

# **Epenthesis and nasal spreading: Theoretical analyses and their practical application in the establishment of the Ma Manda orthography**

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**Abstract:** In this paper I discuss epenthesis, vowel reduction, and nasal spreading in Ma Manda (formerly Sauk), a previously undescribed Finisterre-Huon language of the Trans-New Guinea family. After describing these processes I address how the theoretical analyses are integral in leading to the practical application of the establishment of a usable orthography.

**Key words:** Epenthesis, Vowel reduction, Nasalization, Orthography

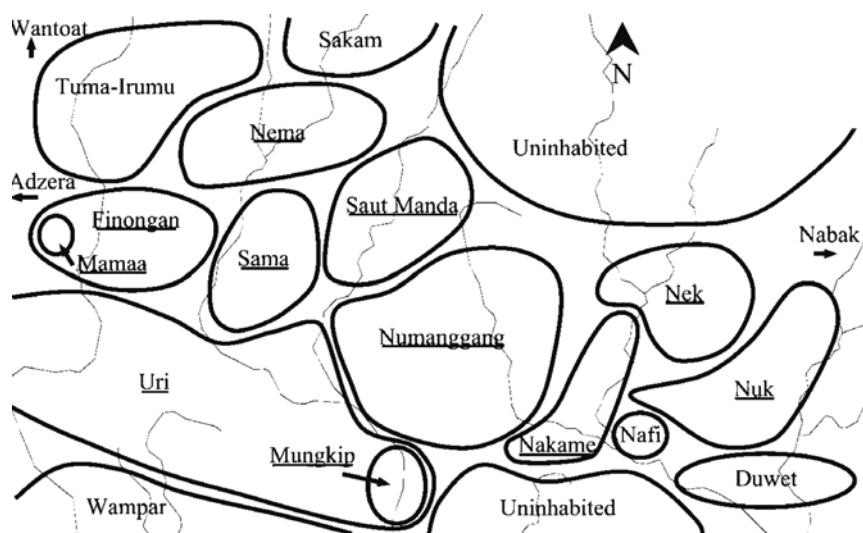
## **1. Introduction<sup>1</sup>**

The linguistic subfield of phonology, though focussed on the fundamental building blocks of language, is remarkably contextual and, at times, even subjective. In his chapter on phonology, Dixon (2010:266) remarks that ‘nowhere in linguistic work is there a uniquely correct analysis for a given set of data. Competing analyses have different virtues and drawbacks. In balancing these, one analytic decision may be most appropriate for a certain purpose, and another for another.’ The clues which lead to a suitable treatment of the sound system of a given language may be found within a gamut of linguistic disciplines: phonetics, morphology, syntax, and discourse. Out of necessity, a basic understanding of the phonology of a given language is required before an attempt can be made at wrestling with syntactical analysis, yet often a finalized statement on the sound system can only be made after all other pieces of the puzzle have been put in place. Phonology relates to every interwoven aspect of a grammar, and therefore one cannot make a definitive statement regarding the phonology of a language without having studied every other facet of the language. However, at some point tentative analyses must be set forth based on one’s own study of the language, along with the research one has undertaken of related languages and general linguistic typology as a whole.

In this paper I present a number of phonological processes which occur in Ma Manda (formerly Sauk<sup>2</sup>) [skc], a previously undescribed Finisterre-Huon language of the Trans-

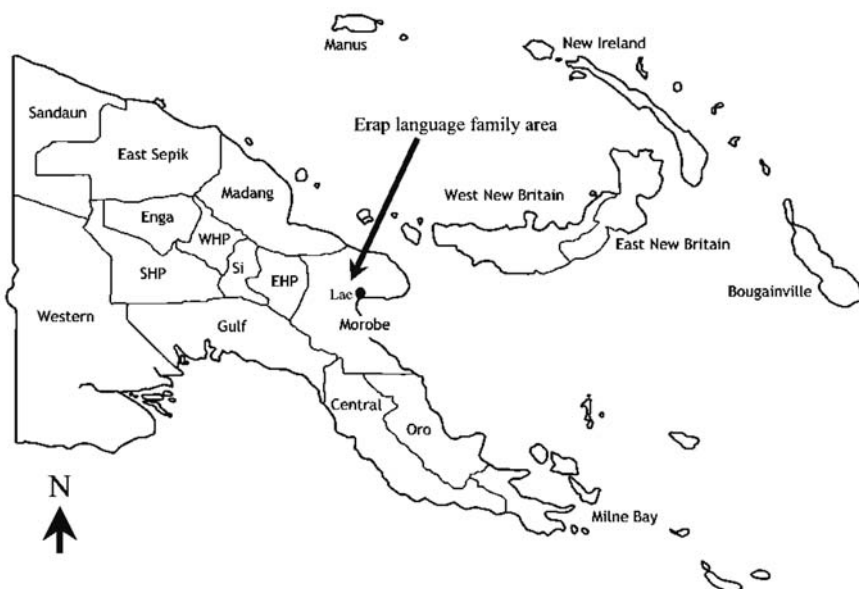
New Guinea family. After a brief overview of Ma Manda segmental phonology and syllable structure, I discuss epenthesis of the high central vowel as the chosen method of resolving syllable template violations. This is discussed from a synchronic viewpoint, followed by a brief diachronic explanation based on Blevins and Pawley (2010). During my treatment of this process, I also discuss vowel reduction of high vowels in unstressed syllables and how this relates to epenthesis. Next I address the process of nasal spreading, where, after a nasal, nasality spreads across vowels and causes prenasalization of plosives. After describing these processes I address how the theoretical analyses are integral in leading to the practical application of the establishment of a usable orthography. Analytical obstacles which are causing issues with regard to the development of an effectual writing system will be discussed as well. The data and analyses are based on approximately six months of living in the village of Saut in Morobe Province of Papua New Guinea.

Ma Manda is classified as Trans-New Guinea, Finisterre-Huon, Finisterre, Erap. The Erap subfamily also includes Finongan, Gusan, Mamaa, Munkip, Nakama, Nek, Nimi, Nuk, Numanggang, and Uri. The Summer Institute of Linguistics has performed tasks in a majority of these languages. SIL fieldworkers have written grammars (some of them unpublished) in Nek, Numanggang, and Uri. Practical orthographies are being used in these languages, as well as in Finongan, Mamaa (now understood to be a one-village dialect of Finongan), Nakama, and Ma Manda. The following map shows the Erap language family and the relative locations of each language with reference to the others (Hiley et al. 2008:7).<sup>3</sup>



**Figure 1: Erap language family (underlined names are Erap languages)**

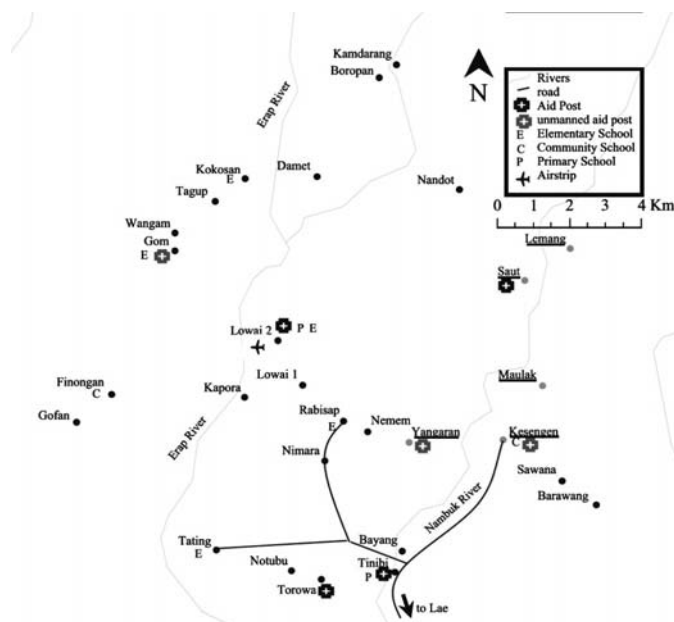
Ma Manda itself consists of six primary villages—Gisapin, Kesengen, Lemang, Maulak, Mosa, and Saut—along with a couple of fringe villages—Sawana and Yangaran—which blend characteristics of Ma Manda with neighbouring related languages, Numanggang and Nimi respectively. Based on the last official census in 2000 and accounting for population growth, I estimate the total population of all eight villages to be approximately 1800 people. The Ma Manda language area is located along the headwaters of the Erap River in the steep southern slopes of the Finisterre mountain range. Kesengen, the southernmost Ma Manda village, is often accessible by road (depending on landslides and the height of rivers) and is approximately 50 km northwest of the major city of Lae.



**Figure 2: Location of the Erap language family**

Though located in a harsh mountainous environment, the Ma Manda people are not completely isolated from contact with the outside world. They have relationships with many neighbouring language groups, especially those that are involved in their Lutheran Church parish. There are grassroots preschools in all of the major villages as well as a primary school in Kesengen that currently has approximately 200 students from grades three through eight from numerous language groups. This school has a functioning generator that is used to provide electrical power for lights in the classrooms as well as a basic computer and printer. Several of the wealthier people in the area have personal generators as well. Also in Kesengen a water project has been installed which supplies water to a variety of

taps located across the village, making it the only village with running water. Due to their relative proximity to Lae, the Ma Manda people are gradually becoming more acquainted with modern conveniences. There are trade stores in every village that sell various basic foodstuffs; many people own and operate mobile phones, though service is unreliable in the Ma Manda language area; and many people often travel by PMV (public motor vehicle) to and from Lae and Kesengen. A majority of the income for the area is dependent on coffee, their major cash crop.



**Figure 3: Ma Manda villages (underlined)**

## 2. Segmental phonology and syllable structure

### 2.1 Phonemic inventory

The Ma Manda inventory is comprised of 20 distinct phonemes: 14 consonants and 6 vowels. The consonant and vowel phonemes are displayed in Figure 4 and Figure 5 below.<sup>4</sup>

	labial	alveolar	palatal	velar
voiceless plosive	p	t		k
voiced plosive	b	d		g
nasal	m	n		ŋ
fricative	f	s		
lateral		l		
approximant	(w)		j	w

**Figure 4: Consonant phonemes**

	front	central	back
high	i	(i) <sup>5</sup>	u
mid	e	ə	o
low		ɐ	

**Figure 5: Vowel phonemes**

This is not the place to present all the allophones of these phonemes or examples of their presence in various environments. Attention will only be paid to allophonic variation and phonotactics when they are relevant to the major phonological processes described herein.<sup>6</sup>

### 2.2 Syllable template

There are four primary syllable patterns in Ma Manda—V, VC, CV, and CVC—forming the maximal syllable template of (C)V(C). CV is the most common syllable by a considerable margin. In addition, one dialect allows the CN syllable type (where N is a syllabified nasal); some speech varieties also allow /l/ to occur as the second element in a consonant cluster, thus forming the CLV and CLVC types as well. In general, however, most speakers insert the epenthetic vowel between the consonant and nasal, and likewise between the consonant and lateral. It is this primary speech variety that is in focus throughout this paper.

### 2.3 Stress placement

Stress is indicated by heightened intensity and pitch, and a slight lengthening of the vowel. Conversely, high vowels in unstressed syllables are often reduced (see §3.1.3). Stress is not a contrastive element in the Ma Manda lexicon. Stress placement is predictable with few exceptions. Ma Manda stress is placed on the first syllable. However, if the first syllable is light and the second syllable is heavy, stress will be placed on the second syllable.

