A Description of the Sound System of Misiones Mbya

Matías N. de Paula

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Jonah Katz, Ph.D.
Sandra Stjepanovic, Ph.D.
Sergio Robles-Puente, Ph.D.

Department of World Languages Literatures and Linguistics

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ABSTRACT

The Sound System of Misiones Mbya

de Paula, Matias N.

Misiones Mbya is an indigenous language of South America spoken by the Mbya people in the Province of Misiones, Argentina. Although there are several studies in the literature about the Brazilian variety of this language, the linguistic information available about Misiones Mbya is extremely scarce. In this thesis I present a segmental analysis of the language (individual vowels and consonants) and a prosodic analysis of nasal harmony based on field data collected in three different communities in Misiones. The segmental analysis shows that this variety is very similar to the Brazilian variety of the language with only a few exceptions. The prosodic analysis of nasal harmony indicates that nasality fades with distance. It is also shown that some methods for carrying out acoustic analysis of nasality can yield results which can be confounded with stress.

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HA’EVETÉ

AGUIJÉ

GRACIAS

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Contents

CHAPTER ONE: INTRODUCTION

1.1. Introduction

This thesis documents the basic sound patterns of Misiones Mbya (or Mbyá), a Tupi-Guarani language spoken in the province of Misiones in northern Argentina. The two main sections of the thesis are a segmental description of the sound system (Chapter Two) and a description of acoustic patterns of nasality and their relationship to phonological representations (Chapter Three).

While there are some published studies that look at social and historical aspects of the Misiones Mbya people, there are no detailed linguistic descriptions of this variety of the language. The very few linguistics publications about the Mbya language concern the Brazilian variety and given the fact that both, political and geographical barriers separate this group from the Paraguayan Mbya and the Argentinean Mbya, it becomes important to report in more detail what the characteristics of each of these varieties are.

Although the language does not appear to be under immediate threat (it continues to be learned as the mother tongue of Mbya children), there is evidence that the influence of Spanish is growing so it is vital to study its characteristics before these influences increase.

The language presents some interesting typological properties, one of the most salient ones is nasal harmony. This is an unbounded local spreading process that affects certain segments in a word so that they all agree in nasality. This means that a nasal segment spreads nasality to all previous segment. Although Mbya is not the only language to display nasal harmony, it works differently for different languages. Several languages of the same family as Mbya display a similar process but it is important to document this type of phenomenon in detail in order to understand how the languages compare. Also, nowhere in the limited data available for any variety of Mbya is there a detail acoustic phonetic description of the sound system, which means that the aforementioned processes have only been described impressionistically. It is important to understand these patterns more clearly in order to better describe the language

The results of this thesis show that the sound system of the language is quite similar to that reported for Brazilian Mbya (Guedes, 1983; Dooley, 2011). The few segmental differences mainly include the difference in backness of some vowels ([ɨ] and [a]) which are more front in the data found here, and the lack of the affricate [ʦ]. With respect to nasality in Misiones Mbya, the acoustic analysis of nasality conducted in this study shows that nasality spreads regressively to other vowels but there is also some evidence of fading so that nasalized vowels are less nasal than fully nasal ones. The study also shows that some methods used to analyze nasality (A1-P0) can yield results which might be confounded with stress because stress can affect the same harmonics which are measured to detect nasality and so sometimes stressed vowels can show a higher degree of nasality. It is postulated that nasal harmony might work as a way of increasing contrast between otherwise similar pairs of words (contrast enhancement, Suomi (1983) and Kaun (2004)) and that the fading effect might be the result of having reached a good amount of contrast: the more harmony we have the less need for it to continue we get.

In the remainder of Chapter One, I will give some background information about the Mbya people and language as well as a brief account of the previous studies about this language, a description of the fieldwork and informants interviewed for this paper. Chapter Two looks at the segmental inventory of sounds of the language. Chapter Three takes a closer look at nasality patterns and how they interact with position and stress. Chapter Four is a conclusion and discussion.

1.2. About Mbyá

Misiones Mbya (or Mbyá) is a Tupi-Guarani language spoken in different areas of the Province of Misiones in Argentina by the Mbya people. According to the National Institute of Statistics and Census of Argentina (INDEC) there are over 4000 speakers of Mbyá in Misiones, and a similar amount living in the Province of Corrientes, south of Misiones (INDEC, 2004, 2005). However this information conflicts with that obtained in the field where my informants indicated that the Mbyá people of Argentina only live in Misiones and that the language is not spoken in other provinces. Mbya is also spoken in parts of Paraguay and Brazil where it has about 5000 and 6000 speakers respectively (Ethnologue, 2015).

Although the language is spoken in the three countries, most of the few publications available describe it as it is used in southern Brazil. Figure 1 below indicates the location of some the main Mbyá communities in Argentina and Paraguay. Notice that although other Guaraní groups coexist in Paraguay and Brazil (Aché, Avai, etc.), the vast majority of the Guaraní communities in Misiones belong to the Mbyá people.

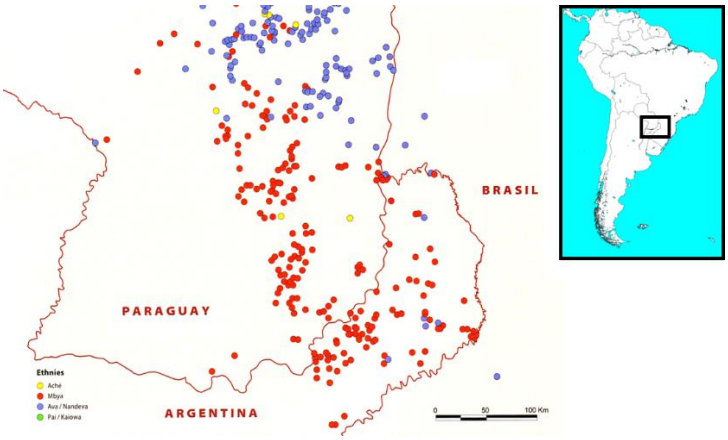

Figure 1: Map showing the distribution of the main Mbya (in red), and other Guaraní communities in the border area between Argentina, Paraguay and Brazil[1]

The Tupí language family is one of the largest language families of the Americas. It encompasses dozens of languages that span all over the central and northern region of South America. The largest subgroup in this family is Tupí-Guaraní, and the most spoken language in this subgroup is by far Paraguayan Guarani, with several million speakers. Paraguayan Guarani is closely related to Mbya and Mbya speakers are frequently able to understand both languages, though the opposite is not so common (Vellard, 1933). Recent genealogical studies place the languages very closely together in the family tree (Michael, et al., 2015) as can be seen in Figure 2 below.

[1] Map taken and modified from "Los Mbyas Guaraníes: Tiempo de Reconocimiento" by Sélim & Micolis, 2013

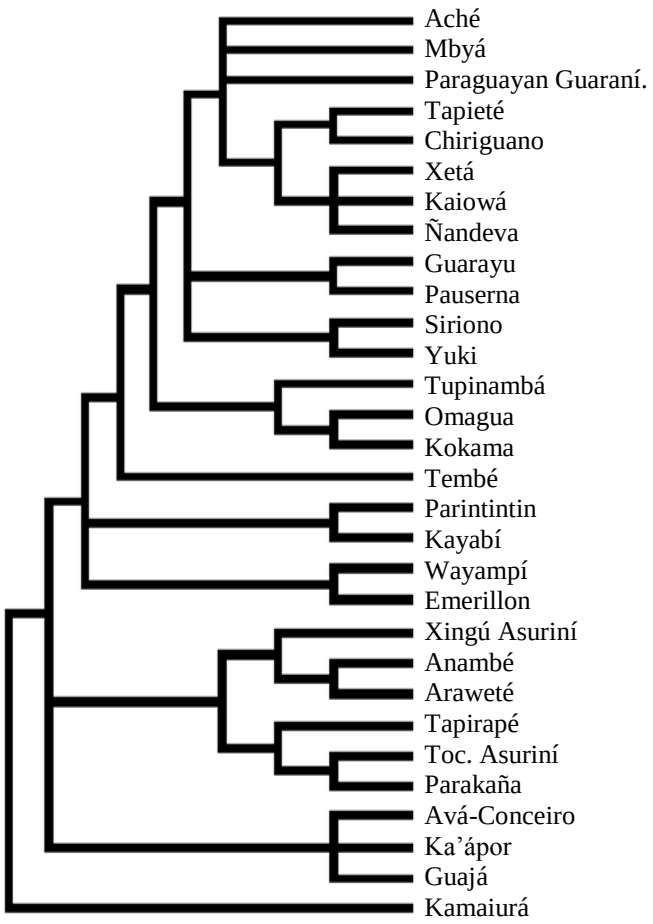

Figure 2: Classification of 30 Tupí languages following a Bayesian Phylogenetic approach (Michael, et al., 2015). The colors indicate family groupings which are ignored for the present paper.

According to the National Institute of Indigenous Affairs of Argentina (INAI) about 60% of the Mbyá people aged 5 or more speak the Mbyá language. Based on the interviews I carried out in the area with members of Mbya communities and individuals who work in Mbya communities, I have reasons to believe this number is much higher. They report (and my observations confirmed) that the vast majority of Mbya children learn the language as their mother tongue and they begin learning Spanish only when they start formal education. So although the population of speakers of the language in Misiones is not very significant (compared to the million native speakers of Spanish), the language is not under immediate threat, especially considering that bilingual education is available to some extent. According to Ethnologue (2015), Brazilian Mbya is "developing", meaning that "it is in vigorous use,

with literature in a standardized form being used by some though this is not yet widespread or sustainable". It also classifies the Mbya spoken in Paraguay and Argentina as "threatened" saying that it is unstandardized and that intergenerational transmission might be in the process of being broken. However, based on the observations made on the field for this paper I believe that intergenerational transmission is not immediately threatened, but influences from Spanish and Paraguayan Guarani are becoming stronger.

1.3. About the Mbya people

The Mbya people form part of the larger "Guaraní nation" (Grünberg, Meliá, & Azevedo, 2009), a group of ethnicities that share some cultural and linguistic traits. Together, the Guarani people encompass about 100.000 individuals that live in about 500 communities in Bolivia, Paraguay, southern Brazil and northern Argentina.

The Guarani people were nomadic farmers and gatherers. They have inhabited the area for almost 2000 years according to archeological findings (Bonomo, C. Angrizani, Apolinaire, & S. Noelli, 2015). Before the European colonization, they lived in societies with self-sustained economies based mainly on hunting and the plantation of corn, cassava (manioc) and other plants, and the gathering of medicinal plants from the sub-tropical forest where they lived. They first came into contact with the European invaders around 1500 and since then they have been subject to slavery, evangelization, and cheap labor. In the 1600's the Jesuit Missionaries came to evangelize. They created communities where they mixed the European and the Guaraní cultures. The Jesuits were also the first to document cultural and linguistic aspects of the Guaraní people such as the first grammar of the language spoken in the Missions "Tesoro de la Lengua Guaraní" (Montoya, 1639). After the Jesuits left, the destruction of the Guarani way of living continued including slavery to work in sugar plantations in Brazil. During the 19th, 20th and even 21st centuries, their communities continued to be forcefully relocated countless times and the spread of industrialized plantations in the area meant the destruction of much of their natural habitat. In the present most of them still live in rural areas, mainly in or near forests. They still plant, gather and to certain extent hunt, but they also produce weaved baskets and other crafts that they sell to tourists in several National and Provincial parks.

Although the Guarani people have inhabited the area for a very long time, most of the current Mbyas that live in Misiones came to the province after the Paraguayan War (or War of the Triple Allience) in the 1860's. Recent genetic studies have shown that the Mbya people of Misiones are genetically closer to Brazilian Mbyas than to other groups which are geographically closer (Sala, et al., 2010), which suggests that the Mbya people living in Misiones now are not direct descendants of the ancient inhabitants of what is now Misiones.

