The Phonology of Nambikwara

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Abbreviation List

1O	first-person object
2O	second-person object
3O	third-person object
1S	first-person subject
2S	second-person subject
3S	second-person subject
ADVZ	adverbializer
AFF	affirmative
APL	applicative
ASP	aspect
AUG	augmentative
AUTH	authenticity
CAUS	causative, causal
CL	classifier
COP	copula
DEM	demonstrative
DES	desiderative
DS	direct speech
DUAL	dual
EMP	emphatic
EV	evidentiality
EXC	exclusive suffix
F	feminine addressee
FUT	future
GRP	group
IMM	imminentive
IMP	imperative mood
INAL	inalienable possession
INCL	inclusive suffix
INST	instrumental
IRR	irrealis
LOC	locative
LV	linking vowel
M	masculine addressee
MZ	modalizer
NEG	negation
NI	noun incorporation
NZ	nominalizer
NPFV	imperfective
NV.EV	non-visual evidentiality
PENS	pensive
PFV	perfective
PL	plural
POS	possessive
PQ	polar question
ROX	proximal (demonstrative)
PRS	present
PST	past

REC.PST	recent past
RECP	reciprocal
RED	reduplicant
REF	referential
REFL	reflexive
SG	singular
SRa.SQ	same reference sequential
SRb.CN	switch reference connective
STAT	stative
SS	stative suffix
T	tense
TMP.FUT	nominal temporal future
TMP.PST	nominal temporal past
V.EV	visual evidentiality
VOC	vocative

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Contents

Chapter 1: The Nambikwaran Peoples and Languages

Introduction

This chapter introduces the reader to the Nambikwaran peoples[1] and their native languages. The information provided in the following sections is the result of a bibliographical survey carried out within a multidisciplinary framework. It is based on official governmental reports published by Brazilian institutions as well as published research in the fields of anthropology, history, ecology, and, especially relevant for this dissertation, linguistics. I start this chapter with a brief discussion of the terminology that is used in this dissertation, defining some words with multiple meanings that are frequently used in the literature on Nambikwaran languages and peoples and may lead to misunderstandings. Following this discussion, I provide an overview of the Nambikwaran peoples, lands, and villages, as well as their mythological origin. Aspects such as culture, cosmology, and demography are also addressed. The discussion is followed by a concise history of the contact between the Western world and the Nambikwaran peoples. It ranges from the first documented contact to the initial language description attempts and briefly covers the COVID-19 pandemic as well as its effects on their communities. After the introduction to Nambikwaran history, I then delve into topics such as language classification and macro-language affiliation hypotheses. In the section dedicated to the classification of Nambikwaran languages, I discuss the multiple attempts to define how many languages/lects comprise the Nambikwaran language family. As I show, there is a consensus on the number of lects/languages that comprise the Northern Nambikwara and Sabanê branches. I suggest that the classification of the languages belonging to Northern Nambikwara and Sabanê is the outcome of constant interest in specific language communities/groups and fieldwork being carried out with individuals pertaining to only one community/group. In contrast with the scenario observed in publications on Northern Nambikwara and Sabanê, the situation in Southern Nambikwara is more diffuse. There have been multiple and sometimes conflicting proposals on the exact number of lects/languages pertaining to it. I argue that one of the main factors contributing to the multiple proposals for the classification of Southern Nambikwaran languages/lects lies in the fact that most descriptive publications on Southern Nambikwara are based on data collected across multiple language communities/groups. In addition, social factors such as demography and internal conflicts within language communities of Southern Nambikwaran speakers also contribute to the multiple descriptive proposals of the languages/lects belonging to this branch. Thereafter, the final sections of this chapter address the state of studies on Nambikwaran languages, mainly focusing on phonology. Finally, I define which Nambikwaran language is described in this dissertation, focusing more specifically on Southern Nambikwara, and show how this study was carried out as well as how it is sectioned.

1.1 Setting the Context: Which Nambikwara, Nambikwara Who?

The term "Nambikwara" is not rooted in any Nambikwaran language. Instead, it is a compound exonym derived from a Tupian language, whose meaningful pieces are recognized as follows: "*nambi*," meaning 'ear,' and "*kuara*," denoting 'hole.' Also spelled Nambikwára, Nambicuara, Nambiquara, Nambikúara, Nambikuara, among others, the word "Nambikwara" was coined by

[1] In this chapter, I use the term "peoples," as a literal translation for the Portuguese word *"povos"* as well as the Spanish word "*pueblos*," which are frequently used terms in the literature on the indigenous South American populations. The term "*povos indígenas*" is employed to refer to different ethnic groups who inhabit the area that is now recognized as Brazil before the Portuguese colonization. Furthermore, the term "indigenous peoples" is also recognized by the United Nations, and it has been in use since 1994 when it was used for the launch of the International Decade of the World's Indigenous Peoples, which started in 1995 and ended in 2004.

Tupian individuals, who used it to refer to the indigenous people they encountered. This indigenous group had their ears pierced – a distinctive physical feature that still sets people who identify ethnically as Nambikwara apart from other indigenous groups. Despite it being an exonym, the word "Nambikwara" was adopted by Nambikwaran individuals, who integrated it into the lexicon of their languages as a common denomination for their shared ethnic origin. Apart from identifying themselves as "Nambikwara," every Nambikwaran language has a word to refer to the common Nambikwaran ancestry. For instance, the word "/a-nũ-su/," lit. 'people' and possessive constructions with it are commonly used by some Nambikwaran individuals living in Central-Western Brazil to refer to their common ancestry.

Despite having this common denomination, Nambikwaran individuals arrange themselves into groups, all of which have a name rooted in a Nambikwaran language, such as the Sabanê, the Kithãulhu, the Negarotê, and so on. These groups are named not only according to their self-declaration (self-identity), but also according to the same principle described in the origin of the word Nambikwara: alterity. Due to the multiple denominations and identities observed, Nambikwaran groups make up distinct Nambikwaran communities. In turn, each of these groups also refers to themselves not only as a group, but also as a "people" – a term often employed in the literature for every one of the attested groups. According to this view, the Kithãulhu group is regarded as one of the peoples/groups belonging to the Nambikwaran people. As such, the Kithãulhu not only have a name but also a specific heritage, which is reflected in their habits and social relations and sometimes in the language/lect they speak. From this perspective, researchers of Nambikwaran languages speak more often of the Nambikwaran *peoples*, rather than the Nambikwaran *people*.

Over the years, especially after researchers and missionaries settled in the Nambikwaran communities, the term "Nambikwara" acquired multiple denotations. Currently, it may refer to: 1) a smallish language family of Brazil; 2) a language belonging to a homonymous language family; 3) an indigenous people of Brazil, comprised of dozens of groups (peoples), who speak Nambikwara; 4) the ethnicity shared by dozens of indigenous peoples, who speak *any* of the languages belonging to the Nambikwara language family, and who share common ancestry, attributes, and cultural heritage; and, more recently, 5) one ethnic group[2] which identifies as such and whose native language is Nambikwara. Given the multiple associations with the word Nambikwara, I have decided to employ the following words and expressions in this work:

1) *The Nambikwaran language family* denotes the meaning described in 1).
2) *Nambikwara* only refers to the language, also known as Southern Nambikwara, as in 2).
3) *The Nambikwaran peoples* refers to the multiple groups/populations sharing the Nambikwaran ancestry, whose individuals speak *any Nambikwaran language,* as in 3).
4) *The Nambikwara* denotes the indigenous people comprised of dozens of ethnic groups who speak Nambikwara (Southern Nambikwara), as in 4).
5) *The Nambikwara group* refers to the meaning in 5).

In addition to the terminology in 1) – 5), I also use the term "*Nambikwaran languages*" to refer to any language belonging to the Nambikwaran Language Family. The words and expressions in 1) – 5) are employed to keep readers from inferring the possible meanings of the word "Nambikwara" in this dissertation.

[2] There is a group in the Cerrado, whose members do not introduce themselves as Kithãulhú, Halotesú, etc., but rather call themselves "Nambikwara." I will include this group in the dissertation, but other Nambikwaran individuals belonging to other groups, especially the elders from the Kithãulhú, expressly disagree with this denomination. One of my interviewees who is also a language teacher, Donaldo Kithãulhú, claims that it is "anthropologically incorrect and unacceptable."

In an upcoming section on language classification, readers will also be introduced to two other words with multiple denotations, namely "Southern Nambikwara" and "Northern Nambikwara." At this point, however, attention is given to the Nambikwaran peoples, covering their indigenous lands[3], villages, and mythological origin.

1.2 The Nambikwaran Peoples

The Nambikwaran Peoples encompass a set of indigenous individuals, who inhabit 10 indigenous lands (*Terras Indígenas*) within the northwestern portion of Mato Grosso, a state in central-west Brazil, and in the southwestern area of Rondônia, a state in northern Brazil. Nambikwaran society is primarily found in the transition of two different ecosystems: the Cerrado (Brazilian savannahs) and the Amazon. Nambikwaran individuals are largely hunter-gatherers and the population is estimated at less than 2500 individuals (SESAI 2014). The exact number of Nambikwaran groups is still unknown, due to constant segregation and internal conflicts among individuals.
Based on the literature on Nambikwaran peoples and languages (Lévi-Strauss 1948; Oberg 1953; Price 1978; Lowe 1999; Eberhard 2009), I have made a list with the names of approximately 50 groups and attempted to verify whether elder Southern Nambikwaran individuals could recognize them. This task did not go as well as expected, especially regarding the names of the groups mentioned in earlier works. Based on the results of the interviews, it was possible to verify the existence of the following groups, which are separated according to two different regions, namely the Amazon and the Brazilian savannahs (Cerrado). The names ending in *-su/lhu* as well as the Manduca belong to Southern Nambikwaran groups, whereas the ones with a final *-ê*, except for Sabanê, are of Northern Nambikwaran origin:

In southernmost Amazon: Alakatesu, Alantesu, Erihitaunsu, Hahãintesu, Hoskokosu, Ilaklorê, Kalunhwasu, Katitãulhu, Lakondê, Latundê, Mamaindê, Manduca, Negarotê, Nutajensu, Qualitsu, Sayulikisu, Sabanê, Tawandê, Uaihlatisu, Waikisu, Wasusu

In the Brazilian savannahs (Cerrado): Halotesu, Kithãulhu, Nambikwara[4], Nḛsu, Sawentesu, Wakalitesu

Each of these groups is usually named after their physical attributes, habits, or other distinctive traits, such as where they live. For instance, the Halotesu, from "*halo*-" meaning field and "-*te*," people, is translated as 'the field people' since this group lives in the fields at the border of the savannahs.

1.3 Nambikwaran Indigenous Lands

Nambikwaran peoples' territory is currently non-continuous. Groups were scattered in three great areas, namely the Serra do Norte, Chapada dos Parecis, and Vale do Guaporé (Santana & Oliveira 2019: 129), in which 10 *Terras Indígenas* (T.I.), lit. indigenous lands, are found. The number of individuals, as well as how many peoples inhabit each indigenous land is unknown/outdated. Some Nambikwaran peoples inhabit a highly linguistically diverse area

[3] Indigenous land is a literal translation for "*Terras Indígenas*" the official terminology adopted in Brazil to refer to any traditional area inhabited by indigenous peoples in the country. I will stick to this terminology instead of using words employed in English-speaking countries to refer to the areas/plots of land inhabited by native North American peoples, as they have a different cultural background and, therefore, a different sense.
[4] Most of the indigenous individuals in the Cerrado, who identify themselves as simply "Nambikwara" are of Halotesú descent.

along the Guaporé River, commonly referred to as "a residual area," which is also believed to have been used as a refuge area in prehistorical times (van der Voort & Ribeiro 2010: 366) because of its wide variety of indigenous peoples and languages, many of which are unrelated. Official demographic surveys were most recently taken almost ten years ago, and some of the demographic data were collected over two decades ago. Table *1* introduces the indigenous lands inhabited by Nambikwaran peoples and provides an overview of some of the groups who live in them. Spelling used in the table follows the orthography used in the official documents[5], on which the table is based:

Table 1: List of demarcated indigenous lands belonging to Nambikwaran peoples.

Terra Indígena (T.I.)	**Population**	**People**	**Language Branch**
Tubarão Latundê	195 (IBGE 2010)	Latundê Sabanê Aikanã Kwazá	Northern Nambikwara Sabanê Language isolate Language isolate
Pirineus de Souza	278 (IBGE 2010)	Idalamare Ilaklore Mamaindê Tawandê Manduca Sabanê	Northern Nambikwara Southern Nambikwara Sabanê
Nambikwara	476 (IBGE 2010)	Halotesu Kithãulhu Sawentesu Wakalitesu	Southern Nambikwara
Vale do Guaporé	482 (IBGE 2010)	Alakatesu Alantesu Erihitaunsu Hahãintesu Hoskokosu Waikisu Wasusu Mamaindê Negarotê	Southern Nambikwara Northern Nambikwara
Lagoa dos Brincos	65 (FUNAI 2002)	Negarotê	Northern Nambikwara
Tirecatinga	174 (IBGE 2010)	Halotesu Sawentesu Wakalitesu	Southern Nambikwara
Pequizal	45 (FUNAI 2002)	Alantesu Erihitaunsu	Southern Nambikwara
Paukalirajausu	117 (SESAI 2014)	*Nambikwara*	Southern Nambikwara
Sararé	188 (IBGE 2010)	Kalunhwasu Katitawlu Qualitsu Nutejansu Sayulikisu Uaihlatisu	Southern Namikwara
Taihãtesu	77 (PACA 2001)	Wasusu	Southern Nambikwara

[5] Demographic information was collected on Terra Indígenas no Brasil - https://terrasindigenas.org.br/.

As one can see in Table *1*, the *Terras Indígenas* inhabited by the Nambikwarn peoples are usually multiethnic/multilingual. Table *1* also gives a glimpse into the sociolinguistic situation and language contact within Nambikwaran communities, which may also be used in further research on sociolinguistics. It may also be used as a starting point to plan studies on intelligibility across the languages/lects spoken by Nambikwaran individuals in specific language communities, both among speakers of a language/lect belonging to the same branch of Nambikwaran languages and across it.

1.4 Nambikwaran Villages

Nambikwaran peoples inhabit dozens of villages in Rondônia and Mato Grosso. As shown in Table *1*, Nambikwaran villages are usually inhabited by members of multiple Nambikwaran groups, who speak a different language, which may belong to different branches within the Nambikwaran language family. Overall, villages are usually named after the proximity to a reference point or landmark, such as the case of Nova Estrela, which is in the surroundings of a farm with the same name, or an event, which took place in it, such as the violent fire that burned a shed down to the ground – hence Barracão Queimado, (lit. burnt shed). Some villages also have a popular name, which is ascribed based on sociopolitical reasons (e.g., leadership or prominent person), such as Aldeia de Davi (lit. Davi's village), which points out the leader of it. All Nambikwaran villages have a native name[6], but they are listed in Portuguese to allow for easier identification with official Brazilian authorities. Table *2* shows Nambikwaran villages inhabited by Southern Nambikwaran peoples[7].

Table 2: Villages inhabited predominantly by Southern Nambikwaran peoples.

Village	**Subdivisions**	**Dialectal Area**
Algodão	-	Nambikwara do Campo
Manduca	-	Manduca
Camararé	Central João Maxixe (current Barracão Queimado) Nova Mutum	Nambikwara do Campo
Kithãulhu	-	Nambikwara do Campo
Manairisu	Tahãintesu Cabeceira Trevo A Trevo B Cabeceira Central	Guaporé/ Manairisu
Nambikwara	13 de Maio Aldeia Branca Auxiliadora Cabeceira Central Serra Azul	Nambikwara do Campo

As one can see in Table *2*, Southern Nambikwaran villages are usually subdivided. Sometimes, such subdivision is based on a set of criteria, such as ethnic grounds (e.g.: a village

[6] Some of the toponyms are only known by the elders, as the Portuguese names are most frequently used by most members of the Nambikwaran communities.
[7] For information on Northern Nambikwaran villages, see Telles (2002), Eberhard (2009), and Braga (2017). For the villages inhabited by the Sabanê, see Araújo (2004).

predominantly inhabited by the Wakalitesu, the “caiman people,” who like to inhabit riverside areas), social isolation from other individuals, etc. It is assumed that all Southern Nambikwaran groups who inhabit the same village belong to the same language dialectal area or language cluster. This topic is discussed in detail in section 1.19.

1.5 The Origin Myth

According to a myth told by the Nambikwara[8] across generations, the Nambikwaran peoples were a single group of people, who originally inhabited a massive rock located in a mountain called Yaitulẽnsu[9], recognized by the Nambikwara as “the sacred mountain.”[10] The original rock was hermetically sealed, and therefore no individual could leave the enclosure, just as if they were in their mother’s womb. Besides the life inside the rock, there was also wildlife outside on the surface. All animals who lived on the surface had evolved from other human beings and therefore still possessed some of the abilities of the occupations that they had in their human forms.

For many days Kadosu[11], a monkey belonging to the species of titi monkey, heard lively noises, screams, and whistles coming from the mountain. The cheerful noise coming from the mountain enticed his curiosity and made him eager to find out who was making such joyful sounds. Hoping to find someone rising from the rock, Kadosu started to observe the mountain every single afternoon but failed to meet anyone coming from the mountain.

Kadosu got his typical, reddish-colored fur on his back from spending so much time under the intense sun. Since Kadosu was the only animal that was interested in finding out the source of the noise coming from the rock, he decided to draw other animals’ attention to what was going on within it. The strange noises coming from the rocks also enticed other animals’ curiosity, such as the tapir, Alũsu, and the giant armadillo, W̰a̰lṵlhu, who decided to break the rock to see what was making the noises.

Despite all the attempts to break the rock, no animal was able to make a single crack in it. Most of them also got hurt during the attempts to break the rock and set loose the beings inside of it. The multiple failed attempts only made them even more curious.

One day, a big black-feathered hummingbird, Khwaissu, who used to be a *Pajé*[12], decided to join the quest to see what lays inside the rock and asked all animals surrounding the mountain to step aside because he could set free the beings who dwelt in it by using his magical knowledge. Carrying a magical sword, Khwaissu flew up, dove fiercely downwards towards the rock and hit it, breaking up the mountain and releasing all the Nambikwaran peoples who lived in it.

Once freed from the rock, the Nambikwara people split into different groups, who started to wander on the land. Time passed by and after internal conflicts, rearrangement, and

[8] This myth is an adapted and simplified version of the ones narrated by Clério Wakalitesu and Tadeu Kithãulhu during the fieldwork sessions in March and April 2017. The common elements and events from both versions were kept, but this adaptation is not intended to replace the original myth. It is, however, an attempt to document it.

[9] Place and animal names are written in a simplified orthography.

[10] The sacred mountain is also the afterlife place where the spirits of the dead go after their transition from this life.

[11] Animals play an important role in most stories and myths narrated by the Nambikwara. In all narratives, they figure as anthropomorphized beings, endowed with distinct characters and particular personalities. Nambikwaran children are also commonly portrayed in their mythology and cosmology.

[12] *Pajé* is the healer and spiritual leader of an indigenous community in Brazil.

geographical displacement, their original language started to change gradually and gave birth to the existing Nambikwaran languages.[13]

1.6 A Concise Contact History with the Nambikwaran Peoples

The contact history of the Nambikwaran peoples is not any different from the history of most South American indigenous peoples. As commonly attested in the other colonized societies, indigenous peoples were not only victims of exploitation, traumatic displacement, forced cultural and social change, genocide, imprisonment and forced labor, but were also exposed to epidemics (e.g., common flu, measles, syphilis) brought by the western world, which decimated their population.

The history of the Nambikwaran peoples can be roughly divided into four stages, based on pivotal historical events that led to significant changes in their society. The first stage touches upon the early contact history, which spans from the 18th century until the beginning of the 20th century. The second stage encompasses the outset of the Marshall Rondon Years and the arrival of Roquette-Pinto. In the third stage, a critical moment in the Nambikwaran history is observed: the arrival of French anthropologist Claude Lévi-Strauss, to whom significant influence on conceiving the Nambikwara is credited (Reesink 2003: 3). The third stage is also marked by the works of David Price, which were of great significance for the description of the Nambikwaran languages and their peoples. Finally, the fourth stage covers the most recent years in Nambikwaran history, including an overview of the most recent works on their languages and peoples as well as the years of the COVID-19 Pandemic.

1.7 Earlier Contact

The earliest documented contact with Nambikwaran peoples happened in the first half of the 18th century, during an attempt to establish a way to the land near the Forte Príncipe da Beira, a fort which was part of the Brazilian defensive system near the Bolivian border. At that time, reports made by António Pires de Campos drew attention to an indigenous group which slept on the floor and lived near the Serra do Norte (Roquette-Pinto 1919: 40).

In the second half of the 18th century, gold was found near the Nambikwaran lands, triggering the rush for it. With the mining, enslaved African people were brought to the area (Price 1972: 9) and some of them escaped to the forests, establishing communities called *quilombos*, which served as a haven for the runaway slaves. In 1770, a military expedition captured groups of indigenous and African individuals who lived in the *quilombos*. This fact may suggest that the African individuals established multiethnic communities, probably by kidnapping indigenous women (Eberhard 2009: 38). Two of the most famous *quilombos* were the Quilombo Galera and the Quilombo Guaritetê, near the Nambikwaran region, inhabited by the Mamaindê and Negarotê. The Quilombo Guaritetê is speculated to have been inhabited by a Northern Nambikwara group (Eberhard 2009: 38).

At the beginning of the 19th century, rubber tapers started to explore and exploit the region. The Nambikwaran peoples were then forced to work for the rubber tapers, who tortured, imprisoned, and spread diseases among them.

[13] The mythological point of view on how Nambikwaran languages started to change has been validated within the scientific community of researchers who have worked in the area. Price (1978: 30) was the first researcher to point out that Nambikwaran languages may be arranged in terms of geographical location, and that geographical distance among Nambikwaran peoples is a valid criterion to determine the degree of intelligibility and level of proximity among them.

1.8 The Marshall Rondon and Roquette-Pinto Years

In 1907, another important event took place in Nambikwaran history: the arrival of the commission of Marshal Cândido Mariano da Silva Rondon. Rondon and his commission oversaw installing a telegraph line between Cuiabá and Porto Velho, current capital cities of the states of Mato Grosso and Rondônia, respectively. Apart from being committed to establishing the new telegraph line, Rondon was also in charge of pacifying the indigenous peoples who inhabited the territories along the telegraph line.

During the construction of the telegraph line, Rondon and his commission had to cross the Nambikwaran lands, which led to he and his team coming into contact with many Nambikwaran individuals from different groups. The initial years of contact with the Nambikwaran peoples were not peaceful (Eberhard 2009: 40). However, the multiple Nambikwaran attacks against Rondon's commission began to cease and a more peaceful relationship between the commissioned Brazilians and the indigenous Nambikwaran groups started. During Rondon's stay, he started to use the term of Tupian origin "Nambikwara" to refer to all the indigenous individuals who had a pierced nose.

While successful in his tasks of installing the telegraph line and establishing good rapport with the indigenous communities in the region, Rondon's commission was also responsible for bringing epidemic diseases to the indigenous groups, whose populations started to decrease.

In 1919, Roquette-Pinto published a book entitled *Rondônia,* in which he describes the Nambikwaran peoples and correlates them with the group of indigenous peoples that were mentioned in the late 18th century by António Pires de Campos. Furthermore, Roquette-Pinto (1919: 17–18) also provided crucial facts about Nambikwaran peoples, namely the way in which they built their houses, their large population, and how problematic it was to name them Nambikwara, since this word is not of Nambikwaran origin.

