] as an example of an adaptation of a loanword into Numanggang. It comes from Tok Pisin *spak* ‘drunk’. Here the word-initial /sp/ cluster is disallowed and therefore [ɪ] is inserted. Webb (1974a:95) provides equivalent examples for Uri: Tok Pisin *slip* ‘sleep’ becomes [siɾip] and *snek* ‘snake’ becomes [sinek]. I contend that these epenthetic vowels are analogous to the barred-i vowel of Ma Manda.

It has been established that, at the very least, the high central vowel is epenthesized to force loanwords to meet the phonological requirements of the language.

[28] The recording of /squl/ 0238 does not contain a barred-i vowel between the onset consonants. Unfortunately, I do not have a recording of the typical pronunciation. I fear that this pronunciation was affected by the methodology, since in this instance the speaker (Garambon) read the Tok Pisin word (i.e., *skul*) before pronouncing it into the recorder.

Morphological evidence provides support for a broader understanding of the process of barred-i epenthesis in Ma Manda. In looking at the words in (42), recall the paragogic process from the loanword adaptations, whereby the high central vowel is inserted word-finally after /l/.

(42) a. [qé.lɨ] 0363 ‘hand’
b. [nó.lu] 0369 ‘brother’

Spoken without any suffixes, both of these inalienably possessed nouns end with high vowels. When the first person possessive suffix is attached though, the two words exhibit different behaviors.

(43) a. /qelɨ-nə/ 0364 [qé.lɨ.nə̀] ‘hand-1sg.poss’
b. /nol-nə/ 0370 [nót.nə] ‘brother-1sg.poss’

There is a prevalent morphophonemic process which causes liquids to alternate with voiceless alveolar plosives when adjacent to nasals (see §9.1.5). This process has no exceptions, and yet it does not come to fruition in (43a). Since this process does occur in (43b), I conclude that ‘brother’ ends in /l/ and not in a vowel. Conversely, ‘hand’ must end in a vowel and not in a liquid. There is no such word as *[nolɨnə]. Either the vowel has been completely lost due to reduction, or it never existed in the first place. Nonetheless, the high central vowel is epenthesized in (42b), in order to rescue the word-final /l/, and also harmonizes in backness and roundness with [o] in the previous syllable. The same thing can be seen with /b/-final verbs, shown in (44)–(45).

(44) a. /lo/ [ló] ‘go up’
b. /lo-be/ 0391 [ló.we] ‘go up (2sg)!’
(45) a. /lab/ [lá.bɨ] ‘come up’
b. /lab-be/ 0431 [lá.be] ‘come up (2sg)!’

As seen in (44b), when the 2SG imperative suffix is attached to a verb ending in a vowel, /b/ is lenited to [w] (see §9.1.6). When a verb stem ends in a /b/ though, the lenition is blocked and a process of degemination leaves only one plosive (as seen in (45b)). If there were an underlying vowel after *lab*, then *[labɨwe] would be the surface form. Since such a form does not exist, I contend that /lab/ ends in an underlying voiced plosive.

In their discussion of "predictable vowels" in Kalam, which are very similar to the patterns at work in Ma Manda, Blevins & Pawley (2010) respond to the typology set forth in Hall (2006). Hall provides a cross-linguistic survey of inserted vowels, dividing them into two types: "In *vowel epenthesis*, a vowel segment is added, along with a vocalic gesture, and this segment forms the nucleus of a new syllable. In *vowel intrusion*, the articulatory gestures associated with existing segments are phased in a way that creates an acoustically vocalic period, but no phonological segment is inserted, and hence no new syllable is created. The primary diagnostic for distinguishing intrusive vowels from epenthetic vowels is to check whether the vowel behaves as a syllable nucleus, both for phonology and for speaker intuitions" (2006:424; emphasis added). She goes on to say that "vowel intrusion is purely a phenomenon of the gestural layer, while vowel epenthesis involves a change to the segmental string."

In response, Blevins & Pawley argue that the barred-i vowel of Kalam does not fit neatly into either the epenthetic or the intrusive category of Hall's typology:

> We will refer to predictable vowels with Kalam-like properties as 'remnant' vowels. Remnant vowels are historical traces of vowel reduction and loss, found sometimes in their historical positions, and sometimes elsewhere. Though

> synchronically, their distribution can be predicted by insertion algorithms, diachronically they reflect inversion of unstressed reduced vowel loss. Since remnant vowels evolve from reduced vowels, they share many of the properties of reduced vowels: they are typically unstressed, very short and greatly influenced by coarticulatory effects. Unlike Hall's 'intrusive' vowel category, remnant vowels are not a rephasing of existing gestures which result in vowel-like percepts. For this reason, they have none of the articulatory hallmarks of intrusive vowels: they are not generally limited to heterorganic clusters, and they do not have a highly variable duration. Like epenthetic vowels, remnant vowels do involve synchronic 'insertion' in the generative sense, leading to true vowel-zero alternations... Unlike epenthetic vowels, remnant vowels may not serve any obvious function: as in Kalam, they may simply reflect former positions of unstressed reduced vowels, and nothing more. (Blevins & Pawley 2010:28–29)

Blevins & Pawley claim that the source of Kalam's epenthetic vowel is vowel reduction. This involves a restructuring of the phonology:

> Our working hypothesis is that historical vowel reduction/deletion led to a restructuring of parts of the Kalam phonological system, with its many predictable vowels. Some predictable vowels in Kalam are true remnants of once-present reduced vowels, while others are non-etymological consequences of reanalysis. (2010:29)

Kalam predictable vowels are analyzed to be the result of vowel loss and subsequent rule inversion, inserting reduced vowels where full vowels never existed in prior stages of the language's development. It appears to be the case that the same explanation can be given for the epenthetic segment in Ma Manda. Once a great number of the high vowels were reduced a majority of the time, the high central vowel became more frequent on the surface than any other vowel except schwa (see Appendix 2 for phoneme frequency counts). At this point, the Ma Manda sound system underwent a reanalysis, where the reduced vowels replaced the former full-vowelled words as the new underlying forms. Regarding Kalam, Blevins & Pawley (2010:34) suggest that "at the

stage where every (or nearly every) consonant-to-consonant transition within the word has a reduced transition vowel, the language learner may reverse the historical process of vowel loss/reduction, and assume that these transition vowels are inserted." Since most consonant sequences are precluded from occurring in Ma Manda phonotactics, and many others now have a reduced high vowel in between them (stemming from unstressed /i/ and /u/), Ma Manda speakers have begun to think of these vowels as epenthetic segments rather than reductions of full high vowels. This explains the fact that when Ma Manda people want to write their language, they often try to write certain words without these reduced vowels at all. For instance, one man, when attempting to write *tɨq* 0260 'clothing', insisted on writing it as <tk>. It seems that the vowel is currently understood to be epenthetic between sC and CL clusters (among others), as well as paragogically after voiced plosives and liquids.

A hindrance to this analysis is that the Ma Manda language is obviously in a state of transition in this area of its phonological diachrony. It appears that many vowels have been lost (remnant vowels), and in their place the high central vowels have been reanalyzed as inserted vowels. However, some other high central vowels occur in vowel sequences, and therefore cannot be analyzed as linking vowels. If the vowel were only a "linking" (or "transitional" or "release") vowel, then it would not be needed in (46)–(47).

(46) [gəq nù̱.u.túm.pə.wè] 0382
/gəq nɨ-utumpə-be/
2sg 3sg.o-praise-2sg:imp
'praise him!'

(47) [gəq nɨ.jó.le] 0384
/gəq nɨ-jol-be/
2sg 3sg.o-force-2sg:imp
'force him!'

In (46)–(47) the predicates are compounds. Ma Manda has a small subclass of approximately thirty verbs which are highly transitive and require bound pronominal object prefixes. This class of verbs, when surfacing without a prefix, assumes a third person object. It appears that these particular verbs have incorporated the third person emphatic pronoun *ni* into their base (third person) forms. The *ni* pronoun, as it almost exclusively occurs in unstressed phrasal positions, is often reduced to [nɨ]. Here the *nɨ* in /nɨutumpə/ is actually just a reduced form of the emphatic pronoun that has been fused to form a specialized verb stem. Since the vowel seems to have lost its ability to function as a full vowel, it may harmonize in backness with the vowel that it is butted up against.

Further proof for the existence of this vowel in surface hiatus is seen in the following minimal pair. In (48) a compound brings the barred-i (which assimilates to [u]) into concatenation with the fossilized morpheme /ula/, while in (49) the barred-i vowel does not occur in hiatus. The vowel hiatus in (48) causes a longer vocalic duration than in (49).

(48) [náq nán.du:.là.lət] 0383
/nəq nandɨ-ula-lət/
1sg know-?-1sg:pres
'I am unknowledgeable'

(49) [nán.dɨ.lá.lət] 0385
/na dlal-ŋət/
1sg.emph break-1sg:npst
'I broke it'

This is supported by the following waveform and spectrogram graphs, where both of these examples are measured from the release of the [d] to the beginning of the first [l]. In [nan.du:.la.lət] this section is 137ms in duration (17.6% of the word), while in [nan.di̯.la.lət] this section is only 41ms (5.3% of the word), almost a full 100ms shorter. This certainly verifies the presence of the extra vocalic unit in (48). The measured sections are indicated by highlighting in the waveform graphs, as well as double-arrows in the spectrograms. These graphs were created using the Praat software (Boersma & Weenink 2012).

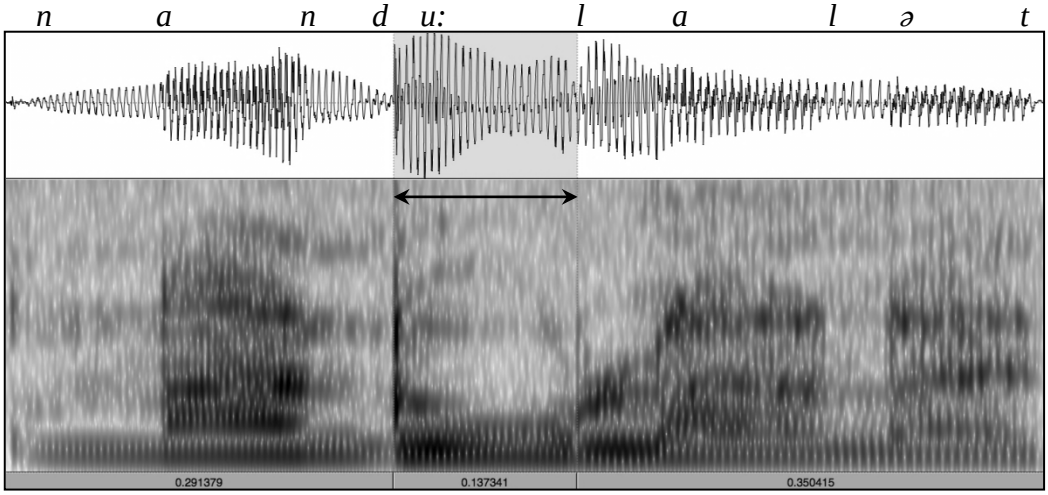


Figure 6: Spectrogram and waveform of [nan.du:.la.lət]

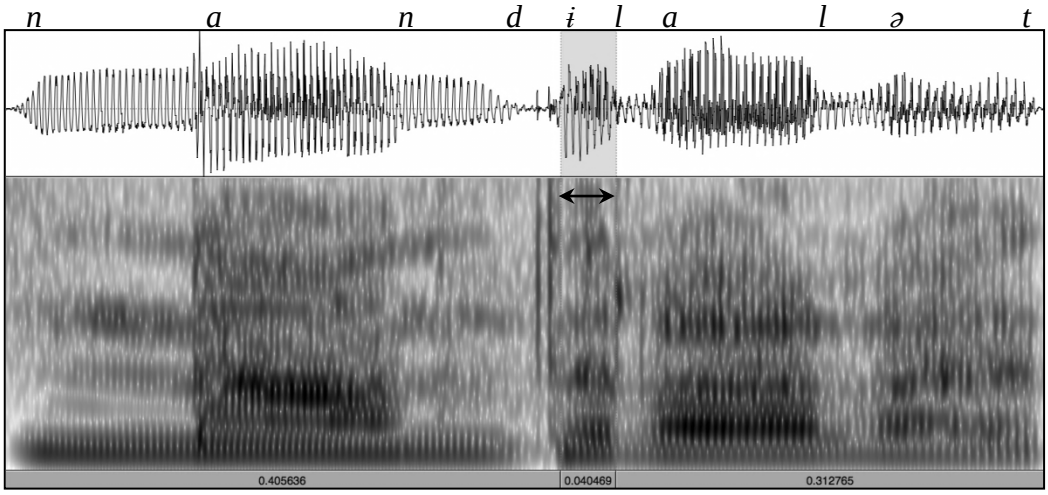


Figure 7: Spectrogram and waveform of [nan.dɨ.la.lət]

The lack of this type of sequence is used in Blevins & Pawley (2010:12) as evidence for the non-phonemic status of [ɨ] in Kalam. In Ma Manda it does occur in hiatus, which gives credence to the idea that it is, at least sometimes, phonemic. On the other hand, unlike every other vowel, it never occurs word-initially, suggesting that this special vowel has arisen from full vowels in particular positions.

Due to the ambiguity involved in interpreting whether a given high central vowel is phonemic or epenthetic, in this thesis they are all analyzed to be phonemic. When a full vowel is not recoverable, the /ɨ/ phoneme is written in its place. The only exceptions are in CL and sC clusters, where it is obvious that there is no underlying vowel present. This is also the case with word-final /b/ and /l/. Morphophonemic alternations ensure that there is no underlying word-final vowel in these wordforms.

Finally, the barred-i vowel does operate as a full vowel in an NV sequence, which allows for the triggering of nasal agreement of a following voiced plosive. See the discussion in §8.5.3.

7.3 Summary

The high central ("barred-i") vowel is a common segment across the Trans-New Guinea language family. It is often debated whether this sound is a phonemic vowel or an epenthetic "linking" or "transitional" vowel. In Ma Manda the high peripheral vowels /i u/—especially /u/—have a propensity to be reduced to [ɨ] in unstressed position. Diachronically, this vowel has become more and more frequent, and at some point in the language's phonological development a reanalysis occurred. During this restructuring of the sound system, the barred-i vowel came to be thought of as an epenthetic segment in many cases. Currently, this short high centralized vowel is inserted in between all disallowed consonant clusters, as well as word-finally after the voiced plosives or the liquid. When certain nouns and verbs—the ones that end in segments that are disallowed from word-final position (i.e., /b d ɡ l/)—are brought into contact with other morphemes, the alternations that arise provide clear evidence that these words do not end in reduced phonemic vowels but in consonants. The issue is somewhat messy though, since Ma Manda is in a stage of transition. Some vowels are certainly epenthetic, while others are certainly reduced.

8 LONG DISTANCE NASAL AGREEMENT

Ma Manda displays a variety of consonant agreement—or harmony—that is unique among the world's languages. In order to understand the peculiar intricacies of this phenomenon, it is important to provide a brief overview of the key typological facts regarding consonant—and especially nasal—harmony systems (§8.1). Subsequently, I discuss nasalization in languages that are related to Ma Manda (§8.2), and then I present the parameters for the system of nasal agreement in Ma Manda, first as it is seen within morphemes as a morpheme structure constraint (§8.3), and second as it applies in heteromorphemic alternations (§8.4). This is done in a descriptive, not a theoretical, fashion. Finally, I address other issues related to nasal agreement (§8.5), then close with a summary of the extraordinary aspects of nasal agreement in Ma Manda (§8.6).

8.1 Overview and definitions

> Harmony is the widespread phenomenon in the world's languages whereby all phonological segments of a particular type (e.g. all vowels, all obstruent consonants, all sibilant consonants) that occur within a particular domain—such as the word, the stem, or the morpheme—are required to agree with respect to some property. (Hansson 2010:1)

In his typology, Hansson (2010:4) provides a useful working definition of *consonant harmony* in particular:

(50) Definition of consonant harmony (Hansson 2010:4): "Any assimilatory effect of one consonant on another consonant, or assimilatory co-occurrence restriction holding between two consonants, where:

- the two consonants can be separated by a string of segmental material consisting of at the very least a vowel; and
- intervening segments, in particular vowels, are not audibly affected by the assimilating property."

In summary, Hansson defines "consonant harmony" as an assimilatory process between two non-adjacent consonants. In order to bring attention to the *non-adjacency* of the participating consonants, Rose & Walker (2004) label this phenomenon "long distance consonant agreement" (or LDCA):

(51) Definition of LDCA (Rose & Walker 2004:476): "Agreement for an articulatory or acoustic property that holds between consonants separated by at least one segment."

In both of these definitions, there is a line drawn between *adjacent assimilation* on the one hand, and *agreement at a distance* on the other.

According to Rose & Walker (2004:84), there are five main types of consonant agreement: nasal, liquid, laryngeal, coronal, and dorsal. Since nasal harmony is the relevant type, it is the sole focus of the ensuing discussion. The following is a definition of nasal harmony:

(52) Definition of nasal harmony (Walker 2011:1838): "Nasal harmony refers to phonological patterns where nasalization is transmitted in long-distance fashion. The long-distance nature of nasal harmony can be met by the transmission of nasalization either to a series of segments or to a non-adjacent segment."

This definition of nasal harmony refers to two similar, but theoretically distinct, processes: (i) nasal vowel-consonant harmony and (ii) nasal consonant harmony.

In nasal vowel-consonant harmony (Walker 2011:1837, 57) nasalization is triggered by a segment and proceeds to spread until it is blocked by some segment or boundary. Both vowels and consonants can participate as triggers and/or targets of the assimilatory process. Vowels can never be skipped by the process, and typically any consonants that do not become nasalized block the spreading instead. These are called opaque segments.

In nasal consonant harmony (Walker 2011:1854, 57) nasalization is triggered by a segment and then another (highly similar) target segment assimilates in nasalization. In this type, intervening segments are unaffected by the agreeing feature and do not block the agreement (these are called transparent segments). Only consonants participate in the assimilatory process, and these consonants are always phonologically similar to one another. This type, which is most strongly exhibited in the Bantu family, characterizes the phenomena at work in Ma Manda morphophonemic alternations and tautomorphemic phonotactic restrictions.

Finally, the following terms are important: In this thesis a *trigger* is a segment that initiates nasal harmony, an *opaque segment* blocks nasal harmony, and a *transparent segment* is impervious to nasalization, but it does not halt the harmony from transmitting beyond it either (Walker 2011:1838).

8.2 Nasalization in related languages

Prenasalization is extremely prevalent in the Finisterre-Huon languages, and across Papua New Guinea as a whole. In fact, every documented language of the Erap subfamily contains prenasalization to some degree. Regarding Nek, Linnasalo (2003b:7) notes that the voiced plosives /b/, /d/, and /g/, along with the voiced sibilant /z/, are prenasalized after vowels, and word-initially they are slightly prenasalized. Webb (1981:11) contends that Uri contains "remnants of prenasalization". Cursory glances at data in Numanggang and Finongan reveal similar, though less structured, prenasalization patterns.

Regarding long distance nasal agreement, however, there has been much less written. It is a rare phenomenon in the first place, and this is true in PNG as well. In southeast New Guinea, however, there is evidence of something quite similar to what exists in Ma Manda. In Oro Province, the Binanderean language family exhibits a form of nasal harmony. In Korafe (Farr & Farr 1974:8–9) all obstruents have prenasalized allophones. When a nasal occurs as the syllable onset, it initiates the nasalization of the following vowel and the prenasalization of a following obstruent. Regarding Binandere, Wilson (1992:4) writes that "the allophones [ᵐb ⁿd ᵑg ⁿdʒ] result when /b d g/ or the allophone [dʒ] follow a syllable with a nasal plosive onset." He goes on to write that "non-phonemic nasalization occurs on all vowels contiguous to a nasal consonant." It is claimed for both of these languages that nasal onsets cause the initiation of the process. Due to the nasalization of intervening vowels in these cases, however, this seems to be a

case of nasal vowel-consonant harmony rather than outright consonant harmony at a distance.

8.3 Tautomorphemic nasal agreement

> Within morphemes, harmony manifests itself merely as a static phonotactic generalization, prohibiting disharmonic co-occurrences but allowing harmonic ones... When the harmony domain extends beyond the confines of individual morphemes, harmony can be directly observed as an active process of assimilation. A potentially disharmonic combination is made harmonic by forcing one segment to agree with another in the phonological feature in question... (Hansson 2010:1)

Though the strongest evidence for nasal agreement in Ma Manda comes from suffixation, it is advantageous to first account for tautomorphemic nasalization patterns. Morpheme structure conditions—or morpheme structure constraints (MSCs)—are limitations on the phonotactic patterns of morphemes.[29] For instance, as shown in §4.1.2, one MSC in Ma Manda is that voiced plosives cannot occur word-finally. A nasal + vowel (NV) sequence cannot be followed by a voiced plosive. Instead, homorganic nasals precede these voiced plosives in all cases.

Though many Finisterre-Huon and other Trans-New Guinea languages require intervocalic voiced plosives to be prenasalized, this is not the case in Ma Manda. Voiced plosives are not prenasalized by default, as seen in (53).

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[29] In Optimality Theory, the idea of MSCs is eliminated since an MSC is basically a constraint that only applies within the morpheme. The distinction disappears due to the principle of Richness of the Base—the idea that constraints apply only to outputs and not to inputs (Booij 2011:2060).

(53) a. /dəbugum/ 0035 [də́.bu.gùm] ‘star’
b. /qədəŋ/ 0120 [qə́.dəŋ] ‘bamboo’
c. /fəgət/ 0053 [fə́.gət] ‘stretcher’

Voiced plosives can follow both homorganic and heterorganic nasal stops.

(54) a. /təndon/ 0255 [tən.dón] ‘night’
b. /əmda/ 0339 [əm.dá] ‘nose’

Voiced plosives cannot, however, follow nasal + vowel sequences. Any voiced plosive after an N+V sequence will always have a nasal preceding that voiced plosive, as seen in (55).