1.4. Previous linguistic studies of Mbyá

Brazilian Mbya has been studied by several authors. Guedes (1983) conducted the first detailed modern description of the phonology of the language. Other authors such as Dooley (1984, 1996, 2013, etc) conducted studies in southern Brazil and carried out a descriptions of syntax and morphology. He also compiled a detailed lexicon of the language (Mbya-Portuguese). There are a lot of anthropological studies about the Mbya people as well. These focus on different aspects of their religion, interaction with outsiders and migratory patterns. Cadogan conducted several such studies and he also published a lexicon of the language as spoken in Paraguay (Cadogan, 1992).

As mentioned before, to the best of my knowledge, with a handful of exceptions there is no linguistic information about Mbya spoken in Misiones. As part of a larger project known as *Atlas Lingüístico Guaraní Románico* (Linguistic Atlas of Guaraní Romance Languages) Dietrich (1993) conducted some interviews with Mbyá speakers in Misiones. Although not much linguistic information is given in this publication, some phonological aspects were analyzed. According to Dietrich the phoneme /h/ in not present in Misiones Mbya. He describes one affricate sound in the language (an alveo-palatal that he transcribes as /č/). Dietrich also found a few lexical differences between Brazilian Mbya and Misiones Mbya.

More recently a Spanish-Misiones Mbya, Misiones Mbya-Spanish dictionary is in the process of being published by Rodas & Benitez. This dictionary also includes some cultural notes and word lists translated in Paraguayan Guarani, Portuguese and English (Rodas & Benitez, 2015).

1.5. Fieldwork and informants

The data used for this paper was collected in several communities of Misiones, Argentina in the months of June and July 2015. Several interviews were carried out with native speakers of the language, all of them bilingual in Mbyá and Spanish. The informants were contacted through colleagues working in Misiones, Argentina. Thanks to social networks, e-mails and messaging services, I was able to communicate with members of different Mbya communities and individuals who work with or in these communities. Thanks to this, it was possible to carry out an informal first interview before going to the field, which allowed me to make a rough comparison with the published data on Brazilian Mbya (Guedes, Dooley). This initial recording was of very poor quality, but it provided enough information to determine that the language in Misiones is similar to Brazilian Mbyá as described by Dietrich, which in turn allowed for a better preparation for the more formal data elicitation.

For this study, the recordings of the interviews with 7 informants were used, all of them aged 19-36. Although attempts were made at interviewing male and female speakers of the language, more male speakers were available than female ones, so most of the data analyzed in the present paper corresponds to males. All recordings were made with a handheld portable digital recorder (Marantz PMD620 MKII). Table 1 below summarizes the main information about each informant, while Table 2 summarizes the data collected from each interview session.

The elicitation was carried out by asking the informant to translate a word from Spanish into Mbya. Before the interviews took place, a list of words was prepared together with the translation of those words into Brazilian Mbya (based on Dooley's lexicon, 2013), Paraguayan Mbya (based on Cadogan's dictionary, 1992) and Paraguayan Guaraní (based on Trinidad Sanabria's dictionary, 2010) (See Appendix) . Knowing that Misiones Mbyá was likely to be very similar to these other varieties, the list was prepared so as to attempt to elicit all of the sounds of the language in different contexts. In most cases the token given by the informant was the same or very similar to that provided by the dictionaries, in some cases the informant provided a different token which was recorded and then the informant was asked if it was possible to say it in a different way. In these cases, sometimes the first part of the attempted token was given to the informant so as to see if he/she recognized that word.

This proved to be a useful strategy as in many cases the informants did not seem to fully understand the given word in Spanish (since they were all native Mbya speakers).

Some of the informants were interviewed more in depth and isolated words as well as connected speech were recorded in those cases. Since the recordings were mostly collected on the field and frequently outdoors, some acoustic interference was present in the form of street sounds, animals and sometimes wind. Most of the data used for analysis corresponds to indoor interviews since the quality of the sound is better. However the outdoor recordings were used to compare results and confirm that similar patterns were present in all speakers.

Speaker	**Gender and age**	**City and community**	**Occupation**	**Use of Mbya**	**Schooling**
A	Male, 36	Santa Ana, Santa Ana Mirí	Teacher at bilingual school. Teaches language and culture	Every day at home and work	Bilingual education up to high school
B	Female, 35~	Santa Ana, Santa Ana Mirí	Housewife	Every day at home	Unknown
C	Male, 19	Aristóbulo del Valle, Ka'aguy Poty/Cuñá Pirú	1st year college student	Every weekend at home	Bilingual education up to high school
D	Female, 24~	Aristóbulo del Valle, Ka'aguy Poty/Cuñá Pirú	5th year college student, park ranger intern	Every weekend at home	Bilingual education up to high school. Spanish undergraduate
E	Male, 24~	Aristóbulo del Valle, Ka'aguy Poty/Cuñá Pirú	Unknown	Every day at home	Bilingual education up to at least primary school.
F	Male, 32~	Iguazú, Jachy Porá	Teacher at bilingual school. Teaches language and culture	Every day at home and work	Bilingual education up to high school
G	Female, 29~	Iguazú, Fortín Mbororé	Unknown	Every day at home	Unknown

Table 1: Individuals interviewed for the present study with details about their occupation, daily use of Mbya and level of school achieved.

Interview session	Speaker/s	Data collected	Usability
1	A, B	Isolated words (A); some phrases (A), interaction	Medium
2	C	Isolated words, some phrases, description	High
3	C, D, E	Some isolated words (E), some phrases (E), interaction, impression about other accents	Medium
4	F	Some isolated words, some phrases	Low
5	G	Some isolated words, some phrases	Low

Table 2: Summary of interview sessions and data collected. All recording were carried out with a Marantz PMD620 MKII set to record in mono in MP3 format at 96kbps

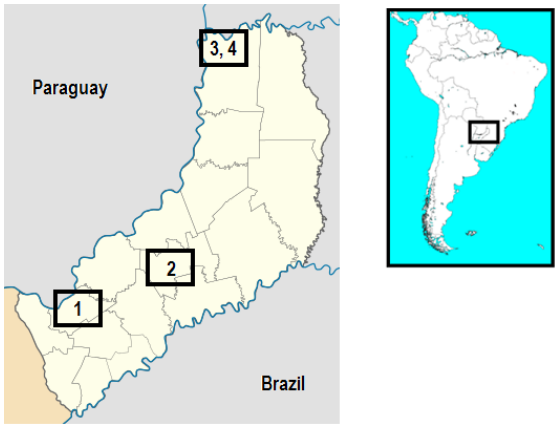

Figure 3: Map showing the location of the four communities from where data was collected. 1: Santa Ana Mirí, 2: Ka'aguy Poty, 3: Jachy Porá, 4:Fortín Mbororé

Speakers A and C were interviewed more in depth: for each of them more than 150 isolated tokens were obtained in addition to some short phrases. For the other informants only a limited set of 20-40 tokens was obtained. In the interview sessions 1 and 2 short conversations between native Mbya speakers were also recorded. Most of the tokens used for the examples on this thesis are based on the interview session 2 which was conducted indoors and that is why their usability was a bit higher. The tokens elicited from informants A, B, D, E, F and G were all recorded outdoors and that is why their usability for instrumental analysis is lower.

Clearly there is very little linguistic information available about Misiones Mbya given that the vast majority of studies of the Mbya language look at data from Brazilian Mbya communities. At the same time census reports from Argentina provide information about the number of speakers in the area that conflict with my observations and the data I gathered from informants. This is obviously an area of difficulty when studying the Mbya people and language, and one of the motivations for the present study. In the next chapter I will present the results of the segmental analysis of sounds for Misiones Mbya.

CHAPTER TWO: SEGMENTAL DESCRIPTION OF MISIONES MBYA

In this chapter I will be presenting a segmental description of the sounds of Misiones Mbya. By segmental I mean each distinct sound (either consonant or vowel) that is used in combination with each other in order to form speech. I begin by giving an overview of oral and nasal contexts in Misiones Mbya, since this is a fundamental factor determining the distribution of sounds in the language. I continue by describing vowels and consonantal segments by manner of articulation and I summarize these findings in Table 5. Finally, the syllable structure is described.

2.1. Nasal and oral contexts

The distribution of allophonic variation in Mbya depends largely on nasal harmony, so before presenting the segmental description of the sounds of the language, it is useful to understand some basic aspects of nasality in Mbya and other Tupí-Guaraní languages (for a detailed description of nasal harmony see Chapter Three).

Nasality in Mbya is a prosodic effect by which all voiced segments in a word or sometimes a phrase agree in nasality so that they are all [+nasal] or [-nasal]. The [+nasal] feature can be triggered either by a stressed nasal vowel or by any pre-nasal consonant (a stop with a nasal closure, see Section 2.3.4). These triggers affect segments to the left including any attached prefixes, and this nasality continues until an oral stressed vowel is reached. The segments that become nasalized in this way is usually referred to as a "span". Voiceless segments are considered transparent since nasality is hard to perceive in those cases, though it is possible that the velum is lowered in their production as well. In some cases nasality also affects segments to the right of the trigger so that suffixes are also nasalized (as in example (4)). The examples below represents this more clearly.

(1)	/ko.te.ˈʋẽ/	→	[kõ.tẽ.ˈṽẽ]	*to need*
(2)	/i.ɾu.ˈⁿd.ɨ/	→	[ĩ.ɾũ.ˈⁿd.ɨ]	*three*

In examples (1) and (2) above, we see how the stressed nasal vowel /ẽ/ and the pre-nasal stop /ⁿd/ respectively trigger regressive nasalization to the left which continues spreading until it reaches the beginning of the word (nasal or nasalized segments are indicated in red).

(3)	A.	/ʧe/ /a + ɲã/	→	[ʧe ã.ˈɲã]	*I speak*
	B.	/ʧe/ /ⁿd + a + ɲã + i/	→	[ʧe nã.ˈɲã.ĩ]	*I don't speak*
(4)	A.	/ʧe/ /a + ɾe.ko/	→	[ʧe aɾeko]	*I have*
	B.	/ʧe/ /ⁿd + a + ɾe.ˈko + i/	→	[ʧe ⁿda.ɾe.ˈko.i]	*I don't have*

In example (3) we see how this nasal spreading is not limited to the root of the word where it is initiated as the prefix /a/ also becomes nasalized. Negative phrases are a good example of nasal harmony in Mbya since they are formed with the addition of a circumfix (/ⁿd/ + /i/) to the verb. This circumfix is affected by nasal harmony as seen in examples (3) and (4). In (3) (*I don't speak)* we see that the circumfix has been nasalized becoming /n/ + /ĩ/ while in (4) (*I don't have*)" the circumfix is /nd/ + /i/. Notice how nasal harmony does not extend to cross word boundaries and so [ʧe] remains [-nasal] regardless of the following segment.

This means that it is not possible in this language to have a non-nasal segment in a nasal "span", or a nasal segment in an oral one, as in (7) and (8) below:

(5)	[tupa]	*bed*
(6)	[tũpã]	*Christian God*
(7)	*[tupã]	
(8)	*[tũpa]	

Notice that although it might seem like a pre-nasal stop can be part of an oral span (as in examples 4B), they can only occur in the boundary between oral and potential nasal spans. It could be argued that given that pre-nasal stops are complex segments (see Section 2.3.4) the oral span ends in the release stage of that stop (which is oral).

2.2. Vowels

Based on a phonological and acoustic analysis presented below, I found that there are 6 vowel pairs in Misiones Mbyá (see Table 3). Vowels can be oral or nasal depending on the environment, but as will be seen in the examples (15) to (18) below, nasality can be contrastive in final position.

	Front	Central	Back
High	i - ĩ	ɨ - ɨ̃	u - ũ
Mid	e - ẽ		o - õ
Low	a - ã		

Table 3: Misiones Mbya vowels based on the instrumental analysis of the first two formants.