Once the new telegraph line was established, Christian missionaries arrived in the Nambikwaran territories. The first missionaries came from the Inland South American Union in 1924 to live among Southern Nambikwaran groups and evangelize to them. After the protestant mission, Jesuits also arrived in the Nambikwaran territory near the region of Utiarity. Both missions were unsuccessful.

1.9 The Ethnographic Years and First Linguistic Descriptions

In 1938, French anthropologist Claude Lévi-Strauss started his ethnographic work with the Southern Nambikwaran peoples. Lévi-Strauss's ethnographic work *La vie familiale et sociale des Indiens Nambikwara* was published in 1948 and became the first anthropological account of a Nambikwaran society. This work was responsible for the dissemination of multiple misconceived ideas about the Nambikwaran peoples, such as their seasonal nomadism. Lévi-Strauss (1948a 187-191) also published a word list, the first one in the literature on Nambikwara, which introduced the notation system used in his transcriptions. In his *cahiers,* he also posited relationships between different Nambikwaran dialects.

During the years of World War II, ongoing invasions brought a series of diseases to the Nambikwaran lands. The most severe epidemic, the measles epidemic, happened in 1945, and it was a pivotal event for the destruction of Nambikwaran villages, which in turn led to the separation of the population into groups. During the epidemic years, the Nambikwaran population was decimated and the remaining Nambikwaran individuals were rearranged into groups. Many deaths were reported to the *Serviço de Proteção ao Índio* (SPI), a governmental organization in charge of the welfare of the indigenous communities, which had been moved to the region of the Rio Galera in 1919.

Some years later, Canadian anthropologist Kalervo Oberg arrived in Nambikwaran lands, accompanied by Rev. L. W. Buckman, who had been living in the region since 1941. In 1953, Oberg published another ethnographic description of the Nambikwaran group called Waklítesu (sic.), which is found in his work entitled *Tribes of Northern Mato Grosso Brazil*. In his description, Oberg (1953: 85) drew attention to some Nambikwaran phenotypical features, such as the dark-gray undertone of Nambikwaran skin[14], waviness of their hair, and the brightness of their typical dark-brown, blackish eyes, all of which contrast remarkably with the physical features of indigenous groups related to other ethnicities. Oberg (1953: 124–126) also attempted to classify Nambikwaran dialects and provided a new word list. Two years after Oberg's publication, Lévi-Strauss (1955) published his memoir *Tristes Tropiques*, focusing on his anthropological work in Brazil. Part 7 of *Tristes Tropiques* (Lévi-Strauss 1955: 287-377) is dedicated to the Nambikwaran peoples and most of what is written in this section comprises what the international community knows about them.

In 1959, missionaries Menno Kroeker and Ivan Lowe from the Summer Institute of Linguistics (SIL) arrived in the Southern Nambikwaran lands to start the linguistic description of Nambikwara, aiming to translate the Bible and evangelize to them. Unlike what had happened to the previous Christian missions, members of the SIL actually succeeded and stayed the longest with the Southern Nambikwaran peoples.

In the 1960s, another series of events marked the Nambikwaran history. In 1960, the telegraph line was closed and the highway crossing Nambikwaran lands was finally completed (Eberhard 2009: 41). The Nambikwaran land in the Valé do Guaporé was invaded by miners, farmers, and other groups, motivated by the establishment of a new road between the cities of Cuiabá and Porto Velho, the BR 364 (Comissão Nacional da Verdade 2014: 215).

After a coup d'état by the Brazilian Armed Forces, supported by the United States government, the military dictatorship in Brazil started in 1964. The situation within the Nambikwaran communities worsened severely. In 1968, the director of indigenous heritage within the recently established *Fundação Nacional do Índio* (FUNAI)[15] attempted to create three indigenous reserves in the Nambikwaran region. This proposal was initially rejected, but in October 1968, the Nambikwara Reserve was finally created[16]. However, the new reserve was established according to false and fraudulent information and covered only the dry lands, which were hardly inhabited by the Nambikwara, and excluded the fertile lands within the Valé do Guaporé (Comissão Nacional da Verdade 2014: 216). Since their original lands in the Vale do Guaporé were not secured by the government, the Vale do Guaporé was more intensively invaded by agriculturalists, who once again put Nambikwaran lives under threat.

As a result of the invasion, a new measles epidemic broke out, killing all Nambikwaran individuals under 15 years old (Comissão Nacional da Verdade 2014: 216). Because of the intense threat, members of FUNAI and the Brazilian Air Force initiated the *Operação Sararé* (lit. Operation Sararé) to rescue all indigenous individuals who survived. Members of the Nambikwaran groups Mamaindê, Negarotê, Wasusu e Alantesu were relocated to the Nambikwara reserve, extending it to Rio 12 de Outubro.

However, the Nambikwaran groups failed to adapt to the new region and started migrating again to the Vale do Guaporé, after almost dying of starvation (Carelli & Severiano 1980: 14). During that time, Nambikwaran peoples also died of malaria and the common flu. Furthermore,

[14] Much is speculated about the darker tone of the skin of the Nambikwara. One of the hypotheses points out that the darker tone is derived from interracial relationships with the enslaved African individuals, who lived in the Quilombos in the area. As 75% of the enslaved African peoples who were brought to Brazil are estimated to be of Bantu origin (de Melo 2008), it is assumed that Nambikwaran peoples had contact with Bantu languages.

[15] Lit. National Indian Foundation, a protection agency for indigenous rights, culture, and interests – such as the demarcation of the *Terras Indígenas*.

[16] More details are found in the document entitled *Decreto* Nº *63.368*, de 8 de Outubro de 1968.

the rivers in the region were contaminated by the chemical defoliant and pesticide popularly known as Agent Orange, which also destroyed the crops and poisoned many individuals, who died.
After the turmoil of the past decades, another prominent figure in the history of the Nambikwaran peoples arrived at their land: the anthropologist David Price. Price researched and published extensively on the language, culture, and history of the Nambikwaran peoples. He was also a witness to the atrocities taking place in their area and became an important advocate of indigenous rights, setting up the Nambikwara Project, which aimed to reduce the mortality rates in Nambikwaran villages between 1974 and 1976. *The Nambikwaran linguistic family* (Price 1978) has become one of the most influential studies of the Nambikwaran language family, along with his co-authored work with Cook (Price and Cook 1969) and other publications such as Price (1976, 1989), among others.
After the epidemic years, the construction of the highway across Nambikwaran lands, and its paving financed by the World Bank in the 1980s, miners and wood smugglers were attracted to the area. Once again, the Nambikwaran peoples were under threat.

1.10 More Recent Years (2001 – Present)

In the past two decades of the 21st century, much effort has been put into describing the languages and cultures of the Nambikwaran peoples. Missionaries Ivan Lowe, Menno and Barbara Kroeker published several papers on the Nambikwara language (Kroeker 2001; B. Kroeker 2003, etc.). They authored much of what has been published in the international scientific community about the Nambikwara. In 2001, Kroeker published the first descriptive grammar of Nambikwara, covering mostly aspects of morphosyntax, with an appendix on phonology.
Northern Nambikwaran languages were also described. Telles (2002) published the first descriptive grammar of Northern Nambikwara languages. Telles's grammar described the language spoken by the Latundê and the one remembered by the only remaining Lakondê speaker. Kingston and Eberhard covered the description of Mamaindê. The latter author published a two-volume grammar covering both phonology and morphosyntax (Eberhard 2009). Works on the history and ethnography of Nambikwaran peoples were also published (Fiorini 2000; Costa 2002; Reesink 2007, Miller 2007, etc.).
Nearly ninety years after Lévi-Strauss's ethnographic works on the Nambikwaran lands, the scenario is not much different from the one he encountered, though there has been some improvement since the foundation of the former *Fundação Nacional do Índio* (FUNAI), now *Fundação Nacional dos Povos Indígenas*, the National Indigenous Peoples Foundation.
During the initial COVID-19 years, the Southern Nambikwaran peoples avoided commuting to the nearest towns and quarantined within their native lands, probably motivated by past epidemic experiences throughout their contact history. According to Donaldo Kithãulhu in a personal interview in 2022, there were no casualties by the new coronavirus among the Nambikwara because of this measure. Although they escaped the virus, another threat started to haunt them: the intense deforestation in the Amazonian and Cerrado areas. The fires were set criminally by farmers and *grileiros* and were motivated by the governmental policies at that time. As massively reported in the international media, President Jair Bolsonaro (2019 – 2022) expressed his sheer determination to exploit Brazil's natural resources through commercial farming and mining in the Amazon area. The exploitation of natural resources was also promoted in indigenous lands[17], which led to other indigenous massacres and crises in Brazil[18].

[17] <https://www.aljazeera.com/news/2022/3/9/bolsonaro-pushes-for-mining-on-brazils-indigenous-lands>.
[18] One of these crises, the Yanomami humanitarian crisis, has attracted international attention due to the major human rights violations that were inflicted on this indigenous group during the presidency of Bolsonaro.

In Mato Grosso, 59.624ha of land is covered by illegal mining[19]. In the whole Amazonian area, illegal mining within indigenous lands increased by 632% between 2010 and 2021, encompassing 62.650ha. The situation in the Cerrado area is also shocking, with an estimated area of 32.817ha. This scenario is observed in the surroundings of Nambikwaran communities. Apart from illegal mining, Nambikwaran lives were also constantly threatened by massive fires[20] that took place near their territories in surrounding cities such as Vilhena and Comodoro[21]. The fires changed the environment[22] drastically and posed a myriad of challenges to their daily lives.
All of these recent happenings have put the Nambikwaran and many other indigenous populations in a highly vulnerable position, making them more susceptible to ethnic extermination and, consequently, language endangerment.

1.11 Language Contact with Other Language Families

In recent years, there have been attempts to establish language contact with the multiple indigenous groups who inhabit South America to provide an archaeolinguistic history of the continent. Jolkesky (2017) suggests evidence of language contact between Nambikwaran languages and other language families through a comparative lexicon of Proto-Nambikwara and surviving Nambikwaran languages with languages from other language families.
In the light of existing similarities across lexical strata within Proto-Nambikwara and living Nambikwaran languages, the following language contact with Nambikwara languages were posited: Guaporé-Tapajós/ Mamoré-Guaporé Arawak (Arawakan), Bororo (Bororoan, Macro-Jê), Karib (Cariban), Aikanã (language isolate), Iranxe (language isolate), Itonama (language isolate), Kanoê (language isolate), Kwazá (language isolate), and Peba-yagua (Peba-yaguan) (Jolkesky 2017: 379, 381, 416, 496, 517, 518, 519).

1.12 The Nambikwaran Language Family

As previously mentioned, Nambikwara is a small and highly endangered language family in Brazil. Nambikwaran languages are commonly regarded as Amazonian languages (Aikhenvald & Dixon 1999, Lowe 1999, etc.). However, they are not exclusively Amazonian. As mentioned, native speakers of Nambikwaran languages predominantly inhabit two great areas, regarded as “biomes” or “ecoregions” in the biosciences because of their distinctive physical environments and regional climates: the Amazonian Forest and the Cerrado.
The portion of the Amazonian Forest inhabited by the Nambikwaran peoples covers two different regions in Brazil. The first region is near the town of Vilhena, in the southwestern area of the state of Rondônia, in the north. The second portion encompasses fractions of the northwestern areas of Mato Grosso, especially in the area by the Guaparé River, locally known

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[19] <https://mapbiomas.org/916-da-area-garimpada-no-brasil-ficam-no-bioma-amazonia>.
[20] <https://www.lemonde.fr/en/environment/article/2022/08/26/wildfires-in-brazil-s-amazon-hit-15-year-high_5994837_114.html>.
[21] The fieldwork, which took place in the area in September 2022, was dangerous in many ways. Right from the beginning, I noticed a remarkable difference in the landscapes that I had seen in my first fieldwork trip in March 2017. Areas of Amazonian forests near the very small airport in Vilhena were clearly destroyed to turn them into soybean plantations. Fires were very intense throughout the whole stay, and it seemed as if the towns had become more isolated from the rest of the world due to a dense surrounding curtain of smoke. The areas along the road that connected Vilhena to Comodoro, where the fieldwork took place, were covered by very dense smog. Furthermore, there was fire literally on both sides of the road during the trips, forcing the driver to drive the whole journey in the middle of the road to avoid the fires. Although I was utterly shocked, the local population was not: they seemed to be very used to the scenario.
[22]<https://www.dw.com/en/how-has-the-amazon-rainforest-changed-under-jair-bolsonaro/a-63211783>.

as Vale do Guaporé (lit. Guaporé Valley), in the Central West. The Amazonian areas in the north are predominantly inhabited by Northern Nambikwaran speakers, such as the Latundê, whereas the portions in Mato Grosso are inhabited by peoples of Northern Nambikwaran (such as the Mamaindê and Negarotê), Sabanê, and, more predominantly, Southern Nambikwaran origins.
The other great area inhabited by the Nambikwaran peoples, the Cerrado, is in the proximity of towns like Comodoro, near the Bolivian border in the Central-West. A substantial number of Nambikwaran peoples (e.g., the Halotesu, Kithãulhu, Sawentesu, among others) dwell in the Cerrado. In contrast with the Amazonian area, the Cerrado is comprised of heterogeneous core areas of tropical and subtropical savannahs, woodlands, grasslands, and shrublands in the Brazilian *planaltos* (highlands). The Cerrado area is also the homeland of other indigenous groups such as the Xavante (Xavante language, Macro-Jê), the Iny rybè, also known as the Karajá (Karajá language, Macro-Jê), and it has a very specific flora and fauna, as well as a climate with two well-defined seasons and a third transitional season between them, all of which are reflected in the lexis and habits of the people who inhabit it.
Nambikwaran individuals usually roam from one village to the next depending on their personal interests (marriage, availability of work, etc.), an issue that makes the task of determining how many languages comprise this language family even harder. Due to frequent mobility, even a person who is originally from an Amazonian area can end up moving to the Cerrado and vice versa. As shown, in the geographical sense, Nambikwaran languages are not "Amazonian" per se.
The term Amazonian is also inaccurate when used to describe languages spoken in the surroundings of the South American Amazon basin. For instance, Payne (1990: 3) points out that "studies […] fail to suggest that there is an Amazonian linguistic area in the technical sense." Other than that, using the term "Amazonian" is also exclusionary since it would not encompass other native indigenous languages spoken in other areas of Brazil or even in South America, such as the one spoken by the Fulni-ô (Yathê, language isolate) in the semiarid area of the *agreste*, in the municipality of Águas Belas, Pernambuco, northeastern Brazil.
Thus, it is partly inaccurate to refer to Nambikwara as an Amazonian language family per se since it does not reflect the complexity of their relations to the environment and their habits that are rooted in their cultures. Furthermore, classifying Nambikwaran languages as strictly Amazonian can also be considered inaccurate in light of colonization theories. Overall, classifying the native languages of Brazil as "Amazonian" also reinforces the colonizer/colonized relationship, in which the term "Amazonian" is viewed as more exotic to the eyes of outsiders, thus becoming more worthy of investigation. In the light of the above arguments, Nambikwaran languages will be regarded throughout this dissertation as simply pertaining to a South American or, to be more precise, Brazilian language family and will be held under the umbrella of languages of Brazil.
The following sections give a historical overview of the attempts to classify Nambikwaran languages. Furthermore, they also address proposals that aimed to affiliate the Nambikwaran language family with other existing macro-families in Brazil.

1.13 Early Classification Proposals

The first attempts to classify Nambikwaran languages were endeavored by the ethnologist Roquette-Pinto (1919) and Rondon & Faria (1947), the first author being the leader of the telegraph commission and responsible for the exploration of the western Amazon basin and the state of Mato Grosso.
Despite the pioneering pursuits to document indigenous languages' vocabulary, neither attempt presented relevant information such as which groups of people had engaged in the

documentation stages of the word lists or transcription information. In light of more recent work on the Nambikwaran language family, most words may be regarded as inaccurate transcriptions or spurious forms. The first researcher to publish word lists with explicit information on the system used for the transcriptions was Lévi-Strauss (1948). Table *3* illustrates Lévi-Strauss's (1948) proposal for the classification of Nambikwaran languages:

Table 3: The Nambikwaran linguistic family according to Lévi-Strauss (1948).

Nambikwaran Languages		
Northern Nambikwara	Southern Nambikwara	Sabanê

According to Table *3*, Lévi-Strauss (1948) recognized three "dialectal" groups, namely Northern Nambikwara, Southern Nambikwara, and Sabanê. Strauss's proposal was the first attempt to link Nambikwaran languages to a common parental origin.

1.14 Historical and Comparative Studies

After Lévi-Strauss (1948), more attempts have been made to classify Nambikwaran languages, such as Swadesh (1959) and Greenberg (1960), who primarily aimed to establish genetic relationships among languages in the Americas. For Greenberg (1960), Nambikwaran languages were affiliated with the Ge-Pano-Carib Phylum, whereas Swadesh (1959: 21) proposed genetic relations to languages such as Carayá (an unknown language spoken in Brazil) and Omurano (a language isolate of Peru). Both proposals of macro affiliation have been disputed and regarded as inaccurate (Rodrigues 1967: 35), and some of the similarities between different languages are regarded as outcomes of statistical chance (Campbell 1997: 230).

1.15 Current Proposals

In 1978, David Price published a comparative work using data collected from three Nambikwaran peoples, namely the Kithãulhu (Southern Nambikwara), Mamaindê (Northern Nambikwara) and Sabanê (Sabanê). The aim of Price's publication was to find phonological correspondences among members of the three major language branches under the Nambikwaran language family, as posited by Lévi-Strauss (1948). Based on word lists comprised of approximately one hundred and eighty lexical items, Price (1978) was able to identify cognate ratios among the languages spoken by the Kithãulhu, Mamaindê, and Sabanê. The data shown in *Table 4* reflects the relation between the total number of lexical items available for comparison and the number of cognates identified in Price's comparative study:

Table 4: Lexical similarity of Kithãulhu, Mamaindê, and Sabanê (Price 1978: 28).

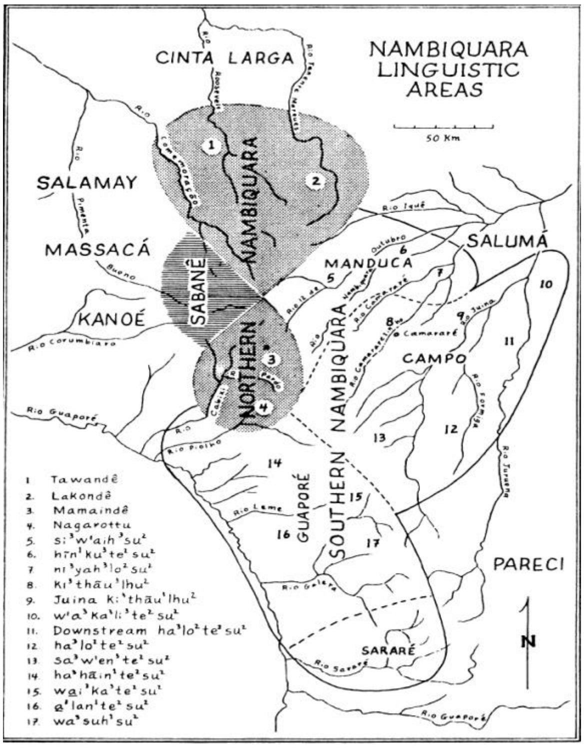
	Kithãulhu - Mamaindê	**Kithãulhu - Sabanê**	**Mamaindê - Sabanê**
No. of cognates	116	95	81
No. of cases[23]	164	190	165
Percentage	71%	50%	49%

Price's findings displayed in Table *4* suggested that not only Kithãulhu, Mamaindê, and Sabanê belonged to the same language family, but also that they could be interpreted as different

[23] The number of cases in the table refers to the exact number of lexical items that were used to compare the similarities in the lexicon among the members displayed in the first row.

languages within it. Although lexicostatistics is not a good basis for family definition, the contrasting extent ratios of cognates per case was used to validate Lévi-Strauss's (1948) proposal for a three-branched language family. Moreover, it was also possible to establish the degree of linguistic proximity among the members of all three language branches. Sabanê was regarded as the most distantly related language within the Nambikwaran language family, a claim which was also validated by Araújo (2004) in his descriptive grammar of Sabanê. Price (1978) also attempted to reconstruct the Proto-Nambikwara language, from which all Nambikwaran languages originated, providing a list of reconstructed forms.
Another crucial finding of Price's was to recognize that there was a correlation between languages, dialects, and the different river systems in the area that the Nambikwaran peoples inhabit. From this view, geographical distance would be regarded as a primary variable to determine language proximity. In regards to rivers and their tributaries, he posited that Northern Nambikwara could be rearranged into two different language clusters, namely the Guaporé and Roosevelt. An illustration of Price's (1978: 17) proposal for the Nambikwaran linguistic areas is given in Figure *1*:

Figure 1: Nambikwaran linguistic areas (Price 1978: 17).



Through the recognition of the Nambikwaran linguistic areas determined by geographical proximity shown in Figure *1*, the Nambikwaran language family could have the threefold language branches subdivided into dialectal areas. For Northern Nambikwara, two dialectal areas were recognized: one by the Guaporé and the other by the Roosevelt Rivers. Southern Nambikwara was subdivided into four major dialectal areas/language clusters, namely Campo, Manduca, Guaporé, and Sararé.
As for the Southern Nambikwara branch, Price (1978: 30) also suggested that each of the four major dialectal areas encompasses a slightly different dialect. Every dialect could be recognized by clear phonological reflexes, noticeable phonological differences, occasional lexical substitution, and subtle grammatical differences.
Groups within the same language cluster, such as the Kithãulhu and Halotesu, which belong to Campo, can easily understand each other despite such linguistic differences. Price (1978: 30)

also noticed that there was a high degree of intelligibility between members of the Maduca and Campo language clusters, which may suggest that the closer the groups are, the higher the intelligibility degree is. This observation could justify why more prominent differences are found between individuals belonging to Sararé and Campo clusters since they are more geographically distant. Table *5* is built upon the information on the Nambikwaran language family found in Price (1978). All language clusters/linguistic areas are listed in the third row in italics. Right below the language clusters, we see the peoples who belong to them. The language areas can also be observed in Figure *1*.

Table 5: The Nambikwaran linguistic family according to Price (1978).

Nambikwaran Languages						
Northern Nambikwara		**Southern Nambikwara**				**Sabanê**
Guaporé	*Roosevelt*	*Campo*	*Manduca*	*Guaporé*	*Sararé*	
Mamaindê Nagarottu	Tawandê Lakondê	Kithãulhu Sawentesu Halotesu Wakalitesu	Niyahlosu Siwxaihsu hĩnkutesu	Hahãintesu Wa̰ḭkatesu A̰lantesu Wasuhsu	Sararé	Sabanê

As shown in Table *5*, both Northern and Southern are subdivided into different language clusters according to geographical location, in contrast with Sabanê, which has no internal subdivision. Another criterion that should be addressed to understand dialectal variation within the same language branch is alterity. Although this topic should be further investigated, my fieldwork among the Nambikwara showed that the dialectal variation seems to reinforce membership and identity of members of a given speech community. Speakers could easily point out which lexical item would be used by a specific group (e.g.: the Kithãulhu) and not by another, as well as highlight phonological differences between speakers belonging to different language clusters.

More recently, Rodrigues (1994: 75) validated Price's findings and regarded Nambikwara as a rather small language family. Rodrigues also suggests that Northern and Southern Nambikwara are dialectal complexes in the southern Amazon.