- |     |               |                  |                             |
|-----|---------------|------------------|-----------------------------|
| (1) | a. /kəme/     | ['kə.mē]         | ‘land’                      |
|     | b. /gənəŋ/    | [gə.'nēŋ]        | ‘hole’                      |
|     | c. /kəlin/    | ['kə.lin]        | ‘good’                      |
|     | d. /mukuwəŋ/  | ['mu.ku.wəŋ]     | ‘fog’                       |
|     | e. /bdməŋ/    | ['bɪ.dɪ.məŋ]     | ‘overgrown garden’          |
|     | f. /kloŋgnəŋ/ | [ki.'loŋ.gɪ.nəŋ] | ‘Eastern Black-capped Lory’ |

The first three examples here are disyllabic roots. (1)a. has word-initial stress just as expected. In (1)b. stress is placed on the final syllable because it is heavy (bimoraic<sup>7</sup>). In

(1)c. stress is placed on the first syllable even though it is monomoraic and followed by a heavy syllable. This occurs because the low central vowel /ɐ/ is heavy and attracts stress. In a majority of the documented Erap languages, vowel length has been claimed to be phonemic.<sup>8</sup> In Ma Manda it seems that the low central vowel functions like a lengthened mid central vowel /ə:/. In one morphophonemic process, the root-initial /l/ of the present tense is elided after a verb-final schwa:

$$(2) \quad /b\ə-/ \quad + \quad /-l\ət/ \quad = \quad [b\text{ɛ}t]$$

‘come’                      ‘PRES.1s’                      ‘I am coming.’

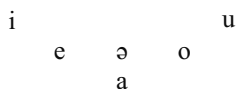
Here, when /l/ is elided it brings two mid central vowels together. Instead of surfacing as a long schwa vowel, however, it becomes a low central vowel. This occurs in every instance where a schwa-final verb root meets a present tense suffix. In summary, a syllable with the low central vowel is treated as heavy and thus attracts stress placement.

In (1)d. stress is placed on the first syllable. Even though the final syllable is heavy, stress prefers to be at the beginning of the word. (1)e. shows another side of the accent system. Even though the only phonemic vowel surfaces in the third syllable after two epenthetic high central vowels, this phonemic vowel isn’t stressed. Instead, the first syllable is stressed.<sup>9</sup> As will be discussed in §3.1.2, this fact provides evidence that the epenthetic vowel is phonologically visible (see §3.1.4 for a discussion on the importance of the epenthetic vowel’s phonological visibility). Finally, (1)f. shows us that secondary stress is placed in alternating syllables after the first stressed syllable (here this occurs on the fourth syllable).<sup>10</sup>

### 3. Phonological processes

#### 3.1 EPENTHESIS

The most common six-vowel system of a Papuan language, set forth by Foley (1986:53), is:

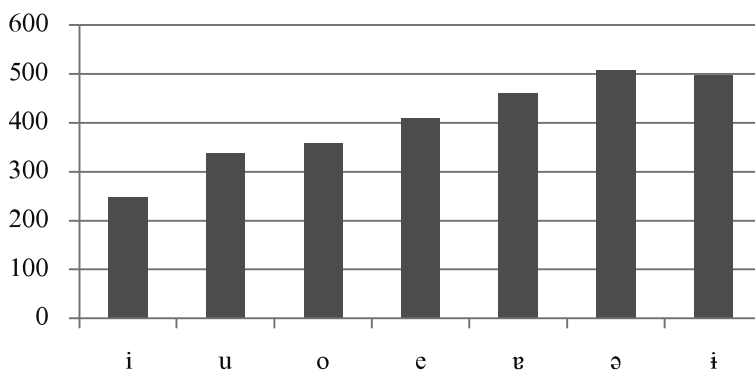


**Figure 6: Typical six-vowel system of a Papuan language**

Exempting the high central epenthetic vowel referenced above, Ma Manda conforms neatly to this pattern. The following minimal pairs will help to establish these as separate vowel phonemes:

(3)	a. /bi/	[bi]	‘lime powder’
	b. /be/	[be]	‘father’
	c. /=b/ <sup>11</sup>	[bu]	‘also’
	d. /bo/	[bo]	‘club’
	e. /bə-/ <sup>12</sup>	[bə]	‘come’
	f. /bɛ-/	[bɛ]	‘deliver (baby)’
(4)	a. /duŋ/	[duŋ]	‘ear’
	b. /deŋ/	[deŋ]	‘squeeze out water’
	c. /doŋ/	[doŋ]	‘search’
	d. /dɛŋ/	[dɛŋ]	‘edible grass sp.’
	e. /dɛŋ/	[dɛŋ]	‘feed (for domesticated animals)’

The following chart portrays the frequency of each Ma Manda vowel, taken from my current database of 1,476 lexemes.



**Figure 7: Vowel frequency**<sup>13</sup>

This chart reveals a noteworthy fact: the more central the vowel, the more frequent its occurrence. In addition, the final vowel shown—the non-phonemic epenthetic vowel—is clearly shown to be quite frequent, occurring more often than all vowels except the mid central vowel.<sup>14</sup> I should point out that this segment occurs with a myriad of phonetic qualities. Due to its inherent shortness in duration, it has a tendency to assimilate to match nearby segments. It seems that it is too short to carry much of a unique phonetic quality. Instead, it is a transitional element that is coloured almost entirely by its surroundings. It surfaces as [i], [ɯ], [u], [ø], [ɪ], and [ə], to name the more common realizations. Blevins and Pawley (2010:21), in their treatment of Kalam predictable vowels, refer to the same

variation. Just as in Ma Manda, Kalam's predictable vowel is most commonly realized as [ɨ], and yet: 'Kalam predictable vowels are sometimes schwa ... and sometimes a copy of a nearby vowel, or influenced by the place of surrounding consonants'. The Kalam predictable vowel surfaces also as [i] and [u], among others. The difficulties this harmony raises with regard to orthographic choices are detailed later on. This epenthetic vowel will now become the focus of our discussion.

### 3.1.1 Transition vowels across Papua New Guinea

In reiteration, the short high central vowel is not a phonemic segment in Ma Manda. On what basis was this conclusion reached? After all, there are a number of Papuan languages which do have the high central vowel as a phoneme. In fact, a number of Sepik area languages are said to have 'basic vowel systems consisting of a three-way contrast in height among central vowels' (Foley 1986:48-52):

i  
ə  
a

**Figure 8: Basic vowel system of a few Ndu languages of the Sepik<sup>15</sup>**

Foley mentions that this basic phonemic vowel system, contrasting only in height, at first impression appears to have seven vowel phonemes<sup>16</sup>:

i            i            u  
          e        ə        o  
                  a

**Figure 9: Common Sepik vowel system (at first impression)**

This vowel system is essentially identical to my own first impression of the Ma Manda vowel system. Upon further inspection, I too have come to see the 'barred-i' vowel as a phone used to break up consonant clusters, as well as to rescue syllable-final consonants that are disallowed in this position.

Foley (1986:50) suggests that the /i/ 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 and other Sepik languages, he asks the following question: 'What is the status of [ɨ] in such languages? Are all [ɨ]s to be analyzed 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 centres 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 process. Whitehead (2006:9) 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 and Nek, fellow Erap languages, contribute to the discussion. Regarding Numanggang, Hynum (1980:6 and pers. comm.) discusses what he terms a ‘voiceless vocoid [ɨ]’. He points out its relative shortness in duration, and its existence in between word-initial consonant clusters (particularly between /s/ and voiceless plosives). Vowel durations are known to be influenced by the type of the following consonant. It is known 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 (Peterson and Lehiste 1960). This helps to explain why Hynum notices this vowel as short in just such an environment.<sup>17</sup> Moreover, it is my contention that the voicelessness is solely due to its shortness. Occurring between two voiceless consonants, this short vowel just doesn’t have the time to develop any periodicity through the vibrations of the vocal folds. Regarding Nek, Linnasalo (2003:12) remarks: ‘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 a mid central vowel occurring as a transitional element, along with the pattern that voiced plosives cannot occur in consonant clusters or outside of onset position in the syllable. These points will be important in the following discussion.

### 3.1.2 Epenthesis in Ma Manda

Turning back to Ma Manda, let us briefly walk through the evidence that establishes the high central vowel as non-phonemic. I begin not with inter-consonantal epenthesis, but with

the process of word-final epenthesis (often called paragoge):

(5)	a. /jəl/	[ˈjəlɨ]	‘two’
	b. /memd/	[ˈmẽmdɨ]	‘sweat’
	c. /jəlob/	[jəˈlobɨ]	‘banana’
	d. /weg/	[ˈwegɨ]	‘mushroom’

These four examples are illustrative of a language-wide requirement: The voiced plosives /b/, /d/, /g/, and the lateral /l/—one may group them together as ‘voiced oral consonants’—are prevented from occurring word-finally. A word simply cannot end in one of these sounds.<sup>18</sup>

Here we see a simple example of a word that has been borrowed from English:

(6)	/kəl/	[ˈkəlɨ]	‘car’
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Clues to the syllable structure of a language are commonly found in the incorporation of borrowed words into the vernacular lexicon. Building on the work of Hyman (1970) among others, Vendelin and Peperkamp (2004) write that, ‘in phonological approaches to loanword adaptations, whether rule-based or constraint-based, the driving force behind the adaptations is the aim to make non-native words conform to the surface phonological structure of the native language. Indeed, loanword adaptations are mainly transformations that apply to foreign forms that would be ill-formed if they were borrowed without modification.’ Since Ma Manda does not have a rhotic vowel or /r/ phoneme, the /r/ in ‘car’ is replaced with its lateral kin.<sup>19</sup> In addition, since /l/ cannot occur in word-final position, the high central vowel is added in order to resolve the violation. Blevins and Pawley (2010:15) state that ‘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’.<sup>20</sup>

In his Menya grammar, Whitehead (2006:9) writes that ‘when the final phoneme of a word is a consonant there is a vocalic release ... . The quality of the vowel varies, but usually /p/ releases to /u/ and /t/ and /k/ release to /i/.’ Here we see evidence of a similar situation, which Whitehead call a vocalic release. Though the vocalic release of Ma Manda is only initiated by voiced oral consonants, the rest of Whitehead’s description rings true here. The Ma Manda ‘vocalic release’ causes a dummy vowel to be inserted word-finally in order to resolve the phonotactic violation.<sup>21</sup>

It has been established that Ma Manda does not allow word final voiced oral consonants, and instead chooses to epenthesize a vowel after the consonant. The following

examples will help to establish a similar process:

(7)	a. /kobse/	[ <sup>1</sup> qobʰsɛ]	‘chicken’
	b. /bkngən/	[buq <sup>1</sup> ɛ̃n] <sup>22</sup>	‘neck’
	c. /bdəm/	[bu <sup>1</sup> dəm]	‘possessions’
	d. /boblat/	[ <sup>1</sup> bobʰlat]	‘butterfly’
	e. /gtnem/	[git <sup>1</sup> nēm]	‘skin’
	f. /sglen/	[ <sup>1</sup> sigiren]	‘strong’
	g. /kədp/	[ <sup>1</sup> qədi:p]	‘wood, fire’
	h. /tk/	[tʰək]	‘clothing’
	i. /gk/	[gʰək]	‘third born male’
	j. /gsbə/	[ <sup>1</sup> gisibə]	‘flying fox’