In order to understand these vowels more clearly, I also conducted and analysis of the first and second formants for these vowels (see Figure 4). Several measurements were taken of each vowel to detect the approximate space for each oral vowel. These vowels were measured from tokens that were particularly salient, such as emphatic pronunciation in final position, so as to avoid interference from other sounds. The high central vowel [ɨ][2] occurs with a lower F1 value than both [u] and [i]. Although it could be more accurately represented with a lowering diacritic as in [ɨ̞], given than previous authors describe this sound in different varieties of Tupí languages simply with the "i-bar" I chose the continue using it. Similarly, the mid back [o] could perhaps be represented as [ɔ] since it quite lower than [u], but given

[2] Most authors use "y" to represent this sound in the spelling system of Tupí-Guaraní languages.

that these results are based on formant measurements of only one speaker, it is hard to make generalizations about these two vowels.

There are two important differences between the vowels reported by Guedes (1983) for Brazilian Mbya and the results presented here. First, [a] is described by her as a back vowel but the data here indicates that it is front. [ɨ] is described as back but in my data it is clearly central and much closer to front than back.

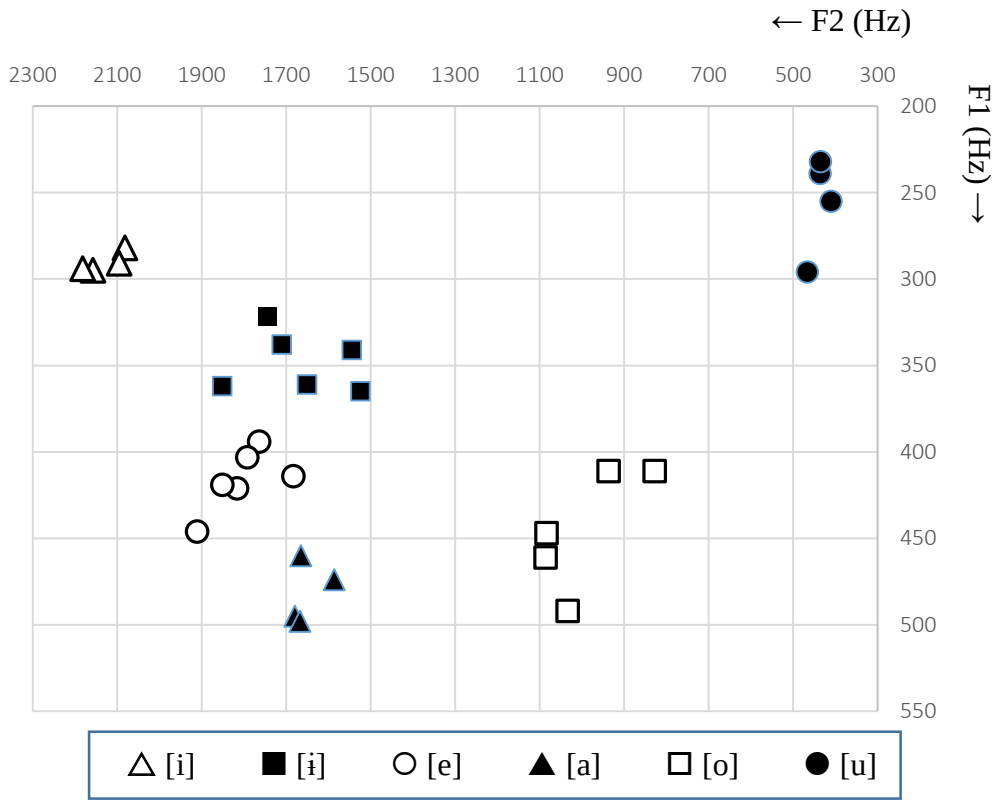

Figure 4: Vowel space for the six Misiones Mbya vowels. Measurements taken from one speaker. The vertical axis represent the first formant (F1) and the horizontal axis represents the second formant (F2)

Evidence for contrast between these vowels is presented in the following examples of vowel contrast in oral contexts. Examples in (9) and (10) show contrast between the high non front vowels [u] and [ɨ], in (11) and (12) we see contrast between the high non-back vowels [ɨ] and [i], in (13) we see contrast between the front vowels [i], [e] and [a], and the minimal pair in (14) shows contrast between the back vowels [u] and [o]:

[u] and [ɨ]

(9) [haku] *heat*

[akɨ] *unripe*

(10) [ãr̃ãⁿdu] *wise*

[ĩr̃ũⁿdɨ] *four*

[ɨ] and [i]

(11) [mẽᵐbɨ] *woman's child*

[nãᵐbi] *ear*

(12) [ᵐbɨa] *Mbya people/language*

[ᵐbiɾi] *squeeze/crush*

[i], [e] and [a]

(13) [teɾi] *yet*

[ʤeɾuɾe] *to ask for*

[mũⁿgʷeɾa] *to heal*

[u] and [o]

(14) [ʧuʔu] *to bite*

[ʧoʔo] *meat*

Oral vowels can also contrast with their nasal counterparts in Misiones Mbya as can be seen in the minimal and near minimal pairs (15) to (18)(17) below:

(15) [ʧ̃ã] *string*

[tuwiʧ̃a] *big*

(16) [kũã] *finger*

[kua] *hole*

(17) [pɨ̃tã] *red*

[pɨta] *heel*

(18) [tũpã] *Christian god*

[tupa] *bed*

2.3. Consonants

An analysis of consonant contrasts based on the elicited data suggests that Misiones Mbya has 21 different consonantal segments. In the numbered examples that follow I present evidence for contrast and allophony in both, initial and medial position. Misiones Mbya has no final consonants (see syllable structure in Section 2.4).

	Bilabial	Labio-dental	Alveolar	Post-alveolar	Palatal	Velar		Glottal
							Labial	
Plosive	p		t			k	g^w	ʔ
Affricate				ʧ ʤ				
Pre-nasal plosive	^{m}b		^{n}d			^{n}g	$^n g^w$	
Nasal	m		n		ɲ	ŋ	$ŋ^w$	
Tap			ɾ					
Fricative		v						h
Approx.	w	ʋ						

Table 4: Misiones Mbya consonants. Note that this table includes all found segments. For relations of allophony see Table 5.

2.3.1. Stops

Misiones Mbya has 10 oral and 5 nasal stops. Of these, only the velar-labial has voicing contrast (although the pre-nasal plosives could perhaps be considered as a voiced version of these oral stops since they coincide in place or articulation. See Section 2.3.4). The language contrasts stops in 4 places of articulation: bilabial, alveolar, velar, and labial velar.

The labial stop [p], the alveolar [t] and the velar [k] can occur in both, initial or medial position as seen in examples (19) to (24)0 below:

[p]

(19) [pota] *to want*

(20) [ʤapepo] *clay pot*

[t]

(21) [tupa] *bed*

(22) [kutu] *to stab/nail/drill*

[k]

(23) [kuʔa] *waist*

(24) [^{m}burukuʤa] *passion fruit*

These stops are contrastive in both, initial and medial position as shown by the near minimal pairs (25) to (29) below. Notice that as mentioned earlier, Mbya has no consonants word finally.

(25) [tata] *fire*

(26) [tupa] *bed*

(27) [kutu] *to stab*

(28) [puku] *long*

(29) [pupu] *to boil*

These three voiceless stops are rarely aspirated. They show an invariable short lag with a voice onset timing (VOT) on the order of 5 to 35 milliseconds with an average of 18 ms (based on 1 speakers and 27 tokens).

Following Guedes (1983), I chose to describe the velar consonant [g^{w}] as a single complex segment instead of two segments such as [g] + [u]. For Guedes, a labialized stop is a complex single segment composed of an oral (or nasal) velar stop with a release produced with lip rounding. For Misiones Mbya, evidence for [g^{w}] is seen in examples below. As can be seen in (30) to (33), while it is possible to find [g^{w}] + a vowel, it is not possible to find [g] + a vowel. This is why example (30) is not transcribed as [ʤogua].

(30) [ʤog^{w}a] *buy*

(31) [hog^{w}e] *tree leave*

(32) [g^{w}ɨrapapa] *hunting bow*

(33) *[ga], *[ge], *[gi], *[gɨ], *[go], *[gu]

The pattern observed with [g^{w}] is persistent in the collected data, and an analysis of Rodas & Benitez (2015) dictionary of Misiones Mbya, reveals that this is also persistent in their data. In addition, with the exception of a few loan words, Brazilian and Paraguayan Mbya dictionaries show the same configuration, this supports the view of [g^{w}] as a single voiced velar stop with labial release.

Note that it could also be argued that there is a [k^{w}] segment since syllables like [k^{w}a] and [k^{w}e] are extremely common in the language. However, given that [k] + a vowel is attested, it is simpler to assume that those are actually instances of [ku.a] and [ku.e].

In my data the glottal stop [ʔ] is only clearly present in medial position, however the lexicon of other authors suggest that it is possible to find this sound in initial position. There is also a tendency to weaken this sound in medial position as seen in (36) below.

[ʔ]

(34) [^{m}boʔa] *to lay eggs*

(35) [kõʔẽ] *dawn*

(36) [ʧoʔo]

[ʧoo] *meat*

2.3.2. Fricatives, approximants and tap

Fricatives are not common in the language, and there is no observed voicing contrast. Only the glottal [h] and labiodental [v] are attested in the language.

The glottal fricative occurs only in initial position:

	[h]	
(37)	[haku]	*hot/heat*
(38)	[haʔi]	*my mother*
(39)	[hɨakua]	*gourd*
(40)	[haʔi]	*my mother*
(41)	[huu]	*black*

Notice that this segment is very frequently omitted, especially in fast speech:

(42)	[hae]	
	[ae]	*he/she*

The labiodental [v] seems to vary freely with the approximants [w] and [ʋ] (as seen below in (43) to (45)) since no convincing cases of contrast were found among these three consonants. In addition, some words were elicited more than once and different consonants were used in each production as can be seen in (43). The segment noted by Dooley as [β] I'm notating instead as [ʋ] due to its approximant nature which is its most common realization in Misiones Mbya.

(43)	[povɨvɨ]	
	[poʋɨʋɨ]	*to find out*
(44)	[kawɨ]	
	[kavɨ]	*wasp*
(45)	[ʤaʋaete]	*dangerous*

The alveolar tap [ɾ] can occur in initial and medial position. Its only allophonic variation is the nasalized version which occurs in nasal contexts.

	[ɾ]	
(46)	[ɾɨʋadʒa]	*parrot*
(47)	[dʒɨɾɨʋi]	*throat*
(48)	[piɾu]	*dry*
(49)	[teɾi]	*yet*
(50)	[uɾukuɾa]	*owl*
(51)	[ɾiɾe]	*afterwards*
(52)	[ʧõñĩ]	*wrinkly*

2.3.3. Affricates

Guedes and Dooley described Brazilian Mbya as having two allophones for /ʧ/, namely [ʧ] and [ʦ]. In contrast, Misiones Mbya only has the post-alveolar [ʧ] which contrasts with the post-alveolar [dʒ] so the language only has two affricate sounds. The voiceless [ʧ] can occur in oral and nasal contexts and in initial and medial position as can be seen in (53) to (55) below:

(53)	[ʧã]	*string*
(54)	[ʧãʧĩ]	*fern*
(55)	[dʒaʧɨ]	*moon*
(56)	[adʒɨɨ]	*scruff of neck*

In Misiones Mbya, the voiceless [ʧ] has no allophonic variation, while the voiced [dʒ] alternates with the palatal nasal [ɲ] in nasalized contexts.