1.16 The Nambikwaran Language Family

My current proposal for the Nambikwaran language family is shown in Table *6*. It is based on Price (1978: 30), Eberhard (2009: 30), Telles (2013: 292), and information collected during original fieldwork in 2022, many of which were discussed in previous sections. Only the lects/languages with living speakers are included.

Table 6: The Nambikwaran language family.

The Nambikwaran language family									
Sabanê	**Northern Nambikwara**		**Southern Nambikwara**						
Sabanê*****	*Roosevelt*	*Guaporé*	**Nambikwara do Cerrado**				**Nambikwara do Vale**		
	Lakondê†	Mamaindê	*Campo*		*Manduca*		*Guaporé*		*Sararé*
	Latundê	Negarotê	*Cluster A*	*Cluster B*	*Cluster C*	*Cluster D*	*Manairisu*	*Wasusu*	Katitãulhu
	Tawandê*	Tawendê*	Kithãulhú	Sawentesu	Hukuntesu	Siwaisu	Hahãintesu	Wasusu	Nutajensu
	Sawaintê*		Halotesu	Wakalitesu	Niyahlosu	Nḛsu	Alãtesu		Kalũhwasu
							Waikisu		Kwalitsu
									Sayulikisu
									Waihlatisu

(*) indicates that the lect/language is moribund.
(†) indicates that the lect/language is only spoken by one individual.

The expansion and subdivisions found under Southern Nambikwara are discussed in detail in section 1.19.

1.17 Branches Within the Nambikwaran Language Family

In this section, I provide more information on all three branches under the umbrella of the Nambikwara language family, starting with the least complex branch, Sabanê, with no internal subdivision, and moving to the more complex Northern and Southern Nambikwara.

1.17.1 Sabanê

As discussed, Sabanê is a branch within the Nambikwaran language family with no internal subdivision, i.e., comprised solely of the Sabanê language. Sabanê is regarded as the most genetically distant Nambikwaran language (Price 1978: 28) and is spoken by the Sabanê people in Rondônia, at Terra Indígena Pirineus de Souza, locally known as Aroeira.
The Sabanê language is believed to be nearly extinct, since there are fewer than 15 individuals who can speak it in a wide range of proficiency levels. Among the 15 individuals, three are native speakers, two acquired it as a second language in childhood, and the remaining portion can communicate in Sabanê through isolated words and sentences (Araújo 2004: 3).
The one and only comprehensive work on Sabanê has been published by Araújo (2004) and consists of a descriptive grammar, covering Sabanean phonology and morphosyntax, and a short dictionary. Apart from Araújo's descriptive grammar, short Sabanean word lists have also been published (Lévi-Strauss 1948; Price 1978: 23-27).

1.17.2 Overview of Sabanê Phonology

There are five phonemic vowels, which have long and nasalized allophones (Araújo 2004: 27). Table *7* illustrates the five Sabanean phonemic vowels:

Table 7: Phonemic vowels in Sabanê (Araújo 2004: 28).

	Anterior	**Central**	**Back**
High	i		u
Mid	e		o
Low		a	

/i/ and /u/ can be combined with other vowels to make diphthongs. There are no phonemic glides. However, vowels /i/ and /u/ occurring at syllable margins are phonetically realized as on- and off-glides, [w] and [j], respectively. Table *8* shows the phonetic realization of the Sabanean diphthongs:

Table 8: Phonetic realizations of diphthongs in Sabanê (Araújo 2004: 41)

	Offglide		**Onglide**	
	w	j	w	j
a	+	+	+	+
e	+	+	+	+
i	+	-	+	+
o	+	+	+	+
u	+	+	-	+

Sabanê consonants are comprised of a series of voiceless plosives, nasal stops, implosives, fricatives, and one lateral, as illustrated in Table *9*:

Table 9: Sabanê phonemic consonants (Araújo 2004: 43).

	Labial	Coronal	Dorsal	Glottal
Stop	p	t	k	ʔ
Implosive	ɓ	ɗ		
Nasal	m	n		
Fricative		s		h
Lateral		l		

Sabanean maximal syllable structure is (C)V(C) in the underlying representation. The most frequent syllable type is /CV/ (Araújo 2004: 67).

1.18 Northern Nambikwara

"Northern Nambikwara" is another term with multiple meanings. It may refer to 1) a branch within the Nambikwaran language family or 2) a general term to refer to the Nambikwaran language and lects spoken by Northern Nambikwaran peoples in the Amazonian areas within the states of Rondônia and Mato Grosso. I will only employ the term Northern Nambikwara to refer to the branch within the Nambikwaran language family.

The motivation for the usage of the two denotations for Northern Nambikwara in the literature is based on the analyses of the researchers. For instance, Northern Nambikwara has been regarded as a single language with five dialects (Lowe 1999: 268; Wetzels & Meira 2011: 350). Hence, the denotation in 2).

Research (Price 1978:30) has suggested that Northern Nambikwaran comprises two language clusters, the Roosevelt and the Guaporé, named after the rivers crossing their lands. Despite similarities in the lexicon, there is a significant difference between the languages spoken along the non-continuous lands near the Roosevelt and Guaporé rivers, at least at the phonological level (Telles 2002, 2013; Eberhard 2009; Braga 2012, 2017). Eberhard (2009: 25) also provided valuable information on intelligibility among lects spoken within both language clusters, using information on the Mamaindê and how easy they think it is to understand other Northern Nambikwaran lects. Much effort has been put into describing the lects/languages belonging to Northern Nambikwara in the past two decades (Kingston 1976; Telles 2002, 2013, 2018; Eberhard 1995, 2004, 2009; Braga 2012; 2017; Costa 2018, among others).

In contrast to Southern Nambikwaran lects, Northern Nambikwara has been investigated in a systemic manner; the available literature focusses on individual languages/lects, which has enabled it to provide a clearer picture of the peoples and linguistic communities belonging to it. Consequently, one has a clearer idea of how many languages, lects, language clusters, and speech communities are included under the umbrella of Northern Nambikwara.

Table *10* is built upon Eberhard (2009: 30), who shows Northern Nambikwara groups belonging to the Roosevelt and Guaporé clusters. In contrast with Table *5* proposed by Price (1978: 30), more lects were added by Eberhard (2009) and shown in Table *10*:

Table 10: The Northern Nambikwara branch (Eberhard 2009: 30).

Northern Nambikwara	
Roosevelt Cluster	*Guaporé Cluster*
Lakondê Latundê Tawandê Sawaintê	Mamaindê Negarotê Tawendê

The language clusters shown in Table *10* display different levels of language vitality, as languages belonging to the Roosevelt cluster are moribund. Lakondê has only one *lembradora*[24] (rememberer) and the Latundê has no more than 15 speakers (Telles 2019: 168). The lects belonging to the Guaporé cluster have a higher number of individuals, but they are also highly endangered.
Works on the Roosevelt clusters have been published by Telles (2002, 2013, 2019, etc.), focusing predominantly on phonology and morphosyntax of Latundê. Lakondê has been covered by Telles (2002), Telles & Wetzels (2006) and more recently by Braga (2012). To date, no comprehensive works on the other lects/languages within the Roosevelt cluster (Tawandê and Sawaintê) have been published.
Research on the Guaporé Cluster was carried out among the Mamaindê by Kingston (1970, and other unpublished manuscripts), and subsequently by Eberhard (1995, 2004, 2022, etc.), who has also published a two-volume grammar (Eberhard 2009). The phonology of Negatorê was described by Braga (2017). There is no current description of Tawendê.

1.18.1 Overview of Northern Nambikwaran Languages Phonology

Table *11* provides an overview of the phonology of four Northern Nambikwaran languages, namely Latundê, Lakondê, Mamaindê, and Negarotê, according to Telles (2002), Braga (2012), Eberhard (2009), and Braga (2017) respectively. As one can see from Table *11*, Northern Nambikwaran languages have similar segmental phonological systems. Mamaindê has the largest phonemic consonantal inventory due to the voiceless aspirated plosive series, as well as the largest phonemic nasal vowel series, with 5 segments, and is the only Nambikwaran language with a phonemic nasal round mid-back vowel /õ/.
In contrast with other Nambikwaran languages, such as Sabanê, Northern Nambikwaran languages do not display any non-pulmonic consonant in their phonemic inventory, although implosives do occur phonetically (Telles 2002: 38; Eberhard 2009: 58, Braga 2017: 44).

[24] *Lembrador* (n. masc. sing.) or *lembradora* (n. fem. sing), lit. rememberer, or the one who remembers, is a term frequently used in the literature on indigenous peoples of Brazil. It denotes an indigenous individual, who knows their indigenous native language, but does not use it since there are no other speakers with which to communicate.

Table 11: Comparative overview of Northern Nambikwaran languages phonology.

			Northern Nambikwara			
			Latundê (Telles 2002)	Lakondê (Braga 2012)	Mamaindê (Eberhard 2009)	Negarotê (Braga 2017)
Consonants	Plosives	Plain	/p, t, k, ʔ/	/p, t, k, ʔ/	/p, t, k,ʔ/	/p, t, k, ʔ/
		Aspirated	-	-	/pʰ, tʰ, kʰ/	-
		Glottalized	-	-	-	-
	Fricatives	Plain	/s, h/	/s, h/	/s, h/	/s, h/
		Glottalized	1)	-	-	-
	Affricates	Plain	2)	-	-	-
	Liquids	Plain	/l/	/l/	/l/	/l/
		Glottalized	3)	-	-	-
	Nasals	Plain	/m, n/	/m, n/	/m, n/	/m, n/
		Glottalized	-	-	-	-
	Glides	Plain	/w, j/	/w, j/	/w, j/	/w, j/
		Aspirated	-	-	-	-
		Glottalized	-	-	-	-
Vowels	Oral		/i, e, a, o, u/	/i, e, a, o, u/	/i, e, a, o, u/	/i, e, a, o, u/
	Nasal		/ĩ, ã, ũ/	/ĩ, ã, ũ/	/ĩ, ẽ, ã, õ, ũ/	/ĩ, ã, ũ/
	Creaky voice		/ḭ, ḛ, a̰, o̰, ṵ/	/ḭ, ḛ, a̰, o̰, ṵ/	/ḭ, ḛ, a̰, o̰, ṵ/	/ḭ, ḛ, a̰, o̰, ṵ/
	Nasal creaky		/ḭ̃, ã̰, ṵ̃/	/ḭ̃, ã̰, ṵ̃/	/ḭ̃, ã̰, ṵ̃/	/ḭ̃, ã̰, ṵ̃/
Vowel sequences	Heterosyllabic		-	yes	yes	yes
	Monosyllabic	Diphthongs	/GV/, /VG/	/iu, au, ãu, au, , a̰u, ou, ei, ḛi, ai, ai, a̰i, ui/	/iu, ḭṵ, ei, ḛḭ, eu, ai, a̰ḭ, au, a̰ṵ, ĩũ, ḭ̃ṵ̃, ẽĩ, ẽũ, ãĩ, ã̰ḭ̃, ãũ, ã̰ṵ̃/	/iu, ĩu, eu, , ḛu, au, ãu, a̰ṵ, ou, ei, ḛḭ, eĩ, ai, ãi, a̰ḭ, ui/ [VG]
		Triphthongs	/GVG/	-	-	-
Syllable Structure	Surface		(C)(C)(V)(C)(C)	(C)(V)V(C)(C)	(C)(C)(V)V(C)(C)	(C)(C)(V)V(C)(C)
	Underlying		(C)V(C)(C)	(C)(V)V(C)(C)	(C)(C)(V)V(C)(C)	(C)(C)(V)V(C)(C)

1.19 Southern Nambikwara

The term "Southern Nambikwara" is also employed with multiple meanings in the Nambikwaran literature. It may refer to 1) a branch within the Nambikwaran language family or 2) a general term to refer to the Nambikwaran languages and lects spoken by Southern Nambikwaran peoples in the state of Mato Grosso, both in the Cerrado and Amazonian areas. In this work, whenever the term "Southern Nambikwara" is employed, it only denotes the branch within the Nambikwaran language family. Although there has been an increasing interest in Southern Nambikwara in the past years, there is still much to learn about it.

In contrast with the scenario in the literature on Northern Nambikwara, the number of peoples and languages pertaining to Southern Nambikwara is disputed. The scenario gets even more complicated, as Southern Nambikwara is spoken within small language communities and only used to perform specific tasks at specific times and places. The limited use of Southern Nambikwara is mainly due to the high levels of bilingualism (Brazilian Portuguese/Southern Nambikwara) caused by the frequent commuting to non-indigenous communities. Brazilian Portuguese is the language preferred in most situations, and the indigenous languages are restricted to rituals and festivals within the indigenous communities.

Currently, it is not possible to determine whether Southern Nambikwara is just one language (commonly referred to as Nambikwara) or a group of languages. It is most likely that Southern Nambikwara is a dialect continuum, whose level of intelligibility is determined by the geographical location of groups. In other words, groups who share the same area are more likely to understand each other. Interviews recorded in the field also suggest that an interlingua is used when members of different groups or inhabitants of different areas interact with one another.

The scenario observed in the research on Southern Nambikwara is probably motivated by two main variables: methodology and social factors within the groups.

In the 1970s, only one attempt was made to provide an overview of the Southern Nambikwaran speech communities, which was carried out by Price (1978). In Price's study, data from 15 different dialects were recorded to provide a clearer picture of the differences among them. However, the collected material did not lend itself to a detailed phonological analysis due to the inclusion of spurious forms that compromised the task and exaggerated the dialectal differences (Price 1978: 30).

Until now, no studies have been done to provide a detailed description of Southern Nambikwara speech communities. Consequently, it is still unknown how many speech communities and groups comprise Southern Nambikwara. The situation is aggravated by the frequent regrouping and isolation of the Nambikwaran peoples. In addition, no intelligibility tests have been carried out to verify whether Southern Nambikwara is a single language with many dialects or a group of closely related and highly intelligible languages.

In contrast to the published material on Northern Nambikwara, few studies have been carried out focusing only on the language, or language variety, spoken by just one specific Southern Nambikwaran group. Most recent descriptive studies on Southern Nambikwara are based on data collected from speakers belonging to different peoples who inhabit the two great areas, the Cerrado and the Valé do Guaporé. For instance, Kroeker (2001) disregards geographic proximity as a variable for dialectal differences and includes participants from very different groups and language communities in his descriptive grammar. More recently, studies such as Costa (2020) and Silva (2021) have been carried out with groups belonging to the same language cluster (such as Nambikwara do Campo, described in the following section), which are assumed to speak the same language. Despite this, all studies focusing on multiple groups do not provide information on how much data was used from each group, as well as which groups contributed the most. Consequently, it is very difficult to characterize specific language communities, their languages, or dialectal features, which also contributes to the question of whether Southern Nambikwara is a single language or not.

One of the few studies which exclusively focused on the description of the language spoken by one specific Southern Nambikwaran group is found in Belo (2021), who published a descriptive grammar of the language/lect spoken by the Hahãintesu.

Moreover, frequent internal sociopolitical conflicts among Southern Nambikwaran groups are also an important factor in the current confusion about their language/s. Groups are commonly split and regrouped. Sometimes, after internal conflicts and regroupings have occurred, displacement is followed by occasional isolation from other Southern Nambikwaran communities. Therefore, geographical proximity can be regarded as one of the most important keys in determining how intelligible certain Nambikwaran dialects are. It can be used as a tool to help draw the line between them.

In the field, whenever I asked native speakers how many languages and peoples live in Southern Nambikwaran lands, the answer was a unanimous "not sure." When it comes to the language they speak, Southern Nambikwaran peoples like the Kithãulhu, Sawentesu, Wakalitesu and Halotesu state that they speak the same language. Moreover, they consistently state that every people/group has a "different accent," and sometimes refer to the language variety that certain groups speak, such as the Halotesu, as a different language. Speakers of Southern Nambikwara who live in the Amazonian area are said to speak in a way that is hard to understand by the inhabitants of the savannahs. The level of intelligibility also decreases if they speak quickly and if inhabitants of the Cerrado witness conversations of individuals from the Amazonian area. However, when speakers from both regions interact, there seems to be an effort to make their languages more "neutral," and, consequently, more intelligible to both groups.

1.19.1 The First Piece of the Southern Nambikwara Puzzle

Based on Price's (1978) classification of the four major dialectal areas of Southern Nambikwara, Eberhard (2009:30) identified more groups to be added to Southern Nambikwara. Table *12* shows the Nambikwaran groups, which belong to the Manduca, Campo, Guaporé, and Sararé dialectal groups (sic.)[25]:

Table 12: The Southern Nambikwara branch (Eberhard 2009: 30).

Southern Nambikwara			
Manduca	**Campo**	**Guaporé**	**Sararé**
Hukuntesu Niyahlosu Siwaisu	Halotesu Kithãulhu Sawentesu Wakalitesu	Alantesu Hahãintesu Waikisu Wasusu	Katitãulhu

Eberhard's proposal displayed in Table *12* is very similar to the one posited by Price (1978), which can be seen in Table *5*. Apart from a slightly different arrangement of the dialectal groups (Manduca, Campo, Guaporé, and Sararé, instead of Campo, Manduca, Guaporé and Sararé)[26], it provides information on the people belonging to Sararé, namely the Katitãulhu.

[25]I will later refer to dialectal groups as language clusters.

[26]This arrangement probably considers the proximity of such dialects with Mamaindê, a Northern Nambikwara language described by the author.

1.20 Another Piece is Added

As mentioned, another relevant criterion to understand Southern Nambikwara is the fact that individuals who speak lects pertaining to this branch inhabit two great areas[27]. Therefore, native speakers suggest that Southern Nambikwara is divided into *Nambikwara do Cerrado* (lit. Nambikwara of the savannah) and *Nambikwara do Vale* (lit. Nambikwara of the valley). Both *Nambikwara do Cerrado* and *Nambikwara do Vale* are assumed to be "two different languages" by Nambikwaran individuals.

One clear distinction between members of the Cerrado and Vale lies in the pronunciation of the final aspect/gender indexation of the addressee suffix. Speakers of the communities in the Cerrado pronounce the final verb suffix as {-ɾa}, whereas the ones from the Guaporé Valley areas pronounce it as {-la}. Hence, the Cerrado groups can be referred to as "the -ɾa people," whereas those in the valley are "the -la people."

As the names suggest, *Nambikwara do Cerrado* is spoken in the Cerrado, and encompasses all groups who inhabit this area. In turn, *Nambikwara do Cerrado* is also subdivided into two great language clusters. They are the *Nambikwara do Campo*, comprised of the Halotesu, Kithãulhu, Wakalitesu, and Sawentesu peoples, and the *Nambikwara do Manduca*, which encompasses the groups Hukuntesu, Nẽsu, Niyahlosu, Siwaisu and Yalakaloru.

The second great linguistic area is the *Nambikwara do Vale*, which encompasses all groups who inhabit the Amazonian area by the Guaporé River. The *Nambikwara do Vale* is also subdivided into two great language clusters. The first cluster is the Guaporé, originally indicated by Price (1978: 30) and Eberhard (2009: 30). It encompasses the groups Alantesu, Hahãintesu, Waikisu, and Wasusu. The second cluster is Sararé, whose main group is the Nutajensu, according to the Kithãulhu. Table *13* illustrates how Southern Nambikwara is organized into two great areas:

Table 13: Southern Nambikwara great areas and its main language clusters.

Southern Nambikwara			
Nambikwara do Cerrado *(Savannah areas)*		**Nambikwara do Vale** *(Guaporé Valley areas)*	
Manduca	**Campo**	**Guaporé**	**Sararé**
Hukuntesu Nẽsu Niyahlosu Siwaisu	Halotesu Kithãulhu Wakalitesu Sawentesu	Alantesu Hahãintesu Waikisu Wasusu	Nutajensu

My fieldwork experience suggests that the Campo, Manduca, and Guaporé dialectal areas may also be subdivided into two smaller clusters, considering how close the communities are in relation to the road near their lands. The current configuration for Southern Nambikwara is shown in Table *14*. The further to the right the community is, the less accessible it is:

[27] For an updated map of the main great areas inhabited by Southern Nambikwara groups, see Silva (2021: 34).

Table 14: A new proposal for Southern Nambikwara.

Southern Nambikwara						
Nambikwara do Cerrado				**Nambikwara do Vale**		
Campo		**Manduca**		**Guaporé**		**Sararé**
Cluster A	*Cluster B*	*Cluster C*	*Cluster D*	*Manairisu*	*Wasusu*	Katitãulhu
Kithãulhu	Sawentesu	Hukuntesu	Siwaisu	Hahãintesu	Wasusu	Nutajensu
Halotesu	Wakalitesu	Niyahlosu	Nḛsu	A̰lãtesu		Kalũhwasu
				Waikisu		Kwalitsu
						Sayulikisu
						Waihlatisu

As shown in Table *14*, the groups under the Nambikwara do Cerrado great area are the most accessible. As a result of higher accessibility to these communities, most of what has been published on Southern Nambikwara is based on research carried out with individuals from these groups.

Table *14* also shows that the two dialectal areas in the *Nambikwara do Cerrado*, namely the Manduca and Campo, are subdivided into two clusters. Cluster A is the most accessible community because it is the closest in relation to the roads. Cluster B is relatively accessible, followed by Clusters C and D. The Manduca dialectal area is the most underdocumented to date. Hence, there is no publication on the lects spoken in the Manduca[28] dialectal area. Members of the Manduca are spread in different areas within the Cerrado, but they also find home among other Northern Nambikwaran peoples and the Sabanê. The subdivision of the Manduca into two clusters was merely based on information provided by the Kithãulhu, based on the cohabitation of the groups and the proximity of their villages in relation to the road. Hence, a more in-depth study should be carried out to validate the subdivision into Cluster C and Cluster D, as well as to confirm how many Nambikwaran groups each of them comprise.

Nambikwara do Campo can also be divided into two different clusters. Cluster A encompasses the lects Kithãulhu and Halotesu, spoken by the homonymous peoples. Both the Kithãulhu and Halotesu live within a gramineous-woody savannah and are the most numerous populations among the Cerrado groups. Moreover, both lects seem to have more prestige than the others belonging to Cluster B, namely the Sawentesu and the Wakalitesu, as discussed. According to information provided during the ethnographic interviews, apart from being less numerous, children of the Sawentesu and Wakalitesu do not learn their native indigenous languages at an early age anymore, since Portuguese is preferred.

Groups under the *Nambikwara do Vale* great area are less numerous than the ones belonging to *Nambikwara do Cerrado*. In the valley, the "-la people" are organized into two great dialectal areas, namely the Guaporé and Sararé. The Guaporé dialectal area may be arranged into two smaller clusters: the Manairisu, encompassing the Hahãintesu, Alãtesu, and Waikisu, and the Wasusu, which is comprised of a group with the same name and are regarded as the most withdrawn people in the area.

[28] The Manduca inhabit additional areas in the wooded and forest savannahs in the *Cerrado*. Members of the Manduca, such as the *Nḛsu* are usually regarded as dangerous, withdrawn, and complicated by members of the Campo dialectal area. Manduca individuals are also considered "poisoners," but it is not clear whether they are named so because they literally use poison against other groups or whether the word "poison" is used to refer to spells and "magical abilities." The Portuguese word for 'poison,' "*veneno*," is also used by the Nambikwaran peoples to refer to sorcery or any type of use of spiritual and magical forces. Hence, the word, "Nḛsu" can be translated as both 'poisoners' and 'sorcerers.'