(55) a. /mombə/ 0178 [mőm.bə] ‘leech’
b. /məndə/ 0160 [mə̋n.də] ‘talk’
c. /nəŋgət/ 0197 [nə̋ŋ.gət] ‘blood’

The examples in (55) reveal a few noteworthy facts. In each case there is a nasal-vowel-nasal-plosive sequence, and each time the second nasal is homorganic with its adjacent voiced plosive. Additionally, the second nasal operates as the coda to the first syllable, and not solely as the prenasalization to the plosive (see §8.5.2). Finally, the intermediate vowel is nasalized in each of these transcriptions.

Thus, the Ma Manda language does not allow a nasal consonant to be followed by a vowel-voiced plosive sequence (i.e., *NV{b d g}).[30] Instead, in all cases, a homorganic nasal is inserted in order to satisfy the language-internal phonotactic constraints. This has been especially evident in discussions regarding the development of the Ma Manda

[30] Except for /nəbiŋ/ 0192 which is pronounced [nə́.biŋ] and is the name of a species of banana. This is the only such word in the Ma Manda lexicon. After having become familiar with the Ma Manda phonotactic patterns, this word sounds quite strange to me. I presume this must be a recently-borrowed loanword.

orthography. The elderly men with whom I consulted consistently preferred to spell (55b) as <mada>, while younger men and women preferred <manda> (even though they all pronounce the word identically). This reveals an interesting clue regarding phonologization of these nasal segments: As speakers have learned to speak Tok Pisin (and some, rudimentary English), they have begun to hear things in their own language that went unnoticed in previous generations. Ma Manda speakers of the past were unaware of the prenasalization of plosives, while Ma Manda speakers of the present are hearing the nasalization as a separate phonemic segment.

Since prenasalized voiced plosives are a prevalent phonological feature of Erap languages, it is safe to hypothesize that Ma Manda has seen a reanalysis of prenasalization. It appears to be the case that at one time all voiced plosives were prenasalized. Eventually, much of the nasalization dropped out. However, in the post-nasal environment nasalization would have been less easily lost. In this environment alone prenasalization has remained, though not as a short non-phonemic segment. Instead, these sounds have been phonologized into segments in their own right (see Smallhorn (2009:34) for a similar discussion regarding the simplification of prenasalized segments into segment sequences in her Binanderean reconstruction). It is also interesting to note an example of a cognate between Ma Manda and neighboring Numanggang. Where nasalization has been lost completely in Numanggang, it remains in Ma Manda. This is illustrated in (56)–(57).

(56) Ma Manda
/membɨ/ 0165 [mém.bɨ] ‘head’

(57) Numanggang (Hiley *et al.* 2008:91)

/mebi/	[me:.bi]	'head'

Often though, the cognates in neighboring languages also have homorganic nasals before all voiced plosives. All the transcriptions in (58) were collected by the same group of people on a survey trip throughout the Erap language family area in 2006.[31]

(58) Cognates for 'tongue' in neighboring languages (Hiley *et al.* 2008:73ff.)

a. Ma Manda:	[məmbɛm]
b. Nema:	[membe], [mambe]
c. Finongan:	[mɛmbe]
d. Sama:	[mambɪn], [mɛmbɪn]
e. Uri:	[mʌbɛm], [mɨmbɛm]
f. Numanggang:	[mebem], [mabelem]
g. Mungkip:	[mabɛm]
h. Nakame:	[mãbi], [mabɛŋi], [mɛbɛm]
i. Nuk:	[məmben], [mɛbɨn]
j. Nek:	[mɛmbəŋ]

Notice that in (58e–i) the voiced bilabial stop can surface without an accompanying homorganic nasal.

It is also important to note that the nasalized vowel allophones are purely phonetic: Often the vowel nasalization is left out, especially in slow, deliberately careful speech. Thus, it is not the case that a nasal stop is initiating a spreading of nasalization across a vowel and into a voiced plosive. Though the nasalized allophones of vowels are more common when they are adjacent to nasal stops, they are in free variation at all times.

The words in (59) illustrate a few more characteristics of, and restrictions on, tautomorphemic nasal agreement.

[31] When transcriptions were different between different villages, these are separate by a comma. I leave out the village names here.

(59)	a. /məndogu/ 0162	[mə̃n.do.gù]	‘tree sp.’
	b. /meləbut/	[mé.lə.bùt]	‘bird sp.’
	c. /muqujə/ 0185	[mù.qu.jə́]	‘pig’
	d. /dəməŋgeq/ 0037	[də́.mə̃ŋ.gèq]	‘laugh’
	e. /məndə/ 0160	[mə̃n.də]	‘talk’
	f. /ugem/ 0275	[u.gém]	‘sharp’

Nasal agreement in Ma Manda does not correlate with general “nasal spreading” or “nasal harmony”. This is seen, for instance, in (59a) where the nasalization does not target all voiced plosives in the morpheme, but only the first one. In (59b) that nasal agreement does not target /l/, and it does not target a voiced plosive that is beyond /l/ either.[32] Example (59c) shows that nasal agreement does not target tautomorphemic *voiceless* plosives. In (59d–f) there are words with very similar segmental makeup. In (59e) a nasal is between the NV sequence and /d/. Conversely, in (59d) the word-initial /d/ is not prenasalized. Example (59f) reveals that a nasal is not inserted before /g/ either. These examples reveal that the directionality of nasal agreement is left-to-right (i.e., a nasal can only target a plosive that occurs later in the morpheme).

8.4 Heteromorphemic nasal agreement

Having set forth the characteristics of tautomorphemic nasal agreement, this section illustrates and describes the effects of nasal agreement across morpheme boundaries. Through heteromorphemic alternations the productivity of the nasal agreement phenomenon becomes much clearer. In the following subsections I present the

[32] There are no known instances of glides occurring in this environment instead of the liquid; i.e., an NVGV sequence preceding a voiced plosive.

parameters for the operation of nasal agreement in Ma Manda: In §8.4.1 the triggers, targets, and transparent segments are described and illustrated; and in §8.4.2 the directionality and domain of nasal agreement are discussed.

8.4.1 Triggers, targets, and transparent segments

In Ma Manda nasal stops are the only triggers for long distance nasal agreement. If a nasal stop is followed by a vowel + voiced plosive sequence, then agreement occurs. The following examples illustrate what happens when various plosive-initial suffixes are attached to two different verb stems. The data in (60) exemplifies a basic verb stem with no nasal segment, while (61) exemplifies a verb stem composed of an NV sequence.

(60)	a. /lo/ ‘go.up’ + /-got/ ‘1sg:rpst’	→	[lo.got] ‘I went up’ 0386
	b. /lo/ ‘go.up’ + /-de/ ‘2du:imp’	→	[lo.de] ‘go up (2du)!’ 0391
	c. /lo/ ‘go.up’ + /-qə/ ‘ss’	→	[lo.qə] ‘go up and ...’ 0392
(61)	a. /mo/[33] ‘go.down’ + /-got/ ‘1sg:rpst’	→	[mõŋ.got] ‘I went down’ 0410
	b. /mo/ ‘go.down’ + /-de/ ‘2du:imp’	→	[mõn.de] ‘go down (2du)!’ 0415
	c. /mo/ ‘go.down’ + /-qə/ ‘ss’	→	[mõɴ.qə] ‘go down and ...’ 0416

There are no alternations in (60a–c), while in (61a–c) a homorganic nasal is inserted before each plosive, and the interconsonantal vowel is nasalized.

(62) Nasal stops are the triggers that target a following plosive for nasalization as long as exactly one vowel intervenes between them.

The nasalization of the intervening vowel is purely phonetic and can be left out without any degradation of meaning. It just happens to be the case that vowels are optionally nasalized when adjacent to nasal stops, and are quite likely to be nasalized

[33] See Table 62 in Appendix 4 for evidence that the underlying form of /mo/ is not */moN/.

between two nasal stops. For instance, in a word like *monə* ‘secondborn son’, nasalization is likely to continue through both vowels, though it is by no means necessary. Some speakers do not nasalize their vowels at all, while others are more likely to do so. The transcription of vowel nasalization does not proceed beyond this point in this thesis.

Especially noteworthy is the fact that voiceless plosives are targeted for nasal agreement just as readily as voiced plosives. Based on Hansson (2001) and Rose & Walker (2004), Walker (2011:1856) suggests the following implicational relationships among place of articulation and voicing: “(i) patterns that target voiceless stops with the same place of articulation as the nasal trigger also target voiced stops with the same place of articulation, and (ii) patterns that target voiced stops with a different place of articulation from the nasal trigger also target voiced stops with the same place of articulation as the nasal.” This can be interpreted to mean that nasal consonant harmony favors targets that are similar to nasals.

(63) If a segment is targeted for nasal agreement, then any segment that is more similar to the nasal should be targeted as well.

This implicational relationship is borne out in Ma Manda. Nasal agreement in Ma Manda is not related to place of articulation at all (e.g., /m/ can target nasalization on /d/, as in [mən.də], or on /g/, as in [moŋ.gɔt]). All plosives, no matter their place, can be targeted by every nasal. Based on the implications above, (61c) [mɔɴ.qə] exhibits agreement between stops that are as far apart as possible (i.e., /m/ and /q/ are pronounced in opposite ends of the mouth, and /m/ is voiced while /q/ is voiceless). This suggests that all other combinations occur as well, and this is the case. With regard to voicing, nasals

target both voiceless and voiced plosives for nasal agreement. This is not in itself all that remarkable, except recall that tautomorphemically voiceless plosives do not undergo nasal agreement. It appears that only the prenasalization of voiced plosives has been phonologized into lexical wordforms. The fact that both voiced and voiceless plosives are targeted heteromorphemically suggests that this type of nasal agreement has not been phonologized as it has in tautomorphemic forms (i.e., it is a derived environment effect).

Long distance nasal agreement is quite rare in the world's languages. In Hansson's (2001/2010) cross-linguistic typology of consonant harmony systems, only 24 languages are found to exhibit nasal consonant harmony (21 of which are substantiated). Of these, only six are found outside of the Bantu family.[34] Due to its rarity, this phenomenon has not been documented as well as nasal harmony (or other types of consonant harmony, for that matter). "Cross-linguistically, nasal consonant harmony appears to be fairly rare—certainly much rarer than nasal harmony—but it is well attested within one language family: the Bantu languages of sub-Saharan Africa" (Hansson 2010:85).

(64) Of the relatively few languages in which long distance nasal agreement is found, only Ma Manda is known to target only voiced plosives tautomorphemically, and both voiced and voiceless plosives heteromorphemically.

[34] Outside of the Bantu family, the following languages are known to have long distance nasal agreement: Izere (Plateau; Nigeria), Ngbaka (Adamawa-Ubangi; D.R.C., Congo), Nyangumarta (Pama-Nyungan; Australia), Sawai (Austronesian; Indonesia), Ulithian (Oceanic; Federated States of Micronesia), and Yabem (Oceanic; Papua New Guinea). See Hansson (2010:381ff.) for the references therein.

This is an important typological discovery. The Bantu languages Ganda (Katamba & Hyman 1991, Hansson 2001) and Tiene (Hyman 1996, Hyman & Inkelas 1997, Hansson 2001) do target voiceless consonants as well, though not solely heteromorphemically as in Ma Manda. For instance, in Ganda nasal agreement targets a homorganic voiceless stop following a nasal within a lexical root (Rose & Walker 2004:479).

Finally, as previously alluded to, in order for nasal agreement to occur, only one segment can intervene between the trigger and target, and this segment must be a vowel. I consider this vowel to be transparent, since its nasalization is optional. Additionally, the nasalization of vowels is somewhat less common heteromorphemically than tautomorphemically. Any other intervening segment blocks nasal agreement from transpiring.

8.4.2 Directionality and domain

It was mentioned in §8.3 that tautomorphemic nasal agreement occurs in left-to-right fashion. This is equally true across morpheme boundaries, as seen in (65).

(65) a. /bə/ ‘come’ + /-ne/ ‘2pl:imp’ → [bə.ne] ‘come (2pl)!’ 0423
b. /mo/ ‘go.down’ + /-be/ ‘2sg:imp’ → [mom.be] ‘come (2sg)!’ 0415

In (65a) the voiced plosive /b/ is not targeted for nasalization by the following /n/, while in (65b) /b/ is targeted by the preceding /m/. Long distance nasal agreement in Ma Manda is *progressive*. This is interesting, because a majority of the long distance

consonant agreement systems around the world are *regressive* (anticipatory, right-to-left) rather than progressive (perseveratory, left-to-right) (Rose & Walker 2004:490, Hansson 2010:138). In fact, regressive agreement is considered the primary tendency, whereas progressive agreement is often considered only to arise due to other phonological factors. It is logical that anticipatory agreement is considered the norm, since it is considered to have a basis in speech planning and physical execution (Walker 2011:1856). For instance, anticipatory consonant agreement is found in the palatalization of /s/ in the tongue-twister "Sally sells seashells by the seashore." Progressive harmony is only considered the norm for long distance *nasal* agreement (Rose 2011), and this is evidenced by the fact that progressive directionality is canonical is in the Bantu family (Hansson 2010:289).

The domain of agreement in Ma Manda is very limited. Whereas in many languages targets are found to occur at great distances, sometimes several syllables, away from the trigger segments, in Ma Manda only an NV sequence can initiate nasal agreement. Other Bantu languages such as Bemba (Hyman 1995) and Lamba (Odden 1994, Piggott 1996) also show agreement over a single intervening vowel. These cases are also considered "long-distance", but they operate over a shorter span due to a restriction on the proximity of the participant segments (Rose & Walker 2004:479). Hansson (2010:87) refers to this restriction as "transvocalic" harmony.[35] This is exactly

[35] Due to the common restriction of syllables to the CV type in Bantu, this proximity restriction is sometimes seen to involve the targeting of nasal agreement in an adjacent syllable, rather than strictly following an NV sequence (Odden 1994, Piggott 1996, Walker 2000b, Rose & Walker 2004).

the case in Ma Manda. For example, in the compound in (66) two vowels surface in hiatus.

(66) /nə+ugem/ 'man+sharp' [nə́^{u}.gem] 'aggressor, spice' 0200

No nasal agreement occurs here. One and only one vowel must intervene between participant segments in order for nasal agreement to surface. Two further examples are sufficient to support this analysis.

(67) a. /mo/ 'pfv' + /ul/ 'hit' + /-got/ '1sg:rpst' → [mo.u.got] 'I hit (him)'
b. /mo/ 'pfv' + /bə/ 'come' + /-got/ '1sg:rpst' → [mom.bə.got] 'I came'

In (67) the adverb *mo* 'done' is cliticized to the front of two different verbs. Since *mo* consists of an NV sequence, this causes nasal agreement to target /b/ in (67b). In (67a) nasal agreement does not occur.

The domain of nasal agreement has been established: A nasal stop can only target a plosive that is one vowel away—a transvocal voiced stop. This agreement is also capable of extending beyond the boundary of the phonological word, as seen in (68).

(68) a. /nə/ 'man' + /bən/ 'a' → [nəm.bən] ~ [nə bən] 'a man'
b. /mi/ 'water' + /qugot/ 'I went' → [miɴ.qu.got] ~ [mi qu.got] 'I went to the water.'

This extension of the nasal agreement process is not as robust as the more typical word-internal type. Between stems and their suffixes, nasalization is required. For (61a) /mo-got/ there is no such form as *[mo.got]. However, across word boundaries the nasalization is optional and is only noticed by Ma Manda speakers upon close inspection.

8.5 Further characteristics of nasal agreement

The following subsections address idiosyncrasies in the nasal agreement process.

8.5.1 Blocking of nasal agreement

There is a prevalent and exceptionless morphophonemic process in Ma Manda where /l/ is elided before /g/ (see §9.1.5). This has a bearing on nasal agreement, shown in (69).

(69) a. /qudəl/ 'bone' + /-gə/ '2sg.poss' → [qu.də́.gə] 'your bone' 0330
b. /nol/ 'brother' + /-gə/ '2sg.poss' → [nó.gə] 'your brother' 0372

The liquid is always deleted when it is brought into contact with /g/. In (69b) this occurs as expected, but this blocks the nasal agreement process (i.e., it does not produce [noŋ.gə][36]). In a derivational approach, this would signal the serial ordering of these processes in an opaque interaction, where nasal agreement counterfeeds /l/-elision.

8.5.2 Blocking of /b/-lenition

Discussed in §9.2, /b/ lenites to [w] after a heteromorphemic vowel. However, this process is blocked when a nasal precedes the vowel. This is shown in (70).

(70) a. /lo/ 'go.up' + /-be/ '2sg:imp' → [lo.we] 'go up (2sg)!' 0391
b. /mo/ 'go.down' + /-be/ '2sg:imp' → [mom.be] 'go down (2sg)!' 0415

[36] One can indeed say [noŋ.gə], but its meaning is different: It is the 2SG.POSS form of *noŋ* 0207 'knife'. Therefore it is possible that this "blocking" of nasal agreement is due to antihomophony rather than the presence of the liquid.

In a derivational approach, these facts suggest that nasal agreement bleeds /b/-lenition. More importantly, this confirms that [m] is a coda here and not just the prenasalization of [b].

8.5.3 Interaction of nasal agreement with epenthesis

As discussed in Chapter 7, [ɨ]-epenthesis is a prevailing synchronic process in Ma Manda phonology: Consonant clusters are dispersed via insertion of [ɨ]. The series of homonyms in (71) displays the interaction of epenthesis with nasal agreement.[37]

(71) a. /Ø-/ '3sg.o' + /n/ 'tell' + /-be/ '2sg:imp' → [nɨm.be] 'tell (him)!'
b. /nɨ-/ '1pl.o' + /m/ 'give' + /-be/ '2sg:imp'→ [nɨm.be] 'give us!'
c. /nɨ-/ '1pl.o' + /b/ 'see' + /-be/ '2sg:imp' → [nɨm.be] 'look at us!'

In (71a), the verb root /n/ is joined with the imperative suffix /-be/. The barred-i is inserted between the consonants, and then an NV sequence allows for nasal agreement to occur. In (71b), the morphemes simply concatenate. In (71c), nasal agreement is triggered between the prefix and verb root /b/. Additionally, contiguous /b/s occur at the suffix boundary, and these are degeminated. In order to resolve the ambiguity here, the people use contextual clues. Over time certain additional words have become almost inseparable from these forms. For 'give to us', people add a dative pronoun before the verb for clarification; for 'look at us', people use the medial form of the verb 'turn around' beforehand: 'Turn around and look at us'. These are shown in (72).

[37] The verb roots in (71) are indeed composed of single consonants and not CV syllables (e.g., */mɨ/ 'give'). This is evident in two ways: First, this would mean that the barred-i vowel elides between [m] and [b], a process that would be incongruous with Ma Manda phonotactic patterns. Second, when speakers have attempted to write this verb root by itself, they have written <m> without any word-final vowel.

(72) a. /n-be/ → [nɨm.be] ‘tell (him)!’
b. /nɨndoq/ ‘1pl.dat’ + /nɨ-m-be/ → [nɨn.doq nɨm.be] ‘give to us!’
c. /fəle-qə/ ‘turn around-ss’ + /nɨ-b-be/ → [fə.le.qə nɨm.be] ‘turn and look at us!’

In a derivational approach, these examples support the ordering of epenthesis before nasal agreement: Epenthesis feeds nasal agreement.

Importantly, these facts suggest that the epenthetic [ɨ] in (71a) operates as a full vowel nucleus, since its presence causes the NV requirement to be satisfied for the initiation of nasal agreement. Furthermore, the barred-i vowel can be nasalized in these environments, further supporting its presence as a full vowel.

8.6 Summary

Long distance nasal agreement is a productive process of assimilation in Ma Manda. Tautomorphemically, nasal agreement is more limited than it is across morpheme boundaries. Within a morpheme, a nasal triggers the prenasalization of a following voiced plosive as long as there is exactly one vowel intervening. This is not prenasalization in the traditional sense, however, since these homorganic nasal segments have been reanalyzed as full nasal phonemes. Heteromorphemically, a nasal stop triggers the prenasalization of both voiced *and* voiceless plosives as long as there is exactly one vowel intervening. No other language has been shown to behave in this unique manner. A further unusual aspect to nasal agreement in Ma Manda is its progressive (left-to-right) directionality, since a majority of described cases of consonant agreement are regressive (apparently due to their origination in speech planning and production).

9 MORPHOPHONEMIC ALTERNATIONS

Ma Manda displays a variety of alternations across morpheme boundaries. This complexity is most evident when sonorants are brought into contact with other consonants in both nominal and verbal morphology. Section 9.1 describes and exemplifies the alternations that occur when consonants—especially sonorants—come into contact with other consonants, whereas §9.2 describes interactions involving vowels. Section 9.3 deals with the simple interactions that take place in reduplication and compounding. Finally, §9.4 summarizes the most salient findings of the chapter.

9.1 Heteromorphemic consonant interactions

Many Finisterre-Huon languages are known for being fairly complex in their manifestation of a plethora of morphophonemic alternations (see Nabak (Fabian *et al.* 1971, McElhanon 1979, Fabian *et al.* 1998) and Wantoat (Davis 1964b) for particularly interesting examples). Ma Manda, likewise, displays a great many morphophonemic alternations, particularly in its nominal and verbal morphology. A majority of the alternations that occur behave identically across all word classes. By this I mean that a /g/-initial noun suffix behaves the same as a /g/-initial enclitic, and likewise with a /g/-initial verb suffix. For this reason, the example sets in the following subsections are arranged based on the segments involved rather than on any grammatical criteria. Since syntax is not the focus of this thesis, I do not spell out full definitions for the various

grammatical morphemes (though see Appendices 3–4 for two sets of morphological paradigms). The alternations in focus here are bolded in the phonetic fields. Stress, lenition, laxing, nasalization, and aspiration are not marked in the transcriptions in order that the segment interactions be clear.