Here the epenthetic vowel is inserted to break up a variety of consonant clusters. Almost every consonant cluster, excepting those where one of the elements is a nasal consonant, is prohibited. Delving into Ma Manda phonotactics is beyond the scope of this paper. Suffice it to say that when an underlying consonant cluster is prohibited, the high central vowel (or one of its many allophones) is inserted to fix the problem. Here is another borrowed term which reveals epenthesis both word-medially and word-finally (notice that these epenthetic vowels are near copies of the phonemic vowel /u/):

(8)	/skul/	[sʰ <sup>1</sup> kulʰ]	‘school’ <sup>23</sup>
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One valid objection to this hypothesis could be that epenthesis is not occurring here at all; instead, the vowel is phonemic and the underlying form of ‘chicken’ is /kobise/ rather than /kobse/. There are several qualities with regard to this high central vowel that reveal its marked status among the language’s vowels; these aid in substantiating my hypothesis. First of all, it is significantly shorter in duration than the other high vowels /i/ and /u/ in the same environments. Recall Whitehead’s mention of the ‘short, high vowel’. Secondly, this vowel is subject to harmonization in backness, roundness and/or height with a preceding vowel. For example, /kobse/ may surface as [kobise] or [kobʰsɛ] or even [kobuse]. The epenthetic vowel may, depending on the speech style of the speaker, become rounded to match the back rounded vowel in the first syllable. Word-finally, /ləgəmænd/ ‘dream’ may surface as [ləgə<sup>1</sup>mɛ̃ndi] or [ləgə<sup>1</sup>mɛ̃ndə]. Here the vowel may lower due to the low central vowel in the previous syllable. The other vowels do not exhibit this vowel harmony.<sup>24</sup> Next, the choice of epenthetic vowel differs among the Ma Manda dialects. For example, in the remote northern villages of Saut and Lemang it surfaces as a high central vowel, while in

the southern village of Kesengen it often surfaces as a front high-mid vowel (i.e. [e] or [ø]); the main northern dialect, however, is the one in focus throughout this paper. Finally, stress placement sheds light on the situation. In (5) above, /jəlob/ is stressed on the second syllable. If the word-final vowel was phonemic, then we would expect stress to default to the first syllable, as there are no heavy syllables. Instead, stress is placed on the second syllable because /b/ is actually the coda, forming a heavy bimoraic syllable. The vowel is simply a 'release'. These facts show beyond any doubt that the high central vowel is epenthetic and non-phonemic.

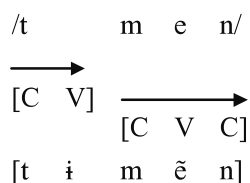
Across morpheme boundaries more consonant clusters are allowed<sup>25</sup>. The /tm/ cluster freely occurs in derivations:

- (9) a. /təmŋ/                    [t̥əmũŋ]                    'woman'  
       b. /təm-təm/                [t̥əm'təm]                'women'

but is disallowed in monomorphemic words:

- (10) /tmen/                    [t̥i'mɛ̃n]                    'old'

As previously mentioned, the maximal syllable template in Ma Manda is (C)V(C). When this template is violated with a consonant cluster, or when a voiced oral consonant occurs word-finally, the process of epenthesis is utilized to cause the surface form to meet the language's requirements. Returning to /tmen/ above, why does the language not cause the surface form to be \*[it̥mɛ̃n] instead of [t̥i'mɛ̃n]? Why are there no examples of word-initial epenthetic segments? The answer to this question is that Ma Manda maps the syllable template onto words from left-to-right. The diagram below portrays the mapping of the syllable template:



**Figure 10: Syllable template mapping**

When the template is placed over /tmen/, a violation occurs when there is a CC cluster at the beginning of the syllable. This problem is resolved by inserting the epenthetic vowel between the segments, creating two syllables—CV and CVC.

The observant reader may have noticed an inconsistency that has not yet been dealt with. If epenthesis is triggered by violations to the CVC template (along with, of course, word-final voiced oral consonants), then why indeed is the process of epenthesis triggered in /kobse/? After all, the word is comprised of two permissible syllable types—CVC and CV. The answer is quite simple really: Voiced oral consonants are precluded from being not just in word-final position, but in syllable-final position. /b/, /d/, /g/, and /l/ are not allowed to occur in the coda position of a syllable. In fact, this is the very same restriction that Nek exhibits with /b/, /d/, /g/, and /z/.<sup>26</sup> So to restate the environments which initiate epenthesis: When the CVC syllable template is violated by a consonant cluster, or when a voiced oral consonant occurs in coda position of a syllable, epenthesis occurs.

### 3.1.3 High vowel reduction in unstressed syllables

Before advancing to the process of nasal spreading, I will handle one other difficulty with the analysis presented above. Unstressed high vowels may reduce to central position. The more syllables in a word, the more likely it is that the reduction will occur.

(11)	a. /sibət/	[sɨ'βət]	'food'
	b. /kondinəm/	['kondɨnəm]	'Emperor Bird of Paradise'
	c. /mukuwəŋ/	['mukɨwəŋ] <sup>27</sup>	'fog'
	d. /nimi-/	['nɨmɨ]	'cousin'
	e. /nimi-/ + /-nə/	['nɨmɨnə]	'my cousin'

Here are just a few examples where, in unstressed syllables, vowels reduce to a central location. /i/ reduces to [ɨ], while /u/ reduces to [ʊ]. In (11)e. the first person possessive morpheme is suffixed to *nimi* 'cousin'. This increase from two to three syllables initiates the reduction of both high front vowels. High vowel reduction is variable. When spoken slowly, the quality of the full vowel may return. In phrases and longer utterances, vowels will often reduce that are not prone to this process when those same words are in isolation.

Now let us look at a more complicated situation. For ['ke.lʌ] 'hand,' an inalienably possessed body part term, one could assume that the phonemic form of this word is \*/kel/, with the lateral causing the epenthesis of [ʌ], a common allomorph of the high central vowel. This is not the case though. The following examples and discussion will help to clarify the matter:

(12)	a. /kelu/	+	/-nə/	=	[ˈkɛlɪnə]
	‘hand’		‘1sg.POSS’		‘my hand’
	b. /nol/	+	/-nə/	=	[ˈnɔ̃lɪnə]
	‘brother’		‘1sg.POSS’		‘my brother’

Spoken without any affixes, both of these words end with the same vowel, the high central rounded vowel [ɪ]:

(13)	a. [ˈkɛlɪ]
	b. [ˈnɔ̃lɪ]

Exemplified in (12), there is a morphophonemic process whereby a stem-final /l/ strengthens to [t] before an /n/. This process has no exceptions, and it holds true for ‘brother’ (an inalienably possessed kinship term) above, but not for ‘hand’. This is because ‘hand’ does not end in /l/, but in /u/.

The high vowels often reduce to a central location in unstressed syllables. This process of vowel reduction produces confusion, because it causes both /i/ and /u/ to surface similarly to the epenthetic vowel. Here, fortunately, the morphological alternation makes it clear that /kelu/ ends in a vowel. In other cases, however, there is another clue that occasionally helps to shed light on whether a vowel is epenthetic or reduced. The epenthetic vowel is very sensitive to its surroundings (see §3.1). Due to this sensitivity, for instance, there is nothing to explain why the phone would surface as [ɪ] following an unrounded vowel. This phone is generally produced when the preceding vowel is rounded (i.e. /u/ or /o/). /kelu/ does not offer this explanation, while /nol/ does.

### 3.1.4 Brief diachronic treatment of Ma Manda reduced vowels

Hall (2006) 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’ (424). 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.’ Blevins and Pawley (2010) respond to Hall’s survey with an analysis of predictable vowels

in Kalam. In so doing, the authors offer a diachronic explanation for the similarity between reduced vowels and epenthetic vowels:

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 rephrasing 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 (28ff).

The authors here offer a summary of their reasons for positing a new type of predictable vowel, separate from the two types set forth in Hall’s typology of vowel intrusion.<sup>28</sup> 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. A simplified version of Table III ‘Vowel reduction reanalysed as vowel insertion, leading to predictable vowels’ from Blevins and Pawley (2010:34) is reproduced below (with a Kalam example):

stage I	full vowels only	*sib-gac ‘large intestine’
stage II	reduction of unstressed (non-phrase final) vowels	sybgac
stage III	reduced vowels reanalysed as consonant release	sybgac</sbgac/
stage IV	reduced vowels inserted where consonant has release	sybygac</sbgac/

**Figure 11: Historical developments of Kalam predictable vowels**

In explanation, Kalam predictable vowels are analyzed to be ‘remnants of once full vowels’. When these vowels were put in unstressed positions (namely, in non-phrase final position),

they became reduced. Once words with these reduced vowels became quite frequent, they replaced the former full-vowelled words as the new underlying forms. ‘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.’ Finally, these vowels begin to be inserted even where they did not exist prior to the phonological restructuring process.

It is my contention that Ma Manda is 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, many other high vowels are still in the process of being reduced. The reduced vowels in (11) may be replaced by the correct full vowels if spoken slowly and in isolation. I predict that these vowels, given enough time, will be completely lost. In their place will be the high central vowel (reanalyzed as epenthetic), as per stage III of Figure 11. In due time, all consonant clusters—including the ones that are currently allowed—may be broken up by this barred-i, as per stage IV.<sup>29</sup> This offers a helpful explanation for the variation in syllable types among the Ma Manda dialects. It was mentioned in §2.2 that this paper is concerned with the main northern dialect, which does not allow the lateral to occur as the second member of a consonant cluster. The CLVC pattern, however, is allowed in the southern dialect. It appears that this dialect is more conservative, as the people have yet to begin inserting the barred-i vowel here to break up this cluster. In the northern dialect, the people are inserting the epenthetic vowel in these positions where traditionally clusters were allowed. This reveals Ma Manda to be somewhere in between stages III and IV from Figure 11. This topic begs further study. Perhaps future research will provide reliable data to substantiate these hypotheses.

### 3.2 Nasal spreading

Prenasalization is very common 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. Referring again to Nek, Linnasalo (2003:7) 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 data reveal similar, though less structured, prenasalization patterns.