As one can see in Table *14*, the groups under the umbrella of Sararé[29] are larger in number than the ones in the other clusters. This is due to little and misleading information on the number of groups. Therefore, I could not provide a clear picture of it. Names of the groups included in the Sararé section in Table *14* were collected using the official information provided by local authorities, such as the *Fundação Nacional dos Povos Indígenas* (FUNAI) and later verified with Kithãulhu individuals.
Despite all dialectal differences, Southern Nambikwara is usually referred to in the literature as simply Nambikwara. In this study, I employ the word Nambikwara to refer to the language or groups of languages belonging to the Southern Nambikwara branch. However, I would like to mention that the time spent on my fieldwork trips in 2017 and 2022 with four different Southern Nambikwara groups, namely the Kithãulhu, Halotesu, Wakalitesu, and Sawentesu led me to believe otherwise. Although the Southern Nambikwaran language spoken in the savannahs is assumed by native speakers to be the same language, every lect has its own specific features, ranging from small lexical variations to optional phonological rules, and consequently has its own linguistic identity. This observation was also pointed out by Price (1978: 30).
Thus, to start the description and documentation of the Southern Nambikwaran languages/lects spoken by different ethnic groups in the savannahs, and, subsequently, in the Amazonian area, this work will focus exclusively on the Nambikwara spoken by the Kithãulhu. The decision to exclusively use Kithãulhu data is intended to provide the clearest picture possible of the language used by this group as well as to document it. The results in this dissertation can also be used to illustrate any significant difference found in other proposals of the phonology for Nambikwara and other comparative and descriptive studies.

1.20.1 Works on Southern Nambikwara

Over a dozen Nambikwara word lists have been published since the beginning of the 20th century (Albuquerque 1910; Anonymous 1942; Boglár 1960; Campos 1936; Lévi-Strauss: 1948a; Oberg 1953; Rondon 1946; Rondon & Faria 1947; Roquette-Pinto 1913; Schmidt 1912; Souza 1920). Most of these lists are very inconsistent regarding the notation used in the transcriptions and fail to provide accurate information on the groups among which the words were collected. Works on syntax were done by Lowe (1999) and Menno Kroeker who published the first Nambikwara grammar (Kroeker 2001). Menno Kroeker, along with his wife Barbara Kroeker, also published several papers on Nambikwara.
More recently, there has been increased interest in Southern Nambikwara languages (Netto 2018; Sotero 2019; Santana & Oliveira 2019; Costa 2020; Silva 2021; Belo 2021), covering topics on the phonology and morphosyntax.

1.20.2 Phonology (or Phonologies) of Nambikwara

Nambikwara phonology is frequently debated. Although most proposals agree regarding the phonemic nature of vowels, with contrastive sets of oral, creaky voice, nasal, and nasal segments, much has been argued regarding the phonemic nature of consonants. Proposals range from a very simplified phonemic consonantal system (Price 1978; Lowe 1999; Netto 2018), to a moderate (Costa 2020) and even a very complex (Kroeker 2001) consonantal inventory.
One of the reasons that would justify the diversity of such proposals is methodologically based. Except for Price (1978) and Lowe (1999) all other phonology proposals are based on data

[29] The Sararé is one of the most inaccessible dialectal areas among the Nambikwaran peoples in the valley. This is due to intense conflict between indigenous individuals, farmers, illegal miners, wood smugglers, and the *grileiros* in the area.

collected from multiple Nambikwaran groups under the umbrella of Nambikwara (usually referred to as Southern Nambikwara).

Table *15* provides an overview of different proposals for Nambikwara. Note that for every proposal, the lects used for the analysis are provided. All lects are presented in alphabetic order, except if the author provides information on data sample rate. Segments in brackets only occur in words borrowed from Brazilian Portuguese:

Table 15: A comparative overview of different proposals for Nambikwara phonology.

Nambikwara Phonology							
			Price (1978)	Lowe (1999)[30]	Kroeker (2001)	Netto (2018)	Costa (2020)
Lects			Kithãulhu	Kithãulhu	Halotesu Katitãulhu (Sararé)* Kithãulhu Sawentesu Wakalitesu Wasusu*	Kithãulhu (80%) Wakalitesu (15%) Halotesu (4%) Sawentesu (1%)	Halotesu Kithãulhu Sawentesu Wakalitesu
Consonants	Plosives	Plain	/p, t, k, kʷ, ʔ/	/p, t, k, ʔ/	/p, t, k, kʷ, ʔ/	/p, t, k, ʔ/	/p, t, k, ʔ/
		Aspirated	-	/s, h/	/pʰ, tʰ, kʰ, kʰʷ/	-	-
		Glottalized	-	/ɗ/	/pˀ, tˀ, kˀ, kˀʷ/	-	/ˀp, ˀt, ˀk/
	Fricatives	Plain	/s, h/	/(f), s, h/	/ɸ, s, h/	/s, h/	/s, h/
		Glottalized	-	-	/sˀ, hˀ/	-	-
	Affricates	Plain	-	-	/ t͡ʃ/	-	-
	Liquids	Plain	/l/	/l/	/l/	/l/	/l, ɾ/
		Glottalized	-	-	/ˀl/	-	-
	Nasals	Plain	/n/	/(m), n/	/(m), n/	/n/	/n/
		Glottalized	-	-	/ˀn/	-	/ˀn/
	Glides	Plain	/w, j/	/w, j/	/w, j/	/w, j/	-
		Aspirated	-	-	/ʰw/	-	-
		Glottalized	-	-	/ˀw, ˀj/	-	-
Vowels	Oral		/i, e, a, o, u/	/i, e, a, o, u/	/i, e, ʌ, a, o, u/	/i, e, a, o, u/	/i, e, a, o, u/
	Nasal		/ĩ, ẽ, ã, ũ/	/ĩ, ẽ, ã, ũ/	/ĩ, ẽ, ã, ũ/	/ĩ, ã, ũ/	/ĩ, ẽ, ã, ũ/
	Creaky voice		/ḭ, ḛ, a̰, o̰, ṵ/	/ḭ, ḛ, a̰, o̰, ṵ/	/ḭ, ḛ, a̰, o̰, ṵ/	/ḭ, ḛ, a̰, o̰, ṵ/	/ḭ, ḛ, a̰, o̰, ṵ/
	Nasal creaky		/ḭ̃, ḛ̃, ã̰, ṵ̃/	/ḭ̃, ḛ̃, ã̰, ṵ̃/	/ḭ̃, ḛ̃, ã̰, ṵ̃/	/ḭ̃, ã̰, ṵ̃/	/ḭ̃, ḛ̃, ã̰, ṵ̃/
	Heterosyllabic		yes	yes	yes	yes	yes

[30] Lowe (1990: 571) also published a different phonological system for Southern Nambikwara, using data from individuals inhabiting three different villages: Serra Azul, Camararé, and Campos Novos. The author does not mention the groups among which the data used was collected. The phonology proposal is as follows. Voiceless plosives: /p, t, k, ʔ/, voiced alveolar implosive /ɗ/, voiceless alveopalatal affricate / t͡ʃ /, voiceless fricatives /s, h/, alveolar nasal /n/, alveolar liquids /l, ɾ/, and glides /w, j/, vowels /i, e, a, o, u/, "all of which except /o/ can be contrastively nasalized […] [and] all vowels can also be contrastively laryngealized" (Lowe 1990: 571). Once again, I used the IPA for the sake of systematization and comparative work.

Vowel sequences	Monosyllabic	Diphthongs	-	-	/ai, au, ãi, ãu, a̰i, a̰u, ã̰i, ã̰u/	/ai, ãi, a̰i, ãu, ã̰u, a̰u, ei, o̰u/ [VG]	Phonetic only [VG, GV]
		Triphthongs	-	-	-	-	Phonetic only [GVG]
Syllable Structure	Surface			(C(CCC)V(C)	-	(C)(C)V(C)(C)	(C)(C)V(C)(C)
	Underlying			(C(CCC)V(C)	(C)(C)(C)V(V)(C)(C)	(C)(C)V(V)(C)(C)	(C)V(C)(C)
Tone	Surface		L, LH, HL	L, LH, HL	L, LH, HL	L, LH, HL	L, LH, HL
	Underlying		L, LH, HL	L, LH, HL	L, LH, HL	L, H	L, H

(*) indicates lects spoken in the Guaporé Valley.

As one may notice in Table *15*, the more lects are included in the analyses, the more complex the phonemic inventory is. This may suggest that some of the lects have more complex consonantal inventories, and that some of the consonants may be neutralized within the Nambikwaran variety spoken by some groups

1.21 The Kithãulhu

The Kithãulhu is a Southern Nambikwara people. They are of the groups who inhabit the Cerrado area in their native land called "Terra Indígena Nambikwara." With approximately 220 individuals, according to Kithãulhu speakers themselves, the Kithãulhu is one of the largest groups of individuals belonging to the Southern Nambikwaran peoples.

The language spoken by the Kithãulhu is commonly regarded as Nambikwara in the literature. However, the Kithãulhu alternatively say that they speak Nambikwara or "the Kithãulhu language." It is not clear what they imply by using the term "language" in this context. Presumably, the expression "the Kithãulhu language" is colloquially used to contrast with "the Halotesu language," spoken by a cohabitee group, the Halotesu.

The association of the word "language" with each of the two groups in this context could possibly arise from the fact that members of both groups recognize linguistic differences between them. One of the most noticeable linguistic differences between the Kithãulhu and the Halotesu is in the lexicon. Some lexical items are just used by the Kithãulhu and avoided – though understood – by the Halotesu, and vice versa. Such differences in the lexicon are spontaneously exposed and explained by speakers of both groups in the fieldwork or in any attempt to communicate with them using Nambikwara. Most studies carried out about Nambikwara (Price 1978; Kroeker 2001; Silva 2021, etc.) included the participation of the Kithãulhu.

1.21.1 A Short History of the Kithãulhu, as Told by Themselves

According to Carlos Kithãulhu, who I interviewed during the 2017 fieldwork sessions, it is very common to name peoples, whether they are indigenous or not, according to their physical features, customs, or other attributes. The Kithãulhu, for instance, were not always called that. As Carlos reported, they were originally known as the "Waisu," meaning 'the screaming people.' Just like other Nambikwaran groups, groups change their names or even have their names changed for a myriad of reasons, especially due to internal conflicts and regrouping.

The name Kithãulhu, however, comes from a humorous event. It derives from the Nambikwaran words "*ki-*" and "*tʰãulsu*," which means 'penis'[31] and 'quince,' respectively, which translates as 'those with quince-shaped penises.' In accordance with the story told by Carlos, people started being called the Kithãulhu, when two brothers-in-law were joking around with each other. During this event, the foreskin of one of them was retracted, revealing his glans, which turned out to "look like a quince." Thereafter, the Waisu started to be called and to identify themselves as the Kithãulhu, commonly referred to as "the quince people."

[31] The actual word for 'penis' is *a-sahˀ-su,* which also means 'vine.' 'Ki' in this case is a reference to the classifier {-ki}, which denotes something round or in the shape of a seed, in this case, the glans.

1.22 This Study

For this study, participants were audio-recorded according to availability and the wish to engage in the data collection. Participation eligibility for this study followed the following criteria: 1) speakers should recognize themselves as Kithãulhu and/or belonging to this group; 2) they may be bilingual in Nambikwara – Portuguese; 3) they should be at least 18 years old, the age of majority in Brazil[32]. Most speakers were indicated by the Kithãulhu themselves, being recognized as good speakers as well as having the ability and availability to participate in the recording sessions. Before attending the sessions, speakers were classified according to age group, and demographic information such as place of residence (villages) and occupation. In the 2017 fieldwork sessions, only male speakers participated in the data collection due to cultural constraints. During the 2022 sessions, however, one female speaker was interviewed.

1.22.1 Age Group Classification

Age groups were classified into two different sets: 1) elder and 2) young, which were arranged according to the following assumptions:

1) An elder speaker is one whose year of birth is closer to or coincides with the initial years of the Summer Institute of Linguistics (SIL) missionary work in the Nambikwaran lands. Some elder speakers may have previously engaged with other language description research in the area. This term refers to people who are at least 40 years old.

2) A younger speaker is one who is at least 18 years old of age but no older than 39 years of age.

Table *16* displays relevant demographic data on the participants of this study. Note that the age displayed reflects how old participants were during the data collection years (2017 and 2022).

Table 16: Demographic data of the participants.

Code	Age	Age Group	Village	Occupation	Sex	Year
CK	56	Elder	Barracão Queimado	L1 Teacher	M	2017
DK	69	Elder	13 de Maio	L1 Teacher, Health Agent	M	2022
NK	19	Young	Barracão Queimado	Student	M	2017
AK	18	Young	Barracão Queimado	Student	M	2017
IK	29	Young	Barracão Queimado	Health Agent	M	2022
EK	29	Young	Nova Estrela	Health Agent	M	2022
RK	54	Elder	-	*Pajé*	M	2017
LK	27	Young	Barracão Queimado	Nurse Student	F	2022

As one may notice from *Table 16*, all speakers had social prestige within their communities, as they were teachers, health agents, students, or a *pajé*. All participants were fluent in both Nambikwara and Brazilian Portuguese, with levels of proficiency in Portuguese being regarded as bilingual.

[32]Research within Brazilian indigenous communities is regulated by Brazilian law. Researchers are only allowed into the communities with approval from both the community and their leaders and local authorities. Indigenous individuals must be legally adults (18 years old) to participate in the studies. Research with indigenous children and teenagers is only allowed under special circumstances and requires a much more detailed screening process.

1.22.2 Brazilian Portuguese

Nambikwaran peoples have been in more intense contact with Brazilian Portuguese for over a hundred years. Most Nambikwara speakers are bilinguals, speaking both Nambikwara and Brazilian Portuguese. From experience in the field, it is clear that the proficiency level in both languages varies considerably across generations and according to other variables such as sex, occupation, and social prestige in the communities – although a more detailed sociolinguistic study should be carried out to validate such a claim.

Male speakers go more often to the urban areas and, consequently, they are most likely to speak Brazilian Portuguese more fluently. The Brazilian Portuguese dialect spoken by the Nambikwara is like the one used in the urban areas surrounding the Nambikwaran territories, and it seems to mix features of both *Sertanejo* and *Serra Amazônica* dialects.

Local proximity to urban areas also favors increased contact with Brazilian Portuguese. In the case of the Kithãulhu and other Cerrado groups like the Halotesu, villages are located approximately 45 km away from urban areas and are relatively easily accessed via motorbikes, a popular means of transportation among the indigenous population who inhabit the area. Most public services, such as primary health services in the *Unidades Básicas de Saúde* (lit. basic health units) are only available in the urban areas, which obliges commuting and, consequently, more intense contact with Brazilian Portuguese.

As with other minority languages around the globe sharing the same geographical area with a dominant and hegemonized language, constant contact with Brazilian Portuguese also affects the dynamics of language. The ongoing use of Brazilian Portuguese restricts the use of Nambikwara to their villages and sometimes only on very specific occasions, such as their traditional celebrations. All these factors posit challenges with regard to language maintenance and preservation, as well as in relation to speakers' attitudes towards their mother tongue. During the elicitation sessions, young speakers were mostly reluctant to tell stories in their native language, giving the reason that "it is difficult." Furthermore, some Nambikwaran words fall out of favor, become outdated and are then replaced by a borrowed Brazilian Portuguese word[33]. Brazilian Portuguese usually affects the productive language skills of young Nambikwara in their native indigenous language, but it does not seem to affect the receptive ones. Although young speakers usually forget common words during lexical translation tasks or just say that there is no word to denote a specific Brazilian Portuguese word, they can easily recognize "new or forgotten words" if an elder speaker uses them. Young speakers also tend to avoid more marked features of Nambikwara phonology, e.g. non-pulmonic consonants, creaky voice vowels, and sounds that are not attested in the local Brazilian Portuguese dialects, such as the pre-aspirated voiceless liquid [ʰl̥].

Participants of this study claimed that children who inhabit the Terra Indígena Nambikwara learn Nambikwara as their first language (L1), but also learn to speak Portuguese as a second language (L2) at an early age. They also claim that the children of some Southern Nambikwaran groups such as the Sawentesu and Wakalitesu cannot speak Nambikwara, as they are more exposed to Brazilian Portuguese, thus learning it instead of Nambikwara. However, even the Nambikwara, who are fluent in Brazilian Portuguese and constantly exposed to it, or the ones who have learned it at an early age, may have difficulties in understanding Brazilian Portuguese words pronounced with a different accent[34].

[33] E.g., the Nambikwaran word for rice (PT: "arroz") is "sisakisu" but has been replaced by "<arroz>kisu." More on borrowings is addressed in chapter 4.

[34] In my first fieldwork trip, speakers usually found it hard to understand some of the words I pronounced because of my accent (Recife dialect from Northeastern Brazil). Coda /R/ was a significant difficult feature for them, as it is pronounced in Recife as [h] ~ [ɦ] > [x] > [ʁ] or ∅, depending on the position within a word, in contrast with retroflex consonants [ɻ] and [ɹ] in the local dialect.

1.23 Fieldwork

Fieldwork consisted of recorded elicitation sessions on lexicons, short phrases, and sentences in the earlier stages. In later stages, the recorded sessions ranged from the collection of short stories, songs, language tasks, and spontaneous speech. All tasks were based on the literature of language description and documentation (Gippert, Himmelmann & Mosel 2006; Sakel & Everett 2012, among others).

1.23.1 First Fieldwork Sessions: March – April 2017

The 2017 fieldwork sessions were primarily focused on eliciting and audio recording lexicon, short phrases, and sentences. Initial sessions took place at *Aldeia 13 de Maio*, a Nambikwaran village in the savannahs. After a tragic event involving an individual while hunting, the following sessions took place in a nearby town.

Figure 2: A panoramic view of the *Aldeia 13 de Maio* at *Terra Indígena Nambikwara*, during the fieldwork sessions in 2017.

In addition to the lexical items, carrier sentences and short stories were also recorded. In this stage, classical word lists were used, such as the Lexicon Questionnaire by Comrie & Smith (1977) and the Swadesh List, a version adapted by Dyen (1992), *Questionário do Museu Nacional* designed by the Summer Institute of Linguistics team, as well as *Questionário do Museu Goeldi*, for comparative research with indigenous languages of Brazil. Phonetic transcriptions were carried out during the elicitation sessions on lexicon, short phrases, and sentences, by means of the International Phonetic Alphabet (IPA) notation and following the guidelines in Ladefoged & Maddieson (1996), Hume & Johnson (2001), among others. In another stage, the audio files were submitted to PRAAT for a more accurate transcription, as well as to ELAN for linguistic annotation.

1.23.2 Second Fieldwork Sessions: September 2022

Second fieldwork sessions took place entirely in a nearby town to avoid the transmission of COVID-19 within vulnerable indigenous communities. All participants involved in the sessions had professional experience in the field of public health. We followed all guidelines provided by the World Health Organization as well as local authorities. Sessions consisted of recording short stories, spontaneous speech, as well as map tasks. Special attention was given to tone and tonal rules.

The phonological analyses are based on works on phonology (Clements & Hume 1995; Spencer 1986; Kenstowicz 1994; Goldsmith 1990; Gussenhoven 2004, among others), as well available literature on Nambikwara (Lowe 1999; Kroeker 2001; Silva 2021, among others) and other Nambikwaran languages (Telles 2002, 2006, 2013, 2019; Eberhard 2009, etc.). Publications on tones with special regard to South American languages were also used.

1.24 A Brief Discussion on the Linguistic Forms Presented in this Study

Most Nambikwaran morphemes have multiple surface forms. The phonetic realizations of morphemes are highly dependent on factors such as phonotactic constraints and resyllabification. Both factors are also mainly motivated by the syllable and segmental structure of surrounding morphemes. Thus, the same morpheme may display multiple forms depending on the morphophonological environment, with which it is associated.

It is on the syllable edges, i.e., the onset and the coda, where differences in the phonetic structure of morphemes are frequently observed. As later discussed in chapter 4, the coda is unequivocally the syllable component more prone to undergo morphophonological rules. These rules are mainly conditioned by the segmental/syllable structure of the following morpheme.

Overall, phonotactic constraints related to the syllable structure of morphemes are observed in particular in the interpolation of two consecutive consonantal segments found at the syllable edges (the coda and the onset) of a morpheme string. For instance, a considerable portion of consonant final morphemes are phonetically realized without a coda, regardless of the segmental structure of the following morpheme. This happens mainly because there is a tendency for codas to become resyllabified. In some cases, the coda of such morphemes can only be attested if the following morpheme is vowel initial. This observation is particularly relevant if the coda of the consonant final morpheme is a liquid. To illustrate the described scenario, let us see the phonetic realization of the root {uil}, 'to be good, to be pretty,' a consonant final morpheme[35]:

1) [ˈwiːˌnaːɾa]
   uil -∅ -na -ɾa
   to be good-3S-PRES-PFV.M
   'he's good'

2) [ˈwiːˌɾiːɾa]
   uil -i -ɾa
   to be good-2S.PRES-PFV.M

3) [ˈwiːˌɾaːwa]
   uil -a -ua
   to be good-1S.PRES-NPFV.M

4) [ˈwiːɾʰã]
   uil -sã
   to be good-SS

Like most consonant final morphemes, the coda /l/ is not phonetically realized in this position, as shown in 1). In fact, 1) shows no evidence of a coda. To determine whether there is a coda in the root, we can turn to vowel initial morphemes. In examples 2) and 3), suffixes {-a} and {-i}[36], which mark the first- and second-person singular, respectively, are attached to {uil-}. Note that, even when {uil} is followed by a vowel initial morpheme, as in 2) and 3), the coda is still not phonetically realized in this position. However, the suffixes {-a} and {-i} are phonetically realized with an initial flap [ɾ], as [aː] and [ɾiː], respectively. It is in this

[35] For illustration purposes, the full gloss was not included, so that one would not be distracted from the main point of this discussion.

[36] Suffixes {-a} and {-i} also have allomorphs, which will be addressed later in this study.

environment that we can suspect that the flap is derived from the syllabification of an underlying coda /l/[37]. Example 4) gives another trace for an underlying coda /l/: the coalescence of the following consonant initial suffix {-sã}, which is post-aspirated.
From examples 1) – 4), we can test other morphemes with a final liquid in the coda to determine if the rules are observed in similar environments. Since the same rules are frequently observed in the data, we can determine that liquids in consonant final morphemes are:

1) never phonetically realized before an /n/-initial syllable,
2) resyllabified as the onset of the following vowel-initial morpheme,
3) resyllabified if the following morpheme is an /s/ initial, triggering coalescence and aspiration observed in the onset following morpheme.

Tests like the ones described above were extensively carried out in the field. Since there is a frequent interplay between the morphological and phonetic/phonological structures in Nambikwara, I included a chapter with the most frequently attested morphophonological rules in the language. The rules described in Chapter 5 not only illustrate how the lexical representation was determined but can also allow readers to see how the phonology and morphology levels are interconnected.

1.25 Chapters Overview

This study is sectioned into six chapters. Chapter 1 addresses the Nambikwaran language family, proposes a new subdivision for Southern Nambikwara, and describes the Kithãulhu, Southern Nambikwara Group, among which the data for this study was collected.
Chapter 2 provides the reader with an overview of the grammar of the morphological structure of Nambikwara, based on the works of Kroeker (2001) and Silva (2021). In this chapter, readers will find relevant information on the morphemes used in the glosses throughout the dissertation.
Chapter 3 provides a description of the segmental phonology of the Nambikwaran language spoken by the Kithãulhu. It initially presents the description of the vowels, followed by the description of the consonantal phonemes.
Chapter 4 touches upon the syllable and syllabification principles in Kithãulhu. I describe the asymmetry between phonetic and underlying syllables and relate the attested syllable types in the phonetic representation to their lexical forms. Furthermore, chapter 4 also provides the description of the stress system, showing how stress is assigned in lexical and grammatical morphemes.
Following the discussion on chapter 4, chapter 5 shows the main morphophonological rules attested in Kithãulhu, relating to stress.
Finally, chapter 6 describes the tone system and shows that tone is independent from stress, although both subsystems sometimes overlap.