For the sake of comparability, I use the words in Table 43 as models for other words which end in the same segments and behave in the same way (e.g., *ul* 'hit' is a model of all liquid-final verb roots). Likewise, the suffixes and enclitics in Table 44 represent all other morphemes of similar types that begin with identical segments (e.g., *=lɨ* is a nominative case enclitic, and behaves in the same way in all circumstances as *=loq*, the benefactive case enclitic). I primarily use the listed morphemes in this section in order to prevent unnecessary complications and confusion, and so that the alternations themselves can take center stage. Additionally, this allows me to avoid cluttering the data with glosses. Unless otherwise noted, every alternation that is shown has no exceptions. Unlisted phonemes and blanks in the table indicate that those segments simply do not occur at morpheme boundaries in my data.

See Appendix 6 for a supplement to this section, which lists and exemplifies every possible heteromorphemic consonant sequence, structured based on the classes of the segments involved (i.e., obstruents, liquids, glides) and their order in each sequence (e.g., the section on liquid/nasal sequences is composed of liquid + nasal sequences, and then nasal + liquid sequences).

Table 43: Noun/verb models for use in examples sets

	nouns		verbs	
_p	/tədep/	‘nephew’		
_t	/jot/	‘house’		
_q	/moq/	‘firstborn.daughter’		
_b			/lab/	‘come.up’
_s	/tas/	‘cane’		
_m	/nam/	‘brother-in-law’	/blam/	‘carry’
_n	/qaqon/	‘uncle’		
_ŋ	/meŋ/	‘mother’	/qoŋ/	‘throw’
_l	/nol/	‘brother’	/ul/	‘hiƚ’

Table 44: Suffix/enclitic models for use in example sets

	noun suffixes		enclitics		verb suffixes	
t_					/-tat/	‘1sg:nfuƚ’
q_					/-qə/	‘ss’
b_					/-be(ŋ)/[38]	‘2sg:imp’
d_					/-de(ŋ)/	‘2du:imp’
g_	/-gə/	‘2sg.poss’			/-gɑt/	‘1sg:rpsƚ’
s_	/-sɨ/	‘23pl.poss’				
n_	/-nə/	‘1sg.poss’			/-ne(ŋ)/	‘2pl:imp’
ŋ_					/-ŋət/	‘1sg:npsƚ’
l_			/=lɨ/	‘nom’	/-lət/	‘1sg:pres’
w_			/=wə/	‘ynq’	/-wam/	‘1pl:pres’
_						
j_	/-je/	‘pl’				

The following sections are ordered as follows: §9.1.1 discusses voiceless plosive interactions, §9.1.2 discusses voiced plosive interactions, §9.1.3 discusses fricative interactions, §9.1.4 discusses nasal interactions, §9.1.5 discusses approximant interactions, and finally §9.1.6 summarizes the various heteromorphemic consonant interactions in a table.

[38] The imperative forms /-be/, /-de/, and /-ne/ are interchangeable with their related subjunctive forms /-beŋ/, /-deŋ/, and /-neŋ/.

9.1.1 Voiceless plosive interactions

Voiceless plosives are the least likely segments to be modified by their environments in Ma Manda. This resistance to alternation is illustrated in (73)–(74), where /tədep/ ‘nephew’ and /moq/ ‘firstborn daughter’ are shown with suffixes and enclitics that begin with a variety of segments.

(73)	a. /tədep+gə/ →	[tə.de**p.g**ə]	‘your nephew’
	b. /tədep+sɨ/ →	[tə.de**p.s**ɨ]	‘their (23pl) nephew’
	c. /tədep+nə/ →	[tə.de**p.m**ə]	‘my nephew’
	d. /tədep+lɨ/ →	[tə.de**p.p**ɨ] ~ [tə.de.**p**ɨ]	‘Nephew did ... (nom)’
	e. /tədep+wə/ →	[tə.de**p.p**ə] ~ [tə.de.**p**ə]	‘nephew?’[39]
(74)	a. /moq+gə/ →	[mo**q.g**ə] ~ [mo.**g**ə]	‘your firstborn daughter’
	b. /moq+sɨ/ →	[mo**q.s**ɨ]	‘their (23pl) firstborn daughter’
	c. /moq+nə/ →	[mo**q.ɴ**ə]	‘my firstborn daughter’
	d. /moq+lɨ/ →	[mo**q.q**ɨ] ~ [mo.**q**ɨ]	‘Firstborn daughter did ... (nom)’
	e. /moq+wə/ →	[mo**q.q**ə] ~ [mo.**q**ə]	‘firstborn daughter?’

Voiceless plosives, when they occur as the first element in a heteromorphemic consonant cluster, do not alternate. This lack of alternation is consistent with the phonotactic patterns discussed in Chapter 5: Voiceless plosives occur freely in coda position. The only exception to this is that [q] can be elided before [g], as seen in (74a). Sonorants undergo several types of alternations, though these are not discussed here: Nasals assimilate in place (see §9.1.4) and approximants assimilate in continuancy (see §9.1.5).

[39] The question marks in glosses throughout this section indicate that the second morpheme is a polar question enclitic.

The same subject medial verb suffix /-qə/ is the only example of a suffix or enclitic that begins with a voiceless plosive. This suffix alternates when preceded by sonorants, as shown in (75)–(77).

(75)	a. /lo+qə/ →	[lo.**qə**]	'go up and ... (ss)'
	b. /lab+qə/ →	[la.**bɨ.qə**]	'come up and ... (ss)'
(76)	a. /blam+qə/ →	[bla**m.pə**]	'carry it and ... (ss)'
	b. /na+m+qə/ →	[na**m.pə**]	'give it to me and ... (ss)'
	c. /Ø+m+qə/ →	[m̩.pə] ~ [m**ɨɴ.qə**]	'give to him and ... (ss)'
	d. /fepm+qə/ →	[fep.**m̩.pə**] ~ [fep.**mɨɴ.qə**]	'cut bush and ... (ss)'
(77)	/ul+qə/ →	[u**t.tə**] ~ [u.**tə**]	'hit and ... (ss)'

In (75) the suffix surfaces unchanged (though epenthesis takes place in (75b)). The occurrence of [-qə] after vowels establishes it as the underlying form. In (76) the underlying voiceless uvular plosive becomes a bilabial plosive (i.e., /q/→[p]) after [m]. This occurs in (76a) and also (76b), where the first person object prefix /na-/ is attached to the verb root. However, in (76c–d) the alternation is optional. In these words the bilabial nasal is not able to be syllabified into the coda of the first syllable. In this case, the bilabial nasal may become syllabic and cause the uvular plosive to alternate. Alternatively, vowel epenthesis may occur after the nasal, which then causes the underlying suffix to surface ([qə]). In (76d) this is accompanied by nasal agreement as well (§8.4). Example (77) illustrates another allomorph [-tə]. The /l/ of liquid-final verb roots assimilates in continuancy to [q] (i.e., /l/→[t]). Next, [q] assimilates in place to [t] and then optionally elides in degemination.

9.1.2 Voiced plosive interactions

Vowel epenthesis occurs after all underlying root-final voiced plosives, since voiced plosives cannot surface in coda position of the syllable. The introduction of [ɨ] prevents (i.e., bleeds) these segments from interacting with other heteromorphemic consonants.[40] This is illustrated in (78), where /lab/ 'come up' is shown with a variety of verb suffixes.

(78)	a. /lab+tat/ →	[la.**bɨ.t**at]	'I will come up (nfut) '
	b. /lab+got/ →	[la.**bɨ.g**ot]	'I came up (rpst)'
	c. /lab+ŋət/ →	[la.**bɨ.ŋ**ət]	'I came up (npst)'
	d. /lab+lət/ →	[la.**bɨ.l**ət]	'I am coming up'
	e. /lab+wam/ →	[la.**bɨ.w**am]	'we are coming up'

The only other alternation involving voiced plosives is degemination, as seen in (79).

(79)	a. /lab+be/ →	[la.**b**e]	'come up (2sg)!'

Two successive /b/ phonemes degeminate. This provides evidence that the [ɨ]s in the surface forms of (78) are not phonemic. Degemination does not occur, however, in the contrastive example in (80).

(80)	/tas+sɨ/ →	[ta.**sɨ.s**ɨ]	'their (23pl) cane'

Since fricatives typically pattern with voiced plosives—neither class can occur word-finally—then it is curious that degemination does not occur here. However, /tas/ 'cane' can be pronounced as either [tas] or [ta.sɨ], due to relaxation of the phonotactic

[40] See the tables in Appendix 4 (e.g., Table 59 and Table 60, *inter alia*) for CV verb roots that provide further evidence for the epenthetic nature of [ɨ] here.

restrictions for fricatives (see §4.1.5 and §7.2). If degemination took place, then contrast would be lost between /tas/ and /tas-sɨ/. This is an example of antihomophony. No other voiced plosives occur in root-final position; therefore it is unknown whether degemination would occur with /d/ and /g/.

9.1.3 Fricative interactions

As with voiced plosives, barred-i epenthesis occurs after root-final fricatives. Unlike voiced plosives, however, epenthesis is often optional for fricatives (i.e., though fricatives are typically disallowed from occurring in coda position, this constraint is relaxed for certain words). Fricative interactions are illustrated in (81), where epenthesis is optional in (81a), (81c), and (81e).

(81)	a. /tas+gə/ →	[ta**s.g**ə] ~ [ta.**sɨ.g**ə]	‘your cane’
	b. /tas+sɨ/ →	[ta.**sɨ.sɨ**]	‘their (23pl) cane’
	c. /tas+nə/ →	[ta**s.n**ə] ~ [ta.**sɨ.n**ə]	‘my cane’
	d. /tas+lɨ/ →	[ta.**sɨ.lɨ**]	‘the cane did ... (nom)’
	e. /tas+wə/ →	[ta**s.w**ə] ~ [ta.**sɨ.w**ə]	‘cane?’

Epenthesis is optional between a fricative and a stop, as seen in (81a) and (81c). Epenthesis is also optional between a fricative and a glide, as seen in (81e). Regarding (81b), recall §9.1.2, where it was mentioned that the lack of degemination in *s*+*s* sequences is probably due to antihomophony.

9.1.4 Nasal interactions

As with all sonorants in Ma Manda, nasal segments are prone to morphophonemic alternations. The primary alternation with nasals is assimilation to the place of articulation of preceding consonants, as shown in (82).

(82)	a. /əmda+nə/ →	[əm.da.**n**ə]	‘my nose’
	b. /tədep+nə/ →	[tə.de**p.m**ə]	‘my nephew’
	c. /jot+nə/ →	[jo**t.n**ə]	‘my house’
	d. /moq+nə/ →	[mo**q.ɴ**ə]	‘my firstborn daughter’
	e. /nol+nə/ →	[no**t.n**ə]	‘my brother’

The vowel-final noun root in (82a) establishes the underlying form of the first person possessive suffix as /-nə/. The phoneme /n/ assimilates to the place of a preceding voiceless plosive, as seen in (82b–f). In (82e) the liquid changes to [t], which is addressed with liquid interactions in §9.1.5. Neither /m/ nor /ŋ/ occur initially in noun suffixes, while /ŋ/ does occur initially as a verb suffix (e.g., /-ŋət/ ‘1SG:NPST’). However, since no verbs end in voiceless plosives there is no further evidence of nasals assimilating to preceding voiceless plosives.

When a nasal is preceded by a voiced plosive or a fricative, the epenthetic vowel surfaces, as seen in (83). The nasal is separated from the obstruent via epenthesis, which prevents further alternations from ensuing (see §9.1.2).

(83)	a. /lab+neŋ/ →	[la.**bi.n**eŋ]	‘come up (2pl)!’
	b. /lab+ŋət/ →	[la.**bi.ŋ**ət]	‘I came up (npst)’
	c. /tas+nə/ →	[ta**s.n**ə] ~ [ta.**si.n**ə]	‘my cane’

When nasals occur as the *first* segment in a heteromorphemic consonant sequence, alternations do not typically occur. This is illustrated in (84)–(87), where all three nasal phonemes are brought into contact with voiced plosives and fricatives.[41]

(84)	a. /nam+gə/ →	[na**m.g**ə]	'your brother-in-law'
	b. /nam+sɨ/ →	[na**m.s**ɨ]	'their (23pl) brother-in-law'
(85)	a. /blam+got/ →	[bla**m.g**ot]	'I carried it (rpst)'
	b. /blam+de/ →	[bla**m.d**e]	'carry it (2du)!'
(86)	a. /men+gə/ →	[me**n.g**ə]	'your mouth'
	b. /men+sɨ/ →	[me**n.s**ɨ]	'their (23pl) mouth'
(87)	a. /meŋ+gə/ →	[me**ŋ.g**ə]	'your mother'
	b. /meŋ+sɨ/ →	[me**ŋ.s**ɨ]	'their (23pl) mother'

Notice especially that there is a surface contrast between [ng] and [ŋg], as seen in (86a) and (87a), respectively.

In verbs, however, the velar nasal does assimilate to the place of a following plosive. This is illustrated in (88).

(88)	a. /qoŋ/	[qoŋ]	'throw'
	b. /qoŋ+qə/ →	[qo**ɴ.q**ə]	'throw and ... (ss)'
	c. /qoŋ+be/ →	[qo**m.b**e]	'throw it (2sg)!'
	d. /qoŋ+de/ →	[qo**n.d**e]	'throw it (2du)!'

There is one possible explanation for the place assimilation seen in (88b–d). The word /qoŋ/ 'throw' could be analyzed as /qoN/, with a nasal autosegment (i.e., the nasal is unspecified for place). When no TAM suffix is present (as in (88a)), [ŋ] surfaces as the default nasal. See Trigo (1988) for a discussion of "nasal absorption", where nasal consonants are lost and yet leave behind nasal autosegments. Though this is a possibility with all /ŋ/-final verbs, there is no further evidence to support such an analysis.

[41] The phoneme /s/ is the only fricative that occurs suffix-initially.

Therefore, throughout this thesis verbs such as /qoŋ/ are analyzed as ending with a phonemic velar nasal. It is potentially the case that the velar nasal is just less resistant to alternations than the other nasal segments.

When nasal-final verb roots concatenate with [t]-initial TAM suffixes, a surprising alternation occurs. Between the nasal and [t], the sequence [bɨ] is inserted, as seen in (89).

(89)	a. /blam+tat/ →	[bla**m.bɨ.t**at]	'I will carry it (nfut)'
	b. /qoŋ+tat/ →	[qo**m.bɨ.t**at]	'I will throw it (nfut)'

In (89a), [bɨ] is inserted between [m] and [t]; in (89b), [bɨ] is inserted between [ŋ] and [t], followed by place assimilation of the velar nasal. There are three suffixes that begin with [t]: the first, second, and third person singular near future tense suffixes. Perhaps this alternation has arisen due to the fact that, without [bɨ] inserted, the words would surface as **blamtat* and **qontat*, quite similar in form to the present tense versions of the same verbs (i.e., *blamtət* and *qontət*, respectively). Since this type of alternation does not occur elsewhere (even before the voiceless uvular plosive), this must be a case of lexically conditioned allomorphy, presumably in order to retain contrast. In other words, it is a historical remnant that is not synchronically robust.

When two nasals concatenate across morpheme boundaries, several different alternations take place, as seen in (90)–(92).

(90)	a. /qaqon+nə/ →	[qa.qo**n.n**ə] ~ [qa.qo.**n**ə]	'my uncle'
	b. /qoŋ+ŋət/ →	[qo**ŋ.ŋ**ət] ~ [qo.**ŋ**ət]	'I threw it (npst)'
(91)	a. /blam+ŋət/ →	[bla**m.ŋ**ət]	'I carried it (npst)'
	b. /blam+neŋ/ →	[bla**m.n**eŋ]	'carry it (2pl)!'

(92)	a. /meŋ+nə/ →	[me**ŋ.ŋ**ə] ~ [me.**ŋ**ə]	‘my mother’
	b. /nam+nə/ →	[na**m.n**ə] ~ [na.**m**ə]	‘my brother-in-law’

If the adjacent nasals are identical, degemination optionally occurs, as in (90). If the nasal segments are not identical, no alternation occurs in verbs (as in (91)), whereas in nominal possession the second nasal can assimilate and then optionally degeminate (as in (92)). Importantly, even though nasals tend most often to assimilate in place to adjacent consonants, this process is blocked within stems. Suffix-initial nasals often undergo assimilatory processes, but stem-final nasals never do (this is seen in (84)–(87) as well). Contrast recoverability is the primary factor here. In OT terms, this means that there is a high-ranked root faithfulness constraint, known as contrast preservation, antihomophony, or “homophony blocking” (see Crosswhite (1999) for the ANTI-IDENT constraint which she considers to motivate such a phenomenon, within Correspondence Theory).

The examples in (93)–(96) further illustrate the tendency of stem-final nasals not to assimilate.

(93)	a. /nam+lɨ/ →	[na**m.p**ɨ]	‘Brother-in-law did ... (nom)’
	b. /qaqon+lɨ/ →	[qa.qo**n.t**ɨ]	‘Uncle did ... (nom)’
	c. /meŋ+lɨ/ →	[me**ɴ.q**ɨ]	‘Mother did ... (nom)’
(94)	a. /blam+lət/ →	[bla**m.t**ət]	‘I am carrying it’
	b. /qoŋ+lət/ →	[qo**n.t**ət]	‘I am throwing it’
(95)	a. /nam+wə/ →	[na**m.p**ə]	‘brother-in-law?’
	b. /qaqon+wə/ →	[qa.qo**n.t**ə]	‘uncle?’
	c. /meŋ+wə/ →	[me**ɴ.q**ə]	‘mother?’
(96)	a. /blam+wam/ →	[bla**m.g**am]	‘we are carrying it’
	b. /qoŋ+wam/ →	[qo**ŋ.g**am]	‘we are throwing it’

In (93)–(94) nasals are brought into contact with heteromorphemic liquids: the enclitic /=lɨ/ ‘NOM’ in (93) and the verb suffix /-lət/ ‘1SG:PRES’ in (94). In (95)–(96) nasals are brought into contact with glides: the enclitic /=wə/ ‘YNQ’ in (95) and the verb suffix /-wam/ ‘1PL:PRES’ in (96). In all these cases, the nasals remain unchanged. The one exception is that in (94b) the velar nasal in /qoŋ/ changes to alveolar. This could either be due to a particular susceptibility to place assimilation of /ŋ/ in Ma Manda, or to the velar nasal being the surface form of an unspecified nasal autosegment. However, while the nasal segments remain unchanged, the approximants do alternate (see §9.1.5).

9.1.5 Approximant interactions

When approximants are brought into heteromorphemic contact with other consonants, alternations almost always occur. This section describes these alternations and their motivations.

When following voiceless plosives, /l/ and /w/ alternate to match all features of the plosive—creating geminates. This is illustrated in (97)–(98). The palatal glide /j/ is different in that it does not undergo any of the alternations that are seen with /w/, as exemplified in (99).

(97)	a. /tədep+lɨ/ →	[tə.de**p.p**ɨ] ~ [tə.de.**p**ɨ]	‘Nephew did ... (nom)’
	b. /jot+lɨ/ →	[jo**t.t**ɨ] ~ [jo.**t**ɨ]	‘the house did ... (nom)’
	c. /moq+lɨ/ →	[mo**q.q**ɨ] ~ [mo.**q**ɨ]	‘Firstborn daughter did ... (nom)’

(98)	a. /tədep+wə/ →	[tə.de**p.p**ə] ~ [tə.de.**p**ə]	'nephew?'[42]
	b. /jot+wə/ →	[jo**t.t**ə] ~ [jo.**t**ə]	'house?'
	c. /moq+wə/ →	[mo**q.q**ə] ~ [mo.**q**ə]	'firstborn daughter?'
(99)	a. /tədep+je/ →	[tə.de**p.j**e]	'his nephews'
	b. /moq+je/ →	[mo**q.j**e] ~ [mo.**qi.j**e]	'firstborn daughters'

These derived geminates are optionally degeminated. In rapid speech degemination occurs, but in careful speech it is obvious that the length of these voiceless plosives is greater than that of a single segment. This is an impresionistic judgment that needs to be followed up with acoustic measurements in a future study. In (99b) a transitional vowel surfaces between [q] and [j] due to the backness of the plosive. When the plosive of /moq/ is fronted—creating [mok]—the transitional vowel no longer surfaces.

In most cases, the alternations in (97)–(98) may be understood as resolving a violation of the Syllable Contact Law (see §3.3.1): Rising sonority across a syllable boundary is cross-linguistically disfavored. There are many potential repair strategies for such a violation. A language may lenite the first consonant; however, Ma Manda does not typically allow stems to be modified.[43] A language may also elide either C_1 or C_2. A language may epenthesize a vowel. This is seen with voiced plosives and fricatives, but never with voiceless plosives in Ma Manda. Occasionally languages allow the consonants to metathesize. Finally, as seen in Ma Manda, a language may fortify the second

[42] The question marks in these glosses indicate that the second morpheme is a polar question enclitic.
[43] In an OT framework, this restriction on the modification of stems would be due to a highly ranked root faithfulness constraint.

consonant. Since the first consonant is a voiceless plosive—the class of segments with the lowest sonority—the approximants become voiceless plosives as well

The SCL is not the only possible motivation. As seen in §9.1.5, liquids tend to undergo similar alternations when following *and* preceding other consonants. This suggests that the SCL is not a complete explanatory principle for the facts of Ma Manda. Instead, /l/ and /w/ assimilate in continuancy and place to heteromorphemic consonant neighbors.

The palatal /j/ does not undergo these alternations. Any approach involving segments divided into natural classes based solely on sonority should treat both /w/ and /j/ equally. The fact that /j/ behaves differently from /w/ is predicted by the notion of perceptibility (see §3.3.2). The cues to glides are most often found in formant transitions beforehand and afterward. When glides are not preceded by vowels, the auditory signal lacks the abundance of cues that would lead to recovery of the contrast. This is solved by causing the /w/ to become a plosive, which increases the modulation between the segment and a following vowel. The /j/ does not have such a strong need to alternate. Due to its status as the sole palatal consonant, the formant transitions in the following vowel are enough to provide contrast to listeners in normal speaking environments. It cannot be confused with any other segment; /w/, on the other hand, is similar to both labial and velar plosives. In summary, from the perspective of perception-based phonology, the alternations are triggered by cue recovery.