### 3.2.1 In monomorphemic words

It will be helpful now to provide the rudimentary facts regarding Ma Manda prenasalization. First, it should be demonstrated that voiced plosives do at times occur without prenasalization:

- |      |              |            |             |
|------|--------------|------------|-------------|
| (14) | a. /dəbugum/ | [ˈdəbugum] | ‘star’      |
|      | b. /kədəŋ/   | [qəˈdəŋ]   | ‘bamboo’    |
|      | c. /fəgət/   | [fəˈgət]   | ‘stretcher’ |

These three examples show the voiced plosives /b/, /d/, and /g/ word-medially after vowels without any prenasalization. There is not the slightest essence of nasalization here. They can also follow homorganic and heterorganic nasals:

- |      |             |            |         |
|------|-------------|------------|---------|
| (15) | a. /əmdə/   | [ˈə̃mdə]   | ‘nose’  |
|      | b. /təndon/ | [ˈtə̃ndon] | ‘night’ |

Now take a look at the following examples, taking special notice of the segments preceding the voiced plosives:

- |      |            |                         |         |
|------|------------|-------------------------|---------|
| (16) | a. /mɔbə/  | [ˈmɔ̃ <sup>m</sup> bə]  | ‘leech’ |
|      | b. /mäden/ | [mɔ̃ <sup>n</sup> ˈdɛn] | ‘back’  |
|      | c. /nəgət/ | [nɔ̃ <sup>n</sup> ˈgət] | ‘blood’ |

Several facts are immediately evident upon the inspection of the examples in (16): First of all, unlike in the previous sets of examples, the voiced plosives here are prenasalized. Secondly, these prenasalized plosives all follow nasalized vowels. Thirdly, each of these nasalized vowels succeeds a nasal consonant. Fourthly, after the plosives nasalization is halted. Finally, the prenasalization does not affect the stress placement. This pattern unequivocally holds true language-wide. Voiced plosives are only prenasalized following a nasal-vowel sequence. More specifically, a nasal causes a succeeding vowel to be nasalized, which in turn causes the prenasalization of the voiced plosive. As was addressed in §2.3, stress is placed on the first syllable of a word unless it is light and followed by a heavy second syllable, in which case stress is placed on the second syllable. In (16) /mäden/ has stress on the second syllable because it is heavy, while the first syllable is light. If the prenasalization [ñ] was instead a phonemic nasal consonant (i.e. /n/), then the first syllable would be heavy and would therefore be stressed. The fact that this is not the case provides a crucial testimony to the nature of prenasalization in Ma Manda. /nəgət/ shows the same pattern, while /mɔbə/ is ambiguous. Since stress defaults to the first syllable when there are no heavy syllables, one would expect this word to be stressed on the first syllable whether it

is analyzed as /mɔbə/ or /mɔmbə/. We can ascertain, however, that the phonemic form is in fact /mɔbə/ due to the shortened duration of the bilabial nasal. Unfortunately, the difference in duration between a prenasalized nasal and a nasal phoneme is miniscule and therefore unreliable as a sole source of proof.<sup>30</sup> Further proof lies in the fact that, when speakers are asked to speak the word very slowly, the prenasalization is left out. Furthermore, the elderly Ma Manda speakers prefer to write /mədə/ ‘talk’ as <mada> while the younger speakers—those who have learned to read and write Tok Pisin—prefer to write <manda>. This unveils a fascinating reality: As speakers have learned to speak Tok Pisin, 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 not just hearing the nasalization, but insisting that it be written. Blevins and Pawley (2010:15) address the same issue, pointing out that Kalam speakers who learned Tok Pisin as teenagers or adults are preserving Kalam sound patterns in loanword adaptations.

Autosegmental Phonology, a model of non-linear phonology first developed by John Goldsmith (1976), provides a formalism that is helpful in our treatment of these matters. The feature tree (see Kenstowicz 1994:146 for the version used in this paper)<sup>31</sup> provides a hierarchical tree structure which ‘provides a natural representation of assimilation as establishing a new connection or *association* between two nodes in the graph’ (Kenstowicz 1994:150). In short, the feature tree intuitively illustrates the nasal spreading process from a non-linear perspective:<sup>32</sup>

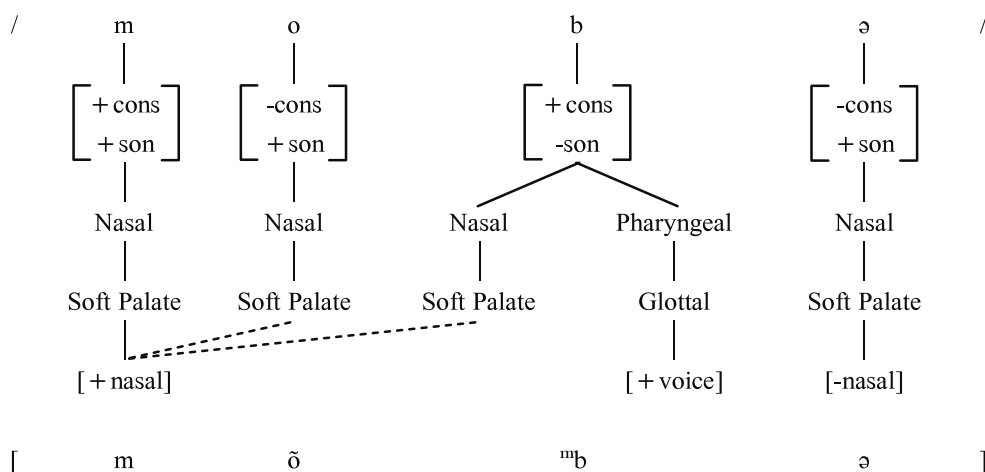
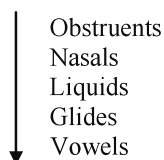


Figure 12: Feature tree representation of (16)a.

Here we can see that the word-initial nasal, in this case /m/, causes the *spreading* of nasality through the vowel and into the voiced plosive. The voiced plosive is then prenasalized, but it also blocks the nasalization from proceeding to the word-final vowel. It does not seem to be the case, however, that nasalization is spread across a *word* in Ma Manda. As will be clarified below, it is the *syllable* which the nasal spreading process is concerned with. Nasalization ceases to be spread beyond the syllable.

Environmentally conditioned nasalization has not been described in any fellow Erp languages. In southeast New Guinea, however, there is some evidence of comparable processes. In Oro Province (officially Northern Province), the Binanderean language family is known to have similar processes of nasal spreading. In Korafe (Farr and Farr 1974:8-9) all obstruents have prenasalized allophones. When a nasal occurs as the syllable onset, it initiates the prenasalization of the following vowel and the prenasalization of a following obstruent. Just as in Ma Manda, the vowel's nasalization is not obligatory. Regarding Binandere, Wilson (1992:4) writes that 'the allophones [ᵐb ᵐd ᵑg ᵑdʒ] 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. In Ma Manda the nasal spreading process is equally concerned with the syllable, as will be seen in examples (17)-(18).

It has been shown that nasalization spreads from a nasal consonant, across a vowel, to cause prenasalization of voiced plosives. The question now remains: what blocks the nasal spreading process? One may be tempted to appeal to the sonority hierarchy for assistance in articulating the Ma Manda situation. Figure 13 below portrays an abbreviated version of the scale, with the categories of highest sonority at the bottom:



**Figure 13: Sonority hierarchy**

We have already seen that nasalization spreads through vowels and is interrupted by voiced plosives. What else interrupts the process?

- (17) a. /məlom/                    [mɔ̃<sup>h</sup>lom]                    ‘owner’  
       b. /məjəpun/                [mɔ̃<sup>h</sup>jəpun]                ‘banana sp.’

We see here that liquids and glides appear to block the spreading process just as plosives do.

- (18) /nəugem/                    [nɔ̃<sup>h</sup>ugem]                    ‘spicy, aggressive’

This example provides an important clue toward discerning an appropriate analysis for the Ma Manda nasal spreading process. Here we see that even a vowel ‘blocks’ the spreading of nasalization. We do not here see \*[nɔ̃<sup>h</sup>ugem]. What now becomes apparent is that nasal spreading is directly dependent on the syllable. Nasality spreads from a nasal in onset position of a syllable, through a contiguous vowel, and into the onset of a following syllable. If that onset is a voiced plosive, then it will be prenasalized. Perhaps as a reflex to the historical prenasalization of Trans-New Guinea languages, voiced plosives are inclined to become prenasalized. Currently, however, the only environment that allows this to happen is when it is preceded by a nasalized vowel, which in turn only presents itself when it is spoken immediately after a nasal consonant.

### 3.2.2 Across morpheme boundaries

The issue is more complicated than it appears here however. Until this point only voiced plosives have been considered with regard to nasal spreading, when in fact, voiceless plosives may undergo the same process. In monomorphemic words, voiceless plosives do not undergo prenasalization:

- (19) /gəmət/                    [gɔ̃<sup>h</sup>mɛt]                    ‘snake’

while across morpheme boundaries voiceless plosives are just as likely to be prenasalized as their voiced counterparts:

- (20) a. /lo-/                    +                    /-kə/                    =                    [lɔ̃<sup>h</sup>okə]  
       ‘go up’                                       ‘SS’                                       ‘go up (and)’  
       b. /lo-/                    +                    /-got/                    =                    [lɔ̃<sup>h</sup>got]  
       ‘go up’                                       ‘RPST.1sg’                                       ‘I went up.’  
       c. /lo-/                    +                    /-de/                    =                    [lɔ̃<sup>h</sup>ode]  
       ‘go up’                                       ‘IMPER.2du’                                       ‘You both go up.’

- (21) a. /mo-/ + /-kə/ = [m̃<sup>h</sup>kə]  
 ‘go down’ ‘SS’ ‘go down (and)’  
 b. /mo-/ + /-got/ = [m̃<sup>h</sup>got]  
 ‘go down’ ‘RPST.1sg’ ‘I went down.’  
 c. /mo-/ + /-de/ = [m̃<sup>h</sup>de]  
 ‘go down’ ‘IMPER.2du’ ‘You both go down.’

In (20) the verb root /lo-/ ‘go up’ is given with three different verbal suffixes: the medial same subject suffix, the remote past tense first person singular suffix, and the imperative second person dual suffix. No nasalization is present in these examples. In (21), the verb root /mo-/ ‘go down’ is given with the same three verbal suffixes. Here, nasalization is present in all three because the verb root consists of a nasal-vowel sequence. It is immediately evident that across a morpheme boundary voiceless plosives are prenasalized just like voiced plosives. This pattern occurs without exception, not just within a word boundary as in (20)-(21), but across word boundaries as well. (22)a. reveals the spreading across word boundaries within a noun phrase, while (22)b. reveals the spreading across word boundaries within a sentence:

- (22) a. /nə/ + /bən/ = [ñ<sup>m</sup>bən]  
 ‘man’ ‘a’ ‘a man’  
 b. /mi/ + /kugot/ = [m̃<sup>n</sup>qu<sup>l</sup>got]  
 ‘water’ ‘I went’ ‘I went to the water.’

It is important to note that, across a word boundary, Ma Manda speakers will still understand someone who leaves out the prenasalization; in fact, this prenasalization is optional. Within the word boundary though, the nasalization must be spoken for the hearer to readily understand what is being said. Also, the nasal vowels are certainly non-phonemic; Ma Manda speakers do not recognize the difference between oral vowels and nasal vowels.

Lastly, it should be noted that the nasal spreading process occurs prior to several other morphophonemic processes:

- (23) /mo/ + /bə-/ + /-got/ = [m̃<sup>m</sup>bə<sup>l</sup>got]  
 ‘PERF’ ‘come’ ‘RPST.1sg’ ‘I came.’  
 (24) /no/ + /-gə/ = [ñ<sup>h</sup>gə]  
 ‘brother’ ‘2sg.POSS’ ‘your brother’

There is a morphophonemic process whereby /l/ is elided before /g/. In (23) the nasal spreading occurs just as expected. In (24), though, the nasalization spreads but does not cause the prenasalization of /g/. This is because the nasal spreading process took place before the /l/ of /nol-/ was deleted.

The following examples provide another morphophonemic rule that interacts with nasal spreading:

(25)	a. /lo-/	+	/-be/	=	[ <sup>l</sup> lowe]
	‘go up’		‘IMPER.2sg’		‘You go up.’
	b. /f-/	+	/-be/	=	[ <sup>l</sup> fawe]
	‘come down’		‘IMPER.2sg’		‘You come down.’
	c. /lɛb-/	+	/-be/	=	[ <sup>l</sup> lɛbe]
	‘come up’		‘IMPER.2sg’		‘You come up.’
	d. /mo-/	+	/-be/	=	[ <sup>l</sup> mõ <sup>m</sup> be]
	‘go down’		‘IMPER.2sg’		‘You go down.’