[37] Liquids have two main allophones: lateral [l] and flap [ɾ]. Lateral [l] follows low and back vowels, while the flap always follows front vowels. This is the case of the root {uil}, which will have a flap resyllabified instead of a lateral since its nucleus is the high vowel /i/. More details are given in chapters 3, 4, and 5.

Chapter 2: Grammar Overview

Introduction

This chapter aims to provide the reader with an overview of the main morphosyntactic components of Kithãulhu (Nambikwara do Campo dialectal area, Southern Nambikwara, Nambikwara) which are used throughout this dissertation. We have seen so far that the language commonly regarded as Nambikwara belongs to the Southern Nambikwara branch within the Nambikwara language family. As previously mentioned, Nambikwara is comprised of a series of multiple intelligible lects, which are assumed to make up a dialect continuum arranged in four great dialectal areas (Campo, Manduca, Guaporé, and Sararé), belonging to two great language areas, the Cerrado and the Vale do Guaporé. I also showed that previous research as well as experience from my own fieldwork mostly based on testimonials from Nambikwara speakers demonstrate that the level of intelligibility among speakers of Nambikwaran lects varies according to the geographical proximity between them. No intelligibility research has been carried out among Nambikwaran groups to date. In addition, I pointed out that there is minimal lexical variation across lects, which are used by native speakers from a specific lect to distinguish themselves from others, not only the ones belonging to the same language clusters and who inhabit the same region, but also across them. Moreover, there seems to be a set of strategies that are used to enhance intelligibility across lects and reduce communication issues by means of employing a "neutral" language. Although Nambikwaran speakers unanimously state that they speak the same language, it is relatively easy to notice linguistic differences among speakers of different lects. Variation in lexical units and, to a lesser degree, variation in pronunciation, is usually spontaneously explained by speakers themselves to state to which group they belong, as well as to evince the existence of other groups that do not use such words. Such linguistic variation may be compared to regional "accents" in one major language and include a higher degree of likelihood in the frequency of phonological rules, especially the neutralization of some groups of more marked consonants. Some lects display more prestige than others.

Lects may also be regarded as more prestigious than others because of their political and demographic dominance. Linguistic prestige among lects is usually determined by a higher number of speakers, a matter that raises the importance of political and demographic dominance across lects, as well as within and across language clusters. For instance, the lects spoken by the Kithãulhu and the Halotesu, two of the most populous Nambikwaran groups, are commonly considered "two distinct languages" by Nambikwaran speakers. This classification is based on the recognition of minimal lexical differences among these lects, typical features in "the way they speak," and to reinforce their political and social status among other Nambikwaran peoples. Less prestigious lects, i.e., the ones with a smaller population, are hardly regarded as a "language" by other speakers and sometimes the "way they speak" is considered "incorrect" and prone to mockery[38].

It is not clear, however, if there is also much variation across lects with regard to morphosyntax. In the literature on Nambikwara, there is a common assumption that lects may follow a common morphosyntactic structure within the same language cluster and across them. Nambikwara (Southern Nambikwara, Nambikwara) morphosyntax was originally described by Kroeker (2001), who used data from individuals from six different lects – namely Kithãulhu, Halotesu, Sawentesu, Wakalitesu, Wasusu, and Katithãulhu (Kroeker 2001: 2) – to write a

[38] In the 2017 fieldwork sessions, I collected data from all four lects belonging to the cluster Nambikwara do Campo. When interviewing speakers belonging to the Wakalitesu and Sawentesu groups, some Halotesu and Kithãulhu speakers were nearby to check what the speakers of the other lects were saying. When individuals of the Wakalitesu e Sawentesu "mispronounced" words, they were mocked, parroted, and corrected on the spot.

grammar of the language. More recently, Silva (2021) published a new descriptive grammar of Nambikwara, which included lects strictly pertaining to the Nambikwara do Campo cluster, namely Kithãulhu, Halotesu, Wakalitesu, and Nambikwara[39] (Silva 2021: 34). Moreover, Belo (2021) accounts for describing morphosyntactic aspects of Hahãintesu, a still underdocumented Southern Nambikwara lect spoken in the Vale do Guaporé area.
Since this dissertation addresses a phonological description of the Nambikwaran lect spoken by the Kithãulhu, which belongs to the Nambikwara do Campo dialectal area, most of the descriptive information in this section will be based on Silva (2021). In this study, it is not my intention to posit a new descriptive grammatical sketch of my own. However, I will point out the topics on which previous descriptive grammars point to different paths, and whenever that happens, I will indicate which point of view I will pursue. Moreover, if the data should lead me towards a different approach on a specific topic, I will mention it and mark the newly added information in *italics*. All data used in this section was collected by me, except when mentioned otherwise. For the sake of systematization, all morphemes are presented using the International Phonetic Alphabet (IPA)[40] in their phonemic forms. Tone will not be indicated, but the tonal patterns of morphemes will be addressed in the tone description section of this dissertation.

2.1 Typological Characteristics

Nambikwara has been regarded as a polysynthetic language (Telles 2013; Netto 2018; Belo, 2021; Silva 2021), whose canonic word order is SOV. Based on the criteria outlined by Fortescue (2007) to define whether a language is polysynthetic, Silva (2021: 39) points out that Southern Nambikwara fulfills most of them and lists the following features that would justify classifying Southern Nambikwara as polysynthetic:

> Many morphological slots,
> Pronominal markers in verbs (subject/object) and nouns (possessor),
> Noun/adjective incorporation,
> Large number of bound morphemes, but a few roots,
> Verbs as a minimal clause,
> Adverbs are integrated into verbs (bound morphemes),
> Inflection head-marking (or double-marking) type,
> Productive morphophonemic rules and complex bound and free forms allomorphy,
> Non-configurational syntax. (Silva 2021: 38, our translation)

Silva (2021) also describes Nambikwara as presenting a split intransitivity system, a morphosyntactic feature, which has never been mentioned in the literature on Nambikwara.

2.2 Grammar Overview

2.2.1 Parts of Speech

Words can be classified into open and closed classes.

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[39] Sawentesu lect also belongs to the Nambikwara do Campo cluster, but it was not mentioned in the grammar.
[40] Kroeker (2001) uses orthographic representation in his work. Therefore, it was necessary to make use of his description of the orthographic system to come up with IPA transcriptions of the data presented in his grammar. In the orthographic system, spelling is usually very similar to Brazilian Portuguese spelling, except for: <x>, which stands for a glottal stop [ʔ] and <j>, which denotes a voiceless alveolar-palatal affricate [tʃ]. Consonant <h> is a voiceless fricative [h] whenever it is at a syllable onset, but it indicates aspiration following a voiceless stop, such as in <th> ~ [t^h], and devoicing if it follows a liquid, as in <lh>, or a nasal consonant <nh>, which are transcribed as [l̥] and [n̥], respectively.

2.2.1.1 Open Class

The open class comprises nouns (including pronouns) and verbs, whereas adverbs and particles make up the closed class[41].

2.2.1.1.1 Nouns

Nouns constitute the most productive open class. The minimal structure of a noun is a root (stem) followed by at least one suffix, usually {-su} or {-a}. Both {-su} and {-a} are regarded as articles (Kroeker 2001) or referential suffixes (Netto 2018; Silva 2021, etc.). Considering that the minimal structure of a root is monosyllabic and that final suffixes are also monosyllables, the minimal syllabic structure of a noun is comprised of two syllables. Table *17* illustrates the minimal morphological structure of nouns:

Table 17: Scheme of a minimal nominal structure.

<table>
<tr><td colspan="3">Nominal Word</td></tr>
<tr><td colspan="2">stem</td><td>Final Nominal Suffix</td></tr>
<tr><td rowspan="2">root</td><td rowspan="2">classifier/class term (optional)</td><td>Referential Suffix</td></tr>
<tr><td>{-a}, {-su}</td></tr>
</table>

In common nouns, the root usually corresponds to a stem, unless it is followed by a classifier – as in the case of compounds. In this case, the stem is comprised of a root and a classifier. Moreover, stems of compound nouns can also be made from multiple roots (noun + noun, noun + verb, etc.) and classifiers.

In syntactic constructions, subjects and objects are not morphologically distinguished through case markings, but rather in terms of word order. However, nouns can be morphologically marked for vocative and locative cases. Furthermore, "in nonverbal clauses, minor differences occur because the equative and descriptive endings are attached to the nouns" (Kroeker 2001: 43).

Silva (2021) and Kroeker (2001) present two different analyses for the nominal word. Silva's proposal shows 12 different slots available for the suffixes. In contrast, Kroeker's (2001: 42) proposal is less complex than Silva's and can be summarized in a scheme with nine available slots for the entire nominal word, i.e., including the root and the possessive prefix [42].

I use Silva's (2021) proposal to describe the nominal morphological structure of Kithãulhu[43]. The scheme for the Kithãulhu nominal word is presented in Table 18. It shows all available slots for the nominal structure and is translated and adapted from Silva (2021: 45). Whenever the same slot is filled by two or more types of morphemes, such as the one in row [+2], it means that only one of these morphemes is allowed to occur in that position, as they are exclusionary. For instance, in row [+2], we see that two types of morphemes are allowed in this slot, namely

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[41] Kroeker (2001: 77 – 78) also distinguishes ideophones as an independent word class but does not classify them as an open or a closed class. Other word classes are also not classified into open and closed.

[42] They are: [+/- POS] [+ N] [+/- CL] [+/- GR] [+/- CE] [+/- TF] [+/- DEM] [+/- N.CLT] [+/- ART]. Legend: POS = possessive, N = root, CL = classifier, GR = group, CE = certainty emphasizer, TF = time frame, DEM = demonstratives, N.CLT = negative clitic, ART = article (Kroeker 2001: 85 – 86). Square brackets were included in this footnote by me, for easier reading. Negative clitics could not be confirmed in the data used in this dissertation.

[43] In Silva's (2021: 45) nominal scheme for Nambikwara do Campo, the 12th slot is called "sufixos dedutivos (modais)," which can be translated as 'deductive suffixes (modals).' In this dissertation, this slot is called "modalizer" and is found in the last position [+11] in the nominal scheme.

the authenticity and emphatic suffixes. This means that both morphemes never occur simultaneously:

Table 18: Nominal morphological structure.

Slot	Gloss	Meaning
-1	POS	possessive prefix
0	**ROOT**	root
+1	CL	nominal classifier
+2	AUTH	authenticity
	EMP	emphatic
+3	GRP	group suffix
+4	TMP.FUT	nominal temporal future
+5	LOC	locative
+6	PL	plural
+7	REF	referential
	VOC	vocative
+8	TMP.PST	nominal temporal past
+9	DEM	demonstrative
+10	INCL	inclusive
	EXC	exclusive
+11	FOC	focus
+12	MDL	modalizers[44]

Despite nominal morphology being comprised of several available slots for the suffixes, no noun filled with all 12 suffixal slots is attested in the data. Some suffixes, such as the nominal temporal future and the nominal temporal past probably do not occur in the same nominal word. Both Silva (2021) and Kroeker (2001) do not elaborate on how many simultaneous slots are permitted to be filled within the same nominal word, nor do they present examples for nominal words presenting all slots filled. A linking vowel /-a/ or a nominalizer suffix {-a}, glossed as LV and NZ, respectively, may be attached between a root and a classifier.

2.2.1.1.2 Prefixes

2.2.1.1.2.1 Possessive

Nouns may be arranged in terms of the obligatoriness of possessive prefixes. Body parts (of humans and non-humans) as well as the null root {ienki} display obligatory possessive, being regarded as inalienable. Other nouns, such as kinship terms, are optionally marked for possession.

Possession is head-marked by attaching first- or second-person possessive prefixes. Third-person possession can be zero-marked through juxtaposition (possessor + possessed noun), in the case of alienable nouns, or head-marked by affixation of the third-person possessive prefix (Silva 2022: 45), in the case of inalienable nouns and some alienable nouns. There is no specific inalienable possessive prefix. Free pronouns are employed to indicate the third-person singular or plural possession of alienable nouns.

[44] Modalizer suffixes in nominal morphology will not be addressed in this dissertation.

The system of inalienability is classified as bound inalienables, and inalienability can be indicated by the possessive prefixes available in the system. Table *19* illustrates the possessive pronouns:

Table 19: Possessive pronouns.

Slot	Gloss	Pronoun
-1	1.SG	ˀta
	2.SG	u̯a̰
	3.SG, 3.PL	a

Possession of first- and second-person plural are indicated by the juxtaposition of morphemes {-nũ-kaˀt(i)-} to the first- and second-person singular prefixes, as shown in Table *20*:

Table 20: Inclusive and exclusive possessive pronouns according to Silva (2022).

Person	Pronoun	Gloss	Translation
1PL incl	ˀta-u̯a̰-nũ-kaˀt(i)	1SG-2SG-CT.people-GRP	you, my group, and I
1SG excl	ˀta-nũ-kaˀt(i)	1SG- CT.people-GRP	my group and I
2PL	u̯a̰-nũ-kaˀt(i)	2SG- CT.people-GRP	you and your group

Morphemes shown in Table *20* also require a final referential suffix {-a}, or less frequently, a referential suffix {-su}.

2.2.1.1.2.2 Roots

Noun roots are usually monosyllabic or disyllabic. Trisyllabic roots are very rare and tend to be the outcome of morphophonological rules such as reduplication and epenthesis. Trisyllabic roots can also be analyzed as the outcome of the lexicalization of suffixes attached to roots, as some trisyllabic roots display similar final structures, such as the syllables {-aˀli}, whose meaning cannot be inferred by native speakers or understood in our analyses. Tetrasyllabic roots are also possible if a disyllabic root is completely reduplicated.
Roots can also be used to indicate augmentative and diminutive forms of nouns, such as {ta̰-} (Silva 2021: 66), which usually means something big or monstrous, and {ũẽs-}[45] 'child,' respectively[46]. Verbal roots, such as {kãĩn-} 'to be big' are also employed in attributive nominal constructions.

2.2.1.1.2.3 Suffixes in Nominal Morphology

2.2.1.1.2.3.1 Classifiers

Classifiers are lexicogrammatical items, that usually participate in derivational word formation. They can be realized as a root or as a suffix belonging to the noun phrase. Overall, classifiers usually appear in the first slot after the root and are mostly employed to describe a more salient

[45] Silva (2021) transcribes this morpheme as {ũẽns-}, with a complex coda. My analysis points out a simplex coda /s/, which may be phonetically realized as [n] following nasal vowels, as described in Chapters 3 and 5. For topics related to the syllable structure, refer to Chapter 4.
[46] Both morphemes are analyzed as '*termos de classe*' (lit. class terms) for Hahãintesu, a Southern Nambikwaran lect (Belo 2021: 109).

visual configuration/appearance of a nominal entity. They usually describe a noun in terms of shape and consistency, but also the origin or even gender (masculine or feminine) of animated beings, such as humans and non-human animals.

Classifiers can be employed in anaphoric constructions and may also function in the nominalization of verbal roots. Published research on Nambikwara diverges in relation to how many classification morphemes are available in the morphological system. Depending on the analysis, the number of classifiers varies considerably. Kroeker (2001: 44) suggests that there are 18 classifiers. On the other hand, Lowe (1999: 280) posits a classifier system comprised of 17 morphemes, whereas Silva (2021: 51) suggests only 16 morphemes, since he distinguishes classifiers from *termos de classe* (lit. class terms)[47], a classification that was not employed by other authors who worked with Nambikwara. In this work, I have decided to use my own list of classification morphemes to include suffixes such as {-tʰoʔ} and {-ṵḭ}, both of which were described by Kroeker (2001) in his Nambikwara grammar, and which were observed in the data collected in my original fieldwork. Table 21 illustrates the suffixes belonging to the classification systems. The current proposal shows 20 suffixes,[48] and it is partially derived from both Kroeker's and Silva's proposals, being more closely related to the former than the latter. I used my own transcriptions for the morphological representation:

Table 21: Noun classifiers.

Type	Subtype	Classifier	Meaning
Configuration	Consistency	{-ḭa̰ṵ}	liquid, *fluid*
		{-nṵ̃}	dough, powder, *granules*
	Shape	{-ẽn}	hole, hollow cavity
		{-ẽh}	string, vine
		{-ien}	circular
		{-kaˀt}	long, solid, cylindrical, *disease*
		{-kalo}	cloth, flatten, hull, surface
		{-ki}	small and round, small fruit, *seed*
		{-nãũʔ}	egg-shaped, *larval*
		{-na̰ˀk(i)}[49]	spherical, usually used in fruits and vegetables, but also used in the loan word '<bola>-na̰ˀk(i)[50]-su', 'ball'.
		{-ˀnãn}	leaf, paper
		{-tĩhno} ~ {ĩhnũ}[51]	trail, string
		{-tʰĩn}	village, houses
		{-ṵḭ}[52]	*tooth*, twig, wood-like, *sharp*

[47] Distinctions between 'class terms' and classifiers are found in Silva (2021) and Belo (2021), for Nambikwara do Campo and Hahãintesu (Manairisu, Southern Nambikwara, Nambikwara), respectively.

[48] This list does not include classifier {-nĩ}, meaning 'interior, round', included in Silva's (2021: 51) analysis.

[49] Kroeker (2001: 44) states that morpheme {-nxa̰x^3} is a classifier, whose meaning relates to a closed receptacle, fruit, sphere. The parenthesis used in my transcription means that the phonemic status of the vowel is uncertain.

[50] Silva (2022: 60 – 62) transcribes {-na̰ˀk(i)} as {-naki}, with no creaky voice vowel /a̰/. In my data, all samples display a creaky voice vowel, which is usually followed by an ejective velar consonant [ˀk]. It is not clear, however, if the glottal phase of [ˀk] is part of the laryngealization of the creaky voice nucleus /a̰/, i.e., derived, or if it is independent of it.

[51] Both Kroeker (2001) and Silva transcribe this morpheme as {-tĩhno}.

[52] Kroeker (2001: 44) analyses this morpheme as a classifier.

Specification	Generic	{-te}[53]	person or thing not specified (generic), origin
	People	{-nũ}	people, usually used in kin terms.
	Land	{-ko̰}[54]	land, region
	Area	{-tʰoʔ}[55]	ash-like, *big fire*
Gender	Masculine	{-ahlo}	male
	Feminine	{-a̰kaˀlo}[56]	female

2.2.1.1.2.4 Other Suffixes

Table *22* illustrates the main nominal suffixes that are used in this dissertation.

Table 22: Suffixes in nominal morphology.

Slot	Gloss	Meaning	Form	Function
+2	AUTH	authenticity	{-kaˀt(i)}	Employed with a derivational role to express authenticity
	EMP	emphatic	{-kʰaiʔ}	Intensifier (size).
+3	GRP	group suffix	{-nãũʔ} ~ {-nãʔ}	Indicate plurality
+4	TMP.FUT	nominal temporal future	{-nũ}	Mark a future element that is indicated by speaker.
+5	LOC	locative	{-nau}	Mark the optional locative case. It may be used to refer to body parts and may occur in locative adverbs.
+6	PL	plural	{-nãũʔ} ~ {-nãʔ} {ãũˀt(i)-} {hala-} {hali}	Indicate plurality.
+7	TMP.PST	nominal temporal past	{-nũta}	Mark a past element that is narrated by speaker.
			{-ũtetã} / {-utaina}	Indicate an intermediary or distant past notion
			{-aitali}	Indicate a past notion in relation to the noun.

[53] Costa (2020) and Silva (2021) state that classifier {-te} is phonetically realized as [te] ~ [ti]. Since [te] and [ti] have different tonal patterns, I assume that [te] and [ti] are phonetic realizations of different morphemes.
[54] Correia a Silva (2021) transcribes this morpheme with an oral vowel {-ko} and analyses it as a classifier, in accordance with Lowe (1999).
[55] Kroeker (2001: 44) also analyses this morpheme as a classifier.
[56] The transcriptions found in Kroeker (2001) and Silva (2021) are, respectively: {-akaˀli} and {-akalo}.

+8	DEM	demonstrative	{-aili}	Indicate something visible, which is very close
			{-aina}	Indicate something visible, which is close in the present.
			{-aitã}	Indicate something not visible, which was far in the past.
+9	REF	referential	{-su}, {-a}	See section <u>*2.2.2.1.4.2.*</u>
	VOC	vocative	{-ãĩ} (B. Kroeker 2003: 43)	Mark vocative case
	INCL	inclusive	{-ĩnti}	Usually indicate subjects that are the beneficiary of a given action. Also emphasize punctuality if it follows an adverb of time. (Silva 2021: 94 – 95)
			{-ĩ}	Indicate listing, serialization, and desiderative.
	EXCL	exclusive	{-soˀli}	Mark restrictions. It occurs after the head of a phrase.
+10	FOC	focus	{-sa}	Highlight a specific referent in an utterance.

Nominal plurality is defined contextually (Silva 2021: 62) and speakers use a myriad of strategies to imply plurality, such as the group suffix {-nãũʔ} (Kroeker 2001: 44), which may be attached to nouns and pronouns to indicate more than one entity, as well as the free morpheme {ãũˀt(i)} (Silva 2021: 64). These constructions indicating plurality must be followed by a final suffix, usually {-a}. Other possibilities are the use of the quantifier {hala} 'a few' derived from the numeral {hali} (Kroeker 2001: 50) and the group suffix {-kaˀt(i)} (Silva 2001: 65 – 66). The latter author also points out that the augmentative root {ta̰} and its reduplicated form {ta̰ta̰} can be attached to nominal structures to indicate plurality.