There are also two idiosyncratic alternations when the liquid is followed by voiceless plosives, as shown in (100)–(101). There are only two suffixes with initial voiceless plosives (both verb suffixes), and therefore these processes cannot be substantiated across word classes.

(100)	/ul+tat/ →	[u.**lɨ.t**at]	'I will hit him (nfut)'
(101)	/ul+qə/ →	[u**t.t**ə] ~ [u.**t**ə]	'hit him and ... (ss)'

As seen in (100), epenthesis occurs between the liquid and [t]. In (101) the *l+q* sequence results in [tt]. The liquid is again assimilating in continuancy, but to a *following* consonant. Degemination optionally occurs as well.

As previously discussed in §9.1.2 and §9.1.3, voiced plosives and fricatives initiate epenthesis before heteromorphemic consonants. This is illustrated once again in (102)–(103). In (103) it is shown that epenthesis is optional between a fricative and a glide.

(102)	a. /lab+lət/ →	[la.**bɨ.l**ət]	'I am coming up'
	b. /tas+lɨ/ →	[ta.**sɨ.lɨ**]	'the cane did ... (nom)'
	c. /lab+wam/ →	[la.**bɨ.w**am]	'we are coming up'
(103)	a. /tas+wə/ →	[ta**s.w**ə] ~ [ta.**sɨ.w**ə]	'cane?'
	b. /tas+je/ →	[ta**s.j**e] ~ [ta.**sɨ.j**e]	'canes'

Generally, the liquid is elided before voiced plosives and fricatives, as seen in (104).

(104)	a. /ul+de/ →	[u.**d**e]	'hit him (2du)!'
	b. /ul+got/ →	[u.**g**ot]	'I hit him (rpst)'
	c. /nol+gə/ →	[no.**g**ə]	'your brother'
	d. /nol+sɨ/ →	[no.**s**ɨ]	'their (23pl) brother'

When the liquid concatenates with the voiced bilabial plosive, however, /b/ elides instead of /l/, as seen in (105).

(105) /ul+be/ → [u.**l**e] 'hit him (2sg)!'

The interactions between nasals and approximants are the most interesting and noteworthy in Ma Manda morphophonemics. In the ensuing discussion, alternations differ based on the different word classes (unlike most other patterns observed thus far).

In nominal morphology, when preceded by a nasal, /l/ and /w/ change to [t] (e.g., /n+l/→[nt] and /n+w/→[nt]). The palatal glide does not alternate in this way. These patterns are shown in (106)–(108).

(106)	a. /nam+lɨ/ →	[na**m.p**ɨ]	'Brother-in-law did ... (nom)'
	b. /qaqon+lɨ/ →	[qa.qo**n.t**ɨ]	'Uncle did ... (nom)'
	c. /meŋ+lɨ/ →	[me**ɴ.q**ɨ]	'Mother did ... (nom)'
(107)	a. /nam+wə/ →	[na**m.p**ə]	'brother-in-law?'
	b. /qaqon+wə/ →	[qa.qo**n.t**ə]	'uncle?'
	c. /meŋ+wə/ →	[me**ɴ.q**ə]	'mother?'
(108)	a. /nam+je/ →	[na**m.j**e]	'brothers-in-law'
	b. /qaqon+je/ →	[qa.qo**n.j**e]	'uncles'
	c. /meŋ+je/ →	[me**ŋ.j**e]	'mothers'

In verbal morphology, however, postnasal /l/ and /w/ behave somewhat differently than seen above. The liquid alternates to [t] after a nasal (i.e., /N+l/→[Nt]), while the glide alternates to [g] in this environment (i.e., /N+w/→[Ng]). These patterns are illustrated in (109)–(110).

(109)	a. /blam+lət/ →	[bla**m.t**ət]	'I am carrying it'
	b. /qoŋ+lət/ →	[qo**n.t**ət]	'I am throwing it'
(110)	a. /blam+wam/ →	[bla**m.g**am]	'we are carrying it'
	b. /qoŋ+wam/ →	[qo**ŋ.g**am]	'we are throwing it'

Similarly, *before* nasals the liquid also alternates to [t] (i.e., /l+N/→[tN]), as shown in (111). This pattern occurs across the board, in both nominal and verbal morphology.

(111)	a. /ul+neŋ/ →	[ut.neŋ]	'hit him (2pl)!'
	b. /nol+nə/ →	[not.nə]	'my brother'

These mirror image processes (i.e., l+N>[tN] and N+l>[Nt]) are completely productive in Ma Manda morphophonemics, by which I mean that there are no exceptions. Examples (106)–(111) are further illustrations of the requirement in Ma Manda for /l/ and /w/ to assimilate in continuancy to adjacent consonants. Additionally, the SCL is invalidated as an explanatory principle for all of these alternations, because it does not provide a unified account of the alternations seen in the two mirrored sequences (i.e., N+L and L+N). These are obviously related, and therefore any adequate approach should treat them both similarly.

Though the Syllable Contact Law has nothing to say about these matters, a "segment contact" (perception-based) approach does lend a helpful explanation. Liquid/nasal sequences lack the modulation necessary to retain contrast over time. This leads to the common alternation of /l/>[t] in Ma Manda, a dissimilatory process that increases modulation greatly.

The sequence *l*+*ŋ* is resolved in three different ways, which are illustrated in (112).

(112)	a. /ul+ŋət/ →	[u.**l**ət]	‘I hit him (npst)’
	b. /ul+ŋɨlɨ/ →	[u**q.ɴ**ɨ.lɨ]	‘hit and ... (23.ds)’
	c. /ul+ŋ/ →	[u.**lɨŋ**]	‘they hit him (npst)’

In (112a), the velar nasal is simply elided. In (112b), the nasal assimilates in continuancy and place (i.e., /l+ŋ/→[qɴ]). Presumably, elision is blocked because the suffix consists only of an underlying consonant cluster (i.e., /-ŋl/). Elision of the velar nasal would result in geminate liquids. Thus, this can be attributed to antihomophony. In (112c) epenthesis separates the two segments, presumably due to an inability to syllabify the stranded nasal.

When approximants concatenate with one another, alternations inevitably ensue. When liquid sequences occur, two possibilities arise. In verbal morphology geminate liquids both alternate with [t], and optionally degeminate.[44] In nominal morphology the liquids simply degeminate. These patterns are illustrated in (113).

(113)	a. /ul+lət/ →	[u**t.t**ət] ~ [u.**t**ət]	‘I am hitting him’
	b. /nol+lɨ/ →	[no.**l**ɨ]	‘Brother did ... (nom)’

When /l/ is followed by glides in nominal morphology, epenthesis separates the segments. When /l/ is followed by /w/ in verbal morphology, these coalesce to form [g], as shown in (114). The alternation involving /j/ is then exemplified in (115).

(114)	a. /nol+wə/ →	[no.**lɨ.w**ə]	‘brother?’
	b. /ul+wam/ →	[u.**g**am]	‘we are hitting him’
(115)	/nol+je/ →	[no.**lɨ.j**e]	‘brothers’

In (114a) epenthesis is triggered. In almost every other heteromorphemic sequence involving liquids and/or glides, more unfaithful alternations occur, such as seen

[44] See §9.3.1.4 for evidence against treating verbs such as /ul/ as /t/-final stems.

in (114b). The word in (114a) does not surface as [nogə], because this is the surface form of /nol+gə/ ‘your brother’, as seen in (116).

(116) /nol+gə/ → [no.**g**ə] ‘your brother’

If =*wə* ‘YNQ’ were allowed to be realized as [gə], then all liquid-final nouns with this polar question enclitic would be homonymous with their 2SG.POSS forms. The principle at work is again contrast preservation.

In (114b) the labiovelar glide is shown to alternate with [g], just as it does after nasals. Derivationally then, the liquid elides before [g] as expected: /w/-fortition feeds /l/-elision. Previously in this section, the alternation of /w/→[g] was attributed to continuancy assimilation, as this takes place adjacent to nasal ([-continuant]) segments. In order to explain why /w/ becomes [-continuant] after liquids, I hypothesize that liquids are [-continuant] in Ma Manda as well. This can be further supported by the fact that /l/ and /t/ have some kind of unexplained historical relationship (see §9.3.1.4). It is possible that, in some cases, the phoneme that exists in underlying forms is underspecified and can surface as either [l] or [t]. This matter must be left for future research, which no doubt should include analysis of morphophonemic patterns in neighboring related languages.

Example (117) is provided for the sake of thoroughness. It is posited that glides do not occur syllable- and word-finally (see §4.1.7 and §5.3). Further evidence for this claim comes from the fact that no alternations arise between these purported glides and following liquids. If the words in (117) were glide-final, then this would be the only

situation where two sonorants are allowed to come into contact without alternations taking place.

(117) a. /bai+lɨ/ → [ba^{i}.lɨ] 'the flute did ... (nom)'
b. /sateu+lɨ/ → [sa.te^{u}.lɨ] 'the marsupial sp. did ... (nom)'

9.1.6 Summary of heteromorphemic consonant interactions

Table 45 summarizes the alternations that occur when consonants concatenate across morpheme boundaries. Only the segments that occur at morpheme boundaries are included. The initial column provides the first segment in the sequence, and the initial row the second segment. The surface form of each alternation is shown in the table. Parentheses indicate an optional segment, while the forward slash indicates a separate alternation (typically due to a different type of behavior among a different word class). Blank cells indicate non-occurring input combinations.

Table 45: Heteromorphemic consonant interactions

	t	q	b	d	g	n	ŋ	s	l	w	j
p_					pg	pm		ps	p(p)	p(p)	pj
t_					tg	tn		ts	t(t)	t(t)	
q_					(q)g	qɴ		qs	q(q)	q(q)	q(ɨ)j
b_	bɨt	bɨq	b	bɨd	bɨg	bɨn	bɨŋ		bɨl	bɨw	
m_	mbɨt	mp	mb	md	mg	m(n)	mŋ	ms	mp/ mt	mg/ mp	mj
n_					ng	n(n)		ns	nt	nt	nj
ŋ_	mbɨt	ɴq	mb	nd	ŋg	ŋ(ŋ)/ n	ŋ(ŋ)	ŋs	ɴq/ nt	ɴq/ ŋg	ŋj
s_					s(ɨ)g	s(ɨ)n		sɨs	sɨl	s(ɨ)w	
l_	lɨt	t(t)	l	d	g	tn	l/ lɨŋ/ qɴ	s	t(t)/ l	g/ lɨw	lɨj

Section 9.1 is summarized in Appendix 6.

9.2 Heteromorphemic interactions involving vowels

There are no vowel-initial suffixes in Ma Manda; therefore, the only heteromorphemic interactions that could arise involving vowels are those between vowel-final stems and consonant-initial suffixes. Of these, only two alternations are known to occur. First, /b/-initial suffixes lenite to [w] when preceded by a heteromorphemic vowel, as seen in (118).

(118) /lo+be/ → [lo.**w**e] 'go up (2sg)!'

In example (119), NV stems are shown to block /b/-lenition.

(119) /mo+be/ → [mo**m.b**e] 'go down (2sg)!'

When a verb stem ends in a nasal + vowel sequence, then /b/ does not lenite to [w]. One possible analysis is that these suffixes actually begin with /w/ (e.g., /-we/ '2SG:IMP'), and the /w/ changes to [b] after an NV sequence, or after a nasal stop (e.g., /mo+we/→[mombe]; /blam+we/→[blambe]). However, examples like the following prove this to be false: The 1PL:PRES suffix surfaces as [wam] after a vowel-final verb root in (120), and also after an NV sequence in (121). This contrasts with the alternation in example (119) above.

(120) /lo+wam/ → [lo.wam] 'we are going up'
(121) /mo+wam/ → [mo.wam] 'we are going down'

The suffix *-wam* '1PL:PRES' really is /w/-initial, while the suffix *-be* '2SG:IMP' in (118) and (119) is /b/-initial.

Second, /ə/-final verb roots cause the elision of liquids in all the liquid-initial present tense singular TAM suffixes. This is shown in (122)–(123).

(122)	a. /bə+got/ →	[bə.got]	'I came'
	b. /bə+wam/ →	[bə.wam]	'we are coming'
	c. /tə+goq/ →	[tə.goq]	'(he) did'
	d. /tə+wam/ →	[tə.wam]	'we are doing'
(123)	a. /bə+lət/ →	[b**a**t]	'I am coming'
	b. /tə+ləq/ →	[t**a**q]	'(he) is doing'

In (122) the underlying /ə/ surfaces, while in (123) it does not. Not only does the liquid elide, but the contiguous schwa vowels coalesce to form the low central vowel [a]. This is evidence that a length distinction in other related languages has been phonologized in Ma Manda as separate vowels. Two schwas come together, and instead of producing a lengthened vowel, they produce a low central vowel. Other evidence supporting this hypothesis is that the /a/ vowel attracts stress over other vowels, and the two vowels seem to be somewhat interchangeable in words of more than two syllables (see §4.2.3).

There is an additional alternation that deserves mention. A few frequently-used vowel-final verb stems cause the liquids of liquid-initial present tense singular TAM suffixes to alternate with [j], which then causes the following schwa vowel to be fronted to [e]. Two examples are provided in (124)–(125).

(124)	/qu+lət/ →	[qu.**je**t]	'I am going'
(125)	/ta+lət/ →	[ta.**je**t]	'I am talking'

9.3 Reduplication and compounds

Both reduplication and compounding are frequent in Ma Manda, though reduplication is not as productive as in many other Finisterre-Huon languges (e.g., in Nukna there are several series of both full and partial reduplication types (Matt Taylor, pers. comm.)). This section briefly describes the various types of reduplication and compounding, paying particular attention to alternations that arise between morphemes. A majority of reduplication is full-morpheme reduplication—partial reduplication is rarer. Often word-final voiceless plosives are elided before the second iteration. The morphophonemic alternations seen in the previous section are not seen in reduplication and compounds; nonetheless, reduplicants and compounds form single words with a single primary stress. The initial iteration generally receives the primary stress.

9.3.1 Reduplication

Reduplication in Ma Manda is used for a variety of purposes among nouns adjectives, adverbs, and verbs. The following sections illustrate these.

9.3.1.1 Reduplication in nouns

Reduplication of nominals indicates either plurality or diminution. These are illustrated in Table 46 and Table 47, respectively.

Table 46: Reduplicated nouns (pluralization)

Base	Gloss	Reduplicated form	Reduplicated gloss
/jot/ 0305	'house'	[jó.jòt] ~ [jót.jòt]	'(all) houses'
/məŋgət/	'thing'	[mə́ŋ.gə.mə̀ŋ.gət] ~ [mə́ŋ.gət.mə̀ŋ.gət]	'(all) things'
/tamɨŋ/ 0246	'woman'	[tám.tàm] 0248	'women'
/gle/	'flock'	[gɨ.lé.gɨ.lè]	'flocks'

Table 46 provides examples of basic nouns being pluralized through reduplication. As can be seen in the first two examples, this plurality is often extended to mean "all" rather than just "some". This process is very productive, such that anyone can reduplicate a noun to indicate its plurality.

Some nouns cannot be pluralized via reduplication; instead, only modifying adjectives can be reduplicated to show plurality of the noun. When one of these nouns is used without an accompanying adjective, only context can reveal whether it is singular or plural. The word /qaudə/ 'stone' is an example, as shown in (126). It is possible that these are mass nouns; further research is needed here.

(126) a. /qaudə/
'stone(s)'
b. */qaudə-qaudə/
c. /qaudə qusəŋ-qusəŋ/
stone big-pl
'big stones'

In some cases, a word can be pluralized using either method. For example, /jot/ 'house' can be pluralized via reduplication (as seen in Table 46) or with a reduplicated adjective, as seen in (127).

(127) /jot timen-timen/
house old-old
'old houses'

Additionally, many nouns have suppletive plural forms, illustrated in (128).

(128) a. /təmel/ 'leaf'
b. /təmeq/ 'leaves'

Finally, regarding the partial reduplication seen with /tamɨŋ/ in Table 46, I suspect that this word may involve a bound morpheme /tam/ followed by a 3SG.POSS suffix. This would make it similar to the suppletive word /tuwoŋ/, the third person possessed form of /tuwə/ 0271 'firstborn son'. Suppletive forms are common, especially among inalienably possessed kinship and body part terms.

Table 47: Reduplicated nouns (diminution)

Base	Gloss	Reduplicated form	Reduplicated gloss
/səp/ 0228	'dog'	[sə́p.sə̀p]	'beetle sp.'
/gəmət/ 0069	'snake'	[gə.mə́.gə.mə̀t]	'caterpillar'
/bəŋ/	'breadfruit tree'	[bə́ŋ.bə̀ŋ]	'frog sp.'
/gisibə/ 0080	'bat'	[gɨ́.sɨ.bə̀.gɨ̀.sɨ.bə̀] 0082	'arachnid sp.'

Table 47 illustrates the diminutive usage of reduplication. In each example a noun with comparatively large size is reduplicated to form a new noun, always an animal, with comparatively small size. These new forms are generally related in some way to their base form, often due to their physical appearance. No examples of the diminutive usage of reduplication have been found with nouns that are not animals.

Finally, many nouns are reduplicants without a base form. In Table 48, none of the expected base forms are grammatical. This is especially common in names of flora and fauna.

Table 48: Reduplicated nouns ungrammatical base forms

Base	Gloss	Reduplicated form	Reduplicated gloss
*/giŋ/	-	[gíŋ.gìŋ]	'balls of the feet'
*/blə/	-	[bɨ.lə́.bɨ.lə̀]	'frog sp.'
*/gumut/	-	[gu.mú.gu.mùt]	'dove sp.'
*/qən/	-	[qə́n.qə̀n]	'insect (generic)'

More research is needed to determine how these types of nouns are pluralized.

9.3.1.2 Reduplication in adjectives

Adjectives can be reduplicated to show either plurality or intensity. The first two examples in Table 49 show pluralization, while the final two show intensification. In order to indicate a plural noun, it is often the adjective that is reduplicated (see (127)).

Table 49: Adjectival reduplication

Base	Gloss	Reduplicated form	Reduplicated gloss
/timen/ 0262	'old'	[tɨ.mén.tɨ.mèn]	'old (pl)'
/qusəmbə/ 0148	'big'	[qu.sə́ɴ.qu.sə̀ŋ] 0306	'big (pl)'
/pasup/	'almost'	[pə́.sɨ.pə̀.sɨp] ~ [pə́.sɨp.pə̀.sɨp]	'very close to'
/moin/ 0175	'wrong'	[mó^{i}n.mò^{i}n]	'very wrong'

The reduplicated form of /qusəmbə/—[qu.sə́ɴ.qu.sə̀ŋ]—suggests that the reduplicant is a disyllabic foot. However, examples like [gɨ́.sɨ.bə̀.gɨ̀.sɨ.bə̀] above show that full trisyllabic morphemes can reduplicate as well.

9.3.1.3 Reduplication in adverbs

A majority of adverbs can be reduplicated to show intensification. Some of the reduplicated forms do not have base forms, as seen in the final two examples in Table 50.

Table 50: Adverbial reduplication

Base	Gloss	Reduplicated form	Reduplicated gloss
/bagɨt/ 0008	'slowly'	[bá.gɨ.bàgɨt] ~ [bá.gɨt.bàgɨt]	'very slowly'
/mun/	'going (with the expectation of returning shortly)'	0314 [mún.mùn]	'temporary'
*/səq/	-	[sə́q.sə̀q]	'quickly'
*/pɨlɨm/	-	[pɨ́.lɨm.pɨ̀.lɨm]	'quickly (sprinting)'

9.3.1.4 Reduplication in verbs

A verb stem can be reduplicated to form a noun. This nominalization usage is illustrated in Table 51.

Table 51: Verbal reduplication (nominalization)

Base	Gloss	Reduplicated form	Reduplicated gloss
/awe/	'to finish'	[a.wè.á.we] 0312	'eternity'
/daampa/	'to be happy'	[dám.pə.dàm.pə]	'happiness'
/mitə/	'to fear'	[mí.tə.mì.tə]	'fear'
/əl/	'to be (at)'	[ə́t.ə̀t]	'presence'

A medial verb or fully-inflected final verb can also be repeated in its entirety. Verbal repetition carries a meaning of continuous aspect. This is illustrated in (129).

(129) /qu-gɨ qu-gɨ qəgəŋ qu-ŋqədopmɨ-qə .../
go-sim go-sim village go-arrive-ss
They kept going and going and arrived at the village and ...

Repeated verbs remain distinct phonological words. Reduplication involves a single primary stress, while continuous aspect repetition involves two primary stresses and a break between the words.

Observe that the base form /əl/ 'to be (at)', the final example in Table 51, surfaces as [ət] in reduplicants. This is important because it may lead one to suggest that liquid-

final verbs (such as the /ul/ prototype used to show alternations throughout §9.1) are underlyingly /t/-final verbs. If this were the case, then the nasal-adjacent liquid alternations (/l/→[t]) are nonexistent. This is certainly one possible explanation, though it is not to be preferred. The major piece of evidence against this analysis is that *t+g* sequences result in [t.g]—there is no alternation, as shown in (130)–(131).

(130)	a. /jot+gə/ →	[jót.gə]	'your house'
	b. /jot-jot/ →	[jót.jòt]	'houses'
(131)	a. /əl+got/ →	[ə.gót]	'I was there (rpst)'
	b. /əl-əl/ →	[ə́t.ə̀t]	'presence'

This does not explain why liquids surface as voiceless plosives in nominal forms. It seems that /t/ and /l/ have some sort of historical relationship that is frozen in certain forms. This alternation between /t/ and /l/ is extremely common in the Finisterre-Huon languages.

9.3.2 Compounds

In Ma Manda, compounds behave in much the same way as reduplication does. Compounds are common among both nouns and verbs. In most cases, the meaning of the compound is related to the two individual elements, but occasionally the meaning is not compositional. Many compounds involve a base form and another reduplicated form, or a regular form compounded to a bound morpheme. This is especially true of the names of flora and fauna. The following subsections describe and illustrate the occurrences of compounds.

9.3.2.1 Compounds in nouns

Nominal compounds are extremely prevalent. Table 52 provides a brief list illustrating some of the variety.