Here we have four different verb roots, all with the second person singular imperative suffix. The underlying form of the suffix is /-be/. Following a vowel, however, morpheme-initial /b/s are lenited to [w]. In (25)a-b. this is exactly what happens.<sup>33</sup> In (25)c. two /b/s are brought together and degeminated. In (25)d. we see that nasality spreads over the vowel and then blocks the lenition of /b/. Nasalization has now been proven to occur prior to both *l elision* and *b lenition*.

The observant reader may wonder whether \*/-we/ can instead be posited as the underlying second person imperative form rather than /-be/. In (26) we see our prototypical /lo-/ and /mo-/ with the first person plural present tense suffix /-wɛm/:

(26)	a. /lo-/	+	/-wɛm/	=	[lo <sup>l</sup> wɛm]
	‘go up’		‘PRES.1pl’		‘We are going up.’
	b. /mo-/	+	/-wɛm/	=	[mõ <sup>l</sup> wɛm]
	‘go down’		‘PRES.1pl’		‘We are going down.’

What we notice is that the nasal spreading process does not cause the suffix to become [b] in (26)b. (i.e. \*[mõ<sup>l</sup>m<sup>b</sup>wɛm]). Morpheme-initial /w/s do not alternate to [b]s. Rather, morpheme-initial /b/s may undergo lenition to [w].

### 3.3 Interaction between epenthesis and nasal spreading

With both of these processes now having been described in detail, let us briefly address the interaction between them. When both of these processes occur together, they cause a wide gap between the underlying form and its surface realization:

- (27) a. /m-/ + /-be/ = [mũ<sup>m</sup>be]  
           ‘give’                   ‘IMPER.2sg’                   ‘Give (to him).’  
 b. /fepm-/ + /-got/ = [ʼfepmũ<sup>n</sup>got]  
           ‘cut grass’                   ‘RPST.1sg’                   ‘I cut the grass.’  
 c. /n-/ + /-kə/ = [nĩ<sup>n</sup>kə]  
           ‘tell’                   ‘ss’                   ‘tell (him) (and)’

These examples provide us with a starting point. In all three, the concatenation of morphemes causes consonant clusters, which trigger epenthesis. Once the vowel is inserted, it causes a nasal-vowel sequence which triggers the nasal spreading process.

Below, three homonyms are displayed; their near-identical surface forms are due to the interaction of three phonological rules:

- (28) a. /∅-/ + /n-/ + /-be/ = [ʼnĩ<sup>m</sup>be]  
           ‘3sg’                   ‘tell’                   ‘IMPER.2sg’                   ‘Tell (him).’  
 b. /n-/ + /m-/ + /-be/ = [ʼnĩ<sup>m</sup>be]  
           ‘1pl’                   ‘give’                   ‘IMPER.2sg’                   ‘Give to us.’  
 c. /n-/ + /b-/ + /-be/ = [ʼnĩ<sup>m</sup>be]  
           ‘1pl’                   ‘see’                   ‘IMPER.2sg’                   ‘Look at us.’

In the first example, the verb root /n-/ is joined with the imperative suffix /-be/. Epenthesis and nasal spreading are both triggered. In the second example, epenthesis is triggered between the first person plural object prefix and the verb root /m-/. Nasality spreads over the initial epenthésized vowel only. In the third example, epenthesis and nasal spreading are both triggered between the prefix and verb root /b-/. Also, the successive /b/ phonemes are degeminated. In order to resolve this ambiguity, the people use contextual clues. Over time certain clues 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’:

(29)	a. /n-be/	=	[nĩ <sup>m</sup> be]		
	‘tell (him)’		‘Tell (him).’		
	b. /ndok/	+	/n-m-be/	=	[nĩ <sup>n</sup> dok nĩ <sup>m</sup> be]
	‘DAT.1pl’		‘give to us’		‘Give to us.’
	c. /fəle-kə/	+	/n-b-be/	=	[ <sup>l</sup> fəlekə nĩ <sup>m</sup> be]
	‘turn around (and)’		‘look at us’		‘Turn around and look at us.’

This description will serve to introduce the complex topic of orthography development.

#### 4. Orthographic considerations

Throughout this paper, I have delved into the theoretical world of phonology, paying special attention to epenthesis and nasal spreading. The important question now is: How does the theory affect the practice? How does the analysis of these processes help to ensure a well-grounded orthography? Before addressing these questions, I provide a list of the graphemes used in the current trial orthography.

##### 4.1 Trial orthography

/	ə	ɐ	b	d	e	f	g	(i)	i	k	l	m	n	ŋ	o	p	s
<	a	aa	b	d	e	f	g	h	i	k	l	m	n	ñ	o	p	s
<	A	Aa	B	D	E	F	G		I	K	L	M	N		O	P	S
		t	u	w	j	/											
		t	u	w	y	>											
		T	U	W	Y	>											

**Figure 14: Trial orthography**

This table pairs each of the Ma Manda phonemes with the graphemes used to represent them in the current trial orthography. The blanks in the final row indicate that these phonemes do not occur word-initially.

##### 4.2 Problems and solutions for Ma Manda

In this section I discuss a number of the issues I have faced and continue to face as I strive to enable the Ma Manda people to have access to written media. I apply the theory to the practical complications. Should the epenthetic vowel be written? How does one decide to write the reduced vowels that occur in unstressed syllables? Should the prenasalization of plosives be written? Each of these questions are handled from the Ma Manda perspective.



In addition, I discuss how the Ma Manda people are choosing to treat other general orthographic considerations such as word length, diacritics, and digraphs.

#### **4.2.1 Alphabet development workshop**

In January of 2011 my wife and I began to advertize with the community that we would be holding an ‘alphabet development workshop’ to design their orthography for the first time. We knew we needed to allow a sufficient amount of time for preparation, so we planned for it to take place during the upcoming school break in May, which gave us approximately five months.<sup>34</sup> We asked for each village to choose several people for the workshop who were proficient in reading Tok Pisin. We explained that we were not too concerned with education level (though we did request that the most highly educated people participate if possible), and that we desired having both men and women of a wide range of ages. We also sought the approval of all community leaders across the language area (local level government, Lutheran church leaders, and clan leaders). Finally, we encouraged the people to take ownership of this project. In order to facilitate this, we explained that we would not provide generator fuel for lighting of the classroom, or food. We wanted them to have an investment in time and money into this workshop. We did commit to providing the printer ink and classroom equipment that was needed for the workshop to be a success.

In May my wife and I, along with another couple, traveled to the village of Kesengen to conduct the anticipated course. There were thirteen participants, all but one from the three main Ma Manda villages (one man came from the fringe village of Sawana). There were ten males and three females, ranging in age from early twenties through early forties. There was a wide range of education levels as well: Two had only finished grade four, while four of them had finished grade ten; the rest of the group was interspersed within that range.

After a brief introduction to the goals of the workshop we had the participants each write a simple story in their own language using whatever letters each person felt best represented the sounds in Ma Manda.<sup>35</sup> The purpose of this was to see how they chose to represent their phonemes before we taught them anything and thus coloured their ideas about what was ‘right’ and what was ‘wrong’. We wanted to see their preferences and their struggles before we did anything else. Once this was finished, the participants took turns reading their stories aloud to the group. We took notes on difficult areas while they read, and afterwards discussed these difficulties and listed the various ways that participants had chosen to deal with them. After each participant had finished their story, I asked them what sounds they were unsure how to write. As we went along, we compiled a list of the sounds that were consistently written a certain way, and another list of the problem sounds that

many seemed to struggle with.

The second day we discussed various qualities of a good alphabet and then showed them working orthographies in related languages as well as the major languages in use in PNG, English and Tok Pisin. We pointed out some of the major weaknesses of the English orthography as well, hoping to lessen their intent to pattern their alphabet wholly after the English alphabet. After this discussion, we took each Ma Manda sound one at a time and discussed the various ways we could represent them. For a majority of the sounds, especially the consonants, this was relatively straightforward. For the most part, all of the participants preferred to match their graphemes with the English ones used for the equivalent phonemes. As we worked through each phoneme, we allowed the participants plenty of time to discuss the advantages and disadvantages that they perceived with regard to each proposed grapheme. In order to aid them in this pursuit, I provided a list of each sound in a few Erap languages and how they are represented by each orthography. I also showed the Tok Pisin, Kâte, and English alphabets.<sup>36</sup> With a few of the sounds, there was no general consensus among the participants as to how the sound should be represented. In these cases, participants were encouraged to take those decisions to community leaders overnight and come to an agreement. In each case, this proved to be the appropriate way to handle such an obstacle. In the morning the participants would return with suggestions. The approval of their elders gave these young men and women the necessary confidence to make the various decisions throughout each day.

A majority of the remaining time was spent developing the various parts of what would become *Ma Manda lê nang tangkatangka endaangka naandêlok*, the Ma Manda trial spelling guide. Part of the purpose of this week-long project was to design, print, and distribute this book. Getting it into the hands of the people allowed us to encourage and excite the community with a tangible result of their hard work, as well as to continue to test the proposed trial alphabet. We were diligent in emphasizing that the end result would be a trial alphabet and that future changes were not only acceptable, but likely. The trial spelling guide served as a catalyst for this process, giving the community a chance to wrestle with the alphabet and decide what things did and did not work. The trial spelling guide consists of the trial alphabet listed as a whole, the consonants with example words, the vowels with example words, spelling rules written in both Ma Manda and Tok Pisin, a collection of short stories written during the workshop, and a small basic dictionary.

In the end, the participants walked away much more educated about their own language. They also walked away with a physical copy of the spelling guide as a testament to their hard work and as a method of testing the recently developed trial orthography.<sup>37</sup>

#### 4.2.2 Sociolinguistic factors

Before I discuss the orthographic considerations with regard to the phonological processes addressed above, it is important that I first present the sociolinguistic factors which played out so heavily in the development of the orthography.

First and foremost, it was important that the Ma Manda people themselves had complete control over the decisions. I presented the pros and cons for various choices that needed to be made—linguistically, sociolinguistically (e.g. choices that have been made in related languages), and technologically (e.g. the ease of texting certain symbols over others)—and gave the authority to the people. They would have happily acquiesced to my preferences, but what would be the benefit of forcing their hand? Maybe the most crucial factor for a well-used alphabet is that the people themselves like it. Linguistics can only take us so far with regard to this domain.

I noticed that the people primarily followed two principles: First, they wanted their language to look like English in many ways. In their minds this gives their language a higher status. In addition, it is easier to type and to text by mobile phone. Texting has become an important method of communication in recent years in Papua New Guinea, so the young people are particularly interested in ensuring that their language is communicable via text message.<sup>38</sup> This meant that many diacritics were not preferred.<sup>39</sup> Second, they wanted their alphabet to be unique. In particular, they wanted to set themselves apart from related Erap languages, as well as from the Morobe church language of Kâte.