(57)	[dʒuu]	*thorn*
(58)	[ɲũã]	*trap*
(59)	[odʒa]	*metal cooking pot*

(60) [õɲã] *he/she runs*

(61) *[ʤã]

*[ɲa]

(62) [ʧoʔo] *meat*

(63) [ʤoʔo] *to dig*

In the near minimal pair (57) and (58), and in minimal pair (59) and (60), the distribution in oral and nasal contexts is clear: [ʤ] only occurs in oral contexts and [ɲ] only occurs in nasal contexts. (61) shows the unattested combination of [ʤ] with a nasal vowel and [ɲ] with an oral one while (62) and (63) show contrast between these two affricates in a minimal pair.

2.3.4 Nasal and pre-nasal stops

In her description of a Brazilian variety of Mbya, Guedes (1983) describes some consonants as single segments instead of contiguous consonants because Mbya lacks any other consonant cluster. Following Guedes, I analyze all four pre-nasal sounds in Misiones Mbya as single complex segments. The labial [^{m}b], the alveolar [^{n}d], the velar [^{n}g] and the labialized velar [^{n}g^{w}]. Pre-nasal stops are voiced stops in which the closure of the consonant is nasal but the release is oral. As mentioned before, pre-nasalized consonants trigger regressive nasalization (though they do it more weakly than stressed nasal vowels, see Section 3.3). This means that a pre-nasal stop cannot be followed by a nasal vowel, but it must be preceded by one as can be seen in (64) below.

(64) [^{m}b]

[hae õmõ^{m}bo] *He/She throws*

[ɲĩ^{m}bo] *thread*

(65) [^{n}d]

[hae õẽ^{n}du] *He/She hears*

[ãɾã^{n}du] *wise*

(66) [ⁿg]

[kãⁿgɨ] *weak*

[aⁿgudʒa] *mouse*

(67) [ⁿgʷ]

[mũⁿgʷeɾa] *to heal*

[kãⁿgʷe] bone

In nasal contexts a pre-nasal stop cannot occur, since it cannot be followed by a nasal vowel. In those cases the allophonic variant would occur: a fully nasal stop. The fully nasal version of the pre-nasal stops has the same place of articulation as the pre-nasal.

(68) [nũpã] *to hit*

*[ⁿdũpã]

*[nupa]

Pre-nasal stops can also occur word initially. In such cases the whole span is oral with the exception of the nasal closure at the beginning of the word:

(69) [ᵐboapɨ] *three*

(70) [ⁿdouwai] *they don't come*

As examples (1) to (70) above clearly show, nasality is a big component in the phonology of Misiones Mbya, and that is why this chapter began with a description of nasal and oral contexts. This allows for a better understanding of the distribution of the sounds in the language. Table 5 below presents a summary of the results of the segmental analysis where the relations of allophony and the distribution of sounds in oral and nasal contexts can be seen more clearly.

Phoneme	**Allophones**	**Distribution**	**Examples**	
			Initial position	**Medial position**
/p/	[p]	Oral and nasal spans	[pota] *to want* [pẽtẽĩ] *one*	[ʤapepo] *clay pot* [põãpẽ] *finger nail*
/t/	[t]	Oral and nasal spans	[tupa] *bed* [tũpã] *Christian god*	[kutu] *to stab/nail* [pɨ̃tũ] *dark*
/k/	[k]	Oral and nasal spans	[kuʔa] *waist* [kũã] *finger*	[mburukuʤa] *passion fruit* [ɲãkũã] *fast*
/ᵐb/	[m]	Nasal spans	[mãɾ̃ãʔɨ̃] *to reach inmortality*	[ŋ̃ʷãĩmĩ] *old woman*
	[ᵐb]	Oral spans	[ᵐboi] *snake*	[ãĩᵐbe] *sharp*
/ⁿd/	[n]	Nasal spans	[nũpã] *to punish*	[ãnɨ̃] *no*
	[ⁿd]	Oral spans	[ⁿde] *you*	[ĩɾ̃ũⁿdɨ] *four*
/ⁿg/	[ŋ]	Nasal spans	*[3]	[ãŋɨ̃ĩ] *now*
	[ⁿg]	Oral spans	*[3]	[kãⁿgo] *to remove bones*
/ⁿgʷ/	[ŋ̃ʷ]	Nasal spans	[ŋ̃ʷãĩmĩ] *old woman*	*[3]
	[ⁿgʷ]	Oral spans	*[3]	[mũⁿgʷeɾa] *to heal*
/gʷ/	[gʷ]	Oral spans	[gʷaʧu] *big*	[ogʷe] *leaf*
/ʤ/	[ɲ]	Nasal spans	[ɲũẽᵐba] *to spill*	[õɲã] *he/she runs*
	[ʤ]	Oral spans	[ʤaʧɨ] *moon*	[ãⁿguʤa] *rat*
/ɾ/	[ɾ]	Oral spans	[ɾɨvaʤa] *parrot*	[ʤeɾuɾe] *ask for*
	[ɾ̃]	Nasal spans	*[3]	[mãɾ̃ãʔỹ] *to reach inmortality*
/v/	[v], [ṽ]	Free variation in oral and nasal spans	*[3]	[povɨvɨ] *to find out*
	[w], [w̃]		*[3]	[kawɨ] *wasp*
	[ʋ], [ʋ̃]		*[3]	[poʋɨʋɨ] *to find out* [ʤaʋaete] *dangerous*
/ʧ/	[ʧ]	Oral and nasal spans	[ʧuʔu] *bite* [ʧĩ] *white*	[gʷaʧu] *big* [ʧãʧĩ] *fern*
/ʔ/	[ʔ]	Oral and nasal spans	*[3]	[ʤoʔo] *to dig* [ʧoʔo] *meat* [kõʔẽ] *dawn*
/h/	[h]	Oral and nasal spans	[hae] *he/she*	*[4]

Table 5: Phonemes and allophonic distribution of consonants for Misiones Mbya with examples

[3] No examples found on my data but segment deemed possible based on Dooley and Guedes
[4] No examples found on my data nor on Dooley's (2013). Segment deemed impossible.

2.4. Syllable structure

Mbyá only allows simple syllables: CV or simply V. This means that there are no final consonants in Mbyá. Having this type of syllable structure means that Misiones Mbyá also has instances of hiatus (two contiguous vowels in separate syllables).

(71) CV.V.CV.CV.CV.CV.V.CV.CV.CV.V.CV

ʧe a.ɾe.ko pẽ.tẽ.ĩ ɲĩ.^{m}be tu.i.ʧa *I have a big bed*

(72) CV.V.V.CV.CV.CV

ʧe.e a.g^{w}a.ta.ʧe *I want to walk*

(73) CV.V.CV

^{n}da.i.po.i *There isn't (something somewhere)*

2.5 Some concluding remarks

A few questions remain unanswered about the segmental inventory for Misiones Mbya. On the one hand there's the unpredictable nature of the labial continuants [v], [ʋ] and [w]. More data is needed in order to determine more conclusively if there is some allophonic distribution for these segments or if they are always in free variation. It should be noted that although Spanish does not have a labio-dental fricative, given that it's spelling system has two graphemes for the same sound ("b" and "v"), primary school teachers frequently teach the pronunciation of "v" as [v] in order to emphasize contrast with "b" which is frequently taught as [b].Given than all my informants were literate and bilingual, and they sometimes write in Mbya, it is possible that the spelling of these phonemes as "v" influences them to pronounce it as more labiodental ([v]), especially in instances of careful pronunciation, in which case this segment might actually not be a part of the speakers' inventory at all.

On the other hand, following previous authors (Guedes, 1983 and Dooley 2006) I chose to describe certain consonantal sounds as single complex segments instead of consonant clusters (see pre-nasal stops in Section 2.3.4). It might very well be possible to describe these sounds in a different way and it might also be possible to find other combinations of sounds

that could be more accurately described as complex segments instead of two separate contiguous segments (such as [k^{w}] instead of [ku]), but there is no particular phonological evidence for one analysis over the other in the data presented here.

CHAPTER THREE: AN ANALYSIS OF NASAL HARMONY FADING

In this chapter I will present the results of some acoustic analysis of nasality for Misiones Mbya. I begin Section 3.1 by providing a background of nasal harmony in general and in Section 3.2 I present the methodology used for the measurements. Section 3.3 presents the results of nasality measurements in vowels in general and Section 3.4 includes the results for nasality measurements in vowels in different positions to explore the possibility that as nasality spreads regressively, it "fades" or becomes weaker. The data presented in these sections corresponds to the analysis of recordings of Speaker C: a 19 year old male (see Section 1.5 for more information about informants). Section 3.5 is a conclusion.

3.1. Nasal harmony

As mentioned in section 2.1, nasal harmony is a well-known characteristic of several languages including Paraguayan Guaraní which is closely related to Mbya. In nasal harmony voiced segments in a word (or sometimes a phrase) agree in nasality (or non-nasality). Paraguayan Guaraní and other Tupí languages are typically known for their regressive nasal harmony, which has traditionally been described as a continuous effect by which a stressed nasal sound (which always occurs word finally in those languages) initiates a regressive nasal span that continues until the beginning of a word (Gregores & Suarez, 1967 & Lunt, 1973) as can be seen in Figure 5 below:

/ko.te.ˈvẽ/ → ko.tẽ.ˈṽẽ → [kõ.tẽ.ˈṽẽ]

(to need)

Figure 5: Illustration of traditional view of regressive nasal harmony in Paraguayan Guaraní. The underlyingly stressed nasal vowel /ẽ/ spreads nasality to the previous sonorant segments.

This could also be illustrated with an autosegmental spreading rule as can be seen in Figure 6. The [+nas] feature spreads regressively (leftwards) and turns all preceding segments which are unspecified for nasality into [+nas]. Similarly, the [-nas] feature at the end of the word spreads to the preceding segment which is already [+nas]. This allows to account for the pre-nasal stop which is both, nasal and oral at the same time: it's [+nas] in its closure and [-nas] in its release (see section 2.3.4 for pre-nasal stops).

Figure 6: Representation of an autosegmental spread rule to explain nasal harmony in Misiones Mbya. The top tier represents the segmental tier and the bottom one the nasal tier. The straight line shows nasal specification and the dotted lines show spreading.

These descriptions imply that phonological representations are derived in one module of the grammar and are then implemented by a phonetic system that maps from phonological representations to phonetic targets. So if we analyze regressive nasal harmony autosegmentally, all instances of [+nas] should be identically [+nas]. There should be no difference between the source of nasality (or the segments that are specified for nasality) and any of its other phonetic realizations (the segments represented with the dotted line in Figure 6). The same is true of other phonological accounts of long distance or unbounded spreading since they all treat all instances of the feature identically. But although this makes the phonology of the system easier to explain, even the earliest descriptions of nasal harmony in Guaraní (Lunt, etc.) noted that perceptually, nasality varies and that different segments can have different degrees of nasality. More recently, other authors also pointed out that nasality in nasal spans can vary. A study conducted by Stewart and Price (2013) analyzed nasality in Paraguayan Guaraní vowels at different distances from the final stressed nasal vowel and found that nasality seems to fade as it gets further away from its "origin" word finally.

If nasal harmony shows this phonetic variable (fading), it might suggest that there is nothing phonological about it, but that it is some sort of co-articulation. This is precisely what Wauters (2013) concludes for Paraguayan Guarani on her examination of transcriptions by previous authors.

For Mbyá as spoken in southern Brazil, Guedes (1983) also describes nasalization in vowels as variable and notes that nasalization in stressed vowels is stronger than in unstressed ones. She marks this by adding a lower nasalization diacritic (such as in [a̰]) for weak nasal vowels and an upper diacritic (such as in [ã]) for the strong ones.

Dooley (1984) notes that there can be different degrees of nasality in vowels, and that the strength of a nasal segment depends on several factors. He mentions that strong nasality is usually found in vowels which are stressed, and weaker nasality is found in vowels which are regressively nasalized by nasal or pre-nasal consonants. He also points out that nasality impressionistically becomes weaker the further it gets from the trigger of the nasal span.