Table 52: Nominal compounds

Base	Gloss	Compound form	Compound gloss
/geq+səp/	'animal+dog'	[géq.sə̀p]	'hunt'
/mi+dam/	'water+blaring sound'	[mín.dàm] 0173	'waterfall'
/nə+tam/	'man+woman'	[nə́n.tàm]	'people'
/dio+gagɨt/	'chest+yellow'	[dí.jo.gà.gɨt]	'bird sp.'
/duŋ+mo+mo/	'ear+go down+go down'	[dúŋ.mò.mo]	'cockroach'
/mondagɨ+membɨ/	'banana sp.+head'	[mon.dá.gɨ.mèm.bɨ]	'bird sp.'
/jəgu+suwə/	'bird sp.+?'	[jə́.gu.sù.wə]	'bird sp.'
/botol+nə/	'bottle+man'	[bó.tol.nə̀]	'type of spirit'
/badi+qədəŋ/	'grass skirt+bamboo'	[bá.dɨ.qə.də̀ŋ] 0313	'bamboo sp. (used to make grass skirts)'

Again I reiterate that the morphophonemic processes, which are so reliable with regard to suffixes and clitics, are not necessarily followed in reduplication and compounding. For instance, see the second to last example in Table 52. The borrowed term 'bottle' is compounded to *nə* 'man' to refer to a very specific spirit that appears as a man who seduces women into sexual intercourse. The liquid does not alternate with [t] in this instance. Neither do nasals undergo place assimilation. This is another example of antihomophony, where the base morphemes are required to withstand change in order to maintain their integrity. However, I have observed no other instance of [l.n], and thus conclude that this loanword has not been fully adapted into the Ma Manda lexicon (although it is compounded with a native morpheme).

9.3.2.2 Compounds in verbs

Verbal compounds are equally as prevalent. Table 53 illustrates some of the variety.

Table 53: Verbal compounds

Base	Gloss	Reduplicated form	Reduplicated gloss
/ufɨ+məŋ/	'?+fall down'	[ú.fɨ.mə̀ŋ]	'to remove kunai grass'
/gem+ne/	'ripe+?'	[gém.nè]	'to ripen'
/məŋ+te/	'fall down+put'	[mə́n.tè]	'to place upright'
/bɨse+lə/	'jungle+?'	[bɨ.sé.lə̀]	'to become overgrown'
/dɨfɨ+gəlo/	'?+break'	[dɨ́.fɨ.gə̀.lo]	'to hatch'
/fep+nə/	'?+eat'	[fép.nə̀]	'to lick'
/ta+efa/	'talk+speak up'	[tá.e.fà] 0381	'to preach, to speak out'
/nandɨ+ula/	'know+?'	[nán.dɨ.u.là] 0383	'to be unknowledgeable'

The compounds here follow the same patterns as the nominal compounds. Adjectives, nouns, and bound morphemes can be used as a member of the compound. The final two examples in Table 53 provide examples of vowel hiatus. This is exceedingly rare, but some compounds do cause vowels to concatenate. The vowels operate as separate nuclei (see §7.2 for a discussion on how the barred-i vowel's occurrence in hiatus points to its phonologization in certain contexts).

The ungrammatical base forms in these compounds are indeed separate morphemes, as revealed by two facts: First, compounds with fossilized forms are always closely related to the known morpheme. For instance, /ufɨ+məŋ/ 'to remove kunai grass' refers to the process of pulling out old kunai grass from a rotting rooftop and letting it *fall*

to the ground. The second piece of evidence is found in multiple uses of the same bound morpheme. In this case, these morphemes have their own meaning, as seen in (132).

(132)	a. /sedɨ+dəqeŋ/	'burn+break apart'	[sé.dɨ.də.qèŋ]	'to burn to pieces'
	b. /sedɨ+gəlo/	'burn+break'	[sé.dɨ.gə̀.lo]	'to break by burning'
	c. /sedɨ+qəge/	'burn+?'	[sé.dɨ.qə.gè]	'to dry over a fire'

9.4 Summary

This chapter has described and illustrated the morphophonemic alternations that occur in nominal and verbal morphology, as well as the processes of reduplication and compounding.

Morphophonemic alternations were described based on the segments involved rather than any grammatical criteria. By viewing the processes in this manner, the consistency with which these alternations occur is obvious. With few exceptions, segments behave in the same way no matter the word class they belong to. Voiced plosives and fricatives initiate barred-i epenthesis before a following suffix. Voiceless plosives generally remain unchanged before a morpheme boundary.

A majority of the alternations involve sonorants. Nasals are particularly susceptible to assimilation in place to adjacent stops. More remarkably, /l/ and /w/ undergo many different types of changes. Generally though, they seem to undergo assimilation of continuancy with neighboring segments (e.g., /l/ becomes [p] when preceded by /p/; /w/ becomes [g] when preceded by a nasal). When liquids come into

contact with each other, they change to the alveolar stop (i.e., /l+l/→[t]), and when liquids come into contact with /w/, the segments coalesce to form [g] (i.e., /l+w/→[g]).

Many of the alternations can be attributed to the effects of the Syllable Contact Law, but this was shown not to provide a uniform treatment of the facts (e.g., liquids alternate with [t] when preceding *or* following a nasal). Synchronically, all of the sonorant alternations can be attributed to assimilation: Sonorants must agree in continuancy with their heteromorphemic neighboring consonants. Diachronically, one can attribute most of these same alternations to well-known principles such as contrast recoverability and the need for sufficient modulation between segments (e.g., this is seen as an explanation for the fact that the palatal glide does not undergo the same alternations as the labiovelar glide). This interpretation of the sound changes relies on a perception-based understanding of phonological behavior.

Finally, the processes of reduplication and compounding are shown. Both of these processes are frequently-occurring in the Ma Manda language. What is noteworthy is that the typical morphophonemic alternations do not occur here. Instead, antihomophony is in force.

10 CONCLUSION

This phonological description is the first thorough linguistic study undertaken on Ma Manda, a Trans-New Guinea language of Papua New Guinea. This has been accomplished through analyses of the segmental phonology (Chapter 4), the syllable and phonotactics (Chapter 5), suprasegmental features (Chapter 6), high vowel reduction and epenthesis (Chapter 7), long distance nasal agreement (Chapter 8), and morphophonemic alternations (Chapter 9).

The consonant inventory is quite simple, with only fourteen phonemes. In place of the expected voiceless velar plosive /k/, Ma Manda has a voiceless uvular plosive /q/. This segment, along with the voiced labial and velar plosives, is prone to intervocalic lenition. The sibilant /s/ freely varies with its glottal allophone [h], and the liquid surfaces as a flap intervocalically.

The vowel inventory is relatively simple, but still more complicated than many Papuan languages. There are seven vowel phonemes, with three of these being central vowels (/a ə ɨ/). Vowels are lowered before the uvular plosive. The high central “barred-i” vowel primarily exists as a reduction of the high peripheral vowels /i u/—occurring especially in long words and in unstressed syllables—but in many cases this reduction has led to the permanent loss of the quality of these full vowels. In their place, the phonemic barred-i vowel has taken its place as a remnant vowel, and thus a phonemic

segment in its own right. Additionally, as more and more remnant vowels arose in the lexicon, Ma Manda underwent a reanalysis in which the barred-i vowel was understood to be epenthetic rather than phonemic. Synchronically, the barred-i vowel is currently in a state of transition: Many instances of this vowel are transitional segments used to break up disallowed consonant clusters, while others have not completely replaced the original vowels from which they derive.

The maximal syllable template is CLVVC. The liquid is allowed as the second element of an onset cluster when the first element is an obstruent, but this is often interrupted with the epenthetic barred-i vowel. Complex vocalic nuclei (off-glides) are allowed, but these are analyzed as separate phonemic vowels. Few consonant clusters are allowed, and these always occur across morpheme boundaries. In compounding and reduplication, consonant clusters and vowel clusters do occasionally arise.

Ma Manda is a stress-accent language, though not in any prototypical way. It has both quality-sensitive and quantity-sentitive tendencies and has a preference for word-initial stress. The default foot is a moraic trochee. The “weight” of each syllable, and thus its likelihood of attracting stress, is related to the presence or absence of a coda consonant, as well as the openness of the nucleus. The more open and peripheral the vowel, the more likely it will attract primary stress. The lack of an exact correlation between this vowel hierarchy and the sonority hierarchy proposed throughout the literature is theoretically relevant, and future acoustic analysis is needed to substantiate such a hypothesis. There is no convergence of the archetypal indicators of stress

however, and therefore it is often difficult to ascertain which syllable is stressed over another. In some instances, pitch appears to be the most reliable indicator, while in others it may be intensity, or length, etc. Secondary stress falls on alternate syllables emanating outward from the primary stress, while iterativity cannot be proven based on the available data. The intonational contours are unexceptional, with falling intonation in statements, rising intonation in questions, and a steady-high contour in imperatives.

Ma Manda exhibits a unique brand of nasal harmony. A nasal-vowel sequence causes prenasalization to occur before a following heteromorphemic plosive. This "prenasalization" is not a short phonetic segment, but a full homorganic nasal phoneme. While NV sequences initiate nasal agreement with heteromorphemic voiced *and* voiceless plosives, tautomorphemically nasal agreement only targets voiced plosives. It appears that historically prenasalized plosives have been phonologized as full nasal segments in the lexicon. *No other language in the world has been shown to exhibit long distance nasal agreement with only voiced plosives tautomorphemically, and with both voiced and voiceless plosives heteromorphemically*. It is also somewhat unique that nasal agreement exhibits progressive (left-to-right) directionality, since a vast majority of consonant harmony systems are regressive (right-to-left) and are understood to be based in speech planning effects.

Ma Manda also has a complex system of morphophonemic alternations. These alternations are not unique to a particular word class, but operate "across the board". For instance, any time a liquid and a nasal concatenate, the liquid alternates to [t]: /l+n/→[tn]

and /n+l/→[nt]. These alternations are particularly prevalent among a majority of the sonorants (/l m n ŋ w/), and can be attributed to the known phonological tendency of continuancy assimilation. Some of the idiosyncratic alternations can be explained by an appeal to perception-based factors.

APPENDIX 1: ALPHABETIZED WORDLIST

The wordlist in Table 54 is composed of the recorded words upon which the analyses of this thesis are based. A majority of the wordforms are monomorphemic nouns and adjectives, though the list also includes some examples of compounds, reduplications, and a few unique verbs. The words are listed alphabetically by phoneme. Every line also includes a phonetic transcription, a gloss, and a number that references the correct audio file on the disc attached at the front of the thesis. Loanwords are indicated with (LW).

For most flora and fauna, 'sp.' is listed after the noun to indicate that a specific species is being referenced. For most birds and mammals, however, I have provided English, as well as scientific (Latin) terminology. These nouns are marked with an asterisk, and on the immediately following line the common and scientific names are listed. The method for gathering these terms was quite simple. I provided books with pictures of New Guinea animals, and asked two Ma Manda men to write down the vernacular terms for any animals they knew. Afterward, I discussed each term with them, asked them corroborating questions such as "What does the bird's call sound like?" and "In what kind of habitat does this bird typically remain?" This discussion enabled me to make tentative claims regarding the assignment of English names for these vernacular terms. Caution must be exercised, however, because specimens have *not* been verified by

zoologists and botanists. The collection of mammal and bird terminology come from Flannery (1995) and Coates & Peckover (2001).

Table 54: Alphabetized wordlist

Phonemic	Phonetic	Gloss	Reference
alaməq	à.la.máq	cloud	0001
aŋgəm	aŋ.gám	banana sp.	0002
awe-awe	a.wè.á.we	eternity	0312
badi	ba.dɨ́	grass skirt	0007
badi-qədəŋ	bá.dɨ̌.qə.dàŋ	bamboo sp.	0313
bagɨt	ba.gɨ́t	slowly	0008
bagɨt-bagɨt	bá.gɨ̌t.bà.gɨ̌t	very slowly	0314
bai	bá^{i}	flute	0009
bam	bám	cold (to the touch)	0010
bameŋ	ba.méŋ	bamboo sp.	0011
baq	báq	pocket	0308
baqaqat	bà.ʁa.χát	frog sp.	0015
bazaqijeʔ (LW)	ba.ʤà.ʁi.jéʔ	Bazakiec (woman's name)	0017
be	bé	father	0315
bedin	be.dín	wet	0018
be-ut	bé^{u}t	with their father	0309
bədaŋ	bə.dáŋ	firewood rope	0012
bəja	bə.já	armpit	0345
bəm	bə́m	woven bamboo	0013
bəq	bə́q	sugar cane	0307
bəsəm	bə́.səm	spear	0014
bəteqɨt	bə.té.χɨ̌t	yam sp.	0016
bi	bí	lime (powder)	0026
bijət	bi.jə́t	*bird sp.	0027
*Belford's Honeyeater (*Belford's Belidectes, Melidectes belfordi*)			
bɨdəm	bɨ̌.də́m	possessions	0019
bɨdɨməŋ	bɨ́.dɨ̌.məŋ	overgrown garden	0020
bɨge	bɨ̌.gé	again	0021
bɨm	^{m}bɨ́m	corpse	0023
bɨqŋan	bɨ́q.ŋan	neck	0022
bɨse	bɨ̌.sé	jungle	0024
bɨse=naŋ	bɨ̌.sé.nəŋ	deep jungle	0025
bo	bó	club	0028
boblat	bó.bɨ̌.làt	butterfly	0029
bot	bót	gathering	0030
bubuq	bu.búq	mud	0031
dabu	dá.bɯ	fourthborn daughter	0032
daf	dáf	mountain protrusion	0033
dagəpmət	dá.ɣəp.mèt	banana sp.	0034

Phonemic	Phonetic	Gloss	Reference
dəbugum	də́.bu.gùm	star	0035
dədaum	də.dáᵘm	dragonfly	0036
dəməŋgeq	də́.məŋ.gèᵊq	laugh	0037
dəpmon	də́p.mon	sleep	0038
didi	dǐ́.dǐ	how?	0039
didi-gɨt	dǐ́.dǐ.ɣ̀ɨ̀t	how many?	0040
didigɨt-didigɨt	dǐ́.dǐ.ɣ̀ɨ̀t.dǐ́.dǐ.ɣ̀ɨ̀t	*bird sp.	0041
*Mountain Mouse-warbler (*Crateroscelis robusta*)			
didimen	dí.di.mɛ̀n	straight	0042
didin	dí.din	*bird sp.	0044
*Bismarck Pied Monarch (*Monarcha verticalis*)			
dijo	di.jó	chest	0333
doip	dóⁱp	robin sp.	0045
*Blue-grey Robin (*Peneothello cyanus*)			
dunom	du.nóm	lip	0043
efore (LW)	é.fo.ɾè	Hefore (woman's name)	0096
eləŋ	e.lə́ŋ	lie (n)	0046
eməq	é.məq	moon	0047
eŋ	éŋ	yes	0048
əju	ə.jú	banana sp.	0006
ələlum	ə̀.lu.lúm	tickle	0003
əmbun	əm.bún	hair	0004
əmda	əm.dá	nose	0339
əŋgon	əŋ.gón	ray of light	0005
fa	fá	cicada	0049
faq	fáq	hero	0050
faqə	fá.qə	piece of bamboo	0051
fauŋ	fáᵘŋ	cheek	0052
fentəgɨt	fɛ́n.tə.ɣ̀ɨ̀t	all	0057
fetne	fɛ́t.ne	bundle	0058
fəgət	fə́.gət	stretcher	0053
fətnaŋ	fə́t.naŋ	white	0054
fi	fí	work, garden	0059
fləŋgon	fləŋ.gon	axe	0055
floŋ	flóŋ	to	0056
flu	flú	wing	0061
fuqunəp	fú.qu.nə̀p	spirit	0060
ganəŋ	gá.nəŋ	yours	0071
gaqɨŋ	gá.qɴ	grease	0062
gebɨŋ	gé.bŋ	inside	0074
gəbe	gə.bé	tail feathers	0063
gəbet	gə.bét	melon sp.	0064
gəbibim	gə́.bi.bìm	bone marrow	0065
gələŋ	gə.lə́ŋ	game	0068
gəmbom	gəm.bóm	bean	0070

Phonemic	Phonetic	Gloss	Reference
gəmət	gə.mə́t	snake (generic)	0069
gənaŋ	gə.náŋ	hole	0081
gənəŋ	gə́.nəŋ	plot of land	0072
geq	gɛ́ᵊq	animal (generic)	0075
gəq	gə́q	you	0066
gəq-ŋa	gəq.ɴá	you yourself	0067
gətneŋ	gə́t.neŋ	frog (generic)	0073
gi	gí	rain (n)	0085
gisawəq	gi.sá.wəq	*friarbird sp.	0086
*Helmeted Friarbird (*Philemon buceroides*)			
gisibə	gí.si.bə̀	bat (Flying Fox)	0080
gisibə-gisibə	gí.si.bə̀ gí.si.bə̀	arachnid sp.	0082
gɨgɨlɨq	gɨ́.ɣɨ.lɨ̀q	gums	0077
gɨq	gɨ́q	thirdborn son	0078
gɨtnem	gɨ̌t.nɛ́m	skin	0084
gɨtnəq	gɨ̌t.nə́q	hiccup (n)	0083
glu	gɾú	scar	0079
go	gó	sun	0087
goin	gó^{i}n	black	0088
gonteq	gón.tɛᵊq	grasshopper	0089
gufut	gú.fut	wind	0076
gulət	gú.lət	year	0090
guma	gu.má	smooth	0091
gumək	gu.mə́q	spider (generic)	0092
guwam	gwám	ginger sp.	0093
guwəŋ-guwəŋ	gwə́ŋ.gwə̀ŋ	round	0095
guwəq-meŋ	gwə́q.mèŋ	*cuscus sp.	0094
*Mountain Cuscus (*Phalanger carmelitae*)			
i	í	this	0097
ibəbo	í.bə.bò	unstable	0098
ibit	i.bít	sprinkle	0099
idi	í.di	this	0100
ifit	i.fít	banana sp.	0101
ijəŋen	i.jə́.ŋɛn	thin	0107
imbən	im.bə́n	yam sp.	0102
imet	i.mɛ́t	banana sp.	0103
ip	íp	bird (generic)	0104
isit	í.ʃit	kunai grass	0105
isopmijaŋ	i.sòp.mi.jáŋ	prayer	0106
jalɨ	já.lɨ	two	0295
jə	jə́	this	0294
jəgu	jə́.gu	*pigeon sp.	0296
*Pinon Imperial-pigeon (*Ducula pinon*)			
jəlobɨ	jə́.lo.bʉ̀	banana (generic)	0298
jəmbəm	jə́m.bəm	tree moss sp.	0299

Phonemic	Phonetic	Gloss	Reference
jəŋen	jə́.ŋɛn	much later	0300
jəŋgloŋ	jə́ŋ.gɾoŋ	thanks	0303
jəq	jə́q	string bag	0297
jəqu	jə́.qu	*rat sp.	0302
*Uneven-toothed Rat (*Anisomys imitator*)			
jəwa	jə́.wa	banana sp.	0301
joŋ	jóŋ	shade	0304
jot	jót	house	0305
lamut	lá.mut	poison (n)	0150
lem	lɛ́m	plateau	0152
ləgəmandɨ	lə̀.gə.mán.dɨ	dream	0151
lofem	lo.fɛ́m	gecko	0153
lumbot	lum.bót	cuscus sp.	0154
mafu	má.fu	pandanus nut	0155
malɨŋ	má.lɨŋ	palm	0156
masɨ	má.sɨ	what?	0157
masɨq	má.sɨq	inner layer of skin	0158
membɨ	mɛ́m.bɨ	head	0165
memdɨ	mɛ́m.dɨ	sweat (n)	0166
men	mɛ́n	mouth	0167
məjəpun	mə́.jə.pùn	banana sp.	0164
məlom	mə.lóm	owner	0159
məndan	mə́n.dan	sound	0161
mənden	mən.dén	back	0321
məndə	mə́n.də	talk	0160
məndogu	mə́n.do.gù	tree sp.	0162
meŋ	mɛ́ŋ	mother	0168
məŋameŋ	mə́.ŋa.mɛ̀ŋ	plant sp.	0163
mi-dam	mín.dàm	waterfall	0173
mi-gəfəŋ	míŋ.gə.fə̀ŋ	lake	0174
miq	míᵊq	bathe	0171
miq-qə	míᵊ.qə	bathe-ss	0172
moin	móⁱn	wrong	0175
molu	mó.lu	citrus	0177
mombə	mɔ́m.bə	leech	0178
mondagɨ	mɔn.dá.gɨ	banana sp.	0180
monə	mó.nə	secondborn son	0179
monsəŋ	món.səŋ	*fantail sp.	0181
*Admiralty Rufous Fantail (*Rhipidura semirubra*)			
moq	mɔ́q	firstborn daughter	0176
mulamut	mu.lá.mut	rain shelter	0169
mulin	mu.ɾín	dried out	0186
mundan	mun.dán	knee	0170
muŋgeq	mŭŋ.géq	eel	0187
muq	múq	enemy, fight	0182