It was difficult to stand back and allow the people to make decisions that I did not agree with. Having studied the Ma Manda phonology for quite some time, I was more linguistically qualified than anyone else to help them. However, as I have already mentioned, linguistic considerations are only a small part of the process. It was more valuable for me to keep my mouth closed, and possibly have the alphabet be changed in the future, than for me to exert dominance and thus take the decision out of their hands. Ma Manda is not my language, and Saut is not my home. It cannot be overstated how important it was for me to allow them to make their own decisions for their own language. With that being said, however, I have encountered an unforeseen obstacle in this process. The people genuinely want to defer to me. They have asked me time and time again, “Please make the decisions based on what you know about our language and then teach us. We want you to choose.” I have worked tirelessly to give up the control in this task, and repeatedly it has been thrown back upon me. I believe there are a couple reasons for this. First of all, they have already made certain statements about what they do and do not like. They have made themselves clear about the choices when they are simply a matter of preference, but

when there are complicated linguistic factors to consider, they are less happy to decide. I believe they feel ill-prepared to make those kinds of choices. Secondly, because they know that nothing is set in stone, and because they trust me, they are content to have me provide the seemingly ideal choices. They will then let me know which of those choices they are not happy with. Throughout the alphabet development workshop and the several months following, I was adamant that I would not make a single decision on their behalf. Since that time, however, I have loosened my grip on that idealistic practice. If the people genuinely want me to make the decisions, then that is what I will do, all the while reminding them that they have the right to speak up and change it!

### 4.2.3 Choice of graphemes

As was mentioned in §4.2.1, most decisions regarding consonant graphemes were very clear-cut. The only consonant that was questioned was /ŋ/. In some related languages it is written as <ŋ> while in others it is written as the digraph <ng>. Unanimously the people chose to represent this phoneme with the digraph for ease of typing, even though this extends the length of words, and causes sequences such as <ngg> /ŋg/. The main problem with this treatment of /ŋ/ is that it leads to a few ambiguities:

(30)	a. /men/	+	/-gə/	=	[ <sup>h</sup> mẽngə]	<menga>
	‘mouth’		‘POSS.2sg’		‘your mouth’	
	b. /meŋ/	+	/-nə/	=	[ <sup>h</sup> mẽŋə]	<menga>
	‘mother’		‘POSS.1sg’		‘my mother’	

Both ‘your mouth’ and ‘my mother’ are written the same. This is because <ng> can represent either /ŋ/ or /ng/. It was decided, however, that because these ambiguities are few and because context will almost always clarify the meaning, this grapheme was acceptable. Since that time, however, we have encountered various words which have lengthened consonants at morpheme boundaries. This fact affects this phoneme more than most:

(31)	/nə-/	+	/-wəŋ/	+	/-ŋəŋ/	=	[nə <sup>h</sup> wəŋŋəŋ]
	‘eat’		‘PRES.23pl’		‘HAB’		‘They eat.’

Here, when the habitual suffix is attached to the present tense second/third person plural suffix, two /ŋ/s are brought together. If this phoneme is written using the digraph <ng> then we get <nawangngang>. It was decided that this is much too complicated to read with any ease. Therefore, we have chosen a rather unconventional grapheme for this phoneme <ñ> (thus

making the verb in (31) *nawaññañ*). Because this letter is easily found on mobile phones due to its importance in the Spanish language, it was deemed an acceptable symbol. This has the added benefit of removing the ambiguity from words like in (30), and shortening many words quite drastically.

The vowels are a much more complicated topic in Ma Manda. The vowels /i/, /u/, /e/, and /o/ have not caused any problems. The people chose for them all to be represented by the English vowels of similar quality: <i>, <u>, <e>, and <o>. It is the group of central vowels which have created a dilemma. Since the mid central vowel /ə/ is the most common vowel phoneme, it did not make sense for it to have a diacritic or be written as a digraph. Both of these could increase the difficulty of reading exponentially. This is what has led to its being written as <a>. This produces a unique problem though. The /ɐ/ phoneme would normally be expected to be written as <a>, as this would particularly match up with Tok Pisin. Originally, the people chose to underdifferentiate the two phonemes with one grapheme, but this proved to be problematic with the many examples of minimal pairs:

(32)	a. /təb-/	+	/-be/	=	[təbe]
	‘do’		‘IMPER.2sg’		‘Do (it).’
	b. /tɐb-/	+	/-be/	=	[tɐbe]
	‘talk’		‘IMPER.2sg’		‘Talk.’

Another important linguistic factor which plays into this decision is that the /ɐ/~ə/ distinction seems to mimic a length distinction present in other Erp languages (see §2.3 for a brief discussion on the evidence for this). In the end, it was decided to write the /ɐ/ phoneme as the digraph <aa>. This is easy to type, and it portrays well its distinction in length.<sup>40</sup>

#### 4.2.4 Epenthetic vowel

It was established in §3.1 that the high central vowel (with its many allophones) is not a phonemic vowel, but this alone does not answer the question of whether it should be written. Choosing not to write this phone allows words to be much shorter, but does not necessarily make them easier to read. This is because of the extensive underlying consonant clusters. The following are the words from (7) without the epenthetic vowel being written:

(33)	a. kobse	‘chicken’
	b. bkngaan	‘neck’
	c. bdam	‘possessions’
	d. boblat	‘butterfly’
	e. gtnem	‘skin’
	f. sglen	‘strong’
	g. kaadp	‘wood, fire’
	h. tk	‘clothing’
	i. gk	‘third born male’
	j. gsba	‘bat’

In fact, this was my first preference. Even though it creates consonant clusters, I felt that few of the words have enough consonants clustered together to cause much difficulty in reading. The people disagreed. They unanimously felt that a vowel should be placed in these spots, word-finally as well as word-medially. I noticed a trend that greater word-length was not something the people deemed an important consideration. For instance, it was decided that reduplicated nouns would not be broken up by a space or hyphen (see (37) i-j.). It will be interesting to see if this changes over time.

What grapheme should be used to represent the epenthetic vowel? In Kalam, the SIL fieldworker developed a practice of representing the predictable barred-*i* vowel with <*i*>, and the high front vowel /*i*/ as <*iy*> (Blevins and Pawley 2010:16).<sup>41</sup> During Pawley’s fieldwork, however, the predictable vowel was removed, leaving behind many words with consonant clusters. This proved not to create many problems for readers either. It is interesting to note two opposite approaches for the same language. Blevins and Pawley (2010:16) point out a similar situation in Haruai, a Piawi language of Madang Province, Papua New Guinea. Comrie (1991:394) says that ‘where Haruai writers have had to write down Haruai words (e.g. names on labour contracts), following the basic spelling conventions of Tok Pisin, they have not provided any orthographic representation of the *i*’.<sup>42</sup> Here too word-internal consonant clusters are broken up with this intrusive vowel, and here too the absence of the vowel in written form has proven not to be an obstacle.

The dilemma for Ma Manda is that all of the basic English vowel graphemes have already been taken by the six vowel phonemes. As a solution, on their own initiative, the people first chose to represent this vowel as <*ê*>. The circumflex above the *e* resembles the circumflex used above the *a* to represent the /*o*/ phoneme in Kâte, the Lutheran church

language that is so ingrained into their religious practices. Regarding this vowel it was said in §3.1.2 that, ‘in the southern village of Kesengen it often surfaces as a front high-mid vowel (i.e. [e] or [ø])’. I believe this is what caused the people to use the *e* as the base of the new grapheme.

This choice certainly makes the words longer: (33)f. becomes <sêgêlen> and (33) j. becomes <gêsêba>. However, the people now feel that it is their alphabet, because they made the decision on their own. It also has the added benefit of helping prenasalization to be expressed. This will be dealt with in §4.2.6. Once this decision was made, however, the participants quickly opened their mobile phones to ensure that this was available in their texting programs. For a majority of the phones, it only required an extra keystroke or two, so this was acceptable. Since that time, I have often wondered whether this diacritic would be lost in texting due to the added difficulty. Without it, there would be far too much confusion due to the <e> vowel. In this case, I wonder how people would recover the contrast? Perhaps they would begin to leave out the vowel. After all, Temple (2011:60) points out that vernacular texting in Papua New Guinea tends to ‘exhibit the same morphological changes that have been observed in other texting lingos’. This means that ‘words tend to be shortened through vowel deletion in easily recognizable words’. This tendency, combined with the fact that this vowel is absent from the lexical makeup of these words, leads me to believe that this vowel will often be omitted altogether in texting communications. In early 2012, approximately nine months after making this decision, we removed <ê> from the orthography. Back in Ukarumpa, Garambon and Tuboin sat at a desk and expressed the difficulty people were encountering with this grapheme. They really struggled with trying to make the vowel sound like an /e/. When reading, the symbol tended to cause the reader to make the vowel longer. He wasn’t reading it as an epenthetic segment, but as a full vowel.

After a few days of discussion, we settled on an alternate solution: <h>. This symbol wasn’t taken by the Ma Manda consonant inventory. After trying it out for just an afternoon, I could already see its vast improvement over <ê>. There was a significant difference in reading speed for Garambon and Tuboin as they read through stories using the <h> in place of the <ê>, and because of its lack of association with any particular place of articulation, these two men were free to pronounce the inserted vowel according to the variation found in natural speech. In reading words with this symbol, Garambon and Tuboin noticed that they didn’t feel pressure to pronounce the inserted vowels in any particular fashion. They were once again free to pronounce it however they are accustomed to. It was a big success!

The only difficulty with regard to this phoneme is that [h] does occur as an allophone

of /s/ in certain Ma Manda dialects. Still, it does not appear that it will be an issue, since /s/ occurs in consonant position and the epenthetic segment occurs in vocalic position.

#### **4.2.5 Reduced vowels**

In §3.1.3 it was explained that often the high vowels /i/ and /u/ are reduced when they occur in unstressed syllables. This process of vowel reduction causes them to become more centralized, thus making them surface in a similar (in many cases, identical) way to the high central epenthetic vowel. How then should these vowels be written? In many words, it is impossible to know the true value of these unstressed vowels. It was discussed in §3.1.4 that Ma Manda is in a state of rapid change in this area. Many vowels have already been lost, leaving remnants that have been reanalyzed as epenthetic vowels. Many others are in the process of being lost, but can still regain their full quality in certain contexts. Adding affixes or clitics to certain words changes the stress and brings out the true vowel quality, but for other words this is not a possibility.

Webb (1981:11-12) addresses the same issue in the development of the Uri orthography:

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.

This is the same policy that we have adopted in the design of the Ma Manda orthography. The vowel in question is written as <i>, <u>, or <h>, depending on what it sounds like. For instance, even though in the word /kelu/ ‘hand’ in (12) the true vowel has been analyzed to be /u/, it is written as <kelh> due to its central tongue position. The most important fact is that we are still in an exploratory stage regarding this issue. Over time as the orthography has been tested and retested through the writing of vernacular stories, we hope to discover the most appropriate way to write many of these words. More often than not, I presume, it will simply be a matter of preference.

The existence of the reduced vowel in vowel clusters is another issue which merits attention:



$$(34) \quad /niutumpa-/ \quad + \quad /-bet/ \quad = \quad [nĩutumpawet] \sim [nũutumpawet]$$

‘praise’                      ‘IRR.1sg’                      ‘I will praise (him).’