Nasal harmony has been extensively studied in Paraguayan Guaraní, however, there is less literature in Mbya and all of the information available concerns the Brazilian variety. In addition, there is no instrumental data reported in the literature for Mbyá, so the data reported here is to my knowledge the first of its kind. One of the goals of this paper is to determine whether this potential variability in nasality is present and to determine if it is predictable or if it fades with distance from the nasal trigger.

Understanding how nasal harmony works is important because it can shed light on how harmony processes work. Is it automatic co-articulation or is it learned by the speakers? Does it work in the same way for every language that presents it? Answering these quesions can allow us to better understand how phonetics and phonology interact with each other. In the next sections I present the literature on the acoustic effects of nasality in vowels, followed by the methodology and analysis of my data. The results confirm that nasal harmony is indeed present in Misiones Mbya. It is possibly related to contrast enhancement, a way of increasing contrast between otherwise similar pairs of words (see Section 3.5 examples (74) and (75)). It is also shown that just like nasal harmony in Paraguayan Guarani, harmony in Mbya seems to fade, and that this fading might be the result of having reached a good amount of contrast so the extra articulatory effort that would be required to continue the span is not needed.

3.2. Nasal vs oral vowels

3.2.1. Acoustic effects of nasality

Nasality in speech sounds has several effects on the acoustic signal. Since nasality is not easily seen in an acoustic spectrogram, it is useful to compare spectral properties of oral and nasal vowels in order to find differences. One of the effects nasality has in speech sounds is that the bandwidth of the formants in nasal vowels will tend to be wider than those in oral vowels. This is due to the fact that the oral and nasal cavities coupled together have a larger surface area than the oral cavity alone (Johnson, 2003). According to Chen (1996), this greater bandwidth and a lowering of the amplitude of the formant are related to acoustic loss from the greater surface area of the vocal tract when the nasal cavity is coupled to it. Another major acoustic effect of coupling the two cavities is the introduction of additional resonant frequencies (poles) and interference patterns (zeros) into the acoustic transfer function of the vocal tract (Chen, 1996).

3.2.2. Methods

In order to understand nasality in Misiones Mbya I analyzed vowels in different contexts. I used two different acoustic analyses: A1 minus P0 and A1 minus P1 (A1-P0 and A1-P1). The first method was originally proposed by Chen (1997) as a way of examining nasality in vowels. A1 is the highest harmonic near the first formant, and P0 is a specific low frequency resonance that is contributed by the nasal cavity (Chen, 1997). This harmonic changes from speaker to speaker but it remains the same for different productions of the same speaker (since speakers do not manipulate the size and shape of their nasal cavities). It is usually H1 for female speakers and H2 for male speakers. A1-P0 works well with vowels which are not high, since in higher vowels the first formant can contain P0. P0 should have a higher amplitude for nasal vowels than for oral ones, because it is a nasal resonance, and the amplitude of A1 will tend to become weaker in nasal vowels (as mentioned in 3.2.1 and as noted by Schwartz, 1968). This means that in general, nasal vowels should have a lower value of A1-P0 than oral ones. For this study [a], [e] and [o] were analyzed using this method (see Section 3.3.1 for the results).

The second method (A1-P1) is based on Chen (1996). A1 is the same as above, and P1 is a specific harmonic at around 1000 Hz which, just like P0, is contributed by the nasal cavity. This measure is better suited for high non-back vowels because there should be no overlap between any formant and P1. Again, since the amplitude of P1 is expected to increase with nasal airflow, A1-P1 should give lower values for nasal vowels than for oral vowels. It is important to note that since the first formant is lower in high vowels, its bandwidth may contain P0 (as described above) making it somewhat stronger in nasal vowels. In the present study I analyzed [i] and [ɨ] with this method (see Section 3.3.2 for the results)

In order to analyze high back vowels, it would be possible in principle to use A1-P2 where P2 would correspond to the "extra resonances (…) between the second and third formants" as described by Schwartz (1968). For the present study I do not use this method since the measurement is likely to be very variable, and since there is only one high back vowel in Mbyá ([u]), so there wouldn't be many tokens to analyze.

3.2.3 Spectral tilt and nasality

One of the central issues analyzed in this section is the effect of position on the magnitude of the measurement of acoustic nasality. In Mbya and other Tupí Guarani languages, position and stress are related because stress is almost always fixed word finally. Stress also has effects on the global shape of the spectrum and therefore it is important to disentangle the spectral effects of nasality from the spectral effects of stress. Sluijter et al (1997) suggest that one element that allows for the perception of a syllable as stressed is the relation between the amplitude of low and high frequencies in a vowel: flatter spectral tilt would correlate with stress. The prediction of greater spectral tilt for unstressed than stressed vowels is based on the acoustic effects of both the tightness and shape of glottal closure (Okobi, 2006)

Because the two factors (position and stress) are confounded in Mbyá (as well as in other Tupí-Guaraní languages) this leads to the question of how the two interact. Figure 7 below represent a schematization of how spectral tilt is expected to affect the measurements of nasality. As can be seen on the left of Figure 7, regardless of the actual nasality, a flatter spectrogram (as expected in a stressed vowel) would reinforce a higher amplitude value of P1 compared to the value of P1 on the right of Figure 7. This should result in more 'nasal-

like' values for A1-P1 in stressed (final) than unstressed (non-final) vowels, regardless of actual nasality. There may also be an effect on P0, but we would expect this to be much smaller as it pertains to a lower harmonic.

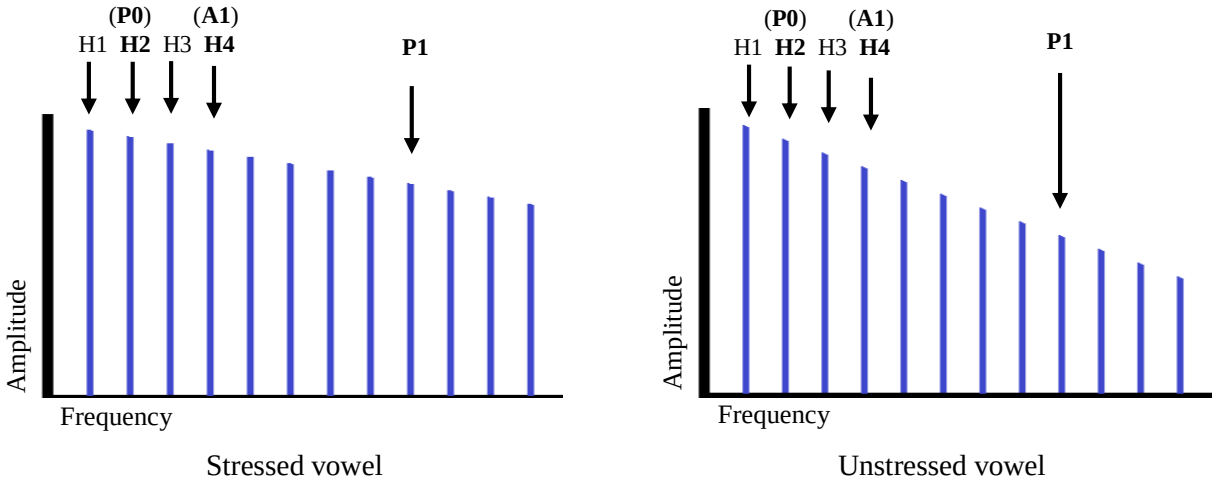

Figure 7: Schematization of hypothetical power spectra of stressed and unstressed vowels, with the P0, A1 and P1 values. The stressed vowel would have a higher amplitude for P1 which would re-inforce a nasality value in and A1-P1 analysis, regardless of actual nasal airflow.

3.3. Acoustic analysis

3.3.1. A1-P0

In order to identify P0 (see Section 3.2.2) for this speaker, several tokens of perceptually clearly oral and clearly nasal non-high vowels were compared to determine which low frequency harmonic was being reinforced.

Figure 8 below shows FFT spectra of an oral and nasal vowel, respectively. Comparing both, we can see that the second harmonic (H2) has a stronger amplitude for the nasal vowel than for the oral one. By doing this oral vs nasal vowel comparison with several tokens, I established that for this particular speaker, P0 corresponds to H2.

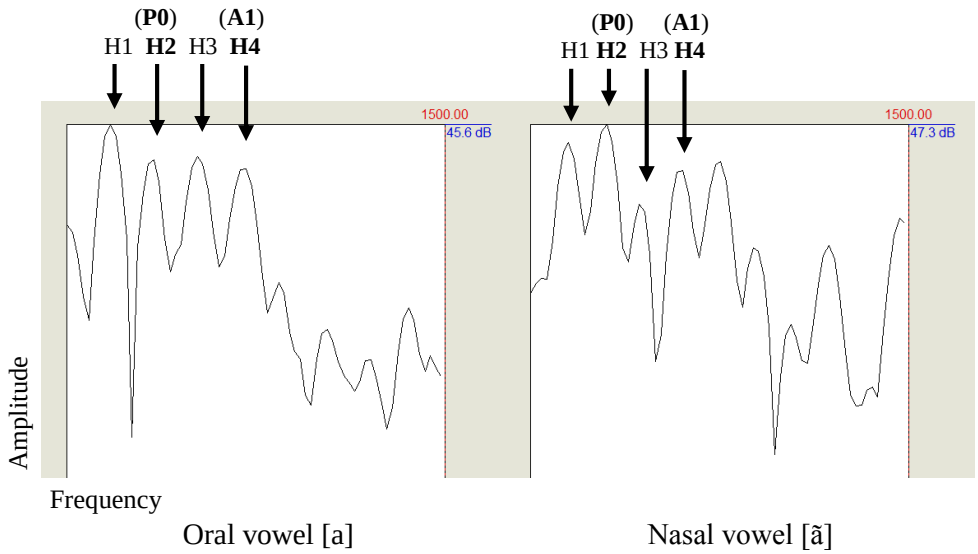

Figure 8: FFT spectra of [a] and [ã]. The arrows indicate the first 4 harmonics. H2 has a stronger amplitude in [ã] compared to [a] because nasality is re-enforcing this harmonic

Next, I identified A1 by looking at the harmonic peak closest to the first formant (F1).

Figure 8 above corresponds to the production of [a] with an F1 value of 526 Hz for the oral vowel and 548 Hz for the nasal vowel. In both cases the closest harmonic peak is H4.

Once A1 and P0 were identified I subtracted the amplitude of P0 from the amplitude of A1. Table 6 and Table 7 below show the results for the analysis of some instances of [a] and [ã] in final position.

Vowel	**A1 (dB)**	**P0 (dB)**	**A1-P0 (dB)**
[a]	44.7	41.6	3.1
[a]	37.3	35.4	1.9
[a]	35.9	34.7	1.2
[a]	46.5	34.7	11.8
[a]	40	36.1	3.9
Average			4.38

Table 6: Amplitude measurement of [a] for A1-P0. A1: measurements of the amplitude of the highest harmonic near the first formant. P0: measurements of the amplitude of the harmonic reinforced by nasality (second harmonic for this speaker)

Vowel	A1 (dB)	P0 (dB)	A1-P0 (dB)
[ã]	41.3	47.3	-6
[ã]	27.2	34	-6.8
[ã]	41.9	40.5	1.4
[ã]	39.7	37.6	2.1
[ã]	38.3	46.8	-8.5
[ã]	34.1	34.6	-0.5
[ã]	39.5	42.9	-3.4
Average			-3.1

Table 7: Amplitude measurement of [ã] for A1-P0. A1: measurements of the amplitude of the highest harmonic near the first formant. P0: measurements of the amplitude of the harmonic reinforced by nasality (second harmonic for this speaker). As expected, most results are lower than the same measurement for [a], which indicates that these are nasal vowels.

As can be seen, in most cases A1-P0 is negative for nasal vowels and positive for oral vowels. Figure 9 illustrates this more clearly. It can be seen that the distinction between oral and nasal vowels is quite robust and there are only a few cases of overlap.