Phonemic	Phonetic	Gloss	Reference
muqɨŋ	mú.qɴ	sprout	0183
muqujə	mù.qu.jə́	pig	0185
muquwəŋ	mú.qu.wə̀ŋ	fog	0184
musu	mú.su	yam sp.	0188
mut	mút	grub	0189
na dlal-ŋət	nán.dɨ̌.lá.lət	1sg.emph break-1sg:npst	0385
nai	náⁱ	time	0190
nain	náⁱn	egg	0191
nandɨ-ula-lət	nán.du:.là.lət	be unknowledgeable-1sg:pres	0383
nəbiŋ	nə́.biŋ	banana sp.	0192
nəjətət	nə.jə́.tət	frog sp.	0202
nənəq	nə.nə́q	child	0195
nənəq-sɨ	nə.nə́q.sɨ	children	0196
nəŋgət	nə́ŋ.gət	blood	0197
nəq	nə́q	me	0193
nə-qaŋ	nə́ɴ.qaŋ	two men	0198
nə-qədeq	nə́ɴ.qə.dèq	men	0199
nəq-ŋə	nəq.ɴá	me myself	0194
nə-ugem	nə́ᵘ.gɛm	aggressor, spice	0200
nəulə	nə́ᵘ.lə	bamboo sp.	0201
nimi-lo	nɨ̌.mɨ̌.ló	o cousin (endearing)	0310
nimin	ní.min	cousin	0375
nindɨ	nín.dɨ	we	0203
nineq	ni.nɛ́q	we two	0204
niŋgɨt	nɨ̌ŋ.gɨ̌t	one	0205
nɨjol-be	nɨ̌.jó.le	force (him)-2sg:imp	0384
nɨləm-nɨləm	nɨ̌.ləm.nɨ̌.ləm	heat vapor	0206
nɨutumpə-be	nù.u.túm.pə.wè	praise (him)-2sg:imp	0382
nol	nó.lu	brother	0369
noŋ	nóŋ	knife	0207
ofən	ó.fən	pig rope	0208
omin	ó.min	rathole	0209
opsa	wóp.sa	grunt (n)	0210
pas	pás	rope	0211
pelɨq	pé.lʉ̃q	yam sp.	0213
pempəŋ	pɛ́m.pəŋ	shoulder	0214
pilup	pí.lup	arrowhead	0217
pit	pít	lightning	0215
puq	púq	crack	0212
pusoŋ	pu.sóŋ	calf	0216
qabuŋ	qá.bŋ	smell	0108
qadɨgɨ	qá.dɨ̌.gɨ	smoke	0109
qadɨp	qá.dɨ̌p	wood, fire	0110
qalaut	qa.láᵘt	cabbage	0111

Phonemic	Phonetic	Gloss	Reference
qalin	qá.ɾin	good	0113
qalɨ (LW)	qá.lɨ	car	0112
qamuŋ	qá.muŋ	cucumber	0114
qanum	qá.nɨ̌m	*tree kangaroo sp.	0115
*Huon Tree-kangaroo (*Dendrolagus matschiei*)			
qapmɨŋgem	qáp.mŋ.gɛm	near	0116
qas	qás	ground trap	0117
qaup	qáᵘp	quiet	0118
qebɨgɨt	qé.bɨ̌.gɨ̌t	rat (generic)	0130
qelɨ	qé.lɨ	hand	0363
qenɨŋ	qé.nŋ	earthquake	0134
qepmə	qép.mə	day	0135
qeqaq	qé.qaq	masalai spirit	0131
qeqe	qé.qe	roots	0132
qəbot	qə́.bot	pot, pan	0119
qədəŋ	qə́.dəŋ	bamboo	0120
qəfedap	qə.fé.dap	claw upwards	0121
qəjəp	qə́.jəp	fourthborn daughter	0128
qəjəp-pinin	qə́.jəp.pi.nín	seventhborn daughter	0129
qəloŋ	qə.lóŋ	greed	0122
qəloŋən	qə.ló.ŋən	*bird sp.	0123
*Yellow-browed Honeyeater (*Melidectes rufocrissalis*)			
qəme	qə́.me	land	0124
qəsigi	qə́.si.gì	*cuscus sp.	0125
*[yellow] Spotted Cuscus (*Spilocuscus maculatus*)			
qətəp	qə.tə́p	twins	0126
qəwə	qə́.wə	in-law	0127
qɨdə	qə̌.də́	greens	0136
qɨtɨl	qɨ̌tɨ́lɨ	(long) bone	0351
qləqlen	qɨ̌.lə́.qɨ̌.lɛ̀n	soft	0137
qloŋginəŋ	qɨ̌.lóŋ.gɨ̌.nə̀ŋ	*lory sp.	0133
*Eastern Black-capped Lory (*Lorius hypoinochrous*)			
qobɨse	qó.bɨ̌.sè	chicken	0139
qoblep	qó.bɨ̌.lèp	anger	0138
qoda	qó.da	new	0140
qodaq	qó.daq	raw	0141
qogɨt	qó.gŭt	not yet	0142
qojepmət	qo.jɛ́p.mət	frog sp.	0146
qondinəm	qón.di.nə̀m	*bird of paradise sp.	0143
*Emperor Bird of Paradise (*Paradisaea guilielmi*)			
qosɨqɨŋ	qó.sɨ̌.qɴ̀	ants (generic)	0144
qowəŋgɨt	qo.wə́ŋ.gɨ̌t	mushroom sp.	0145
qudal	qu.dá.lɨ	(fat) bone	0327
qulibi	qú.ɾi.bì	navel	0147
qusəmbə	qu.sə́m.bə	big	0148

Phonemic	Phonetic	Gloss	Reference
qusəŋ-qusəŋ	qu.sə́ʁ.qɯ.sə̀ŋ	big-pl	0306
qusuwət	qù.su.wə́t	tree sp.	0149
saqumpə	sá.qum.pə	small	0218
sateu	sa.té^{u}	rat sp.	0219
sawə	sá.wə	fourthborn son	0220
sendapoq	sɛ́n.da.pòq	cocoon	0231
seut	sɛ́^{u}t	*bird sp.	0232
*Grey-streaked Honeyeater (*Ptiloprora perstriata*)			
səduwəm	sə́.du.wə̀m	spider sp.	0221
səflet	sə́.fɨ̃.lèt	*sugar glider	0222
*Sugar Glider (*Pataurus breviceps*)			
səlefəqa	sə.lé.fə.qà	gust	0224
səmujuq	sə́.mu.jùq	lizard sp.	0225
səŋem	sə́.ŋɛm	door	0226
səŋgotə	sə́ŋ.go.tə̀	*quoll sp.	0227
*New Guinea Quoll (*Dasyurus albopunctatus*)			
səp	sə́p	dog	0228
səquwəq	sə́.qu.wə̀q	flea	0223
sətɨq	sə́.tɨ̌q	termite	0229
səwə	sə́.wə	*duck sp.	0230
*Salvadori's Teal duck (*Anas waigiuensis*)			
sglen	sɨ̌.gɨ̌.ɾén	strong	0236
sibət	sɨ̌.bə́t	food	0233
sibət-gem	sɨ̌.bə́t.gɛm	coconut	0234
sibim	si.bím	cold	0235
sidə	sí.də	sweet potato (Tok Pisin: *kaukau*)	0242
snɨq	sɨ̌.nʉ̋q	true	0241
soŋgal	sóŋ.gal	*bird sp.	0243
*Huon Bowerbird (*Amblyornis macgregoriae germanus*)			
soweq	só.weq	*cassowary sp.	0244
*Dwarf Cassowary (*Casuarius bennetti*)			
squl (LW)	sɨ̌.qú.lu	school	0238
squla	sɨ̌.qú.ɾa	joint	0237
squn	sqún	bump	0239
squn-squn	sqún-sqùn	mountains	0240
ta-efa-be	tá.e.fà.we	preach-2sg:imp	0381
tameŋ	tá.mɛŋ	tomorrow	0245
tameŋslə	ta.mɛ́ŋ.sɨ̌.lə̀	morning	0247
tamɨŋ	tá.mɨŋ	woman	0246
tam-tam	tám.tàm	women	0248
tas	tás	cane	0250
taweŋ	tá.weŋ	*taro sp.	0252
*Singapore Taro, Taro kongkong (*Colocasia hontosoma*)			
teflet	té.fɨ̃.lèt	rubbish	0258

Phonemic	Phonetic	Gloss	Reference
tequp	té.ʁup	hat	0259
təfələ	tə.fə́.lə	afternoon	0253
təndon	tən.dón	night	0255
tənəpmoŋ	tə.nə́p.mɔŋ	*ring-tailed possum spp.	0254
*Plush-coated Ringtail (*Pseudocheirops corinnae*)			
*Painted Ringtail (*Pseudocheirus forbesi*)			
təŋan	tə́.ŋan	branch	0256
təŋgə	tə́ŋ.gə	*turkey sp.	0257
* Wattled Brush-turkey (*Aepypodius arfakianus*)			
təqəsep	tə́.qə.sɛ̀p	closed	0249
təwa	tə́.wa	ridge	0251
tibijam	tì.bi.jám	frog sp.	0263
tibijam-meŋ	tì.bi.já.mɛ̀ŋ	fly sp.	0264
timen	tí.mɛn	old	0262
tisəŋ	ti.sə́ŋ	sneeze (n)	0265
tɨ̋q	tɨ̋́q	clothing	0260, 0357
tɨ̋q-jəq	tɨ̋́q.ɨ̌.jə̀q	clothes	0261
tlan	tɾán	snakeskin	0266
tlən	tɾə́n	ringworm	0267
tlɨ̋q	tɾʊ̋́q	mosquito	0268
tobuŋ	tó.buŋ	facial hair	0269
tupmuŋqə	túp.mʊ̆ʁ.qə̀	short	0270
tuwə	tú.wə	firstborn son	0271
tuwə-nə	tú.wə.nə̀	firstborn son-1sg.poss	0311
tuwəsaq	tú.wə.sə̀q	leaf sp. (for smoking tobacco)	0272
u	ú	that	0273
udu	u.dú	that	0274
ugem	u.gɛ́m	sharp	0275
ujaŋ	u.jáŋ / wi.jáŋ	tail	0279
usuŋ	ú.suŋ	above	0276
ut	út	stinging nettle	0277
utabɨ̋	u.tá.bɨ̋	crossbeams	0278
wagem	wà.gɛ́m	bad	0281
wagem=nəŋ	wà.gɛ́.məŋ	bad place	0282
wagum	wá.gum	hand drum	0283
we	wé	*parrot sp.	0286
* Papuan King-parrot (*Alisterus chloropterus*)			
wegɨ̋	wé.gɨ̋	mushroom (generic)	0287
wembi	wɛ́m.bi	frog sp.	0288
wenə	wé.nə	secondborn daughter	0290
wenɨ̋m	wé.nɨ̌m	mango	0289
wə	wə́	that	0280
wəgəm	wə́.gəm	nothing	0284
wəmsəŋ	wə́m.səŋ	fireplace	0285
wip	wíp	freckle	0291

Phonemic	Phonetic	Gloss	Reference
wo	wó	name	0292
woŋ	wóŋ	steam	0293

APPENDIX 2: PHONEME FREQUENCY COUNTS

Table 55 and Table 56 provide the frequencies of every consonant and vowel phoneme, respectively, based on a collection of 1448 morphemes. This collection includes nouns, verbs, adjectives, adverbs, pronouns, demonstratives, connectives, and indigenous proper nouns. Bound verbal and nominal suffixes and enclitics are included as well. The collection *excludes* all reduplicated forms, compounds, alternant forms, and phrases, because the goal is that every morpheme in the list be unique (i.e., used only one time). However, a few overlaps occur. This is due, for instance, to recurrences of some bound morphemes (e.g., in compounds). Additionally, some morphemes occur both as nouns and as verbs, and these are thus counted twice. The sample is taken from the lexicon that I have personally compiled since 2009.

The phonemes in the left columns are listed in order of decreasing overall frequency within each major class (i.e., consonant vs. vowel). The "total #" column indicates the total number of *tokens* within the collection (e.g., if a single morpheme contains two /m/s, then two are counted in this tally). Consonant token totals are counted for the following environments (divided into separate columns in the tables): morpheme-initial, morpheme-final, preconsonantal, postconsonantal, and intervocalic. Vowel token totals are counted for the following environments: morpheme-initial, morpheme-final, prevocalic, postvocalic, and interconsonantal. The environments refer to *morpheme boundaries* rather than word boundaries since many bound inflectional affixes are

included as separate entries. This results in certain categories being skewed in a way that is not consistent with word-initial and -final environments (e.g., /ŋ/ does not typically occur word-initially, but a number of suffixes begin with this phoneme). The percentages given indicate the percentage of consonants or vowels *in that environment*. Therefore, 575 total /m/s is equal to 13.1% of all consonant tokens in the collection. Additionally, 155 /m/s occur in morpheme-initial position, accounting for 10.6% of all morpheme-initial consonants.

The tokens in the various environments do not necessarily add up to the total number of tokens (in the first column). This is due to various statistical complications in the data (e.g., the morpheme /m/ ‘give’ is counted once in initial position, and once in final position). Nonetheless, the numbers and percentages provide a clear overall picture of the distribution of segments.

Finally, note that the barred-i vowel is counted in every location where it *surfaces*. Therefore, even though /floŋ/ ‘to’ has a phonemic consonant cluster (as discussed in §5.1), this is typically interrupted with the epenthetic [ɨ]. In order to illustrate the particular frequency of [ɨ], morphemes with underlying consonant clusters are analyzed as being CɨC sequences (e.g., /floŋ/ → /fɨloŋ/). This explains why /l/ does not occur postconsonantally in Table 55.

Table 55: Consonant phoneme frequency chart

	Total #	%	Initial	%	Final	%	V_ C	%	C _V	%	V _ V	%
m	575	13.1	155	10.6	186	18.4	75	21.7	40	12.2	116	8.8
q	491	11.2	210	14.4	156	15.4	4	1.2	21	6.4	97	7.4
ŋ	443	10.1	12	0.8	275	27.1	100	29.0	3	0.9	47	3.6
n	407	9.3	86	5.9	126	12.4	87	25.2	23	7.0	97	7.4
l	396	9.0	26	1.8	47	4.6	0	0.0	0	0.0	323	24.6
t	375	8.5	143	9.8	140	13.8	18	5.2	26	7.9	39	3.0
g	327	7.4	150	10.3	0	0.0	0	0.0	75	22.8	87	6.6
b	286	6.5	114	7.8	9	0.9	0	0.0	52	15.8	106	8.1
d	284	6.5	108	7.4	0	0.0	0	0.0	65	19.8	115	8.8
s	244	5.6	115	7.9	4	0.4	0	0.0	6	1.8	111	8.5
p	190	4.3	28	1.9	68	6.7	61	17.7	15	4.6	10	0.8
f	146	3.3	75	5.1	2	0.2	0	0.0	1	0.3	71	5.4
w	118	2.7	73	5.0	0	0.0	0	0.0	0	0.0	51	3.9
j	112	2.6	67	4.6	0	0.0	0	0.0	2	0.6	41	3.1
	4394		1462		1013		345		329		1311	

Table 56: Vowel phoneme frequency chart

	Total #	%	Initial	%	Final	%	_ V	%	V _	%	C _ C	%
ə	895	28.6	11	12.8	128	29.4	4	10.5	0	0.0	752	29.7
ɨ	493	15.7	0	0.0	70	16.1	1	2.6	0	0.0	422	16.6
a	409	13.1	12	14.0	48	11.0	25	65.8	1	2.6	323	12.7
e	387	12.4	9	10.5	79	18.2	4	10.5	0	0.0	295	11.6
u	367	11.7	22	25.6	36	8.3	0	0.0	22	57.9	287	11.3
o	335	10.7	8	9.3	34	7.8	4	10.5	0	0.0	289	11.4
i	247	7.9	24	27.9	40	9.2	0	0.0	15	39.5	168	6.6
	3133		86		435		38		38		2536	

In summary, the surveyed compilation of 1448 morphemes contains a total of 4394 consonants and 3133 vowels. Consequently, on average each Ma Manda morpheme consists of a mean of 3.0 consonants and 2.2 vowels, *modulo* a few minor complications.

APPENDIX 3: NOMINAL POSSESSION PARADIGMS

Table 57 supplies eleven nouns in possession paradigms. These nouns were used as a source for my understanding of a number of morphophonemic alternations. Every noun except /tɨq/ ‘clothing’ is an inalienably possessed noun. In Ma Manda, a majority of body part and kinship terms are inalienably possessed. Often the 3SG form of these nouns is suppletive (with a segment or two different from the suffixable form). The words are alphabetized by phoneme, and then listed in their various possessive forms. Each form includes a number that references a specific audio file on the disc.

Table 57: Nominal possession paradigms

/stem/ ‘gloss’	3sg	1sg	1pl	2sg	23pl	23du
/be(p)/ ‘father’	/be/ [bé] 0315	/bep-nə/ [bɛ́p.mə] 0316	/bep-neq/ [bɛ́p.mɛq] 0317	/be-gə/ [bɛ.ɣə] 0318	/be-sɨ/ [bɛ́.sɨ] 0319	/be-seq/ [bɛ́.sɛq] 0320
/bəjaq/ ‘armpit’	/bəja/ [bə.já] 0345	/bəjaq-nə/ [bə.jáq.ɴə] 0346	/bəjaq-neq/ [bə.jáq.ɴɛq] 0347	/bəjaq-gə/ [bə.já.ɣə] 0348	/bəjaq-sɨ/ [bə.jáq.sɨ] 0349	/bəjaq-seq/ [bə.jáq.sɛq] 0350
/dijoq/ ‘chest’	/dijo/ [di.jó] 0333	/dijoq-nə/ [di.jóq.ə̃] 0334	/dijoq-neq/ [di.jóq.ɴɛq] 0335	/dijoq-gə/ [di.jo.ɣə] 0336	/dijoq-sɨ/ [di.jóq.sɨ] 0337	/dijoq-seq/ [di.jóq.sɛq] 0338
/əmda/ ‘nose’	/əmda/ [əm.dá] 0339	/əmda-nə/ [əm.dá.nə] 0340	/əmda-neq/ [əm.dá.nɛq] 0341	/əmda-gə/ [əm.dá.ɣə] 0342	/əmda-sɨ/ [əm.dá.sɨ] 0343	/əmda-seq/ [ə̀m.da.sɛ́q] 0344
/mənde/ ‘back’	/mənden/ [mən.dɛ́n] 0321	/mənde-nə/ [mə́n.de.nə̀] 0322	/mənde-neq/ [mə̀n.de.nɛ́q] 0323	/mənde-gə/ [mən.dé.ɣə] 0324	/mənde-sɨ/ [mən.dé.sɨ] 0325	/məndeseq/ [mən.de.sɛ́q] 0326

/stem/ ‘gloss’	3sg	1sg	1pl	2sg	23pl	23du
/nimi/ ‘cousin’	/nimin/ [ní.min] 0375	/nimi-nə/ [nɨ̌.mɨ̌.nə́] 0376	/nimi-neq/ [nɨ̌.mɨ̌.nɛ́q] 0377	/nimi-gə/ [nɨ̌.mɨ̌ŋ.gə́] 0378	/nimi-sɨ/ [nɨ̌.mɨ̌.sɨ́] 0379	/nimi-seq/ [nɨ̌.mɨ̌.sɛ́q] 0380
/nol/ ‘brother’	/nol/ [nó.lu] 0369	/nol-nə/ [nót.nə] 0370	/nol.neq/ [not.nɛ́q] 0371	/nol-gə/ [nó.ɣə] 0372	/nol-sɨ/ [nó.su] 0373	/nol-seq/ [no.sɛ́q] 0374
/qelɨ/ ‘hand’	/qelɨ/ [qé.lɨ] 0363	/qelɨ-nə/ [qé.lɨ̌.nə̀] 0364	/qelɨ-neq/ [qè.lɨ̌.nɛ́q] 0365	/qelɨ-gə/ [qé.lɨ̌.ɣə̀] 0366	/qelɨ-sɨ/ [qé.lɨ̌.sɨ̀] 0367	/qelɨ-seq/ [qè.lɨ̌.sɛ́q] 0368
/qɨtɨl/ ‘(long) bone’	/qɨtɨl/ [qɨ̌.tɨ́.lɨ] 0351	/qɨtɨl-nə/ [qɨ́.tɨ̌t.nə̀] 0352	/qɨtɨl-neq/ [qɨ̀.tɨ̌t.nɛ́q] 0353	/qɨtɨl-gə/ [qɨ̀.tɨ̌.ɣə́] 0354	/qɨtɨl-sɨ/ [qɨ̀.tɨ̌.sɨ̀] 0355	/qɨtɨl-seq/ [qɨ̀.tɨ̌.sɛ́q] 0356
/qudəl/ ‘(fat) bone’	/qudal/ [qu.dá.lɨ] 0327	/qudəl-nə/ [qu.də́t.nə] 0328	/qudəl-neq/ [qu.də́t.nɛq] 0329	/qudəl-gə/ [qu.də́.ɣə] 0330	/qudəl-sɨ/ [qu.də́.sɨ] 0331	/qudəl-seq/ [qu.də́.sɛq] 0332
/tɨq/ ‘clothing’	/tɨq/ [tɨ́q] 0357	/tɨq-nə/ [tɨ́q.ɴə] 0358	/tɨq-neq/ [tɨ́q.ɴɛq] 0359	/tɨq-gə/ [tɨ́q.gə] 0360	/tɨq-sɨ/ [tɨ́q.sɨ] 0361	/tɨq.seq/ [tɨ́q.sɛq] 0362

APPENDIX 4: VERBAL TAM PARADIGMS

The following tables provide full TAM (tense, aspect, modality) and subject agreement suffix paradigms for ten verbs (TAM and subject agreement suffixes are fused). These verbs were used in order to analyze many of the morphophonemic alternations that take place. Each of these verbs behaves slightly differently from all the others for one reason or another. In each table, every row belongs to a separate tense or mood and has a number that corresponds to the correct audio file. The final row is composed of medial suffixes that are not fully inflected for tense. This row also includes the participle form of the verb.

Unlike the other audio files, the files here each include a series of verb forms in carrier sentences (frames). Due to the clausal nature of these recordings, stress is not transcribed for these verbs. Table 58 provides each of the words that are spoken before each verb in the various recorded sentences.