This verb root, along with around thirty others in Ma Manda, takes bound object pronominal prefixes. This class of verbs, when surfacing without a prefix, assumes a third person object. It appears that this particular verb has incorporated the third person emphatic pronoun *ni* into its third person form. The *ni* pronoun, as it almost exclusively occurs in unstressed phrasal positions, is often reduced to [nĩ]. Here we see that the /ni/ in /niutumpa-/ is actually just a reduced form of the emphatic pronoun that has been fused to form a specialized verb stem. Since the vowel here has seemed to have lost its ability to function as a full vowel, it may copy the vowel that it is butted up against. Here is an example where the choice to write the vowel is shown to be advantageous. <nutumpawet> would not be an acceptable way to write such a word, but <nhutumpawet> or <nuutumpawet> will work fine.

#### 4.2.6 Prenasalized plosives

The nasal spreading process, dealt with in §3.2, adds a new level of complexity in attempting to create a simple orthography. It was mentioned in §3.2.1 that one of the proofs for the existence of prenasalization in Ma Manda is the attitude of the speakers. I remarked that the elderly speakers, who have not grown up speaking Tok Pisin, prefer to avoid writing the prenasalization, while the younger speakers prefer to write it. The younger speakers have grown up learning Tok Pisin and, to some degree, English. This has caused them to become attuned to the sounds of their language in a different way. During the alphabet development workshop, the participants (a majority of whom were of the younger generation) decided to write the prenasalization. Therefore the prenasalized voiced plosives are written as <mb>, <nd>, and <ñg>. The Korafe (Farr 1974:34) and Binandere (Wilson 1992:4) orthographies have also been written in the same way. The prenasalization of plosives is only written when it surfaces—namely, after a nasal-vowel sequence.<sup>43</sup>

This choice interacts in important ways with the choice to write the epenthetic vowel. The following examples elaborate on /fepm-/ ‘cut grass’ from (27)b:

$$(35) \quad \begin{array}{llll} \text{a. } /fepm-/ & + & /-be/ & = & [fepmũ^mbe] \sim [fepmbe] \sim [fepimbe]^{47} \\ & \text{‘cut grass’} & \text{‘IMPER.2sg’} & & \text{‘Cut the grass.’} \\ \text{b. } /fepm-/ & + & /-got/ & = & [fepmũ^ngot] \sim [fepmgot] \\ & \text{‘cut grass’} & \text{‘RPST.1sg’} & & \text{‘I cut the grass.’} \end{array}$$

This illustrates a primary difficulty with the decisions that have been made. If epenthesis were not written, (35)a. would be represented as <fepmbe>. This word is short and the morphemes are easily divided: *fepm-be*. It is the simplest option. Instead, because both epenthesis and prenasalization are written, we encounter a difficulty. How does one write /fepm-be/? Should it be written as <fepmbe>, <fepmhmb>, or <fepmhmb>? The second option is long and somewhat convoluted. The third option is shorter, but it breaks up the underlying verb root and is less common in regular speech. It was decided to write instances of this kind without the epenthetic vowel, so <fepmbe>. (35)b. reveals the same process with a different solution. <fepmgot> is not preferred because it does not symbolize the epenthetic vowel. Since there is a change in place of articulation, the vowel surfaces to provide a transition, thus often causing the production of /ŋ/ as well. This leaves <fepmhŋot> as the only viable option. It expresses the most common realization of the word, including both the epenthesis and nasal spreading processes. Unfortunately, it is two symbols longer than the phonemic form would require: *fepmgot*.

Though simple and relatively straightforward in monomorphemic words, these added symbols begin to complicate matters greatly across morpheme boundaries. There are pros and cons to every decision, and one must be thorough in the analysis to truly understand what complications may arise when certain choices are made. These final examples illustrate an important positive outcome of the decisions that have been made:

(36)	a.	/n-/	+	/n-/	+	/-be/	=	[n̄n̄ĩm̄be]
		‘1pl’		‘tell’		‘IMPER.2sg’		‘Tell us.’
		b.	/ul-/	+	/-kə/	=	[utta]	
			‘hit’		‘ss’		‘hit (and)’	

Due to the choices detailed above, the word in (36)a. is written as <n̄n̄h̄m̄be>. If epenthesis was not written, then this word would be written as *nnbe* or *n̄m̄be*. These representations could be extremely confusing. Does *nn* symbolize /n:/? Does *n̄m̄be* represent something like [n̄n̄ĩm̄be]? After all, the point was raised in 4.2.3 that lengthened consonants do occur at morpheme boundaries. Though they wouldn’t occur here, it is very confusing! The example in (36)b. reveals the other side of the coin. This word is written as <utta>. Now that consonant clusters are written with intervening <h>s, it leaves the door open to write lengthened consonants just as they are. If we had decided to leave out the epenthetic vowel from the orthography, <utta> would be ambiguous. These issues are not necessarily any less complicated than the issues that have already been raised. It is a matter of choice. Which drawbacks are the people comfortable with? Every decision is made at the expense

of another.

With these decisions having been explained, let us look at a selection of words used through this paper using the current Ma Manda trial orthography:

(37)	a. /gɔnɛŋ/	[gɔ. <sup>l</sup> nɛŋ]	<ganaañ >	‘hole’
	b. /mukuwəŋ/	[ <sup>l</sup> mũ.ku.wəŋ]	<mukuwañ >	‘fog’
	c. /kloŋgnəŋ/	[kɪ. <sup>l</sup> loŋ.gɪ. <sup>l</sup> nɔŋ]	<khloŋghnañ >	‘lory sp.’
	d. /kəl/	[ <sup>l</sup> kɛli]	<kaalh >	‘car’
	e. /jəlob/	[jə <sup>l</sup> lobɛ]	<yalobh >	‘banana’
	f. /kobse/	[ <sup>l</sup> qobɛse]	<kobhse >	‘chicken’
	g. /sglen/	[ <sup>l</sup> sigɪren]	<shghlen >	‘strong’
	h. /tk/	[tɛk]	<thk >	‘clothing’
	i. /gsbə/	[ <sup>l</sup> gisibə]	<ghshba >	‘flying fox’
	j. /gsbə-gsbə/	[ <sup>l</sup> gisibə <sup>l</sup> gisibə]	<ghshbaghshba >	‘arachnid sp.’
	k. /skul/	[sɛ <sup>l</sup> kulɛ]	<shkulh >	‘school’
	l. /tmen/	[tɪ <sup>l</sup> mɛn]	<thmen >	‘old’
	m. /mobə/	[ <sup>l</sup> mɔ <sup>m</sup> bə]	<momba >	‘leech’
	n. /nəgət/	[nɔ <sup>l</sup> gət]	<naŋgat >	‘blood’
	o. /məjəpun/	[ <sup>l</sup> mɛjəpun]	<mayapun >	‘banana sp.’
	p. /men-gə/	[ <sup>l</sup> mɛŋgə]	<menga >	‘your mouth’
	q. /meŋ-nə/	[ <sup>l</sup> mɛŋɔ]	<meña >	‘my mother’
	r. /mo-kə/	[ <sup>l</sup> mɔ <sup>o</sup> kə]	<moñka >	‘go down-ss’
	s. /f-be/	[ <sup>l</sup> fɛwe]	<fhwe >	‘come down-IMPER.2sg’

## 5. Conclusion

The various phonological processes exhibited in this paper help to display the singularity of the Ma Manda language. No other language in the world is the same, and thus the study of these phonological processes is a valuable endeavour in its own right. Let us recapitulate the phonological processes that have been delineated in this paper.

Since Ma Manda disallows most consonant clusters, a short high central linking vowel is inserted in order to force the surface form to meet the language’s demands. This vowel is also used to resolve the prohibition against ‘voiced oral consonants’ in coda position. In addition, when high vowels serve as nuclei of unstressed syllables they are often reduced. It is often difficult or impossible to determine whether a given high central vowel is a remnant

from a historically full vowel in the same position, or a reduced allophone of the high front or back vowel. There is also a prevalent process of nasal spreading, where nasal consonants cause nasality to be spread through vowels to cause the prenasalization of plosives.

Research into these processes has the added benefit of helping to ensure that the Ma Manda people have a firm footing as they take the first steps toward becoming literate in their own language. Without at least a basic grasp of the issues presented in this paper, many of the decisions in the development of the orthography would have been made blindly. It is not always possible to devote such focussed time to the study of the phonology of a particular language before attempting to work out an orthography. When it is possible, however, it is a must! Realistically though, no amount of preparation or linguistic analysis will solve all of the potential problems one could face. Orthography development is a messy business. Thorough testing of the orthography over time is the only true litmus test.

Even once all the decisions have been made, and an orthography developed, the primary method of reading involves memorization of the most commonly used words. The famed Swiss linguist Ferdinand de Saussure stated this well: ‘We read in two ways: a new or unknown word is spelled out letter by letter; but a common, ordinary word is embraced by a single glance, independently of its letters, so that the image of the whole word acquires an ideographic value’ (1916). The reason these decisions are so important is that, in the beginning stages, every person is having to learn every word. For Ma Manda speakers, the words have yet to be memorized. Time will tell how these choices will work. What is important is that we hold our decisions with an open hand. We must not be afraid to disregard ineffectual choices and try new ideas. Then, after every choice has been trialled through the writing of extensive texts, the final decisions can be made. At the proper time the tried and true Ma Manda alphabet will be established.

## **Notes**

1. I would like to express my gratitude to René van den Berg for his guidance and mentorship, and for pointing me to a number of valuable resources. I would also like to thank Eileen Gasaway for referring me to the prenasalization processes in the Binanderean language family. Finally, I am indebted to my wife Crystal for her corrections and constant edification.
2. The naming of languages and people groups has not been a cultural value in this area. When presented with the name ‘Sauk’, it was unfamiliar to them. In place of this term the people have chosen to call their language Ma Manda, which means ‘what talk?’
3. This map, along with the following two maps, were produced by the SIL survey office after their survey of the Erap languages in March of 2006. The team split into two groups, one

team taking the western Erap languages and the other taking the eastern Erap languages. I am indebted to Rachel Hiley, Paul Hurst, and Bonnie MacKenzie for spending over three weeks hiking from village to village collecting wordlists and answering sociolinguistic questionnaires. Their initial research is what led me to seek out the Ma Manda language group. In the map presented here, as well as the map of the Ma Manda villages, the name ‘Saut Manda’ is used. The people proffered this suggestion of a name for their language to the survey team. ‘Saut Manda’ literally means ‘talk of Saut’. In subsequent interactions with people from various Ma Manda villages, it was decided that they did not want the name of any one village in the language name. This is what led to ‘Ma Manda’ (see fn 2). Additionally, the survey team utilized other names that were collected from the survey as opposed to the names as presented in the Ethnologue: Nema=Gusan (gsn) and Sama=Nimi (nis).

4. All phonetic and phonological segments in this paper are presented using the traditional IPA symbols. Therefore, for instance, /f/ is a labiodental fricative, while the rest of the labial consonants are bilabial.
5. The high central vowel is displayed in parentheses because it is not a phonemic vowel, but an epenthetic segment. It is only shown here to portray the symmetry of the Ma Manda vowel inventory. Much more attention will be paid to this vowel throughout the paper.
6. It should be mentioned, however, that the voiceless velar plosive /k/ often surfaces much further back, much like a uvular plosive [q]. This will be evident in various phonetic transcriptions throughout, but the description of this process is beyond the scope of this paper.
7. For the purpose of this paper a heavy syllable is understood to be composed of two morae. A mora is equal to one unit of syllable weight. When a syllable ends in a vowel (other than /ə/), it is understood to be light (monomoraic). A heavy syllable—consisting of two morae—ends in either /ə/ or a consonant (bimoraic).
8. See Finongan (Rice and Rice 2010:1), Numanggang (Hynum 2001:3), and Uri (Webb 1974:47-51).
9. Foley (1991:77) discusses this same property of stressed epenthetic vowels for Yimas: ‘Yimas has a surface phonetic constraint that one of the first two syllables of the phonetic form of the word must carry primary stress. If both vowels of the first two syllables are epenthetic, then the first one carries stress.’ See also Bruce (1984:62-63) for his comparable treatment of the Alambalak stress system.
10. For the remainder of this paper secondary stress will not be transcribed.
11. The = symbol indicates that this morpheme is a clitic.
12. The - symbol indicates that this morpheme is a bound root requiring a suffix. Most verbs in Ma Manda require either a tense/subject suffix or a medial verb suffix.