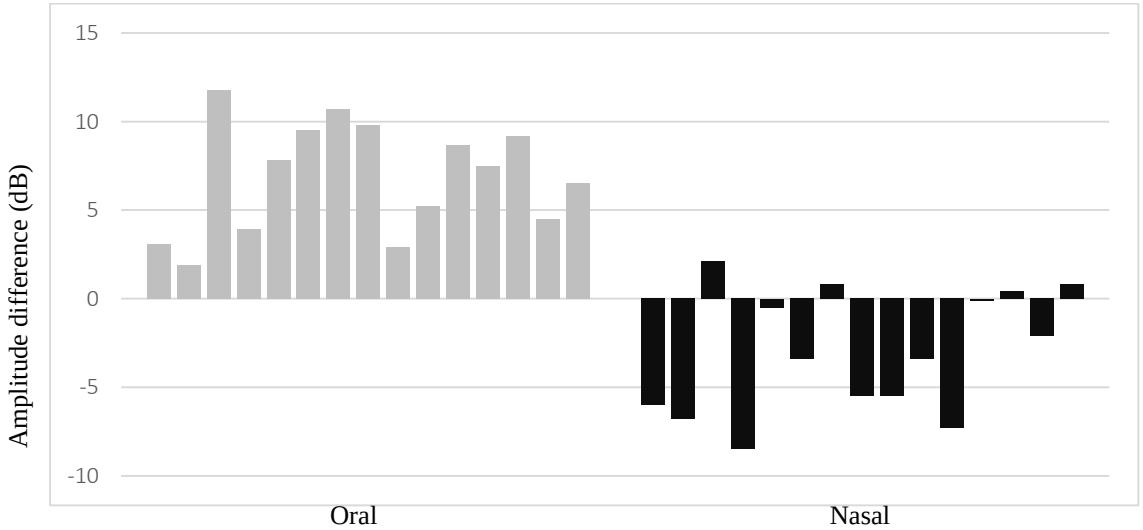

Figure 9: Results of A1-P0 measurements for oral (gray) and nasal (black) vowels. Lower differences should correspond with nasal vowels. As expected, the difference in amplitude is a lot lower in nasal vowels than in oral ones.

3.3.2. A1-P1

Finding P1 is a more challenging task as this peak does not always occur in the same place. In addition, as noted by Price & Stewart (2013), formants tend to widen with nasality creating overlaps between the second formant and P1.

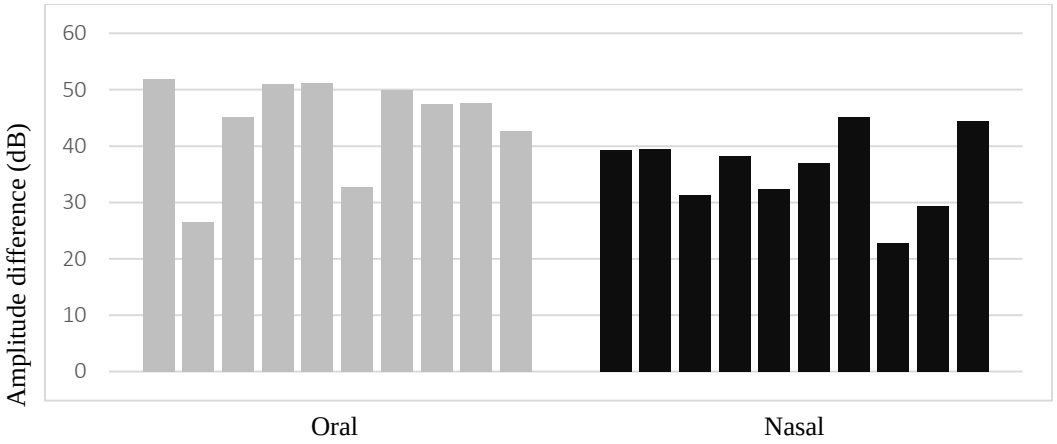

Figure 10: Results of A1-P1 for oral (gray) and nasal (black) vowels. Lower differences should correspond with nasal vowels. The difference in amplitude is on average, somewhat lower in nasal vowels than in oral ones though it is not as clear as with A1-P0.

As seen in Figure 10, although the results of the A1-P1 analysis are not as strong as the A1-P0 analysis, there is a tendency for nasal vowels to have a lower number here as well.

Both analyses indicate that there is indeed a difference between oral and nasal vowels that can not only be perceived, but can also be acoustically detected. Other studies on spectral correlates of nasality tend to use high-quality laboratory recordings and it is worthy of note that in recordings made in the field, even when the quality of the recordings is not optimal (due to background noise, echo, etc.) this methodology can still provide reasonably robust results.

3.4. Nasal harmony fading

As mentioned earlier, although traditional accounts of nasal harmony for Paraguayan Guarani describe it as a continuous effect, some authors (Guedes, 1983; Dooley, 1984 Price & Stewart, 2013; Wauters, 2013) question this and point to a variability in the degree of nasality. Price & Stewart (2013) suggest that there might be a gradient effect by which nasality fades (or becomes weaker) the further it is from the stressed nasal vowel. This is an interesting aspect to analyze as it may have consequences for the phonology of the language.

In their 2013 unpublished study on Paraguayan Guaraní, Price & Stewart analyzed nasality in nasal vowels in final position and at different distances from the final position using different methods (A1-P0, A1-P1 and A1-P2). They also analyzed oral vowels in final position. Their results suggest a gradient effect which supports the idea of nasal harmony fading. This section of my study tries to replicate some of those results, but in addition to measuring oral vowels in final position, I also measured oral vowels in penultimate position as a control, in order to determine to what extent the effect might be confounded with stress (see Section 3.2.3).

I analyzed nasality contrasts (using the methods mentioned above) for vowels in final position and penultimate position. If nasal harmony fades with distance, then final position nasal vowels would be expected to have a stronger nasal value than those one syllable away. On the other hand, the value for oral vowels should remain the same, no matter whether they occur word finally or one syllable before since oral vowels cannot become "more oral".

The result of the A1-P0 analysis suggests quite strongly that nasality tends to become weaker as it gets further away from its final position origin. The boxplot in Figure 11 below indicates the results for final position nasal vowels (N_#), penultimate nasal vowels (N_CV#), final oral vowels (O_#), and penultimate oral vowels (O_CV#). When comparing nasal and oral vowels in final position the results clearly indicate that A1-P0 robustly tracks nasality. A paired T-test using near minimal pairs was also carried: $t=7.83$, p (one-tailed) <0.0001.

As expected, a slight fading effect can be observed for the N_CV# vowels. Since oral vowels cannot fade in this way they would be expected to remain roughly the same and this is indeed what we see in Figure 11.

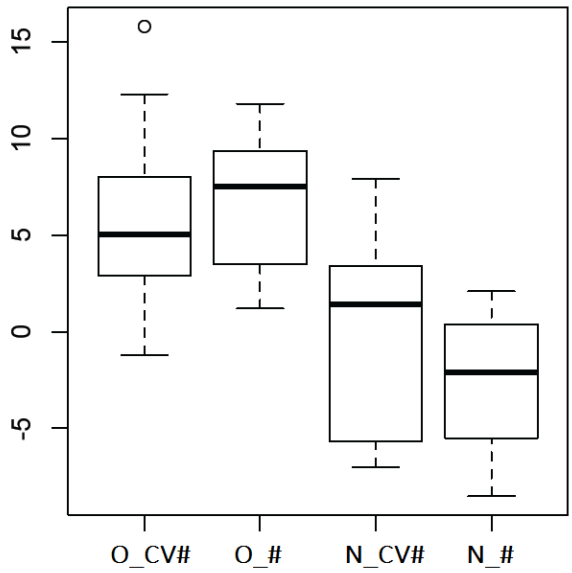

Figure 11: Boxplot with results of A1-P0 analysis. O_CV#: penultimate oral vowels, O_#: final oral vowels, N_CV#: penultimate nasal vowels, N_#: final position nasal vowels. Lower values indicate more "nasal" values.

With the A1-P0 method nasality measurements are somewhat more variable in non-final position than in final position. The same is true for oral vowels, so it may be the case that all acoustic properties tend to be more variable in non-final vowels (since they are always unstressed), or it may simply be that they are harder to measure.

There is tantalizing evidence that nasality interacts with position. Figure 11 shows, and a regression model confirms, that oral vowels are not very different with respect to this measurement in final and penultimate positions. The means difference is very small, and not close to statistical significance. In penultimate position, nasal vowels have significantly lower values than oral ones as expected: $b = -0.99$, $t = -3.71$, $p < 0.001$. In final position, this difference between nasal and oral vowels is even larger than it is in penultimate position; however, the difference between differences (interaction) does not quite reach the level of statistical significance: $b = -0.65$, $t = -1.81$, $p = 0.08$. So it could be concluded that penultimate vowels show large nasality differences, and final vowels show the same pattern (no significant interaction). However, given the small size of the data set, it is probably safe to say that this result is at least consistent with a nasal fading effect.

A closer look at the data by vowel suggests an explanation for the statistical non-robustness of the pattern: the oral-nasal contrast on average is much larger in final than non-final position for [a] and [e], but not for [o] where it is enormous in both positions (see Table 8 below). This may be due simply to the fact that different vowels have different frequencies which affect the measurement of specific harmonics.

		A1-P0 in oral vowels (dB)	**A1-P0 in nasal vowels (dB)**	**Difference**
[a]	Penultimate	3.5	2.23	1.27
	Final	4.38	-3.1	7.48
[e]	Penultimate	7.45	2.23	5.22
	Final	7.02	-1.93	8.95
[o]	Penultimate	6.07	-4.48	10.55
	Final	8.14	-3.4	11.54

Table 8: Oral-Nasal contrast by vowel. These are measurements of A1-P0 by vowel and position. The third column represents the contrast between oral and nasal vowels.

The A1-P1 analysis, on the other hand, shows different results. As can be seen in Figure 12, although at first it looks like there is some nasal fading (N_CV# seems to be less "nasal" than N_# but more than O_#), we also notice that penultimate oral vowels look "more oral". This cannot be attributed to nasal fading as an oral vowel cannot become "more" oral. It is possible though, that this effect is being caused by spectral tilt (see section 3.2.3). Given than all Mbyá words are stressed word finally, it is possible to assume that a stressed vowel is more likely to have a stronger amplitude in the higher frequencies than an unstressed one (as Figure 7 illustrates). Since P1 is at around 1000 Hz, we can assume that the A1-P1 analysis is being affected by this tilt and the results are due to stress, not to changes in the degree of nasality.

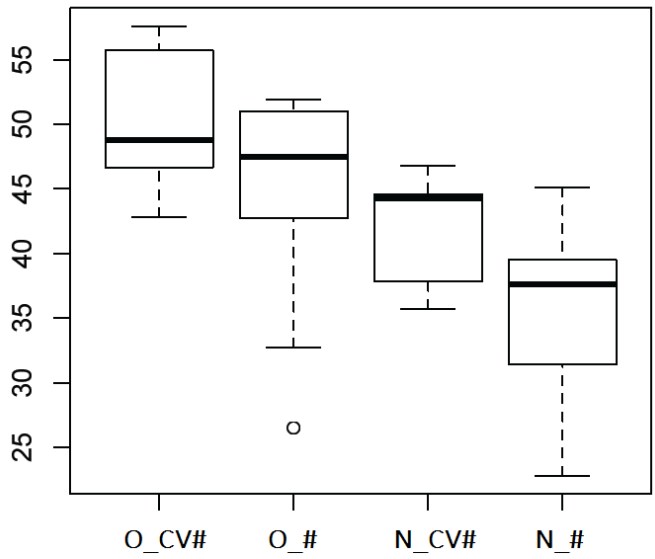

Figure 12: Boxplot with the results of A1-P1 analysis. O_CV#: penultimate oral vowels, O_#: final oral vowels, N_CV#: penultimate nasal vowels, N_#: final position nasal vowels. Lower values indicate more "nasal" values.