Table 58: Frames for TAM paradigms

	1SG	2SG	3SG	1DU	23DU	1PL	23PL
RPST	/sisə/ '±2 days' →						
NPST	/tameŋslə/ 'morning' →						
PRES	/tameŋslə/ 'morning' →						
NFUT	/təfələ/ 'afternoon' →						
SBJV	/sisə/ '±2 days' →						
IMP		/gəq/ '2sg'			/sɨdɨ/ '23pl'		/sɨdɨ/ '23pl'
	SS	1SG.DS	23.DS	1PL.DS	SIM		
MED	–	–	–	–	–	PART	–

Table 59: /lo/ ‘go up’

	1SG	2SG	3SG	1DU	23DU	1PL	23PL
RPST 0386	/lo-got/ [lo.got]	/lo-goŋ/ [lo.goŋ]	/lo-goq/ [lo.goq]	/lo-gɨmot/ [lo.gŭ.mot]	/lo-gɨmoq/ [lo.gŭ.moq]	/lo-gɨm/ [lo.gŭm]	/lo-gɨŋ/ [lo.gŭŋ]
NPST 0387	/lo-ŋət/ [lo.ŋət]	/lo-ŋəŋ/ [lo.ŋəŋ]	/lo-ŋəq/ [lo.ŋaq]	/lo-ŋamot/ [lo.ŋa.mot]	/lo-ŋamoq/ [lo.ŋa.moq]	/lo-ŋam/ [lo.ŋam]	/lo-ŋ/ [loŋ]
PRES 0388	/lo-lət/ [lo.lət]	/lo-ləŋ/ [lo.ləŋ]	/lo-ləq/ [lo.laq]	/lo-wamot/ [lo.wa.mot]	/lo-wamoq/ [lo.wa.moq]	/lo-wam/ [lo.wam]	/lo-wəŋ/ [lo.wəŋ]
NFUT 0389	/lo-tat/ [lo.tat]	/lo-taŋ/ [lo.taŋ]	/lo-taq/ [lo.taq]	/lo-ntamot/ [lon.ta.mot]	/lo-ntamoq/ [lon.ta.moq]	/lo-ntam/ [lon.tam]	/lo-ntaŋ/ [lon.taŋ]
SBJV 0390	/lo-bet/ [lo.wet]	/lo-beŋ/ [lo.wɛŋ]	/lo-beq/ [lo.wɛq]	/lo-dem/ [lo.dɛm]	/lo-deŋ/ [lo.dɛŋ]	/lo-nɨm/ [lo.nŭm]	/lo-neŋ/ [lo.nɛŋ]
IMP 0391		/lo-be/ [lo.we]			/lo-de/ [lo.de]		/lo-ne/ [lo.ne]
	SS	**1SG.DS**	**23.DS**	**1PL.DS**	**SIM**		
MED 0392	/lo-qə/ [lo.qə]	/lo-ŋələ/ [lo.ŋə.lə]	/lo-ŋɨlɨ/ [lo.ŋŭ.lŭ]	/lo-ŋɨtnə/ [lo.ŋɨ̆t.nə]	/lo-gɨ/ [lo.gu]	**PART** 0393	/lo-ban/ [lo.wan]

Table 60: /qu/ ‘go’

	1SG	2SG	3SG	1DU	23DU	1PL	23PL
RPST 0394	/qu-got/ [qu.got]	/qu-goŋ/ [qu.goŋ]	/qu-goq/ [qu.goq]	/qu-gɨmot/ [qu.gŭ.mot]	/qu-gɨmoq/ [qu.gŭ.moq]	/qu-gɨm/ [qu.gŭm]	/qu-gɨŋ/ [qu.gŭŋ]
NPST 0395	/qu-ŋət/ [qu.ŋət]	/qu-ŋəŋ/ [qu.ŋəŋ]	/qu-ŋəq/ [qu.ŋaq]	/qu-ŋamot/ [qu.ŋa.mot]	/qu-ŋamoq/ [qu.ŋa.moq]	/qu-ŋam/ [qu.ŋam]	/qu-ŋ/ [quŋ]
PRES 0396	/qu-jət/ [qu.jɛt]	/qu-jəŋ/ [qu.jəŋ]	/qu-jəq/ [qu.jaq]	/qu-wamot/ [qu.wa.mot]	/qu-wamoq/ [qu.wa.moq]	/qu-wam/ [qu.wam]	/qu-wəŋ/ [qu.wəŋ]
NFUT 0397	/qu-tat/ [qu.tat]	/qu-taŋ/ [qu.taŋ]	/qu-taq/ [qu.taq]	/qu-ntamot/ [qun.ta.mot]	/qu-ntamoq/ [qun.ta.moq]	/qu-ntam/ [qun.tam]	/qu-ntaŋ/ [qun.taŋ]
SBJV 0398	/qu-bet/ [qu.wet]	/qu-beŋ/ [qu.wɛŋ]	/qu-beq/ [qu.wɛq]	/qu-dem/ [qu.dɛm]	/qu-deŋ/ [qu.dɛŋ]	/qu-nɨm/ [qu.nŭm]	/qu-neŋ/ [qu.nɛŋ]
IMP 0399		/qu-be/ [qu.we]			/qu-de/ [qu.de]		/qu-ne/ [qu.ne]
	SS	**1SG.DS**	**23.DS**	**1PL.DS**	**SIM**		
MED 0400	/qu-qə/ [qu.qə]	/qu-ŋələ/ [qu.ŋə.lə]	/qu-ŋɨlɨ/ [qu.ŋŭ.lu]	/qu-ŋɨtnə/ [qu.ŋŭ̆t.nə]	/qu-gɨ/ [qu.gu]	**PART** 0401	/qu-ban/ [qu.wan]

Table 61: /fɨ/ ‘come down’

	1SG	2SG	3SG	1DU	23DU	1PL	23PL
RPST 0402	/fɨ-got/ [fŭ.got]	/fɨ-goŋ/ [fŭ.goŋ]	/fɨ-goq/ [fŭ.goq]	/fɨ-gɨmot/ [fŭ.gŭ.mot]	/fɨ-gɨmoq/ [fŭ.gŭ.moq]	/fɨ-gɨm/ [fŭ.gŭm]	/fɨ-gɨŋ/ [fŭ.gŭŋ]
NPST 0403	/fɨ-ŋət/ [fŭ.ŋət]	/fɨ-ŋəŋ/ [fŭ.ŋəŋ]	/fɨ-ŋəq/ [fŭ.ŋaq]	/fɨ-ŋamot/ [fŭ.ŋa.mot]	/fɨ-ŋamoq/ [fŭ.ŋa.moq]	/fɨ-ŋam/ [fŭ.ŋam]	/fɨ-ŋ/ [fŭŋ]
PRES 0404	/fɨ-lət/ [fŭ.lət]	/fɨ-ləŋ/ [fŭ.ləŋ]	/fɨ-ləq/ [fŭ.laq]	/fɨ-wamot/ [fŭ.wa.mot]	/fɨ-wamoq/ [fŭ.wa.moq]	/fɨ-wam/ [fŭ.wam]	/fɨ-wəŋ/ [fŭ.wəŋ]
NFUT 0405	/fɨ-tat/ [fŭ.tat]	/fɨ-taŋ/ [fŭ.taŋ]	/fɨ-taq/ [fŭ.taq]	/fɨ-ntamot/ [fŭn.ta.mot]	/fɨ-ntamoq/ [fŭn.ta.moq]	/fɨ-ntam/ [fŭn.tam]	/fɨ-ntaŋ/ [fŭn.taŋ]
SBJV 0406	/fɨ-bet/ [fŭ.wet]	/fɨ-beŋ/ [fŭ.wɛŋ]	/fɨ-beq/ [fŭ.wɛq]	/fɨ-dem/ [fŭ.dɛm]	/fɨ-deŋ/ [fŭ.dɛŋ]	/fɨ-nɨm/ [fŭ.nŭm]	/fɨ-neŋ/ [fŭ.nɛŋ]
IMP 0407		/fɨ-be/ [fŭ.we]			/fɨ-de/ [fŭ.de]		/fɨ-ne/ [fŭ.ne]
	SS	**1SG.DS**	**23.DS**	**1PL.DS**	**SIM**		
MED 0408	/fɨ-qə/ [fŭ.qə]	/fɨ-ŋələ/ [fŭ.ŋə.lə]	/fɨ-ŋɨlɨ/ [fŭ.ŋŭ.lɯ]	/fɨ-ŋɨtnə/ [fŭ.ŋɨ̌t.nə]	/fɨ-gɨ/ [fŭ.gɯ]	**PART** 0409	/fɨ-ban/ [fŭ.wan]

Table 62: /mo/ ‘go down’

	1SG	2SG	3SG	1DU	23DU	1PL	23PL
RPST 0410	/mo-got/ [moŋ.got]	/mo-goŋ/ [moŋ.goŋ]	/mo-goq/ [moŋ.goq]	/mo-gɨmot/ [moŋ.gŭ.mot]	/mo-gɨmoq/ [moŋ.gŭ.moq]	/mo-gɨm/ [moŋ.gŭm]	/mo-gɨŋ/ [moŋ.gŭŋ]
NPST 0411	/mo-ŋət/ [mo.ŋət]	/mo-ŋəŋ/ [mo.ŋəŋ]	/mo-ŋəq/ [mo.ŋaq]	/mo-ŋamot/ [mo.ŋa.mot]	/mo-ŋamoq/ [mo.ŋa.moq]	/mo-ŋam/ [mo.ŋam]	/mo-ŋ/ [moŋ]
PRES 0412	/mo-lət/ [mo.lət]	/mo-ləŋ/ [mo.ləŋ]	/mo-ləq/ [mo.laq]	/mo-wamot/ [mo.wa.mot]	/mo-wamoq/ [mo.wa.moq]	/mo-wam/ [mo.wam]	/mo-wəŋ/ [mo.wəŋ]
NFUT 0413	/mo-tat/ [mom.bɨ.tat]	/mo-taŋ/ [mom.bɨ.taŋ]	/mo-taq/ [mom.bɨ.taq]	/mo-ntamot/ [mon.ta.mot]	/mo-ntamoq/ [mon.ta.moq]	/mo-ntam/ [mon.tam]	/mo-ntaŋ/ [mon.taŋ]
SBJV 0414	/mo-bet/ [mom.bet]	/mo-beŋ/ [mom.bɛŋ]	/mo-beq/ [mom.bɛq]	/mo-dem/ [mon.dɛm]	/mo-deŋ/ [mon.dɛŋ]	/mo-nɨm/ [mo.nŭm]	/mo-neŋ/ [mo.nɛŋ]
IMP 0415		/mo-be/ [mom.be]			/mo-de/ [mon.de]		/mo-ne/ [mo.ne]
	SS	**1SG.DS**	**23.DS**	**1PL.DS**	**SIM**		
MED 0416	/mo-qə/ [moɴ.qə]	/mo-ŋələ/ [mo.ŋə.lə]	/mo-ŋɨlɨ/ [mo.ŋŭ.lɯ]	/mo-ŋɨtnə/ [mo.ŋɨ̌t.nə]	/mo-gɨ/ [moŋ.gu]	**PART** 0417	/mo-ban/ [mom.ban]

Table 63: /bə/ ‘come’

	1SG	2SG	3SG	1DU	23DU	1PL	23PL
RPST 0418	/bə-got/ [bə.got]	/bə-goŋ/ [bə.goŋ]	/bə-goq/ [bə.goq]	/bə-gɨmot/ [bə.gɨ̆.mot]	/bə-gɨmoq/ [bə.gɨ̆.moq]	/bə-gɨm/ [bə.gɨ̆m]	/bə-gɨŋ/ [bə.gɨ̆ŋ]
NPST 0419	/bə-ŋət/ [bə.ŋət]	/bə-ŋəŋ/ [bə.ŋəŋ]	/bə-ŋəq/ [bə.ŋaq]	/bə-ŋamot/ [bə.ŋa.mot]	/bə-ŋamoq/ [bə.ŋa.moq]	/bə-ŋam/ [bə.ŋam]	/bə-ŋ/ [bəŋ]
PRES 0420	/bə-lət/ [bat]	/bə-ləŋ/ [baŋ]	/bə-ləq/ [baq]	/bə-wamot/ [bə.wa.mot]	/bə-wamoq/ [bə.wa.moq]	/bə-wam/ [bə.wam]	/bə-wəŋ/ [bə.wəŋ]
NFUT 0421	/bə-tat/ [bə.tat]	/bə-taŋ/ [bə.taŋ]	/bə-taq/ [bə.taq]	/bə-ntamot/ [bən.ta.mot]	/bə-ntamoq/ [bən.ta.moq]	/bə-ntam/ [bən.tam]	/bə-ntaŋ/ [bən.taŋ]
SBJV 0422	/bə-bet/ [bə.wet]	/bə-beŋ/ [bə.wɛŋ]	/bə-beq/ [bə.wɛq]	/bə-dem/ [bə.dɛm]	/bə-deŋ/ [bə.dɛŋ]	/bə-nɨm/ [bə.nɨ̆m]	/bə-neŋ/ [bə.nɛŋ]
IMP 0423		/bə-be/ [bə.we]			/bə-de/ [bə.de]		/bə-ne/ [bə.ne]
	SS	**1SG.DS**	**23.DS**	**1PL.DS**	**SIM**		
MED 0424	/bə-qə/ [bə.ʁə]	/bə-ŋələ/ [bə.ŋə.lə]	/bə-ŋɨlɨ/ [bə.ŋɨ̆.lɨ]	/bə-ŋɨtnə/ [bə.ŋɨ̆t.nə]	/bə-gɨ/ [bə.gɨ]	**PART** 0425	/bə-ban/ [bə.wan]

Table 64: /lab/ ‘come up’

	1SG	2SG	3SG	1DU	23DU	1PL	23PL
RPST 0426	/lab-got/ [la.bŭ̆.got]	/lab-goŋ/ [la.bŭ̆.goŋ]	/lab-goq/ [la.bŭ̆.goq]	/lab-gɨmot/ [la.bŭ̆.gŭ̆.mot]	/lab-gɨmoq/ [la.bŭ̆.gŭ̆.moq]	/lab-gɨm/ [la.bŭ̆.gŭ̆m]	/lab-gɨŋ/ [la.bŭ̆.gŭ̆ŋ]
NPST 0427	/lab-ŋət/ [la.bɨ̆.ŋət]	/lab-ŋəŋ/ [la.bɨ̆.ŋəŋ]	/lab-ŋəq/ [la.bɨ̆.ŋaq]	/lab-ŋamot/ [la.bɨ̆.ŋa.mot]	/lab-ŋamoq/ [la.bɨ̆.ŋa.moq]	/lab-ŋam/ [la.bɨ̆.ŋam]	/lab-ŋ/ [la.bɨ̆ŋ]
PRES 0428	/lab-lət/ [la.bŭ̆.lət]	/lab-ləŋ/ [la.bŭ̆.ləŋ]	/lab-ləq/ [la.bŭ̆.laq]	/lab-wamot/ [la.bŭ̆.wa.mot]	/lab-wamoq/ [la.bŭ̆.wa.moq]	/lab-wam/ [la.bŭ̆.wam]	/lab-wəŋ/ [la.bŭ̆.wəŋ]
NFUT 0429	/lab-tat/ [la.bɨ̆.tat]	/lab-taŋ/ [la.bɨ̆.taŋ]	/lab-taq/ [la.bɨ̆.taq]	/lab-ntamot/ [la.bɨ̆n.ta.mot]	/lab-ntamoq/ [la.bɨ̆n.ta.moq]	/lab-ntam/ [la.bɨ̆n.tam]	/lab-ntaŋ/ [la.bɨ̆n.taŋ]
SBJV 0430	/lab-bet/ [la.bet]	/lab-beŋ/ [la.bɛŋ]	/lab-beq/ [la.bɛq]	/lab-dem/ [la.bɨ̆.dɛm]	/lab-deŋ/ [la.bɨ.dɛŋ]	/lab-nɨm/ [la.bɨ̆.nɨ̆m]	/lab-neŋ/ [la.bɨ̆.nɛŋ]
IMP 0431		/lab-be/ [la.be]			/lab-de/ [la.bɨ̆.de]		/lab-ne/ [la.bɨ̆.ne]
	SS	**1SG.DS**	**23.DS**	**1PL.DS**	**SIM**		
MED 0432	/lab-qə/ [la.bŭ̆.qə]	/lab-ŋələ/ [la.bɨ̆.ŋə.lə]	/lab-ŋɨlɨ/ [la.bɨ̆.ŋɨ̆.lɨ]	/lab-ŋɨtnə/ [la.bɨ̆.ŋɨ̆t.nə]	/lab-gɨ/ [la.bŭ̆.gɯ]	**PART** 0433	/lab-ban/ [la.ban]

Table 65: /tə(b)/ ‘do, make’

	1SG	2SG	3SG	1DU	23DU	1PL	23PL
RPST 0434	/tə-got/ [tə.got]	/tə-goŋ/ [tə.goŋ]	/tə-goq/ [tə.goq]	/tə-gɨmot/ [tə.gɨ̆.mot]	/tə-gɨmoq/ [tə.gɨ̆.moq]	/tə-gɨm/ [tə.gɨ̆m]	/tə-gɨŋ/ [tə.gɨ̆ŋ]
NPST 0435	/tə-ŋət/ [tə.ŋət]	/tə-ŋəŋ/ [tə.ŋəŋ]	/tə-ŋəq/ [tə.ŋaq]	/tə-ŋamot/ [tə.ŋa.mot]	/tə-ŋamoq/ [tə.ŋa.moq]	/tə-ŋam/ [tə.ŋam]	/tə-ŋ/ [təŋ]
PRES 0436	/tə-lət/ [tat]	/tə-ləŋ/ [taŋ]	/tə-ləq/ [taq]	/tə-wamot/ [tə.wa.mot]	/tə-wamoq/ [tə.wa.moq]	/tə-wam/ [tə.wam]	/tə-wəŋ/ [tə.wəŋ]
NFUT 0437	/tə-tat/ [tə.bŭ̆.tat]	/tə-taŋ/ [tə.bŭ̆.taŋ]	/tə-taq/ [tə.bŭ̆.taq]	/tə-ntamot/ [tən.ta.mot]	/tə-ntamoq/ [tən.ta.moq]	/tə-ntam/ [tən.tam]	/tə-ntaŋ/ [tən.taŋ]
SBJV 0438	/tə-bet/ [tə.bet]	/tə-beŋ/ [tə.bɛŋ]	/tə-beq/ [tə.bɛq]	/tə-dem/ [tə.dɛm]	/tə-deŋ/ [tə.dɛŋ]	/tə-nɨm/ [tə.nɨ̆m]	/tə-neŋ/ [tə.nɛŋ]
IMP 0439		/tə-be/ [tə.be]			/tə-de/ [tə.de]		/tə-ne/ [tə.ne]
	SS	**1SG.DS**	**23.DS**	**1PL.DS**	**SIM**		
MED 0440	/tə-qə/ [tə.qə]	/tə-ŋələ/ [tə.ŋə.lə]	/tə-ŋɨlɨ/ [tə.ŋɨ̆.lɨ]	/tə-ŋɨtnə/ [tə.ŋɨ̆t.nə]	/tə-gɨ/ [tə.gɨ]	**PART** 0441	/tə-ban/ [tə.ban]

Table 66: /ta(b)/ ‘talk’

	1SG	2SG	3SG	1DU	23DU	1PL	23PL
RPST 0442	/ta-got/ [ta.got]	/ta-goŋ/ [ta.goŋ]	/ta-goq/ [ta.goq]	/ta-gɨmot/ [ta.gɨ̆.mot]	/ta-gɨmoq/ [ta.gɨ̆.moq]	/ta-gɨm/ [ta.gɨ̆m]	/ta-gɨŋ/ [ta.gɨ̆ŋ]
NPST 0443	/ta-ŋət/ [ta.ŋət]	/ta-ŋəŋ/ [ta.ŋəŋ]	/ta-ŋəq/ [ta.ŋaq]	/ta-ŋamot/ [ta.ŋa.mot]	/ta-ŋamoq/ [ta.ŋa.moq]	/ta-ŋam/ [ta.ŋam]	taa-ŋ/ [taŋ]
PRES 0444	/ta-lət/ [ta.jɛt]	/ta-ləŋ/ [ta.jəŋ]	/ta-ləq/ [ta.jaq]	/ta-wamot/ [ta.wa.mot]	/ta-wamoq/ [ta.wa.moq]	/ta-wam/ [ta.wam]	/ta-wəŋ/ [ta.wəŋ]
NFUT 0445	/ta-tat/ [ta.bŭ̆.tat]	/ta-taŋ/ [ta.bŭ̆.taŋ]	/ta-taq/ [ta.bŭ̆.taq]	/ta-ntamot/ [tan.ta.mot]	/ta-ntamoq/ [tan.ta.moq]	/ta-ntam/ [tan.tam]	/ta-ntaŋ/ [tan.taŋ]
SBJV 0446	/ta-bet/ [ta.bet]	/ta-beŋ/ [ta.bɛŋ]	/ta-beq/ [ta.bɛq]	/ta-dem/ [ta.dɛm]	/ta-deŋ/ [ta.dɛŋ]	/ta-nɨm/ [ta.nɨ̆m]	/ta-neŋ/ [ta.nɛŋ]
IMP 0447		/ta-be/ [ta.be]			/ta-de/ [ta.de]		/ta-ne/ [ta.ne]
	SS	**1SG.DS**	**23.DS**	**1PL.DS**	**SIM**		
MED 0448	/ta-qə/ [ta.qə]	/ta-ŋələ/ [ta.ŋə.lə]	/ta-ŋɨlɨ/ [ta.ŋə̆.lɨ]	/ta-ŋɨtnə/ [ta.ŋɨ̆t.nə]	/ta-gɨ/ [ta.gɨ]	**PART** 0449	/ta-ban/ [ta.ban]

Table 67: /ul/ ‘hit’