2.2.1.1.2.4.1 Putative Suffix {-li}

In more recent literature on Nambikwara (Costa 2020; Belo 2021; Silva 2021), analyses show the inclusion of a putative suffix {-li}. In contrast, previous works on Nambikwara (Lowe 1999; Kroeker 2001; B. Kroeker 2003) never presented attestations of {-li} in their publications.
According to Costa (2020), Belo (2021), and Silva (2021), the meaning of {-li} cannot be inferred through the analyses and is regarded as semantically opaque. Furthermore, the meaning of {-li} is also not recognized by native speakers. Despite presenting {-li} throughout

their works, the latter two authors, who published on the morphosyntax of Nambikwara, did not include {-li} in the schematic representation of nouns and did not provide a function for it, which to date is still unknown. However, it is possible to see that the putative suffix {-li} always occupies the penultimate position within the nominal word, between the root and a final suffix. In the field, I tried to elicit and test nominal constructions with {-li} in order to verify their meaning and function. However, no speaker could refer to any meaning or function of such a morpheme, exactly as described in the most recent literature. Although it is possible that {-li} was once a suffix, I assume that it is not. It is rather the outcome of a phonological rule (epenthesis), restricted to a specific phonological environment and applied to prevent certain classes of consonants from forming clusters, which are not permissible to occur on the surface.
The reasons not to include {-li} as a separate morpheme in this work make use of two arguments: 1) Occam's razor and 2) the results of grammaticality tasks in the field in 2022. I use Occam's razor to simplify the explanations on morphophonology (see section 2.2.1.1.2.4.1) based on the principle that presenting the smallest sets of elements to account for the phenomena attested in the data is the best solution. If {-li} ever occurred at an early stage in the language's internal history, it has currently lost its meaning and function in the system since no speaker could comment on it, a fact that contrasts with the considerations on all the other morphemes. I assume that {-li} is derived from a coda material /l/ occurring in the ultimate syllable of a root/stem, and which undergoes epenthesis to avoid more marked phones, such as [ʰl̥] ~ [l̥] and [ɾʰ], being phonetically realized.
Avoidance of more marked phones is more evident in the speech of younger speakers, who often employ the strategy of inserting a high vowel [i] between a root's final liquid and a following /s/ initial morpheme. By inserting an epenthetic vowel in an /l#s/ environment, phones [ʰl̥, l̥, ɾʰ] would not be phonetically realized.
Although {-li} is not regarded as a suffix, it is possible that the syllable /ˀli/, displaying a glottalized liquid, can be analyzed as a suffix or part of another root, as it is frequently attested in the structure of some nouns. In contrast with roots with final /l/, sequences of /ˀli/ + /s/ initial morphemes never render the phones *[ʰl̥, l̥, ɾʰ]. Compare examples (01) and (02):

(01) /ianal-su/	[jaˈnaːʰl̥u] ~ [jaˈnaːlisu]	'jaguar'
(02) /uaiaˀli-su/	[ˈwajːaˀlisu] *[ˈwajːaʰl̥u]	'dog'

In (01), coda /l/ coalesces into [ʰl̥] if followed by an /s/ initial morpheme. In this example, the surface form [jaˈnaːlisu] is also possible and accepted by young speakers. When questioned about the difference between forms such as [jaˈnaːʰl̥u] and [jaˈnaːlisu], young speakers say unanimously that both forms are correct and mean the same. In contrast with the results observed among the youngsters, the elders claim that the surface form [jaˈnaːl**i**su] is wrong, and they do not accept it.
The scenario presented in (02) is different. There is no vowel elision in /ˀli/, which would trigger the coalescence of the liquid in the coda. Both young and elder speakers state that *[ˈwajːaʰl̥u] is incorrect, and the only accepted form is [ˈwajːaˀlisu]. As shown in section 2.2.1.1.2.4.1, the coalescence of liquids /l/ in the coda followed by a morpheme initial /s/ is a very productive rule in both nominal and verbal morphology. As data in (01) and (02) show different scenarios and phonetic realizations for the examples, I will not include {-li} in the morpheme glosses in this dissertation and assume that it is just the outcome of epenthesis.

2.2.1.1.2.4.2 Referential Suffixes

There is much debate on the classification of final suffixes {-su} and {-a}. Kroeker (2001) and Lowe (1999) describe both morphemes as articles. On the other hand, Silva (2021) labels them as referential suffixes, in accordance with the classification of analogous suffixes presented in the descriptions of Northern Nambikwaran lects (Telles 2002; Eberhard 2009, among others). Although {-su} and {-a} are related to features such as definiteness and specification, which can be translated as the English articles ‘the’ and ‘a, an,’ I will refer to them as referential suffixes in accordance with Silva’s (2021) analysis for Nambikwara do Campo. The same author presents some descriptive uses of such morphemes, which are presented below. The information in italics is from my own analysis. Issues related to the morphology and phonology interface will be addressed in the morphophonology and tone chapters of this dissertation.

Table 23: Uses of referential suffixes based, adapted, and translated from Silva (2021: 90).

{-su}	{-a}
Occurs *mostly* in nouns uttered in isolation	Occurs *mostly* in nouns within sentences
Is the head of nominal compounding in isolation	Delimits phonological words
Occurs in possessive structures	Occurs in possessive structures
Occurs within indefinite nouns	Occurs within indefinite nouns
Is the head in genitival constructions	Is the head of attributive constructions
Is the head of identifying equative constructions with no copula	Subject of equative constructions with copula
- Specific	+ Specific
+/ - S argument marker	*+ S, O argument marker*
Occurs within phonological boundaries	*Occurs within phonological boundaries*

2.2.1.1.3 Nominal Loanwords

As described in Chapter 1, the level of proficiency in Nambikwara – and as an extension, in Kithãulhu – varies considerably from speaker to speaker according to variables such as age/generation, literacy level, profession, ethnicity/group, gender, and social status in the community. Since there has been over 100 years of contact with non-indigenous/Brazilian-Portuguese-speaking communities, many Brazilian Portuguese words have been incorporated into the Nambikwaran lexicon.

Apart from borrowed discursive markers[57] and some institutional[58] names, every Brazilian Portuguese word, including proper nouns, borrowed in the lexicon, displays Nambikwaran morphology, usually classifiers and referential suffixes. Such words are referred to by speakers as “intercultural words” since they include features of both languages. Some examples are given below:

(03) <celular>-te-su [seluˈlaːtesu]
cellphone-CL.generic-REF
‘cellphone’

(04) <dengue>-a-kaˀt-su [ˈdẽːgaˌka̰ʔtsu]
dengue fever-LV-CL.disease-REF
‘dengue fever’

[57] Some examples are: *aí* ‘then, so, thereafter,’ *então* ‘then, so, thereafter, exactly,’ *isso* ‘exactly,’ *tá* ‘okay.’

[58] Institutional names and some place names usually display variations from speaker to speaker. Words such as FUNAI, *Fundação Nacional do Índio*, may or not include Nambikwaran morphology in spontaneous speech.

(05) <Vilhena>-tʰĩn-a [viˈʎeːnaˌtʰĩːna]
Vilhena-CL.village-REF
‘Vilhena (city)’

(06) <Luiz>ahlo-a [luˈiːahla]
Luiz-CL.male-REF
‘Luiz’

In some cases, even if there is a Nambikwaran word for the entity, to which speakers want to refer, they tend to use borrowings instead of the original Nambikwaran word, especially the younger speakers. In the field, most young speakers could not recall “authentic” Nambikwaran words and used “intercultural” words instead. However, in some cases, they could easily understand the meaning of original words based on morphological structure. Table *24* illustrates a lexical variation of some nouns:

Table 24: Lexical variation of nouns.

Nambikwaran Words	Borrowed Words
(07) /soh-a/ [ˈsoːha] banana-REF ‘banana’	(08) /<banã>-su/ [baˈnãːsu] banana-REF ‘banana’
(09) /tuh-a-nṵ̃-su/ [ˈtuːhaˌnṵ̃ːsu] honey-NZ-CL.granules-REF ‘sugar’	(10) /<açúcar>-nṵ̃-su/ [aˈsuːkaˌnṵ̃ːsu] sugar- CL.granules-REF ‘sugar’
(11) /sis-a-ki-su/ [ˈsiːsakisu] grass-NZ-CL.seed-REF ‘rice’	(12) /<arroz>-a-ki-su/ [aˈɾoːsakisu] rice-NZ-CL.seed-REF ‘rice’

Borrowings follow the Brazilian Portuguese stress system. However, some words, probably borrowed in the initial years of language contact, display traces of phonological accommodation by adapting the phonological structure of the newly borrowed words to the Nambikwaran stress rules. Chapter 4 will touch upon stress and tone in loanwords.

2.2.1.1.4 Pronouns

2.2.1.1.4.1 Personal Pronouns

2.2.1.1.4.1.1 Basic Forms

Basic forms of personal pronouns are:

Table 25: Basic forms of personal pronouns.

Gloss	Pronoun
1.SG	ˀtai
2.SG	ṵa̰ḭ
3.SG	te

2.2.1.1.4.1.2 Free Personal Pronouns

Free personal pronouns are made from their corresponding basic form followed by demonstrative, evidential suffixes, or other nominal morphology such as classifiers and referentials[59].

Table 26: Free personal pronouns.

Gloss		Pronoun
1SG		ˀtaina (ˀta + aili + na)
2SG		ṵa̰ḭna (ṵa̰ + aili + na)
3SG	M	tiahla (te + iahlo + a)
	F	ta̰kaˀla (te + a̰kaˀlo + a)

According to Silva (2021: 99), other forms for the 3rd person singular pronoun include:

Table 27: Other 3rd personal singular pronouns.

Form	Pronoun + Gloss	Translation
3SG (+)	tea (te + a)	this
3SG.PROX (+)	tena	this (near, I see)
3SG.PROX (+)	teta (te + ta)	that (far)
3SG.PROX (-)	tetih	not this

2.2.1.1.5 Numerals

Analyses of the numeral systems vary. Kroeker (2001: 49) suggests that Nambikwara has three numerals, with a "one, two, many" system, from which all other cardinal numbers are derived. On the other hand, Silva (2022: 119) posits a quinary system, with cardinal numbers being counted from one to five, which is also verified in this dissertation. The author also points out that numerals may occur with body parts, nouns, pronouns, and classifiers to denote a defined quantity. Cardinal numerals such as seven may display many forms using the words for "two" and "one," but it is not clear if they can be made up from constructions such as "five" and "two."

Table 28: Numeral system.

Numeral	Translation
kanaki	one
hali	two
hali kanaki	three (two + one)[60]
hali hali	four (two + two)
hali hali kanaki	five (two + two + one)
hˀiˀka hati	five (one hand)[61]

[59] Silva (2021: 98) suggests that free personal pronouns derive from their basic forms + demonstrative {aili} + evidential {-na} suffixes for the first- and second-person singular. For third person singular, we have basic form {te-} (classifier) + gender classifier + referential suffix {-a}.

[60] Although *hali kanaki* is the standard form, one can also use *kanaki hali* to denote three.

[61] The numbers "hˀiˀka hati" and "hˀiˀka hali" are neologisms. They were recently adopted by Nambikwaran teachers to use in the classroom to make calculations in Nambikwara easier for students. Younger or less literate speakers do not often use "hˀiˀka hati" and "ˀhˀiˀka hali," so they tended not to remember such forms in the elicitation sections. The meaning of such forms, however, is easily inferred by them.

hˀiˀka hali	ten (two hands)
kala	many, much

Numerals may also function as verbs and Silva (2022: 121) also suggests that *hali* 'two' is used as a quantifier to indicate an uncountable portion, as in (13):

(13) ki-hali
CL.seed-two
'handful' (lit. two grains) (Silva 2022: 121)

(14) kanakanat-∅-na-ɾa [kanakaˈnaːˌtãːɾa]
RED.to be one-3PS-PRS.V.EV-PFV.M
'it's one'

(15) hati-a hali -∅ -na -ɾa [haˈtiːa# haˈliːˌnaːɾa]
basket-REF to be two-3S-PRS.V.EV-PFV.M
'it's two baskets'

2.2.1.1.6 Quantifiers

Silva (2022: 68) suggests that there are only three quantifiers, which are interpreted as non-numerals: {hala} 'a few', {kala} 'many', {ai̯o̯haka} 'all, everything.' According to the author, quantifier {hala} has a different distribution in comparison to the derived form {hali} 'two' + referential suffix {-a} since the former may occur as a free morpheme and may optionally be followed by a classifier suffix. On the other hand, Kroeker (2001) suggests that there are two quantifiers, {hala} and {kanaku}, both of which are derived from numerals two and one, {hali} and {kanaki}, respectively, followed by endings {-a} and {-u}. Table *29* presents Nambikwara quantifiers:

Table 29: Quantifiers.

Quantifier	Translation
hala	a few
kanaku (Kroeker 2011: 68)[62]	a few
kala	many
ai̯o̯haka	all, everything

2.2.1.1.7 Ideophones

Ideophones can work as nominal and verbal roots and depict a sonorous feature and phonetic imitation of the entity to which they refer or the sounds intrinsic to movements, in the case of verbs, as onomatopoeias. As Silva (2022: 123) points out, the morphological structure of ideophones usually includes reduplication.

[62] Silva (2022: 68) states that he could not verify in his data the occurrences of "kanaku." In my data, however, there are two occurrences of "kanaku," used in isolation in elicitation sections to indicate 'a few.' Therefore, I included it and leave as an open question whether it is derived from numeral {kanaki} and has a different distribution, such as claimed by Silva for {hali} + {-a} versus {hala}.

(16) /tãn-su/ [ˈtãn^{d}zu]
frog-REF
‘frog, sp.’

(17) /tã̰ḭ̃tã̰ḭ̃l-su/ [tã̰j̰̃ˈtã̰j̰̃ːɾ^{h}u]
RED.cricket-REF
‘cricket, sp.’

2.2.1.1.8 Verbs

Verbs display the most complex morphological structure among the word classes, allowing noun incorporation and up to 12 slots for suffixation. Just like nouns, assuming the most basic structure of a verbal word is comprised of a root followed by a final suffix, both of which are monosyllables, verbs are minimally disyllabic. Table *30* provides a scheme for the simplest verbal word:

Table 30: Scheme of a minimal verbal word.

root	Final suffix
stem	{-sã}

A root usually corresponds to a stem, but stems can encompass more morphemes, especially in cases of serialization. Once again, morphophonemic rules take place between the root and suffixes. In this dissertation, I will use the scheme adapted from Silva (2021) to illustrate the morphological complexity of verbal words, which is given in Table *31*:[63]

Table 31: Verbal word morphological structure.

	Slot	**Gloss**	**Meaning**
Prefixes	-1	INST	Instrumental prefix
		STAT	Stative prefix
	-2	NI	Noun incorporation
	0	**Root**	Verbal root
Suffixes	+1	SS	Stative suffix
		NZ	Nominalizer
	+2	APL	Applicative
	+3	O	Objective suffixes
	+4	ASP	Aspectual suffixes
		MZ	Modalizer suffixes
		IRR	Irrealis mood
	+5	DES	Dessiderative
		IMM	Imminentive
	+6	CAUS	Causative

[63] The scheme presented by Kroeker (2001: 52) for the verbal word is as follows: [+/- INSTL] [+ Verb stem] [+/- CS] [+/- BN] [+/- ADV1] [+/- O.Person] [+/- ADV2] [+/- S.Person] [+/- NEG] [+/- AUX] [+/- S1.SG] [+ T/E] [+ ASP] [+/- DS.CLT]. Legend: INSTL = Instrumental; CS = Change of State suffix; BN = Benefactive suffix; ADV1 = Adverb 1; O.Person = Object Person; ADV2 = Adverb; S.Person = Subject Person; 2 NEG = Negative; AUX = Auxiliary; S1.SG = Subject 1st Person Singular; T/E = Tense/ Evidential; ASP = Aspect; DS.CLT = Discontinuous Phrase Clitic. I included square brackets between the morphemes in Kroeker’s representation for easier reading.

	+7	REFL	Reflexive
		RECP	Reciprocal
	+8	S	Subjetive suffixes
	+9	NEG	Negation
	+10	T/EV	Tense/ Evidentiality
	+11	ASP/GM	Aspect/ Gender marker
	+12	DS	Direct speech

Given verbal word complexity, I will once again restrict the presentation of morphemes in relation to the scope of this current study. The classification of verbs into classes according to what happens within the stems, as well as the gloss and meaning of suffixes, will be presented in relevant sections on morphophonology and tone.

2.2.1.1.9 Prefixes

2.2.1.1.9.1 Instrumental Prefixes

Instrumental prefixes provide information on who/what, how and/or with which object an action is performed. The meaning of the following instrumental prefixes is still debatable:

Table 32: Agentive instrumental prefixes.

Type	Prefix	Meaning
agentive	{u̯a̰-}	Action performed with the hands/paws (human or nonhuman).
	{ũh-}	Action performed with means of an object or a movement, which is realized towards something (Silva 2021: 128-129). Implement as agent acting on the (Kroeker, 2001, p. 52)
	{sa-}	Unspecified agent acting on the goal (Kroeker 2001: 53). *Used in both human and nonhuman agents, as long as it is unspecified.*
	{ĩ-}	Unspecified agent acting in continuum (Kroeker 2001: 53).

2.2.1.1.9.1.1 Other Prefixes

1.2.1.1.9.1.1.1 Stative Prefixes {an} ~ {ã}[64]

[64] Kroeker (2001: 53) describes {ã-} as an instrumental prefix used to indicate an unspecified agent acting on itself.

The stative prefixes {an} and {ã} are used to turn active verbs into stative verbs (Silva 2021: 134).

2.2.1.1.10 Roots

Verbal roots tend to be monosyllabic or disyllabic. Other polysyllabic roots, such as trisyllabic ones, are very rare and usually derived from serialization and/or reduplication. Serialization may also display morphophonological rules within the stem, at morpheme boundaries.

2.2.1.1.11 Adverbs

Adverbs are derived from verbs or nouns. Therefore, adverbs may display nominal and verbal suffixes. A very productive derivational morpheme, which turns verbs into this word class, is the adverbializer suffix {-ˀti}, added to the verbal root. Silva (2021:109) also posits that adverbs may be incorporated into verbal morphology through affixation. The most frequent adverbs presented in this dissertation fall into three categories: adverbs of time, manner, and locative. Each of these are presented in the tables below.

2.2.1.1.11.1 Adverbs of Time

Table 33: Adverbs of time according to Silva (2021).

Adverbs of Time	Translation
hakanã	days ago
hĩna	time, today, *now*
hĩna-aina	now, *in this moment*
hĩna-ĩnti	right now
nekakatsa	noon
ĩli-hĩna	at every moment
ĩlu-hĩna	any day
ianna̰ṵã	in the future
ie-kalati	many times
ieieiena	soon
kãn-su, kãĩn-hĩna, kãĩn-hĩna-aitã	a long time ago
kaˀnahatana	today's morning
kaˀnahata, kaˀnahata-aina	tomorrow
sũnt(i)-hĩna-aitã, sũnt(i)-a-t(e)-aitã	yesterday
sũnt(i)-hĩna	afternoon

2.2.1.1.11.2 Adverbs of Manner

Table 34: Adverbs of manner according to Silva (2021).

Adverbs of Manner	Translation
ãʔ	again, still
ã̰la	already
soli	only
nũhli, nũʔ	alone
uiˀta	slowly
uasu-ˀti	fast

hua̰ḭna	until

2.2.1.1.11.3 Locative Adverbs

Table 35: Locative adverbs according to Silva (2021).

Locatives	Translation
netauã	there
nekata/ ãkata	in front of
taloa/ titalokana	back/ behind
tanã	beside, next to
iohatihnaua	on the other side
auita, nakuaiehlaka, nauasa	amidst, in the middle of
nekatauã	at the end
nekanaha	on
iuhẽna	under
iokatehnaua	close
ṵli	far

2.2.1.2 Closed Class

Closed class is comprised of particles. In this dissertation, only emotion, negation, and question particles are presented.

2.2.1.2.1 Particles

2.2.1.2.1.1 Emotion and Negation Particles

Table 36: Emotion and negation particles.

Type	Particle	Translation
Emotion	haã	yes
	haio[65]	agreed, sure
Negation	haiti	no, never

2.2.1.2.1.2 Question Particles

Kroeker (2021) and Silva (2021) have different proposals for the analysis of interrogative words. Whereas the former analyzes them as interrogative pronouns, the latter names them wh-questions. However, both authors agree that question words occur in the initial position of a sentence. Table *37* provides a summary of the most frequent wh-questions attested in the data used in this dissertation. Morphemes and segments in brackets mean that they are optional. The morpheme segmentation was adapted and translated from Silva (2021: 108) in the cases where it was provided:

[65] ‘haio’ is also used as common greeting, meaning ‘hi’, and ‘good morning’. It also means ‘okay,’ ‘thank you’ and ‘you’re welcome,’ depending on the context.

Table 37: Question particles (wh-questions).

Pronoun	Translation
ĩh-te-a	Who (human)
iã-te-(t)a	What (nonhuman)
ĩh-(ˀnẽ)-hĩna	When, what day
ĩh-nũna	Whence
ĩh-nũ-te-a	Where
ĩh-ˀne	How? How much/ many?
ĩh-ˀne-hakḭ̰	Why?
ĩh-tel-a	Which of these

Apart from question particles, Nambikwara also displays interrogative morphology in the verbal string.

Chapter Summary

This chapter introduced the reader to the main morphological categories of Southern Nambikwara grammar by displaying the morphological structure of open classes (nouns, verbs, and adverbs), as well as one closed class (particles), mainly theoretically supported by the descriptive works of Kroeker (2001) and Silva (2021). Ideophones are regarded by Kroeker (2001) as an independent closed word class, but they are regarded as dependent from other classes (nouns and verbs) in this study. As shown, Southern Nambikwaran is regarded as a polysynthetic language since it fulfills most of the criteria outlined to identify a polysynthetic language, according to Fortescue (2007). Nouns display complex morphology, including nominal tempora suffixes and a rich classifier system, which is also employed in loanwords. Despite the complex nominal morphological structure, verbs comprise the most complex word class in terms of morphological information because of the availability of multiple slots for suffixation, which include a myriad of morphemes, such as the portmanteau suffixes for evidentiality and tense, for instance. Verbs can derive adverbs, by means of suffixation with the adverbializer morpheme {ˀti}. They may function as adjectival words and be included in the nominal morphology via juxtaposition. Both nominal and verbal words are minimally disyllabic, with the smallest structure being a monosyllabic root followed by a monosyllabic suffix. This is due to the obligatoriness of a final suffix {-a} and {-su}, in the case of nouns, and {-sa}, in the case of verbs. However, adverbial words may escape this rule, once certain adverbial categories do not require nominal or verbal morphology, even though most of them do require additional morphology such as demonstratives, classifiers, and referential suffixes. Verbs undergo inflection and display interrogative suffixes, which vary according to the sex of the addressee, and which may be combined with interrogative participles (wh-questions) in questions. Furthermore, inflected verbs are comprised of a stem (usually a root, except in some specific cases, such as verbal serialization) and a suffix string, which is added to the stem.

Chapter 3: Segmental Phonology

Introduction

This chapter provides a synchronic description of Kithãulhu segmental phonology[66]. First, I present the vowel inventory, along with their respective allophones and distribution, and show that vowels are distinguished according to articulatory parameters such as height (high, mid, and low), backness (front, central, and back), and roundness (rounded and unrounded) as well as in terms of values for nasalization and phonation (modal and creaky voice). Hence, there are four different series of contrastive vowels because of oral, nasal, creaky voice, and simultaneous nasal and creaky voice features.

Thereafter, I introduce the consonant inventory, along with their respective distribution and allophones, classifying them according to the degree of stricture. I show that four manners of articulation are contrastive, and symmetrically organized into two types of obstruents (plosives and fricatives) and two types of sonorants (nasal and liquids), which are articulated in four different places along the vocal trait, namely labial, alveolar, velar, and glottal.

There is no phonemic distinction between voiceless and voiced counterparts of a same segment. However, plosives and nasals are distinguished in terms of co- and more complex degrees of articulation and are arranged into three series of contrastive features: plain, aspirated, or glottalized. Fricatives and liquids only display plain and glottalized counterparts in the underlying representation, but occurrences of aspirated fricatives and liquids are attested in the surface representation, resulting from (morpho)phonological processes, described later in Chapter 5.

3.1 The Vowels

This section and subsequent subsections introduce the reader to the vowel inventory. Firstly, the vowel phones are introduced, so that the reader becomes familiarized with the phonetic system of Kithãulhu vowels. Then, the description of the phonology per se starts with the introduction of the vowel phonemes along with their respective phonemic oppositions.

3.1.1 The Vowel Phones

The vowel phones are comprised of 44 segments. Table 38 illustrates and categorizes the attested:

Table 38: Kithãulhu vowel phones.

			Front	**Central**	**Back**
High	Close	Oral	i, iː		u, uː
		Nasal	ĩ, ĩː		ũ, ũː
		Creaky	ḭ, ḭː		ṵ, ṵː
		Nasal Creaky	ḭ̃, ḭ̃ː		ṵ̃, ṵ̃ː
	Near Close	Oral	ɪ, ɪː		ʊ
		Creaky	ɪ̰		
Mid	Close-mid	Oral	e, eː		o, oː
		Nasal	ẽ, ẽː		
		Creaky	ḛ, ḛː		o̰, o̰ː
		Nasal Creaky	ḛ̃ː		

[66] Sounds were initially classified on a perceptual basis during the transcription stage in the fieldwork sessions. Thereafter, spectral analyses were carried out, followed by additional perception tasks with the Kithãulhú.