A statistical analysis of the data from the A1-P1 also indicates that there's little interaction between nasality and position. It was found that oral vowels show a near-significant difference between final and penultimate positions with regards to this measure: b = -0.62, t = -1.66, p = 0.11. This is consistent with stress having a raising effect on this measurement, as mentioned before. This measurement is still able to track nasality contrasts in penultimate position: b = -0.97, t = -2.18, p = 0.038. There is virtually no difference between this magnitude of the nasality contrast in penult position and its magnitude in final position, and the statistics are nowhere near significance. So it would seem that the measurement is indeed tracking nasality. It also seems to be the case that whatever nasal fading effects might previously have been found (Price & Stewart, 2013) using this measurement on final and non-final nasal vowels might be due to confounding with stress (see Section 3.2.3), because the present study found that the final vs. non-final difference is near-significant even for oral vowels.

3.5. Conclusion

The study of the data shows that even with recordings of a non-ideal quality, quantitative analysis of nasality is certainly possible. My data partially supports the findings of the study of Price & Stewart (2013) but it extends it by comparing oral vowels in final and penultimate position. This addition to the analysis seems to suggest that although A1-P0 can be a very accurate way of measuring differences between oral and nasal vowels, A1-P1 is not appropriate as a measure of nasality fading, because it appears to be confounded with stress. In addition, my data show that although nasality is somewhat less clear (and more variable) in non-final possition, vowels in these syllables are still robustly nasal. It would be interesting to extend this study by analysing more tokens at more distances from the stressed syllable to find even more solid results.

If nasality fades and it is variable the further away it gets from its putative source that would be consistent with an automatic effect of co-articulation. Nevertheless, nasal harmony fading seems to be consistent: nasality in vowels is variable but in systematic ways (nasality becomes weaker the further it gets from the "source" of the span) which means that it must be following some laws. We can perhaps talk about a phonetic grammar or a phonetic implementation which is separate from the phonological grammar, but we should still account for it. Also, if nasal harmony was merely a co-articulatory effect, we would expect it to be somewhat common cross linguistically. We would at least expect it to be very similar in languages that present nasal harmony, but this does not seem to be the case. Nasal harmony works very differently in other languages that exhibit it. For example in Yaka (Congo), vowels are transparent to nasal harmony and only some consonants are affected by it, and in some Choco languages (Colombia) nasal harmony does not work regressively as in Mbya (Rose & Walker, 2011). It would also be expected that a co-articulatory effect would imply some articulatory ease, and while it's quite clear that co-articulatory nasalization is in some sense "natural"' or "easy" with adjacent segments, it seems unlikely that it would make it "easier" over an entire word. And given that this property differs across languages, it must be the case that it is learned by Mbya speakers, which means that it is part of the grammar, it is implicit knowledge which must be acquired to know the language.

A more classical analysis (either with an autosegmental approach or optimality theory) would be suitable to describe this harmony if there was no fading at all. Nasal harmony fading is hard to explain with those accounts since, as mentioned in Section 3.1, they imply that the features should spread and be exactly the same in all spread positions (as seen in Figure 6 above). That is to say, it would work very well if the [+nasal] feature was spreading consistently. However, given that the data supports a fading effect it is hard to see a way in which an autosegmental analysis could predict or explain phonetic differences between different implementations of the same feature.

Demolin (2009) reported aerodynamic and acoustic measurements of nasality from Paraguayan Guaraní. His findings suggest that nasal harmony in that language is more than just coarticulation in the sense of being a single nasality gesture that extends over a long period of time. The nasal articulations in some consonants are being re-articulated at different points during a regressive nasal span, which suggests that the speaker is actively controlling nasality and this is not simply an automatic co-articulation. Although the nasal fading effect suggested by the A1-P0 data here, and the increased variability of this measure in penultimate nasal vowels, seem consistent with a coarticulatory account, the A1-P1 data, suggest that once the effect of stress is taken into account, nasalization on non-final vowels is as robust as, and not more variable than, that on final vowels. This study thus finds some, albeit limited evidence converging on Demolin's conclusion that nasalization is under active grammatical control.

It seems clear based on the data available that neither the classical phonological nor the "automatic" phonetic account of this process is satisfactory enough. Perhaps a good way of understanding nasal harmony's function for a language like Mbya is to see it as a way of enhancing contrast between oral and nasal words. Authors such as Suomi (1983) and Kaun (2004) suggest that since harmony gives rise to an extension of the temporal span associated with some perceptually vulnerable quality (in this case nasality), by increasing the listener's exposure to the quality in question, harmony increases the probability that the listener will accurately identify that quality. So, it may be possible that Mbya developed this harmony as a way of adding somewhat redundant information to make a clearer contrast between words that would otherwise sound very similar.

(74) [kuɾa] versus [kuɾ̃a]

(75) [kuɾa] versus [kũɾ̃a]

As seen in the two hypothetical examples above, if the only difference in a minimal pair of words was the nasality in the last segment (as in (74)), the two words would be distinguishable, but they would be even more so if the nasal feature was present in a longer section of the word (as in (75)). In this way, multiple acoustic cues converge to enhance the contrast and make the distinction clearer.

The concept of enhancement might be able to explain a potential function of nasal harmony, however, it does not explain why nasal harmony would fade. One possibility is that although a nasal span might increase the perceptibility of nasality, this span does not need to be very long or to cover the entire word in order to reach a good clear contrast. In other words, there could be perceptual "diminishing returns" on an unbounded process like this the further we get from the source and so the increases we get in distinctness are not "worth" so much articulatory effort as we get further and further away from the source of the contrast. This is illustrated more clearly in the examples below.

(76) CV.CV.CV vs. CV.CV.CṼ *little contrast*

(77) CV.CV.CV vs. CV.CṼ.CṼ *big contrast*

(78) CV.CV.CV vs. CṼ.CṼ.CṼ *big contrast but not much more than (77)*

Finally, it should be noted that this contrast-enhancement account of nasal harmony fading would also apply to other types of unbounded harmony processes in other languages and it would predict that they will all show fading effects of this kind.

CHAPTER FOUR: DISCUSSION AND CONCLUSION

In this thesis I presented a segmental and prosodic analysis of some phonetic and phonological features of Misiones Mbya with the aim of contributing to the scarce linguistic literature of this language.

The data shows that Misiones Mbya is indeed very similar to other reported varieties of Mbya: it has a similar lexicon, and sound system. However some differences were found such as the lack of the affricate sound [ts] which is present in Brazilian Mbya (Guedes, 1983; Dooley, 2011), and possibly the quality of some vowels (such as backness of [ɨ] and [a] which are reported as being more back in Brazilian Mbya (Guedes, 1983)). Since there is no instrumental data available about the quality of consonants and vowels for Brazilian or Paraguayan Mbya, and since my data is based on few informants, it becomes difficult to compare them in more detail, but it would seem that overall they are similar to Misiones Mbya.

An acoustic analysis of nasality was carried out using different methods. Nasality was shown to be robustly present in nasal vowels and to contrast sharply with oral vowels. In addition nasality was also measured in two different places to determine if it was confounded with stress (which always occurs word finally in Mbya) and if it faded with distance from the trigger of nasality. The results support the idea that nasality measurements can indeed be affected with stress when using certain methods to analyze nasality (particularly A1-P1). There is also evidence that indicates a slight fading effect in nasal spans: measurements of nasality indicate that it is stronger in final position than in other positions. A discussion was presented to explore possible explanations that would account for this fading effect. Nasal harmony fading seems consistent with an automatic co-articulatory effect, but given that nasal harmony manifests itself in very different forms cross-linguistically it seems unlikely that an automatic co-articulatory effect could be the case. On the other hand, a more classical approach, such as an autosegmental spreading rule, would predict no fading at all. Thus, it remains somewhat unclear whether a compelling description of this phenomenon would fall best in the phonetics or in the phonology of the language, and it goes beyond the scope of this paper to determine so. From a functional perspective nasal harmony seems to serve the

purpose of enhancement, allowing for a better contrast between oral and nasal words. The fact that there is a fading effect might have to do with having reached a good contrast, so that there is little need to continue with harmony the further it goes.

APPENDIX

Table 9 below shows more examples of Misiones Mbya words arranged by consonant sound distribution. As can be noted there are several cases of allophonic variation in oral and nasal contexts for some consonants, while the others remain "transparent" to the nasality of the word.

	Oral context		**Nasal context**	
	Initial position	**Medial position**	**Initial position**	**Medial position**
/p/ [p]	[pota] *to want*	[ʤapepo] *clay pot*	[pẽtẽĩ] *one*	[põãpẽ] *finger nail*
/t/ [t]	[tupa] *bed*	[kutu] *to stab/nail*	[tũpã] *Christian god*	[pɨ̃tũ] *dark*
/k/ [k]	[kuʔa] *waist*	[ᵐburukuʤa] *passion fruit*	[kũã] *finger*	[ɲãkũã] *fast*
/ʔ/ [ʔ]	*[3]	[choʔo] *meat*	*[3]	[kõʔẽ] *dawn*
/ʤ/ [ʤ] [ɲ]	[ʤaʧɨ] *moon*	[ãⁿguʤa] *rat*	[ɲũẽᵐba] *to spill*	[õɲã] *he/she runs*
/ᵐb/ [ᵐb] [m]	[ᵐboi] *snake*	[ãĩᵐbe] *sharp*	[mãɾ̃ãʔɨ̃] *to reach inmortality*	[ŋ̃ãĩmĩ] *old woman*
/ⁿd/ [ⁿd] [n]	[ⁿde] *you*	[ĩɾ̃ũⁿdɨ] *four*	[nũpã] *to punish*	[ãnɨ̃] *no*
/ᵑg/ [ᵑg] [ŋ]	*[3]	[kãᵑgo] *to remove bones*	*[3]	[ãŋɨ̃ĩ] *now*
/ⁿgʷ/ [ⁿgʷ] [ŋʷ]	*[3]	[mũⁿgʷeɾa] *to heal*	[ŋ̃ãĩmĩ] *old woman*	*[3]
/ɾ/ [ɾ] [ɾ̃]	[ɾɨʋadʒa] *parrot*	[ʤeruɾe] *ask for*	*[3]	[mãɾ̃ãʔỹ] *to reach inmortality*
/h/ [h]	[hae] *he/she*	*[4]	*[3]	*[4]
/gʷ/ [gʷ] [ŋʷ]	[gʷaʧu] *big*	[ogʷe] *leaf*	[ŋ̃ãĩmĩ] *old woman*	*[3]
/v/ [v] [ʋ] [w] [ṽ] [ʋ̃] [w̃]	*[3]	[poʋɨʋɨ] *to find out*	*[3]	[kõ.tẽ.ˈʋ̃ẽ] *to need*
/ʧ/ [ʧ]	[ʧuʔu] *bite*	[guaʧu] *big*	[ʧĩ] *white*	[ʧãʧĩ] *fern*

Table 9: More examples of Misiones Mbya words. Arranged by consonants in oral and nasal contexts in initial and medial position. Notice that Misiones Mbya never has consonants in final position.

*3 No examples found on my data but segment deemed possible based on Dooley and Guedes.

*4 No examples found on my data nor on Dooley's (2013). Segment deemed impossible.