13. The barred-i vowel is shown here in order to portray its frequency in comparison to the phonemic vowels. Most of its occurrence is due to epenthesis in places where no phonemic vowels are present. In a few words it is difficult to determine whether this vowel is the epenthetic high central vowel, or a reduction of a high front or back phonemic vowel (see §3.1.3).
14. Blevins and Pawley (2010:13), while discussing the ‘notable characteristics’ that set apart the predictable (epenthetic) vowels from other vowels in Kalam, mention that predictable vowels have the highest frequency of any vowels.
15. See Iatmul (Staalsen 1966) and Abelam (Laycock 1965); also see Yessan-Mayo (Foreman and Marten 1973)—now called Yamano.
16. Rules are then used to form the front and back allophones of the central vowel phonemes: [i] and [u] from /i/, and [e] and [o] from /ə/.
17. Baart (2009) summarizes a discussion in Nootboom (1997:654-656) that explains that a number of studies have been performed which reveal that, when sounds are between 40 and 250 ms in duration, one sound needs to be 5-15 percent longer than another sound for a difference to be perceived. Outside this range, sound durations are less accurately perceived. In fact, very short sounds (shorter than 20 ms) are ‘not perceived as having duration at all’. Instead, these duration differences are perceived as differences in loudness. A point of further study would be to analyze the duration of these Numanggang vowels in a broad-band spectrogram.
18. Recall Linnasalo (2003:12), where a similar statement is made with regard to Nek. In addition, regarding the Finongan language Rice & Rice (2010:9) state that only voiceless plosives and nasals can occur word-finally.
19. The alveolar flap is an allophone of /l/, but it generally only occurs when it is the second element of a consonant cluster.
20. In example (13) of this article, some Tok Pisin loanwords are given. Tok Pisin is the name of one of the three official languages of Papua New Guinea, also including English and Hiri Motu. It is a pidgin with roots in English, German, Portuguese, Malay, and various local languages. It is the primary *lingua franca* in use throughout Morobe Province. Two examples from Kalam will suffice: Tok Pisin *helpim* ‘help’ becomes /alpim/ [a'liβi'm] (notice the barred-i between the /l/ and /p/), and *spet* ‘spade’ becomes /spet/ [si'βe'r] (notice the barred-i between the consonants in the word-initial consonant cluster).
21. Blevins and Pawley (2010:4) recall that transition vowels like those discussed so far have been referred to by a variety of names in the literature: excrescent, intrusive, invisible, morales, paragogic, parasitic, svarabhakti, transitional, and weightless.
22. Here the velar nasal is elided, leaving only the nasalized vowel as evidence of its phonemic

- presence.
23. Hynum (1980:7) gives [sɪp<sup>h</sup>ak<sup>ɿ</sup>] 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 (1974:95) provides equivalent examples for Uri: Tok pisin *slip* ‘sleep’ becomes [sirip] and *snek* ‘snake’ becomes [sinek].
  24. This variability in vowel quality correlates with the typology put forth by Hall (2006) for ‘intrusive vowels’.
  25. Nek reveals the same pattern (Linnasalo 2003:12).
  26. In contrast, Linnasalo (2003:10) makes the claim that /l/ can occur, though rarely, in syllable-final position. There is only one Ma Manda word which reveals a syllable-final lateral without the epenthesis process being triggered: /soŋgel/ ‘Huon Bowerbird’. In addition, names ending in /l/ tend not to initiate epenthesis. For instance, in saying my wife Crystal’s name the people most often pronounce it as [ki<sup>h</sup>listəl].
  27. Recall that this word was introduced in (1)d. with the phonetic form of [‘mukuwəŋ]. In careful speech this is its pronunciation, while in regular speech the /u/ phonemes are reduced to central location (i.e. [ʊ]).
  28. Kalam’s predictable vowels are similar to Hall’s ‘intrusive’ category in vowel quality, and also in the fact that the vowels do not seem to have the ‘general function of repairing illicit structures’. They are similar to the ‘epenthetic’ category in that the vowel’s quality can be copied over any intervening consonant, the vowel’s presence is not dependent on speech rate, the vowel does not only occur in heterorganic clusters, and the vowel is phonologically visible (i.e. it can carry word stress). Two qualities that do not relate to either of Hall’s classifications are that the vowel’s presence may be associated with consonant release, and the lexical forms may contain long strings of consonants and lack vowels altogether (Blevins and Pawley 2010:36).
  29. See Blust (2003) for an example of remnant high vowels for the Selau dialect of Halia, an Oceanic Austronesian language in northern Bougainville. Here, word-final high vowels were reduced and lost. Blevins and Pawley (2010:37-38) treat this as a further example of vowel reduction and loss, and rule inversion.
  30. The difference in duration between prenasalization and phonemic nasals is something that needs to be studied further. A proper acoustic analysis of these sounds is needed.
  31. Based on proposals by Halle (1992).
  32. The oral nodes are not portrayed here for simplicity; it has no bearing on the analysis.
  33. Incidentally, (23)b. shows that epenthesis occurs prior to this morphophonemic process. /f/ is released in the form of the transitional vowel, which causes the lenition of /b/.

34. The only acceptable venue to hold such a workshop was the school, so this is the reason we had to plan for May.
35. Beforehand though, we had the participants sign informed consent documents expressing that any stories they wrote during the workshop would be allowed to be shared with the public.
36. The alphabets that were used for comparison are presented in the appendix (with the exception of English). Kâte was chosen because it is the Lutheran church language used in the area—most people own Kâte hymnals. In the Ma Manda area, most people can read Kâte.
37. In fact, just a month after the workshop one of the participants came to Ukarumpa, SIL's PNG centre, and we worked through some issues that had already been raised in the community. We made a number of valuable changes and reprinted several revised copies of the spelling guide to send out for further testing. Then, once again in early 2012 two men came to Ukarumpa to further revise the alphabet now that certain problems had been noticed by the people.
38. Temple (2011:60) discusses the use of texting in Papua New Guinea. One major finding was that a majority of texting was done in Tok Pisin due to the wide cross-cultural communication needs, as well as generally low literacy levels in vernacular languages. In addition, when vernacular orthographies contain symbols that are difficult to transcribe using a mobile phone keypad (like tone markings), then the texters are more likely to resort to using Tok Pisin.
39. With each new suggested diacritical mark (e.g. <sup>^</sup>) or grapheme (e.g.  $\eta$ ) there was a shuffle to test them out with various mobile phones. If it was shown that some of the phones could handle such a symbol, then it was deemed acceptable.
40. A word of caution here: I am aware of a certain vowel harmony process which causes the low central vowel to be raised to the mid position in an environment following the mid central schwa. This same process also causes the schwa to be lowered to match a previously spoken low central vowel. There seems to be a lot of variation here, and therefore I have not been able to come to any firm conclusion about how this process is operating. What I do know is that this variation between the vowels is producing a lot of confusion, especially due to their underdifferentiation in the English alphabet.
41. Granted, Scholz (1995) reveals that his analysis does not include a high front vowel phoneme. In his analysis <iy> represents /əj/. His schwa is the same unit as Pawley's barred-i. For our purposes here the phonemic analysis is not as important as the symbols chosen to represent the sounds of the language. <iy> is an attested method, though I am unaware of the efficaciousness of this decision.
42. An obvious refrain here is that Haruai speakers would not have any appropriate symbol at their disposal to write this sound. Since it is absent in Tok Pisin and in English, speakers of languages with one of these sounds are often clueless on how to represent the sound they hear



in their head. In 2009 I had my first opportunity to enlist the help of a Ma Manda man to write words from a word list. Garambon first chose to write the barred-i vowel as a hyphen. Later he corrected his transcriptions and removed the vowel altogether (i.e. for /tk/ he wrote <t-k> and later <tk>).

43. For Binandere, Wilson has analyzed there to be phonemic nasalized vowels as well. Following a nasalized vowel, the same process of prenasalization occurs. This leads me to posit the correction that it is not a nasal-vowel sequence which causes prenasalized allophones of the voiced plosives. Instead, like in Ma Manda, it is the nasalized vowel that causes it. I venture to suggest the same for Korafe as well. For all three of these languages, the nasal consonant causes nasal vowel allophones, which then cause the plosives to be prenasalized. For Binandere, underlying nasal vowels also cause prenasalization of voiced plosives as well.
44. When spoken slowly, people pronounce this word [fepm-be]. They understand that this is the underlying form in this instance. In regular speech, though, the first option is the most likely pronunciation.

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**APPENDIX: ALPHABETS COMPARED**

Finongan		Numanggang		Kâte		Nek		Tok Pisin	
<>	[ ]	<>	[ ]	<>	[ ]	<>	[ ]	<>	[ ]
A,a	a	A,a	a	A,a	a	A,a	a	A,a	a
B,b	b	B,b	b	Â,â	o	B,b	b	B,b	b
c	ʔ	D,d	d	B,b	b	D,d	d	D,d	d
D,d	d	E,e	e	C,c	ʔ	E,e	e	E,e	ε
E,e	ε	F,f	f	D,d	d	G,g	g	F,f	f
F,f	f	G,g	g	E,e	e	I,i	i	G,g	g
G,g	g	Gw,gw	g <sup>w</sup>	F,f	f	i	ə	H,h	h
h	ɸ	H,h	h	G,g	g	J,j	z	I,i	i
I,i	i	I,i	i	H,h	h	K,k	k	J,j	j
K,k	k	K,k	k	I,i	i	L,l	l	K,k	k
Kw,kw	k <sup>w</sup>	Kw,kw	k <sup>w</sup>	J,j	j	M,m	m	L,l	l
L,l	ɾ	L,l	l	K,k	k	N,n	n	M,m	m
M,m	m	M,m	m	L,l	l	Ŋ,ŋ	ŋ	N,n	n
N,n	n	N,n	n	M,m	m	O,o	o	O,o	o
Ng,ng	ŋ	Ŋ,ŋ	ŋ	N,n	n	P,p	p	P,p	p
O,o	o	O,o	o	Ŋ,ŋ	ŋ	S,s	s	R,r	r
P,p	p	P,p	p	O,o	o	T,t	t	S,s	s
S,s	s	S,s	s	P,p	p	U,u	u	T,t	t
T,t	t	T,t	t	Q,q	kp̄	W,w	w	U,u	u
U,u	u	U,u	u	Œ,œ	gb̄	Y,y	y	V,v	v
W,w	w	W,w	w	S,s	s			W,w	w
Y,y	j	Y,y	j	T,t	t			Y,y	y
				U,u	u				
				W,w	v				
				Z,z	ts				
				Ʒ, ʒ	dz				