	Open-mid	Oral	ɛ(ː)		ɔ(ː)
Low	Near-open	Oral		ɐ, ɐː	
		Nasal		ɐ̃, ɐ̃ː	
	Open	Oral		a, aː	
		Nasal		ã, ãː	
		Creaky		a̰, a̰ː	
		Nasal Creaky		ã̰, ã̰ː	

Most of the segments shown in Table 38 are allophonic forms of vowels or resulting from (morpho)phonological processes. Long vowels are not interpreted as phonemic. They only occur in stressed positions within the stem (see 4.9.3 about the Stress Lengthening Rule in Chapter 4), in case of primary stress, or in the penultimate syllable of a verbal string, in case of secondary stress, except in special cases with some prefixes (such as possessive pronouns embedded into nominal morphology or instrumentals, in the case of verbal morphology). For information about the stress system, see 4.8.
Vowels may also occur in the surface as long vowels due to compensatory lengthening usually when the coda of an underlying closed syllable is resyllabified. Near-close vowels are attested in two different positions within a word and are determined according to backness: 1) lengthened high near close front vowels [ɪː, ɪ̰ː] occur in stressed positions, whereas 2) short high near close front vowels [ɪ, ɪ̰] and the high near close back vowel [ʊ] are only attested within unstressed positions. Low near open central vowels [ɐ, ɐː, ɐ̃, ɐ̃ː] are attested as the phonetic realizations of the third person singular possessive/ inalienable prefix {a-}. Open-mid vowels [ɛ(ː), ɔ(ː)][67] result from phonological rules such as monophthongization, described in detail in Chapter 5.

3.1.2 The Vowel Phonemes

There are 18 phonemic vowels, which are predominantly in opposition within stressed syllables. Unstressed syllables may also display a phonemic vowel contrast, such as the case of low central vowels /a/ and /a̰/[68]. Table 39 illustrates the phonemic vowels, according to height, backness, and the values for nasalization, and phonation type:

Table 39: Kithãulhu phonemic vowels

			Front	**Central**	**Back**
High	Close	Oral	i		u
		Nasal	ĩ		ũ
		Creaky	ḭ		ṵ
		Nasal Creaky	ḭ̃		ṵ̃
Mid	Close-mid	Oral	e		o
		Nasal	ẽ		
		Creaky	ḛ		o̰
		Nasal Creaky	ḛ̃		
Low	Open	Oral		a	
		Nasal		ã	
		Creaky		a̰	
		Nasal Creaky		ã̰	

[67] They may also be interpreted as a phonetic influence from Brazilian Portuguese Phonology.
[68] Such as in [**a**ˈlã̰ːsu] and [**a̰**ˈla̰ːsu], 'pink trumpet tree' and 'guan (sp.),' respectively or [w**a**ˈluːtsu] and [w̰**a̰**ˈlṵːtsu], 'paca' and 'calabash,' respectively.

To provide evidence of the phonemic status of vowels in Table 39, vowel oppositions are presented below, as minimal pairs, triplets, or even quadruplets, the latter contrasting vowels of the same height, backness, and roundness, in terms of the [+/-nasal] and [+/- creaky] features. Since samples of contrastive vowels are more often attested in the data within stressed positions, the vowel opposition examples below are given with regards to stress. I also present samples with the most possible analogous phonetic environment in the cases in which a minimal set is not given. Contrasting segments are indicated in bold.

Vowel Oppositions

/i/, /ĩ/, /ḭ/, /ḭ̃/

[ˈ**i**ːaːˌtuːwa] ‘I’ll fetch it’
[ˈ**ĩ**ːaːˌtuːwa] ‘I’ll see it’
[ˈ**ḭ**ːaːˌtuːwa] ‘I’ll light it up’
[ˈ**ḭ̃**ːaːˌtuːwa] ‘I’ll plant it’

/i/, /e/

[ˈ**i**ːaːˌtuːwa] ‘I’ll fetch it’
[ˈ**e**ːaːˌtuːwa] ‘I’ll speak’

/ẽ/, /ḛ/, /ḛ̃/

[aˈn**ẽ** ːkisu] ‘head’
[aˈˀn**ḛ**ːˀkisu] ‘leg, thigh’
[aˈˀn**ḛ̃**ːˀkisu] ‘wing’

/a/, /ã/, /a̰/

[aˈn**a**ːaːˌtuːwa] ‘I’ll drop (it)’
[ãˈn**ã**ːaːˌtuːwa] ‘I’ll lay down’
[ãˈn**a̰**ːaːˌtuːwa] ‘I’ll fish’

/ã/, /ã̰/

[aˈl**ã**ːsu] ‘macaw (general)’
[aˈl**ã̰**ːsu] ‘pink trumpet tree’

/o/, /o̰/

[ˈ**o**dˌnaːɾa] ‘it’s been left, it remains’
[ˈ**o̰**dˌnaːɾa] ‘it’s burning, it’s burnt’

/u/, /ṵ/

[ˈj**u**ːʰl̥u] ‘mouse, sp.’
[ˈj**ṵ**ːʰl̥u] ‘knife’

/ũ/, /ṵ̃/

[ˈ**ũ**ːsu] ‘capybara’
[ˈ**ṵ̃**ːsu] ‘bee, sp.’

In the following sections, I introduce the reader to the phonemic vowel system. As mentioned, Kithãulhu displays a rich vowel system with 18 segments, which contrasts height (high, mid, and low), backness (front, central, and back), and roundness (rounded and unrounded). Moreover, they are also categorized according to articulation types, namely oral and nasal, as well as phonation type (creaky), which can be combined with the nasal articulation, resulting in vowels, which are simultaneously creaky and nasal.
As I demonstrated, mid-back /o/ and creaky mid-back creaky /o̰/ vowels are never nasalized (*[õ, õ̰]). Due to the lack of nasal and creaky, and nasal mid-back vowels, one may infer that the vowel system is not symmetrical, considering the gap in this position of the series, in contrast with the oral and creaky vowels series, which distinguish 5 different types of vowels. However, if we arrange vowels in terms of absence or presence of the [+nasal] feature, what we will find is a symmetrical series of a) [-nasal] vowels: i) the oral series /i, e, a, o, u/ and the ii) creaky voice series /ḭ, ḛ, a̰, o̰, ṵ/; and b) [+nasal] vowels: iii) the nasal series /ĩ, ẽ, ã, ũ/ and iv) the creaky nasal series /ḭ̃, ḛ̃, ã̰, ṵ̃/.
Furthermore, [-nasal] and [+nasal] vowels display a relatively similar distribution, as the main difference between the series within each of these categories is the occurrence of the phonemes within them: creaky voice is a more marked phonation type [+creaky], and consequently it is less frequent than its modal counterpart [-creaky]. Therefore, the vowel distribution is presented in this section according to the absence or presence of the nasal feature.
All vowels are lengthened in the stressed position of a word if there is no coda in the underlying representation or if the syllable coda undergoes morphophonological rules, such as resyllabification. Lengthened vowels are allophonic and restricted to primary stressed positions only, except for possessive prefixes, whose nucleus may be lengthened due to secondary stress. Vowel lengthening is related to stress assignment, as described in Chapter 4.

3.1.3 The [-nasal] Vowels

The [- nasal] vowels are comprised of 10 vowels, distributed in two distinct symmetric series: on the one hand, the oral vowels and, on the other hand, the creaky voice vowels.

3.1.3.1 The Oral Vowels

The oral vowels are the most frequent vowels. In general, oral vowels are attested following all consonants. They may also be followed by all consonants that are allowed to occur in the coda. As I illustrate below, oral vowels such as mid-vowels /e/ and /o/ have a more restricted distribution, in comparison with the other vowels.

3.1.3.1.1 /i/

/i/ is a high front unrounded oral vowel. /i/. It is, along with /a/ and /u/, one of the most frequently attested oral vowels. The allophones of /i/ are [i] and [iː].

Phonotactics

/i/ is attested following all consonants, except for /ɾ/ and /ˀp/. It occurs in stressed (18), unstressed (24), or both positions (28) within a word. /i/ occurs word-initially, medially, or finally, as shown in (19), (20), and (31), respectively. /i/ is also found in syllables on its own (18).
The allophone [iː] is restricted to stressed positions if the syllable is open (18). However, note that syllables with phonetic [iː] may also be closed in the underlying representation, as in (23). In this case, occurrences of [iː] are due to resyllabification. When followed by the low vowel /a/, /i/ is never realized as the palatal glide [j], as seen in (18):

(18)	#_	/i-a-tu-ua/	[ˈiːaˌtuːwa]	'I'll fetch (it)'
(19)	p_	/pit-su/	[ˈpiːtsu]	'gourd'
(20)	t_	/a-tih-a/	[aˈtiːha]	'blood'
(21)	k_	/kikin-na-ɾa/	[kiˈkidˌnaːɾa]	'it has parallel stripes'
(22)	ʔ_	/hoʔi-na-ɾa/	[hoˈʔiːˌnaːɾa]	'he's bathing'
(23)	s_	/sil-su/	[ˈsiːɾʰu]	'mouse
(24)	h_	/hi-ie-kalo-su/	[hiˈjeːkaˌloːsu]	'vehicle'
(25)	l_	/tali-na-ɾa/	[taˈliːˌnaːɾa]	'it's thundering'
(26)	n_	/nik(i)[69]-su/	[ˈniːkisu] ~ [ˈniːksu]	'*breu*, candle'
(27)	pʰ_	/pʰipʰin-na-ɾa/	[pʰiˈpʰidˌnaːɾa]	'it's chubby'
(28)	tʰ_	/u̯a̰-tʰin-ˀki-na-ɾa/	[ˌw̰a̰ːˈtʰiᵍŋɠiˌnaːɾa]	'he's shooting'
(29)	kʰ_	/haiakʰin-na-ɾa/	[hajaˈkʰidˌnaːɾa]	'he's tired'
(30)	ʰn_	/hˀi-ḭ̃ã̰ḭ̃-ʰni-na-ɾa/	[ˌhˀiːˈj̰̃ã̰j̰̃ːʰniˌnaːɾa]	'it's healing'
(31)	ˀt_	/uasu-ˀti/	[waˈsũːɗĩ] ~ [waˈsuːdḭ]	'quickly'
(32)	ˀk_	/uˀki-na-ɾa/	[uˈˀkiːˌnaːɾa]	'he's going down'
(33)	sˀ_	/sˀih-su/	[ˈsˀihsu] ~ [ˈsḭːʰsu]	'house'
(34)	hˀ_	/a-hˀiˀk(i)-su/	[ɐˈhˀiːˀksu] ~ [aˈhˀiːˀkisu]	'hand'
(35)	ˀl_	/haˀlin-su/	[haˈˀliᵈnᵗsu]	'smoke'
(36)	ˀn_	/kaˀni-na-ɾa/	[kaˈˀniːˌnaːɾa]	'he's getting off'

/i/ may be followed by coda /t, k, s, h, n, l, ˀt, hˀ, ˀn/:

(37)	_t	/pit-a/	[ˈpiːta]	'gourd'
(38)	_k	/nik(i)-su/	[ˈniːkisu] ~ [ˈniːksu]	'*breu*, candle'
(39)	_s	/sis-su/	[ˈsiʔtsu]	'grass (general)'
(40)	_h	/anih-a-tu-ua/	[aˈniːhaˌtuːwa]	'I'll run'
(41)	_n	/in-na-ɾa/	[ˈidˌnaːɾa]	'it's flying'
(42)	_l	/il-su/	[ˈiːɾʰu]	'howler monkey'
(43)	_ˀt	/iˀt-su/	[ˈiʔtsu] ~ [ˈiʔtisu]	'wind'
(44)	_hˀ	/ˀtihˀ-su/	[ˈɗĩhsu] ~ [ˈdḭːʰsṵ]	'snake' (general)
(45)	_ˀn	/ualiˀn-a/	[waˈliːˀna] ~ [waˈliːna̰]	'manioc'

[69] Whenever a consonant is followed by '(i)' in the phonemic transcriptions, it indicates an epenthetic vowel. I used this notation because speakers use both forms interchangeably, and usually accept both forms, i. e., with or without the vowel. However, there is a tendency for the version with the epenthetic vowel to prevail and become 'standard' as a strategy to avoid consonant clusters such as [ts, ks, ˀts, ˀks] occurring in the onset. Epenthetic vowel rules are described in 1.5.2.12.1.

3.1.3.1.2 /e/

/e/ is a mid-front unrounded oral vowel. The allophones of /e/ are [e], [eː] and [ɪ].

Phonotactics

/e/ follows consonants /t, k, s, h, l, n, tʰ, kʰ, ʰn, ˀt, ˀk, sˀ, ˀl, ˀn/. It is attested word-initially (48) and medially (47), in stressed (49) and unstressed positions (52) or both, simultaneously (53). /e/ is also found in syllables on its own, as in (46). /e/ may be realized as [e] or [ɪ] in unstressed or stressed positions with a coda (50). Both phones are in free variation.

(46)	#_	/e-a-tu-ua/	[ˈeːaˌtuːwa]	‘I’ll speak’
(47)	t_	/halo-te-su/	[haˈloːtesu]	‘the Halotesu’
(48)	k_	/nek-eˀki-ʰna-na-ɾa/	[nekeˈˀkiːʰnaˌnaːɾa]	‘he’s thinking’
(49)	s_	/a-sen-su/	[ˌɐːˈseᵈnᵗsu]	‘footprint, trace’
(50)	h_	/hehen-na-ɾa/	[heˈhedˌnaːɾa] ~ [hɪˈhɪdˌnaːɾa]	‘it’s red’
(51)	l_	/taleh-a/	[taˈleːha]	‘parrot, sp.’
(52)	n_	/a-nekḭ̃s-a/	[ˌaːneˈkḭ̃ːsa]	‘hair’
(53)	tʰ_	/tʰetʰen-na-ɾa/	[tʰeˈtʰedˌnaːɾa]	‘it’s flaccid, soft’
(54)	kʰ_	/kʰe-na-ɾa/	[ˈkʰeːˌnaːɾa]	‘he’s a good hunter’
(55)	ʰn_	/ʰnekai-na-ɾa/	[ʰneˈkajːˌnaːɾa]	‘it’s disseminating’
(56)	ˀt_	/ˀteh-su/	[ˈɗehsu] ~ [ˈɗeːʰsu]	‘bee, sp.’
(57)	ˀk_	/saˀke-sã/	[saˈˀkeːsa]	‘to get worse’
(58)	sˀ_	/sˀesˀek(i)-su/	[sˀeˈsˀeːkisu]	‘scorpion, sp.’
(59)	ˀl_	/kaˀlen-su/	[kaˈˀleᵈnᵗsu] ~ [ka̰ˈˀleᵈnᵗsu]	‘frog (general)’
(60)	ˀn_	/ˀne-na-ɾa/	[ˈˀneːˌnaːɾa]	‘it’s like that’

/e/ may be followed by coda /t, ʔ, h, n, l, hˀ/, as illustrated below:

(61)	_t	/et-na-ɾa/	[ˈeːˌtãːɾa]	‘he’s grating’
(62)	_ʔ	/a-sˀeʔ-a/	[ˌaːˈsˀeːʔa]	‘wife’
(63)	_h	/heh-na-ɾa/	[ˈhehˌnaːɾa]	‘he’s hungry’
(64)	_n	/ten-na-ɾa/	[ˈtedˌnaːɾa]	‘he wants it’
(65)	_l	/ail-tel-a-ua/	[ˈajːteˌɾaːwa]	‘I’ll hunt soon’
(66)	_hˀ	/ehˀ-a/	[ˈehʔa]	‘ax’

3.1.3.1.3 /a/

/a/ is a low central, unrounded, oral vowel. It is, along with /u/, the most frequently attested vowel in the data. The allophones of /a/ are [a], [aː], [ɐ], and [ɐː].

Phonotactics

/a/ is attested following all consonants, except for /ˀp/, in stressed (68), unstressed (75), or both positions (78) within a word. /a/ occurs word-initially, medially, or finally, as shown in (76), (81), and (75), respectively. /a/ is also found in syllables on its own (67).
The prefix {a-}, whenever followed by a stressed syllable, may be phonetically realized as [a], [ɐ], or [ɐː], in free variation (69):

(67)	#_	/alu-su/	[aˈluːsu]	‘mouse (general)’
(68)	p_	/pat-su/	[ˈpaːtsu]	‘duck’
(69)	t_	/a-ta-su/	[aˈtaːsu] ~ [ɐˈtaːsu] ~ [ɐːˈtaːsu]	‘evil spirit’
(70)	k_	/kalakala-su/	[kalaˈkalaːsu]	‘chicken’
(71)	ʔ_	/uakon-na-ʔa/	[waˈkodˌnaːʔa]	‘I’m working’
(72)	s_	/a-sahˀ-su/	[aˈsahsu]	‘penis’
(73)	h_	/han-na-ɾa/	[ˈhadˌnaːɾa]	‘it’s bright’
(74)	l_	/ialan-su/	[jaˈlaᵈnᵗsu]	‘toucan, sickle’
(75)	ɾ_	/ĩ-na-ɾa/	[ˈĩːˌnaːɾa]	‘he’s biting’
(76)	n_	/nanuh-su/	[naˈnuːʰsu] ~ [naˈnuːʰsu]	‘slug’
(77)	tʰ_	/tʰatʰan-na-ɾa/	[tʰaˈtʰadˌnaːɾa]	‘it’s flexible, soft’
(78)	kʰ_	/kʰakʰan-na-ɾa/	[kʰaˈkʰadˌnaːɾa]	‘it’s soft’
(79)	ʰn_	/ten-sa-ʰna-ua/	[ˈteᵈnᵗsaˌʰnaːwa]	‘I want (it)’
(80)	ˀt_	/ˀta-huˀk(i)-a/	[ˈɗaːˈhuːˀka]	‘my bow’
(81)	ˀk_	/ĩhneˀkaḭa̰ntita̰/	[ˌĩhneˀkaˈja̰ᵈndita̰]	‘what for’
(82)	sˀ_	/sˀah-na-ɾa/	[ˈsˀahˌnaːɾ̰a] ~ [ˈsˀaːˌnaːɾa]	‘he’s laid’
(83)	hˀ_	/hˀan-na-ɾa/	[ˈhˀadːˌnaːɾa]	‘it’s over’
(84)	ˀl_	/kaˀla-na-ɾa/	[kaˈˀlaːˌnaːɾa] ~ [ka̰ˈˀlaːˌnaːɾa]	‘they’re many’

/a/ may also be followed by coda /t, k, ʔ, h, n, l, ˀt, ˀk, hˀ, ˀn/:

(85)	_t	/pat-su/	[ˈpaːtsu]	‘duck’
(86)	_k	/tak(i)-su/	[ˈtaːkisu] ~ [ˈtaːksu]	‘grasshopper, sp.’
(87)	_ʔ	/saʔuen-su/	[saʔˈweᵈnᵗsu]	‘jungle’
(88)	_h	/ah-su/	[ˈahsu] ~ [ˈaːʰsu]	‘spider, sp.’
(89)	_n	/kan-na-ɾa/	[ˈkadˌnaːɾa]	‘it’s hard’
(90)	_l	/ianal-su/	[jaˈnaːʰl̥u]	‘jaguar’
(91)	_ˀt	/haˀt(i)-su/	[ˈhaʔdisu]	‘bridge’
(92)	_ˀk	/haˀk(i)-su/	[ˈhaʔkisu] ~ [ˈhaˀksu]	‘yam’
(93)	_hˀ	/kuasahˀ-a/	[kwaˈsahʔa]	‘dove’
(94)	_ˀn	/a-naˀn-ẽn-kalo-su/	[aneˈnẽːgaˌloːsu] ~ [anaˈˀnẽːgaˌloːsu]	‘ear’

3.1.3.1.4 /o/

/o/ is a mid-back rounded oral vowel. It is the second least frequent oral vowel in the data. The allophones of /o/ are [o] and [oː].

Phonotactics

/o/ is attested following consonants /p, t, k, s, h, l, n, pʰ, tʰ, kʰ, ˀt, ˀl/, mostly in stressed syllables (96), but it also occurs in unstressed (102) or both positions (103) within a word, especially in reduplicated syllables or compounds. /o/ occurs word-initially and medially, as shown in (96) and (97), respectively, but it is not attested word-finally. /o/ is never found in syllables on its own: it necessarily follows (99) and/or is followed by a consonant (101):

(95)	#_	/on-na-ɾa/	[ˈodˌnaːɾa]	‘it’s been left, it remains’
(96)	p_	/pon-su/	[ˈpoᵈnᵗsu]	‘cattle’

(97) t_	/totot-na-ra/	[toˈtoːtãːɾa]	‘it’s knocking’
(98) k_	/ũãkon-na-ra/	[w̃ã ˈkodˌnaːɾa]	‘it’s leftover’
(99) s_	/sa-so-ki-na-tu-ua/	[sa ˈsoːkinaˌtuːwa]	‘I’ll take it from him’
(100) h_	/hos-a-ta̰-su/	[ˈhoːsata̰su] ~ [ˈhoːsataʰsu]	‘monkey, sp.’
(101) l_	/a-lon-su/	[aːˈloᵈnᵗsu]	‘brother’
(102) n_	/tĩhno-su/	[ˈtĩhnosu]	‘road’
(103) pʰ_	/pʰopʰon-na-ɾa/	[pʰoˈpʰodˌnaːɾa]	‘it’s pot-bellied’
(104) tʰ_	/saʔuen-a-tʰoʔ-a]	[saʔˈweːnaˌtʰoːʔa]	‘big fire in the jungle’
(105) kʰ_	/kʰon-na-ɾa/	[ˈkʰodˌnaːɾa]	‘it’s broken’
(106) ˀt_	/ˀto-sã/	[ˈɗoːsã]	‘to be sharp’
(107) ˀl_	/ṵa̰ˀloh-su/	[w̰a̰ˈˀlohsu] ~ [w̰a̰ˈˀloːʰsu]	‘snail’

/o/ may also be followed by coda /t, ʔ, s, h, n, l, ˀk, hˀ/:

(108) _t	/kalot-na-ɾa/	[kaˈloːˌtãːɾa]	‘it’s leaking’
(109) _ʔ	/saʔuen-a-tʰoʔ-a/	[saʔˈweːnaˌtʰoːʔa]	‘big fire in the forest’
(110) _s	/hos-su/	[ˈhoʔtsu]	‘monkey’
(111) _h	/soh-a/	[ˈsoːha]	‘banana’
(112) _n	/uakon-na-ɾa/	[wa ˈkodˌnaːɾa]	‘he’s working’
(113) _l	/ol-sã/	[ˈoːʰl̥ã]	‘to get startled’
(114) _ˀk	/takoˀk(i)-su/	[taˈkoˀksu] ~ [taˈkoːˀkisu] ~ [taˈkoːkisu]	‘forest’
(115) _hˀ	/ohˀ-a/	[ˈohʔa]	‘sky’

3.1.3.1.5 /u/

/u/ is a high back rounded oral vowel. The allophones of /u/ are [u], [uː] and [ʊ].