Words for elicitation Misiones Mbyá Guaraní (MMG)

"Alphabet" according to Cadogán's dictionary for Paraguayan Mbya (1992)

A, CH, E, G, H, I, J, K, M, MB, N, Ñ, O, P, R, T, U, V, Y, ’

"Alphabet" according to Dooley's lexicon for Brazilian Mbya (2013)

A, E, G/GU, H, I, J, K/KU, M/MB, N/ND/NG/NH, O, P, R, T, U, V, X, Y, ’

Equivalences

Cadogán	Dooley
CH /ʧ/ /ʃ/ or "sch"	X /ts/ -> _a, e, i /ʧ/ -> _o, u, ɨ
Ñ	NH

(D) Dooley; (C) Cadogán, (TS) Trinidad Sanabria

"ch" used for either /ts/ or /ʧ/

List of words

	Spanish	***English***	***Mbyá (Cadogán)***	***Mbyá (Dooley)***	***Guaraní PY (Trinidad S)***
1.	cuerda, racimo de fruta (D)	String, fruit bunch (D)	chã	chã	sã
2.	helecho	Fern	chachĩ	chachĩ	amambái
3.	yo	I	che	che	ʃe
4.	querer	To want	che	che	se
5.	"yo quiero hablar"	I want to speak	che añe'e-che	che añe'e-che	ʃe añe'e-se
6.	blanco	White	chĩ, chĩ i	chiĩ	morotĩ
7.	luna	Moon	jachy	jachy	jasy
8.	carne	Meat	cho'o	cho'o	so'o
9.	arrugado	creased	chorĩ	chorĩ	apicha'ĩ, cha'ĩ
10.	Morder	To bite	chu'u	chu'u	su'u
11.	Lastimar, golpear, herir	To hurt/hit	jeapi i	jeai	jatyka, hunga, japicha
12.	"no hay"	"There isn't"	jipói	jipoi (o póí?)	¿?
13.	Comprar	To buy	jogua	jogua	jogua

14.	Espina (C), (D), aguja (D) (TS)	Thorn, needle	ju	juu	Ju, ñuati (espina)
15.	Brazo	Arm	jyva	jyva	jyva
16.	Garganta	Throat	jyryvi	jyryvi	jyryvi, ahy'o (exterior)
17.	Correr	To run	ña	ña	ñani
18.	derramar	To spill	ñeẽ	ñeẽ	hykuavo, ñehẽ, ñohẽ
19.	Cama	Bed	ñimbe	ñimbe	inimbe
20.	hilo	thread	ñimbo	ñinbo	inimbo, tenimbo
21.	Pegar (con pegamento	To glue	ñomo	ñomo	mboja
22.	Flechar, tirar con flecha	To draw an arrow	ñyvõ	ñyvõ	
23.	Trampa, cárcel/prisión (D)	Tramp, prison	ñuã	ñuã	ñuhã
24.	Calabaza, porongo	Pumpkin	y'a	y'a	hy'a, andai (calabaza)
25.	Sombra	Shadow	kuaray'ã	kuaray'ã	kuarahy'ã
26.	Erizo, puerco espín	Hedgehog	kui'ĩ	kuĩ'i	kui'ĩguasu
27.	Cavar, excavar, extraer miel (C)	To dig, to extract honey	jo'o	jo'o	jo'o
28.	Bocio, manzana de adán	Adam's apple	ju'ái	ju'ái	ju'ái
29.	Asar a la parrilla (C) (TS), cicatrizar (C) (D)	To roast, to scar	ka'ẽ	ka'ẽ	ka'ẽ
30.	pescuezo	Scruff of neck	aju'y	aju'y	ajúra
31.	Oír, percibir, darse cuenta	To hear, to realize	endu	endu	hendu
32.	Anciana, vieja	Old woman	guaimĩ	guaimí, guaiguĩ	guaiguĩ
33.	Labio	Lip	tembe	embe	tembe
34.	mochuelo	A type of small Owl	chuinda	chuina	urukure'a
35.	Sabio	Wise	arandu	arandu	arandu
36.	Filoso, afilado	Sharp	aimbe (aĩmbe?)	aĩmbe	hãimbe
37.	Mirar, abrir los ojos, ayudar (D)	Look, open eyes, help	ma'e (ẽ?)	ma'ẽ	
38.	Hijo o hija de una mujer	Child of a woman	memby	memby	
39.	Remedio	Remedy	moã (también poa)	moã (también poa)	
40.	Poner a cocinar, armar trampas (C)	To cook, to set up traps	moĩ	moĩ	
41.	Animal doméstico	Domestic animal	mymba	mymba	
42.	Maracuyá	Passion fruit	mbarakuja	mbarakuja	mburukuja
43.	Machucar, comprimir	To crush, compress	mbiri, umbiri	mbiri, umbiri	
44.	seco	Dry	mbiru, piru	mbiru, piru	
45.	Poner huevos	Lay eggs	mbo'a	mbo'a	
46.	Víbora	Snake	mbói	mboi	
47.	Mbyá	Mbyá	mbya	mbya	
48.	Anguila	Eagle	mbuchu	¿?	
49.	Pan, pastel (bollo?)	bread	¿?	mbujape	

50.	Oreja	ear	nambi	nambi	
51.	Hediondo (C), carne podrida, carroña (D)	Smelly, stinky	ne	ne	
52.	Pegar, castigar	Hit, punish	nupã	nupã	
53.	Granizo	Hail	amandáu	amandau	
54.	Se halla, está (C),estar localizado dentro de un lugar, sentado (D)	It's there, it's in a place, sitting	iny	iny	
55.	Vos, tú	You	nde, ndee	nde, ndee	
56.	No hay nadie	There isn't anyone	ndouvái	¿?	
57.	ciertamente	Truly	ni'ã	¿?	
58.	Casarse	To get married	menda	menda	
59.	Banco, asiento, mesa	Bench, seat, table	enda, tenda	enda, tenda	
60.	Cuatro	Four	irundy	irundy	
61.	Inmortal	Immortal	kandire	¿?	
62.	Alimento que se come solo, recipiente vacío	Foot eaten on its own, empty bowl	nandi	¿?	
63.	Flaco, ser flaco	Thin, to be thin	angai	angai	
64.	Hace un rato, momento, "hoy"	A while ago	ange	ange	
65.	Rata	Rat	anguja	anguja	
66.	Ahora	Now	aỹ, ãngy (más común)	aỹ	
67.	Hablar de forma descomedida (demasiado, irrespetuoso) (C), hablar como respuesta (D)	To speak too much/dispespecfully; to speak as an answer	ñe'ẽngi	ñe'ẽngi	
68.	Un tipo de pez	A type of fish	chango	chango	
69.	Débil	Weak	kangy	kangy	
70.	Deshuesar	To bone	kãngo	¿?	
71.	hueso	Bone	kãngue	kãgue	
72.	Juntar, recoger, amontonar (D)	To gather, to pile up	mono'o, no'ã, no'a, mboaty	mono'õ, no'õ, mboaty (reunir)	
73.	Sacar, extraer	Remove, extract	noẽ	¿?	
74.	no	No	any	any (en respuesta a preguntas)	
75.	De ninguna manera	No way	any ragái, any ragári	ni, ani	
76.	Aquí, acá	Here	apy	apy	
77.	Quemar	To burn	(h)apy	apy	
78.	Partir, abandonar un lugar (C), mudarse, cambiar de mujer (D)	To leave; to move house, to change wife	japavo	japavo	
79.	Olla de barro (C), cacerola	Clay pot	japepo	japepo	

80.	Alacrán, cangrejo (D)	Scorpion, crab	japeucha	japeucha	
81.	Necesitar	To need	kotevẽ	kotevẽ	
82.	Alcanzar	To be enough	upity	upity	
83.	apuñalar , Clavar (C), hincar (C), perforar (D)	To stab, to nail; to drill	kutu	kutu	
84.	Diós	God	tupã	tupã	
85.	Plantar, enterrar	To plant, to burry	ñoty	ñotỹ	
86.	Uña de dedo	Finger nail	poapẽ	poapẽ (todo nasal)	
87.	codo	Elbow	poapĩ	poapĩ (todo nasal)	
88.	Aún, todavía	Yet, still	poteri, teri	poteri, teri	
89.	Obscuridad, obscuro	Darkness, dark	pytũ	pytũ	
90.	Respirar	To breath	pytuẽ	pytuẽ	
91.	Fuego	Fire	tata	tata	
92.	Hervir	To boil	pupu	pupu	
93.	Ombligo	Bellybutton	puru'ã	puru'ã	
94.	Buscar a tientas, hurgar (C), sentir con las manos (D)	To look for something with the hands (as if in the dark)	povyvy	povyvy	
95.	Día, cielo (C)	Day, sky	ára	'ára, 'ará	
96.	Esperar	To wait	arõ, aarõ	arõ,	
97.	Feroz, terrible, peligroso (D)	Fierce, terrible, dangerous	avaete	avaete	
98.	Pedir	To ask for	jerure	jerure	
99.	Avispa	Wasp	kavy	kavy	
100.	Cada	Each	ñavõ	ñavõ	
101.	hablar	To speak	ayvu	ayvu, ayuvuẽ	ñe'e (griterío)
102.	Envolver, cubrir (D), forrar (D)	To wrap	ñovã	ñovã	
103.	Loro pequeño	Small type of parrot	ryvaja	ryvaja	
104.	Ser grande	To be big	tuvicha	tuvicha	
105.	Chicharra (cigarra, coyuyo)	Cicada	tokoiro	tokoiro	
106.	Mamá, (mi mamá) (D)	My mum	ha'i	ha'i	
107.	Serpiente grande (C), pene (D)	Big snake, penis	embo, hembo	embo	
108.	Su (propia) casa	His/her (own) house)	goo	¿?	
109.	Comer	To eat	mokõ	mokõ	
110.	Grande, (también venado)	Big, deer	guachu	guachu	
111.	Ladrar el perro mientras persigue animal (C) correr atrás de caza (D)	To bark while chasing, to follow pray	guãi	guaĩ	

112.	Bajar, descender, bajar a un arroyo a tomar agua (D)	To go down to a stream to drink water	guejy	guejy	
113.	Recular, caminar hacia atrás	To walk backwards	guevi	guevi	
114.	Pájaro	Bird	guyra	guyra	
115.	Su propio padre	His/her own father	guu	¿?	
116.	En esta manera, así (C), así como se ve ahora (D)	In this way, like this	guirami	guirami	
117.	Cabeza	Head	akã	akã	
118.	Calor, caliente	Heat, hot	aku	aku	
119.	Veloz, va rápido (D)	Fast, goes fast	akuã	akuã	
120.	Verde, no maduro	unripe	aky	aky	
121.	Puerta	Door	okẽ	okẽ	
122.	Lluvia, llueve	Rain, it rains	oky	oky, ‘oky, ‘ongy	
123.	Amanecer	dawn	ko’ẽ	ko’ẽ	
124.	Aquí, este (C), aquel aquella (no se ve) (D)	Here, this, that (not seen)	ki	ki	
125.	En esta dirección (C)	In this direction	ki katy	¿?	
126.	Ayer	yesterday	kuee	kuee	
127.	Agujero	Whole	Kua	kua	
128.	Dedo de la mano	Finger	kuã	kuã	
129.	Cintura	Waist	Ku’a	Ku’a	
130.	Caer, desprenderse (C)	To fall, to become detached	Kúi	kui	
131.	Hoja (no caída)	Tree leave (on the tree)	O	o	
132.					
133.					
134.					
135.					
136.					
137.	miel	Honey	ei	ei	eíra, eirete
138.	“Él habla”	“He speaks”			
139.	“Él no habla”	“He doesn’t speak”			
140.	Cabello	Hair	a	‘a	
141.	decir	To say	e	‘e	
142.	Salir (salir el sol)	To come out (the sun)	ẽ	ẽ	
143.	Estar, haber (D) (C)	To be in a place	ĩ	ĩ	ĩ
144.	Sin duda (C), salir, quitarse,	Without doubt, to leave,	i	i	

	desaparecer (una mancha), abrirse (C); destacarse, despedazarse (D)	to take off (clothes), to disappear (stain), to open up			
145.	agua	water	y, yy	y, yy	y

Números 1-10 (numbers 1-10)

Colores (colors)

Presentación personal (personal presentation)

- Conversación informal entre dos informantes (informal conversation between two inforants)
  - Temas (topics)
    - Se cuentan lo que hicieron ayer (they say what they did yesterday)
    - Describen a su familia (the describe their families)

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