	1SG	2SG	3SG	1DU	23DU	1PL	23PL
RPST 0450	/ul-gɔt/ [u.gɔt]	/ul-gɔŋ/ [u.gɔŋ]	/ul-gɔq/ [u.gɔq]	/ul-gɨmɔt/ [u.gŭ.mɔt]	/ul-gɨmɔq/ [u.gŭ.mɔq]	/ul-gɨm/ [u.gŭm]	/ul-gɨŋ/ [u.gŭŋ]
NPST 0451	/ul-ŋət/ [u.lət]	/ul-ŋəŋ/ [u.ləŋ]	/ul-ŋəq/ [u.ləq]	/ul-ŋamɔt/ [u.la.mɔt]	/ul-ŋamɔq/ [u.la.mɔq]	/ul-ŋam/ [u.lam]	/ul-ŋ/ [u.lŭŋ]
PRES 0452	/ul-lət/ [u.tət]	/ul-ləŋ/ [u.təŋ]	/ul-ləq/ [u.təq]	/ul-wamɔt/ [u.ga.mɔt]	/ul-wamɔq/ [u.ga.mɔq]	/ul-wam/ [u.gam]	/ul-wəŋ/ [u.gəŋ]
NFUT 0453	/ul-tat/ [u.ɾŭ.tat]	/ul-taŋ/ [u.ɾŭ.taŋ]	/ul-taq/ [u.ɾŭ.taq]	/ul-ntamɔt/ [ut.n.ta.mɔt]	/ul-ntamɔq/ [ut.n.ta.mɔq]	/ul-ntam/ [ut.n.tam]	/ul-ntaŋ/ [ut.n.taŋ]
SBJV 0454	/ul-bet/ [u.let]	/ul-beŋ/ [u.lɛŋ]	/ul-beq/ [u.lɛq]	/ul-dem/ [u.dɛm]	/ul-deŋ/ [u.dɛŋ]	/ul-nɨm/ [ut.nĭm]	/ul-neŋ/ [ut.nɛŋ]
IMP 0455		/ul-be/ [u.le]			/ul-de/ [u.de]		/ul-ne/ [ut.ne]
	SS	**1SG.DS**	**23.DS**	**1PL.DS**	**SIM**		
MED 0456	/ul-qə/ [u.tə]	/ul-ŋələ/ [uq.nə.lə]	/ul-ŋɨlɨ/ [uq.nə̆.lɨ]	/ul-ŋɨtnə/ [uq.nĭt.nə]	/ul-gɨ/ [u.gu]	**PART** 0457	/ul-ban/ [u.lan]

Table 68: /fepm/ ‘cut bush’

	1SG	2SG	3SG	1DU	23DU	1PL	23PL
RPST 0458	/fepm-gɔt/ [fɛp.mĭŋ.gɔt]	/fepm-gɔŋ/ [fɛp.mĭŋ.gɔŋ]	/fepm-gɔq/ [fɛp.mĭŋ.gɔq]	/fepm-gɨmɔt/ [fɛp.mĭŋ.gŭ.mɔt]	/fepm-gɨmɔq/ [fɛp.mĭŋ.gŭ.mɔq]	/fepm-gɨm/ [fɛp.mĭŋ.gŭm]	/fepm-gɨŋ/ [fɛp.mĭŋ.gŭŋ]
NPST 0459	/fepm-ŋət/ [fɛp.mĭ.ŋət]	/fepm-ŋəŋ/ [fɛp.mĭ.ŋəŋ]	/fepm-ŋəq/ [fɛp.mĭ.ŋaq]	/fepm-ŋamɔt/ [fɛp.mĭ.ŋa.mɔt]	/fepm-ŋamɔq/ [fɛp.mĭ.ŋa.mɔq]	/fepm-ŋam/ [fɛp.mĭ.ŋam]	/fepm-ŋ/ [fɛp.mĭŋ]
PRES 0460	/fepm-lət/ [fɛp.mĭn.tət]	/fepm-ləŋ/ [fɛp.mĭn.təŋ]	/fepm-ləq/ [fɛp.mĭn.taq]	/fepm-wamɔt/ [fɛp.mĭŋ.ga.mɔt]	/fepm-wamɔq/ [fɛp.mĭŋ.ga.mɔq]	/fepm-wam/ [fɛp.mĭŋ.gam]	/fepm-wəŋ/ [fɛp.mĭŋ.gəŋ]
NFUT 0461	/fepm-tat/ [fɛp.ṃ.bĭ.tat]	/fepm-taŋ/ [fɛp.ṃ.bĭ.taŋ]	/fepm-taq/ [fɛp.ṃ.bĭ.taq]	/fepm-ntamɔt/ [fɛp.mĭn.ta.mɔt]	/fepm-ntamɔq/ [fɛp.mĭn.ta.mɔq]	/fepm-ntam/ [fɛp.mĭn.tam]	/fepm-ntaŋ/ [fɛp.mĭn.taŋ]
SBJV 0462	/fepm-bet/ [fɛp.ṃ.bet]	/fepm-beŋ/ [fɛp.ṃ.bɛŋ]	/fepm-beq/ [fɛp.ṃ.bɛq]	/fepm-dem/ [fɛp.ṃ.dɛm]	/fepm-deŋ/ [fɛp.ṃ.dɛŋ]	/fepm-nɨm/ [fɛp.mĭ.nĭm]	/fepm-neŋ/ [fɛp.mĭ.nɛŋ]
IMP 0463		/fepm-be/ [fɛp.ṃ.be]			/fepm-de/ [fɛp.ṃ.de]		/fepm-ne/ [fɛp.ṃ.ne]
	SS	**1SG.DS**	**23.DS**	**1PL.DS**	**SIM**		
MED 0464	/fepm-qə/ [fɛp.mĭɴ.qə]	/fepm-ŋələ/ [fɛp.m.ŋə.lə]	/fepm-ŋɨlɨ/ [fɛp.m.ŋĭ.lɨ]	/fepm-ŋɨtnə/ [fɛp.mĭ.ŋĭt.nə]	/fepm-gɨ/ [fɛp.mĭŋ.gɨ]	**PART** 0465	/fepm-ban/ [fɛp.ṃ.ban]

APPENDIX 5: INTERLINEARIZED STORY

The following 1 minute 8 second interlinearized story, spoken by Garambon Magu, is taken from file 0466 on the attached disc. 0466a is a high definition video file, recorded on an Olympus LS-20M recorder with a Shure SM10A headset microphone (.mov; 123.3 MB); 0466b is a reduced version of this video file (.m4v; 62 MB); and 0466c is the extracted audio file only (.wav; 13.1 MB). This story portrays many of the phenomena that have been discussed throughout this thesis. Each new sentence is marked with its temporal location in the media files (e.g., 00:54:50=54.5 seconds into the recording).

Tetwap wədiŋ təwaməŋ
How we plant yams

(133)	0:05:10	[tetwáp	tènɨmpə́	təwám	wə́hɨnə̀ŋ	tábɯtàt]
		/tetwap	tə-nɨm-qə	tə-wam	wəsɨnəŋ	ta(b)-tat/
		plant.yams	do-1pl:sbjv-ss	do-1pl:pres	about	talk-1sg:nfut

'I am going to talk about how we plant yams.'

(134)	0:08:93	[wágɨt		tetwáp	təwám]
		/wagɨt		tetwap	tə-wam/
		now	plant.yams	do-1pl:pres	

'These days we (still) plant yams.'

(135) 0:10:13 [tetwáp imó tɨmə́ŋ qú fí
/tetwap imo tɨməŋ qu fi
plant.yams okay first go garden

fépmɯŋgàm]
fepm-wam/
cut.bush-1pl:pres

'Yam planting, okay: First, (after) going to the garden we cut down the bushes.'

(136) 0:17:55 [fí fepmáɴqoɴqə̀ tɨqə́ qádɨp
/fi fepm-maŋqoŋ-qə t-qə qadɨp
garden cut.bush-compl-ss put.sg-ss tree

dɨ̀nijə́pməŋgàm]
dɨnɨ-jəpməŋ-wam/
chop-3pl.o:drop-1pl:pres

'Having cut the bushes (in the) garden, we chop down the trees.'

(137) 0:22:73 [qádɨp dɨ̀nijə́pməŋədə̀ fɯ́ŋɯ́lɯ́
/qadɨp dɨnɨ-jəpməŋ-ŋədə f-ŋɨlɨ
tree chop-3pl.o:drop-1pl.ds come.down-23.ds

mòfàleléqə fəŋáqɴqə̀ bót
mo=falele-qə fə-(ŋ)aqɨŋ-qə bot
pfv=strip.off.limbs-ss get.pl-arise-ss group

bemáɴqoŋgàm]
be-maŋqoŋ-wam/
put.pl-compl-1pl:pres

'Having chopped down the trees, we strip them (the branches), lift them up, and group them together.'

(138) 0:31:42 [bemáɴqoɴqə̀ bəŋáqɴɨdə̀ gó
dɨ́qə
/be-maŋqoŋ-qə bə-(ŋ)əl-ŋədə go
d-qə
put-compl-ss come-be.at-1pl.ds sun light-ss

múrin tə́ŋ səsə́q qádɨp təméq
mulin tə-ŋ səsəq qadɨp təmeq
dry do-ds greenery tree leaves

fépmɨɴqə̀ bewám wə́]
fepm-qə be-wam wə/
cut.bush-ss put.pl-1pl:pres there

'Having finished putting them, we come, and the sun lights and dries them, and we cut the plants and trees and leaves and place them there.'

(139) 0:37:74 [múrin təmáŋqòŋ bɨgé qú wólɯqə̀
/mulin tə-maŋqoŋ-ŋ bɨge qu wolu-
qə
dry do-compl-ds again go gather-ss

semáɴqoɴqə̀ bɨgé qɨlɨ́ɴqɨlɨ̀ŋ bə́n
se-maŋqoŋ-qə bɨge qlɨŋqlɨŋ bən
cook-compl-ss again rake a

təwàm]
tə-wam/
do-1pl:pres

'(The bushes) having finished drying, we again go gather them up and burn them
and again rake them.'

(140) 0:43:66 [qɨlɨ́ɴqɨlɨ̀ŋ tə́qə ləqomáɴqə tét wélɨ
/qlɨŋqlɨŋ tə-qə ləqo-maŋ-qə tet welɨ
rake do-ss throw.pl-compl-ss yam seed

tə́metə̀ quwám]
təmel-qə qu-wam/
hang.from.head-ss go-1pl:pres

'Having finished raking we carry yam seeds and go.'

(141) 0:50:02

[támtàmpə	nə́	féntəgɨt	tét	wélɨ
/tam-tam-wə	nə	fentəgɨt	tet	welɨ
woman-pl-ynq	man	all	yam	seed

təmetə̀	fə́pmo	fíŋ	wə́
təmel-qə	fəpmo	fiŋ	wə
hang.from.head-ss	take.down.pl	garden	that

bemáɴqoŋ	nə́lɨ	qənéq
be-maŋqoŋ-ŋ	nə=lɨ	qəneq
put.pl-compl-ds	man=nom	stick

sópmɨɴqə̀	bə́ŋətə̀	wápmɨŋgàm]	
isopm-qə		bə-(ŋ)əl-qə	wapm-wam/
hold.pl-ss	come-be.at-ss	plant.yams-1pl:pres	

'All the women or men carry the yam seeds, and after putting them in the garden,
(we) men grab the (marking) sticks and come and plant the yams.'

(142) 0:58:22

[bɨqánəŋ	qə́nətə	wápmɨŋgàm]
/bɨqŋa=nəŋ	qən-əl-qə	wapm-wam/
garden.top=loc	up-be.at-ss	plant.yams-1pl:pres

'We are at the top of the garden and we plant yams.'

(143) 0:59:80

[wə́lɨ	wápmɨɴqə̀tə	móɴqə	móɴqə
/wə=lɨ	wapm-qə-tə	mo-qə	mo-qə
that=nom	plant.yams-ss-iter	go.down-ss	go.down-ss

móɴqə	gəbénəŋ	qúm
mo-qə	gəbe=nəŋ	qum
go.down-ss	garden.bottom=loc	down

móɴqədòpmɨŋgàm]
mo-qədopm-wam/
go.down-arrive-1pl:pres

'They keep planting yams and we work our way down to the bottom of the garden.'

(144) 1:03:43 [móɴqə ìfɨŋáwewàm]
/mo-qə ifɨŋ-awe-wam/
go.down-ss caus-finish-1pl:pres

'We gown down and finish it.'

(145) 1:05:61 [wədɨŋ təwáməŋ tètwáp]
/wədɨŋ tə-wam=nəŋ tetwap/
like.that do-1pl:pres-hab plant.yams

'That is how we plant yams.'

APPENDIX 6: HETEROMORPHEMIC CONSONANT INTERACTIONS

Chapter 9 discusses the various morphophonemic processes that occur when consonants concatenate across morpheme boundaries. This appendix supplements that chapter by providing a complete listing and exemplification of every possible heteromorphemic consonant sequence, organized by classes of segments rather than by types of alternations, as is done in §9.1. In the cases when there is more than one known behavior with regard to a particular sequence, both are listed one after the other. Additionally, for the sake of thoroughness, if a particular interaction is seen in both verbal and nominal morphology, then both are listed. The alternations in focus are bolded in the phonetic fields. Stress, lenition, laxing, nasalization, and aspiration are not identified in order that the segment interactions are clear. As in §9.1, prototypes are used for the noun and verb roots, as well as the enclitics and suffixes. These prototypes are established in Table 43 and Table 44. Only the morphemes from these tables are used in the following data sets.

Table 69: Obstruent/ obstruent sequences

	Voiceless plosive + obstruent		
p+g	/tədep+gə/ →	[tə.de**p.g**ə]	'your nephew'
p+s	/tədep+sɨ/ →	[tə.de**p.s**ɨ]	'their (23pl) nephew'
t+g	/jot+gə/ →	[jo**t.g**ə]	'your house'
t+s	/jot+sɨ/ →	[jo**t.s**ɨ]	'their (23pl) house'
q+g	/moq+gə/ →	[mo**q.g**əm] ~ [mo.**g**əm]	'your firstborn daughter'
q+s	/moq+sɨ/ →	[mo**q.s**ɨ]	'their (23pl) firstborn daughter'

	Voiced plosive + obstruent		
b+t	/lab+tat/ →	[la.**bɨ.t**at]	'I will come up (nfut)'
b+q	/lab+qə/ →	[la.**bɨ.q**ə]	'come up and ... (ss)'
b+b	/lab+be/ →	[la.**b**e]	'come up (2sg)!'
b+d	/lab+de/ →	[la.**bɨ.d**e]	'come up (2du)!'
b+g	/lab+got/ →	[la.**bɨ.g**ot]	'I came up (rpst)'
	Fricative + obstruent		
s+g	/tas+gə/ →	[ta**s.g**ə] ~ [ta.**sɨ.g**ə]	'your cane'
s+s	/tas+sɨ/ →	[ta.**sɨ.s**ɨ]	'their (23pl) cane'

Table 70: Obstruent/ nasal sequences

	Obstruent + nasal		
p+n	/tədep+nə/ →	[tə.de**p.m**ə]	'my nephew'
t+n	/jot+nə/ →	[jo**t.n**ə]	'my house'
q+n	/moq+nə/ →	[mo**q.ɴ**ə]	'my firstborn daughter'
b+n	/lab+neŋ/ →	[la.**bɨ.n**eŋ]	'come up (2pl)!'
b+ŋ	/lab+ŋət/ →	[la.**bɨ.ŋ**ət]	'I came up (npst)'
s+n	/tas+nə/ →	[ta**s.n**ə] ~ [ta.**sɨ.n**ə]	'my cane'
	Nasal + obstruent		
m+t	/blam+tat/ →	[bla**m.bɨ.t**at]	'I will carry it (nfut)'
m+q	/blam+qə/ →	[bla**m.p**ə]	'carry it and ... (ss)'
m+b	/blam+be/ →	[bla**m.b**e]	'carry it (2sg)!'
m+d	/blam+de/ →	[bla**m.d**e]	'carry it (2du)!'
m+g	/blam+got/ →	[bla**m.g**ot]	'I carried it (rpst)'
	/nam+gə/ →	[na**m.g**ə]	'your brother-in-law'
m+s	/nam+sɨ/ →	[na**m.s**ɨ]	'their (23pl) brother-in-law'
n+g	/men+gə/ →	[me**n.g**ə]	'your mouth'
n+s	/men+sɨ/ →	[me**n.s**ɨ]	'their (23pl) mouth'
ŋ+t	/qoŋ+tat/ →	[qo**m.bɨ.t**at]	'I will throw it (nfut)'
ŋ+q	/qoŋ+qə/ →	[qo**ɴ.q**ə]	'throw and ... (ss)'
ŋ+b	/qoŋ+be/ →	[qo**m.b**e]	'throw it (2sg)!'
ŋ+d	/qoŋ+de/ →	[qo**n.d**e]	'throw it (2du)!'
ŋ+g	/qoŋ+got/ →	[qo**ŋ.g**ot]	'I threw it (rpst)'
	/meŋ+gə/ →	[me**ŋ.g**ə]	'your mother'
ŋ+s	/meŋ+sɨ/ →	[me**ŋ.s**ɨ]	'their (23pl) mother'

Table 71: Obstruent/ liquid sequences

	Obstruent + liquid		
p+l	/tədep+lɨ/ →	[tə.de**p.p**ɨ] ~ [tə.de.**p**ɨ]	'Nephew did ... (nom)'
t+l	/jot+lɨ/ →	[jo**t.t**ɨ] ~ [jo.**t**ɨ]	'the house did ... (nom)'
q+l	/moq+lɨ/ →	[mo**q.q**ɨ] ~ [mo.**q**ɨ]	'Firstborn daughter did ... (nom)'
b+l	/lab+lət/ →	[la.**bɨ.l**ət]	'I am coming up'
s+l	/tas+lɨ/ →	[ta.**sɨ.l**ɨ]	'the cane did ... (nom)'

	Liquid + obstruent		
l+t	/ul+tat/ →	[u.**lɨ.t**at]	'I will hit him (nfut)'
l+q	/ul+qə/ →	[u**t.t**ə] ~ [u.**t**ə]	'hit him and ... (ss)'
l+b	/ul+be/ →	[u.**l**e]	'hit him (2sg)!'
l+d	/ul+de/ →	[u.**d**e]	'hit him (2du)!'
l+g	/ul+got/ →	[u.**g**ot]	'I hit him (rpst)'
	/nol+gə/ →	[no.**g**ə]	'your brother'
l+s	/nol+sɨ/ →	[no.**sɨ**]	'their (23pl) brother'

Table 72: Obstruent/ glide sequences

	Obstruent+ glide		
p+w	/tədep+wə/ →	[tə.de**p.p**ə] ~ [tə.de.**p**ə]	'nephew?'
t+w	/jot+wə/ →	[jo**t.t**ə] ~ [jo.**t**ə]	'house?'
q+w	/moq+wə/ →	[mo**q.q**ə] ~ [mo.**q**ə]	'firstborn daughter?'
b+w	/lab+wam/ →	[la.**bɨ.w**am]	'we are coming up'
s+w	/tas+wə/ →	[ta**s.w**ə] ~ [ta.**sɨ.w**ə]	'cane?'
p+j	/tədep+je/ →	[tə.de**p.j**e]	'his nephews'
q+j	/moq+je/ →	[mo**q.j**e] ~ [mo.**qɨ.j**e]	'firstborn daughters'
s+j	/tas+je/ →	[ta**s.j**e] ~ [ta.**sɨ.j**e]	'canes'

Table 73: Nasal/ nasal sequences

	Nasal + nasal		
m+n	/blam+neŋ/ →	[bla**m.n**eŋ]	'carry it (2pl)!'
	/nam+nə/ →	[na**m.n**ə] ~ [na.**m**ə]	'my brother-in-law'
m+ŋ	/blam+ŋət/ →	[bla**m.ŋ**ət]	'I carried it (npst)'
n+n	/qaqon+nə/ →	[qa.qo**n.n**ə] ~ [qa.qo.**n**ə]	'my uncle'
ŋ+n	/qoŋ+neŋ/ →	[qo.**n**eŋ]	'throw it (2pl)!'
	/meŋ+nə/ →	[me**ŋ.ŋ**ə] ~ [me.**ŋ**ə]	'my mother'
ŋ+ŋ	/qoŋ+ŋət/ →	[qo**ŋ.ŋ**ət] ~ [qo.**ŋ**ət]	'I threw it (npst)'

Table 74: Nasal/ liquid sequences

	Nasal + liquid		
m+l	/nam+lɨ/ →	[na**m.p**ɨ]	'Brother-in-law did ... (nom)'
	/blam+lət/ →	[bla**m.t**ət]	'I am carrying it'
n+l	/qaqon+lɨ/ →	[qa.qo**n.t**ɨ]	'Uncle did ... (nom)'
ŋ+l	/meŋ+lɨ/ →	[me**ʁ.q**ɨ]	'Mother did ... (nom)'
	/qoŋ+lət/ →	[qo**n.t**ət]	'I am throwing it'

	Liquid + nasal		
l+n	/ul+neŋ/ →	[u**t.n**eŋ]	'hit him (2pl)!'
	/nol+nə/ →	[no**t.n**ə]	'my brother'
l+ŋ	/ul+ŋət/ →	[u.**l**ət]	'I hit him (npst)'
	/ul+ŋɨlɨ/ →	[u**q.ɴ**ɨ.lɨ]	'hit and ... (23.ds)'
	/ul+ŋ/ →	[u.**lɨŋ**]	'they hit him (npst)'

Table 75: Nasal/ glide sequences

	Nasal + glide		
m+w	/blam+wam/ →	[bla**m.g**am]	'we are carrying it'
	/nam+wə/ →	[na**m.p**ə]	'brother-in-law?'
n+w	/qaqon+wə/ →	[qa.qo**n.t**ə]	'uncle?'
ŋ+w	/meŋ+wə/ →	[me**ɴ.q**ə]	'mother?'
	/qoŋ+wam/ →	[qo**ŋ.g**am]	'we are throwing it'
m+j	/nam+je/ →	[na**m.j**e]	'brothers-in-law'
n+j	/qaqon+je/ →	[qa.qo**n.j**e]	'uncles'
ŋ+j	/meŋ+je/ →	[me**ŋ.j**e]	'mothers'

Table 76: Liquid/ liquid sequences

	Liquid + liquid		
l+l	/ul+lət/ →	[u**t.t**ət] ~ [u.**t**ət]	'I am hitting him'
	/ul+lət/ →	[no.**lɨ**]	'Brother did ... (nom)'

Table 77: Liquid/ glide sequences

	Liquid + glide		
l+w	/nol+wə/ →	[no.**lɨ.w**ə]	'brother?'
	/ul+wam/ →	[u.**g**am]	'we are hitting him'
l+j	/nol+je/ →	[no.**lɨ.j**e]	'brothers'

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