Phonotactics

/u/ is attested following consonants /t, k, s, h, l, n, tʰ, kʰ, ˀt, ˀk, sˀ, ˀl/. It occurs in stressed (117) unstressed (118), or both positions (119) within a word. /u/ is attested word-initially, medially, or finally, as shown in (117), (121), and (118), respectively. /u/ is not found in syllables on its own, as it should follow and/or be followed by a consonant. When followed by a low vowel, /u/ is never realized as labial-velar glide [w], as in (121):

(116) #_	/ul-sã/	[ˈuːʰl̥a]	‘to be lazy, far’
(117) t_	/tuh-su/	[ˈtuːsu] ~ [tuːʰsu]	‘bee, honey’
(118) k_	/kanaku/	[kaˈnaːku]	‘some’
(119) s_	/a-su-su/	[ˌaːˈsuːsu]	‘bone’
(120) h_	/huˀk(i)-su/	[ˈhuˀkisu] ~ [ˈhuˀksu]	‘bow’
(121) l_	/alu-a/	[aˈluːa]	‘mouse (general)
(122) n_	/nanuh-su/	[naˈnuːsu] ~[naˈnuːʰsu]	‘slug’
(123) tʰ_	/tʰutʰun-na-ɾa/	[tʰuˈtʰudˌnaːɾa]	‘it’s crooked, bent’
(124) kʰ_	/kʰukʰul-su/	[kʰuˈkʰuːʰl̥u]	‘owl, sp.’
(125) ˀt_	/ˀtuhˀ-a/	[ˈɗuhʔa]	‘*urucum*’
(126) ˀk_	/a-ˀkun-a/	[ˌaːˈˀkuːna]	‘brow’

(127) sˀ_	/sˀul-su/	[ˈsˀuːʰl̥u]	‘mouse, sp.’
(128) ˀl_	/aˀlu-su/	[a̰ˈˀluːsu] ~ [aˈlṵːsu]	‘mantis’

/u/ may also be followed by the coda /t, s, h, n, l, ˀt, ˀk, hˀ/:

(129) _t	/ualut-a/	[waˈluːta]	‘paca’
(130) _s	/us-a/	[ˈuːsa]	‘tayra’
(131) _h	/ˀtuh-su/	[ˈɗuːsu] ~ [duhsu] ~ [duʰsu]	‘woman’
(132) _n	/tun-sã/	[tuᵈnᵗsã]	‘to be violet’
(133) _l	/ul-na-ɾa/	[ˈuːˌnaːɾa]	‘it’s far’
(134) _ˀt	/uˀt-su/	[ˈuːtsu] ~ [ˈuʔtisu]	‘potoo’
(135) _ˀk	/huˀk(i)-su/	[ˈhuˀkisu] ~ [ˈhuˀksu]	‘bow’
(136) _hˀ	/ualuhˀ-a/	[waˈluhʔa]	‘vulture’ (general)

3.1.3.2 Creaky Vowels

The creaky vowels occur less frequently than oral vowels. They are attested following almost all consonants, except for /p, pʰ, tʰ, kʰ, ʰn, sˀ, hˀ, ˀl, ˀn/. Creaky vowels may also be followed by the consonants /t, s, h, l, n, ˀk/ in the coda.

3.1.3.2.1 /ḭ/

/ḭ/ is a high front, unrounded, creaky voice vowel. The allophones of /ḭ/ are [ḭ] and [ḭː].

Phonotactics

/ḭ/ is attested following the consonants /t, k, h, l, ˀp, ˀt/. It mostly occurs in stressed positions within a word, but it may occur in unstressed positions if the stressed syllable is reduplicated (138). /ḭ/ occurs only word-initially (139) and medially (140). It is also found in syllables on its own (137).
The allophone [ḭː] is restricted to stressed positions if the syllable is underlyingly open or when the syllable coda is resyllabified, as in (139) and (140), respectively. When followed by the low central vowel /a/, /ḭ/ is never realized phonetically as palatal glides [j̰] or [ˀj], as shown in (137):

(137) #_	/ḭ-a-tu-ua/	[ˈḭːaˌtuːwa]	‘I’ll light it up’
(138) t_	/tḭtḭn-na-ɾa/	[tḭˈtḭdˌnaːɾa] ~ [dḭˈdḭdˌnaːɾa]	‘it’s black’
(139) k_	/kḭ-su/	[ˈkḭːsu]	‘termite’
(140) h_	/a-hḭl-su/	[ˌaːˈhḭːɾʰu]	‘liver’
(141) l_	/ta̰lḭh-su/	[ta̰ˈlḭːsu] ~ [ta̰ˈlḭːʰsu]	‘nanday parakeet’
(142) n_	/nḭs-a-nek(i)-su/	[ˈnḭːsaˌneːkisu]	‘herb, sp.’
(143) ˀp_	/ˀpḭˀpḭt-aˀli-su/	[ɓḭˈɓḭːtaˀlisu] ~ [bḭˈbḭːtaˌlḭːsu]	‘finch, sp.’
(144) ˀt_	/a-ˀtḭ-su/	[aˈɗḭːsu] ~ [aˈdḭːsu]	‘belly, abdomen’

/ḭ/ may also be followed by the coda consonants /t, s, h, l, n/:

(145) _t	/kḭkḭt-su/	[kḭˈkḭːtsu]	‘cicada’
(146) _s	/nḭs-a-nek(i)-su/	[ˈnḭːsaˌneːkisu]	‘herb, sp.’
(147) _h	/ta̰lḭh-su/	[ta̰ˈlḭːsu] ~ [ta̰ˈlḭːʰsu]	‘nanday parakeet’
(148) _l	/a-hḭl-su/	[aˈhḭːɾʰu]	‘liver’

(149) _n	/tḭtḭn-na-ɾa/	[tḭˈtḭdˌnaːɾa] ~ [dḭˈdḭdˌnaːɾa]	‘it’s black’

3.1.3.2.2 /ḛ/

/ḛ/ is a mid-front unrounded creaky voice vowel. The allophones of /ḛ/ are [ḛ], [ḛː] and [ɪ̰].

Phonotactics

/ḛ/ follows the consonants /t, h, n, ˀp, ˀk, ˀn/. It is attested word-initially (152) and medially (160), only in stressed positions. /ḛ/ also occurs in syllables on its own, as in (150). /ḛ/ may be realized as [ɪ̰], when followed by a voiceless alveolar plosive [t] or glottal plosive [ʔ] in the coda, as in (151) and (158), respectively. If the coda is [t], [ɪ̰] is free variation with [ḛː]. However, [ɪ̰] only occurs if coda [t] is not resyllabified. In case resyllabification of [t] takes place, /ḛ/ is phonetically realized as [ḛː] following the vowel lengthening rule, as shown in (151):

(150) #_	/ḛ-su/	[ˈḛːsu]	‘swallow, sp.’
(151) t_	/ḭa̰tḛt-su/	[ja̰ˈdɪ̰tsu] ~ [ja̰ˈdḛːtsu]	‘tick, sp.’
(152) h_	/hḛl-su/	[ˈhḛːɾʰu]	‘buriti’
(153) n_	/nḛ-su/	[ˈnḛːsu]	‘the Manduca’
(154) ˀp_	/ˀpḛl-su/	[ˈɓḛːɾʰu] ~ [ˈˀpḛːɾʰu]	‘melon’
(155) ˀk_	/ˀkḛl-su/	[ˈˀkḛːɾʰu]	‘urine, gall’
(156) ˀn_	/a-ˀnḛˀk(i)-su/	[aˈˀnḛːˀkisu]	‘leg, thigh’

/ḛ/ may be followed by consonants /t, s, l, ˀk/ in a simple coda:

(157) _t	/ḭa̰tḛt-su/	[ja̰ˈdɪ̰tsu] ~ [ja̰ˈdḛːtsu]	‘tick, sp.’
(158) _s	/ḛs-su/	[ˈɪ̰ʔtsu]	‘tobacco’
(159) _l	/ḛl-su/	[ˈḛːɾʰu]	‘cashew’
(160) _ˀk	/a-ˀnḛˀk(i)-su/	[aˈˀnḛ̃ːˀkisu]	‘leg, thigh’

3.1.3.2.3 /a̰/

/a̰/ is a low central unrounded creaky voice vowel. The allophones of /a̰/ are [a̰] and [a̰ː].

Phonotactics

/a̰/ follows consonants /t, k, s, h, l, n, ˀp, ˀt/. It is attested word-initially (161) and medially (163), in stressed (164) and unstressed positions (165). /a̰/ also occurs in syllables on its own, as in (166). Unstressed /a̰/ is the only creaky voice vowel to occur in unstressed syllables, other than reduplicated. Moreover, the presence of an unstressed /a̰/ implies that the nucleus of the stressed syllable is also creaky, as in (165) and (166). The allophone [a̰] mostly occurs in unstressed syllables, but it may occur in stressed syllables whose coda is not resyllabified (162). Note that, whenever [a̰] occurs in stressed positions within a word, stressed /a̰/ necessarily follows and is followed by a consonant (162):

(161) #_	/a̰l-su/	[ˈa̰ːʰl̥u]	‘armadillo, sp.’
(162) t_	/ta̰n-na-ɾa/	[ˈta̰dˌnaːɾa]	‘it’s bitter’
(163) k_	/uali(ˀn)-ka̰l-su/	[waliˈka̰ːʰlu]	‘manioc, sp.’
(164) s_	/ṵ̃ã̰ḭ̃s-a-sa̰l-su/	[ˌw̰̃ã̰j̰ːsaˈsa̰ːʰl̥u]	‘*imbira*’

(165) h_	/ha̰la̰t-su/	[ha̰ˈla̰ːtsu]	'comb, *pitomba*'
(166) l_	/a̰la̰-su/	[a̰ˈla̰ːsu]	'guan (general)'
(167) n_	/iana̰l-su/	[jaˈna̰ːʰl̥u]	'lizard, sp.'
(168) ˀp_	/ˀpa̰l-su/	[ˈɓa̰ːʰl̥u]	'Leishmaniasis'
(169) ˀt_	/ˀta̰-su/	[ˈɗa̰ːsu]	'rhea'

/a̰/ may be followed by consonants /t, l, n/ in the coda, as shown below:

(170) _t	/ha̰la̰t-su/	[ha̰ˈla̰ːtsu]	'comb, *pitomba*'
(171) _l	/a̰l-su/	[ˈa̰ːʰl̥u]	'armadillo, sp.'
(172) _n	/ta̰n-na-ɾa/	[ˈta̰dˌnaːɾa]	'it's bitter'

3.1.3.2.4 /o̰/

/o̰/ is a mid-back rounded creaky voice vowel. The allophones of /o̰/ are [o̰] and [o̰ː].

Phonotactics

/o̰/ follows consonants /k, l, n, ˀt/. It is attested word-initially (173) and medially (175), mostly in stressed (176) positions within a word. However, unstressed /o̰/ also occurs in reduplicated syllables, as in (174).
/o̰/ never occurs in syllables on its own: it follows or is followed by a consonant. [o̰] is restricted to unstressed syllables, as in (174), or when the syllable coda is a phonetic realization of /n/, as in (173):

(173) #_	/o̰n-na-ɾa/	[ˈo̰dˌnaːɾa]	'it's burning, it's burnt'
(174) k_	/ko̰ko̰-su/	[ko̰ˈko̰ːsu]	'enemy'
(175) l_	/alo̰-su/	[aˈlo̰ːsu]	'*tucumã*'
(176) n_	/no̰n-ḭa̰ṵ-a/	[ˈno̰ᵈnˌdʒʲa̰w̰ːa]	'noise'
(177) ˀt_	/ˀto̰l-sã/	[ˈɗo̰ːʰl̥ã]	'to feel cold'

/o̰/ may be followed by consonants /l, n/ in a simple coda.

(178) _l	/ˀto̰l-sã/	[ˈɗo̰ːʰl̥ã]	'to feel cold'
(179) _n/	o̰n-na-ɾa/	[ˈo̰dˌnaːɾa]	'it's burning, it's burnt'

3.1.3.2.5 /ṵ/

/ṵ/ is a high back rounded creaky voice vowel. The allophones of /ṵ/ are [ṵ] and [ṵː].

Phonotactics

/ṵ/ follows consonants /t, l, ˀt/. It is attested word-initially (182), medially (181), and least frequently word-finally (180). /ṵ/ is mostly attested in stressed (181) positions within a word, but it is also attested in unstressed positions, as in (180).
/ṵ/ never occurs in syllables on its own: it follows or is followed by a consonant. [ṵ] is restricted to unstressed syllables, as in (180):

(180) t_	/ˀkainãntṵ/	[ˀkajˈnãːdṵ] ~ [ˀkajˈnãndṵ]	‘if’
(181) l_	/a̰lṵt-su/	[a̰ˈlṵːtsu]	‘armadillo, sp.’
(182) ˀt_	/ˀtṵl-su/	[ˈɗṵːʰl̥u]	‘agouti’

/ṵ/ may be followed by consonants /t, l/ in a simple coda:

(183) _t	/a̰lṵt-su/	[a̰ˈlṵːtsu]	‘armadillo, sp.’
(184) _l	/ṵa̰lṵl-su/	[w̰a̰ˈlṵʰl̥u]	‘armadillo, sp.’

3.1.4 The [+nasal] Vowels

The [+nasal] vowels are comprised of eight segments, distributed in two symmetric series: four nasal vowels and four nasal and creaky voice vowels. As I describe in the following sections, although [+nasal] vowels may co-occur with an adjacent/tautosyllabic nasal consonant /n/ or a glottal fricative /h/, they are not restricted to such environments. In fact, many examples in which [+nasal] vowels occur independently are provided, which supports the claim that [+nasal] vowels are phonemic[70].

3.1.4.1 Nasal Vowels

Nasal vowels are the most frequent vowels among the [+nasal] sets of vowels. In general, they are attested following all consonants and may also be followed by most consonants that are licensed to occur in the coda. As I illustrate below, the mid-front unrounded nasal vowel /ẽ/[71] has a more restricted distribution, in comparison to the other phonemic nasal vowels. Moreover, nasal vowels may be followed by a coda.

3.1.4.1.1 /ĩ/

/ĩ/ is a high front unrounded nasal vowel. The allophones of /ĩ/ are [ĩ] and [ĩː].

Phonotactics

/ĩ/ is attested following consonants /t, k, s, h, l, n, t^h, ˀt, ˀl, ˀn/. It occurs most frequently in stressed positions (187) within a word, but it may occur in unstressed positions, as in (188). /ĩ/ occurs mostly word-initially (187) and medially (190), but it is also attested word-finally, as in (188) with the listing suffix {-ĩ}. /ĩ/ also occurs in syllables on its own (185).
Allophone [ĩ] is restricted to two different environments: unstressed syllables and when /ĩ/ is followed by a glottal plosive [ʔ], as in (186) and (194), respectively. Note that, when followed by a low central vowel /a/, /ĩ/ is never realized phonetically as nasalized palatal glide [j̃], as shown in (185):

(185) #_	/ĩ-a-tu-ua/	[ˈĩːaˌtuːwa]	‘I’ll see/ bite it’
(186) t_	/uatĩtĩ-su/	[watĩˈtĩːsu]	‘dragonfly’
(187) k_	/kĩn-na-ɾa/	[ˈkĩːˌnaːɾa]	‘it’s tall’

[70] Despite this claim, unstressed oral vowels can be nasalized because of morphophonological rules. Nasalization in unstressed vowels is described in detail in Chapter 5.
[71] In my previous work (Netto 2018: 134), I claimed that the mid-front unrounded nasal vowel /ẽ/, as well as its nasal and laryngeal counterpart /ḛ̃/ were phonetic realizations of /e/ and /ḛ/ respectively. In this dissertation, I revisit my claim and provide evidence that both vowels are not nasalized in the surface but phonemic nasal vowels per se. See page 62 for minimal pairs.

(188) s_	/a-sĩn-ten-ĩ/	[aˈsĩːˈteːnĩ]	‘and meat (listing)’
(189) h_	/hĩn-a/	[ˈhĩːna] ~ [ˈhĩːnã]	‘now’
(190) l_	/talĩ-su/	[taˈlĩːsu]	‘woodpecker, sp.’
(191) n_	/ninĩ-su/	[niˈnĩːsu] ~ [nĩˈnĩːsu]	‘mosquito, sp.’
(192) tʰ_	/saʔuen-tʰĩn-a/	[sa̰ˈweːˌtʰĩːna]	‘village’
(193) ˀt_	/aˀtĩ-su/	[aˈɗĩːsu]	‘ani, sp.’
(194) ˀl_	/kuaˀlĩs-su/	[kwaˀlĩʔᵗsu]	‘*lambari*, sp.’
(195) ˀn_	/uaˀnĩn-na-ɾa/	[waˈˀnĩːˌnaːɾa]	‘he’s practicing *pajelança*’[72]

/ĩ/ may be followed by consonants /s, h, n, l, ˀl, ˀn/ in a simple coda:

(196) _s	/kuaˀlĩs-su/	[kwaˈˀlĩʔᵗsu]	‘*lambari*, sp.’
(197) _h	/ĩhneˀkaḭa̰ntita̰/	[ˌĩhneˀkaˈja̰ᵈndita̰]	‘what for’
(198) _l	/hĩhĩl-su/	[hĩˈhĩːɾʰṵ]	‘tinamou, sp.’
(199) _n	/saʔuen-tʰĩn-a/	[sa̰ˈweːˌtʰĩːna]	‘village’
(200) _ˀt	/kalĩˀt-a/	[kaˈlĩːɗa]	‘squirrel’
(201) _ˀl	/a-ĩˀl-a/	[ˌaːˈĩːˀɾa] ~ [ˌaːˈĩːɾa̰]	‘name’
(202) _ˀn	/nĩˀn-a/	[ˈnĩːˀna] [ˈnĩːna̰]	‘skunk’

3.1.4.1.2 /ẽ/

/ẽ/ is a mid-front unrounded nasal vowel. The allophones of /ẽ/ are [ẽ] and [ẽː].

Phonotactics

/ẽ/ is attested following consonants /t, k, s, n, l, tʰ, ˀn/. It occurs most frequently in stressed positions within a word (203), but it may occur in unstressed positions if reduplicated (205). /ẽ/ occurs only word-initially (208) and medially (206), and it is also found in syllables on its own (203):

(203) #_	/ẽˀki̩-na-ɾa/	[ˈẽːˀkiˌnaːɾa]	‘it’s heating up’
(204) t_	/tẽn-su/	[ˈtẽːdzu]	‘drums’
(205) k_	/ã-kẽkẽn-ih-na-ɾa/	[ãkẽkẽˈnihˌnaːɾa]	‘it’s mixed up’
(206) s_	/nṵ̃s-ẽn-su/	[ˈnṵ̃ːˌsẽnᵈzu]	‘pestle’
(207) n_	/a-nẽk(i)-a/	[aˈnẽːka]	‘head’
(208) tʰ_	/tʰẽ-kaˀt-su/	[ˈtʰẽːˌkaːˀtisu]	‘tree, sp.’
(209) ˀn_	/a-ˀnẽ-su/	[ˌaːˈˀnẽːsu]	‘noise’

/ẽ/ may be followed by consonants /h, n/ in a simple coda, as shown below:

(210) _h	/huˀk(i)-ẽh-su/	[ˌhuˈˀkẽh-su] ~ [ˌhuˈˀkẽːʰsu]	‘vine’
(211) _n	/huˀk(i)-ẽn-a/	[ˌhuˈˀkẽna] ~ [ˌhuˈˀkẽːna]	‘shotgun’

3.1.4.1.3 /ã/

/ã/ is a low central unrounded nasal vowel. The allophones of /ã/ are [ã] and [ãː].

[72] *Pajelança* is an indigenous ritual act performed by the *Pajé*.

Phonotactics

/ã/ is attested following consonants /p, t, k, ʔ, s, h, n, ˀp, ˀt, ˀn/. It is the most frequently attested nasal vowel along with /ĩ/. /ã/ occurs predominantly in stressed positions within a word (214) but it may occur in unstressed positions, regardless of reduplication, as is the case for certain morphemes, such as {ã-} in (212). /ã/ occurs word-initially (214), medially (215), but it is also attested word-finally (216). Furthermore, /ã/ is also found in syllables on its own (212).
The allophone [ãː] is restricted to stressed positions if the syllable is open (219) when the syllable coda is elided (218) or resyllabified (225):

(212)	#_	/ã-kẽkẽn-ih-na-ɾa/	[ãkẽˌkẽːˈnihˌnaːɾa]	‘it’s mixed up’
(213)	p_	/pãpãn-na-ɾa/	[pãˈpãːˌnaːɾa]	‘it’s over’
(214)	t_	/tãn-su/	[ˈtãːᵈzu] ~ [ˈtãnᵈzu]	‘frog, sp.’
(215)	k_	/uakãl-su/	[waˈkãːʰl̥u]	‘heron, sp.’
(216)	ʔ_	/ĩãteta̰-tel-a-ʔã/	[ˌɲãːˈteːta̰ˈdeːˌɾaːʔã]	‘what is it?’
(217)	s_	/sãl-su/	[ˈsãːʰl̥u]	‘macaw, sp.’
(218)	h_	/hãn-na-ɾa/	[ˈhãːˌnaːɾa]	‘it’s white’
(219)	l_	/alã-su/	[aˈlãːsu]	‘macaw (general)’
(220)	n_	/nã-na-ɾa/	[ˈnãːˌnaːɾa]	‘he’s drinking’
(221)	ˀp_	/iaˀpãn-su/	[jaˈɓãnᵈzu]	‘*taioba*’
(222)	ˀt_	/ˀtãn-na-ɾa/	[ˈɗãːˌnaːɾa]	‘it’s tight’
(223)	ˀn_	/a-ˀnãn-su/	[ˌaːˈˀnãːᵈzu]	‘leaf’

The coda segments that may follow /ã/ are /ʔ, s, h, n, l/[73]. It is the nasal vowel that may be followed by the widest variety of coda segments:

(224)	_ʔ	/te-iahlo-a-nãũʔ-a/	[ˈtʃahloˌnãːʔa]	‘they (masc.)’
(225)	_s	/nãs-a/	[ˈnãːsa]	‘tarantula’
(226)	_h	/tãtãh-su/	[tãˈtãhsu] ~ [tãˈtãːʰsu]	‘*curiaca*’
(227)	_n	/iaˀpãn-su/	[jaˈɓãnᵈzu]	‘*taioba*’
(228)	_l	/sãl-su/	[ˈsãːʰl̥u]	‘macaw, sp.’

3.1.4.1.4 /ũ/

/ũ/ is a high back rounded nasal vowel. The allophones of /ũ/ are [ũ] and [ũː].

Phonotactics

/ũ/ is attested following consonants /t, k, s, h, l, n, k^h, ˀt/. It is most frequently attested in stressed positions within a word (229). However, it may occur in unstressed positions if reduplicated (230) and in some compounds (231). Moreover, /ũ/ is only attested word-initially (239) and medially (234). Just like other nasal vowels, /ũ/ is also found in syllables on its own (229).
When followed by the low central vowel /a/, /ũ/ is never realized phonetically as a nasalized labial-velar glide [w̃], as shown in (229):

(229)	#_	/ũ-a/	[ˈũːa]	‘capybara’
(230)	t_	/ialan-a-tũtũˀt-ki-su/	[jaˈlaːnatũˈtũːˀkisu]	‘*araçari*’
(231)	k_	/kũ-nek(i)-su/	[kũˈneːkisu]	‘sucupira’

[73] Although no coda /t/ was attested following /ã/, I assume that it is likely that a (C)ãt syllable occurs in Kithãulhu.

(232) s_	/sũn-t(i)-a-t(e)-aitã/	[ˈsũːdaˌtajːtã]	‘yesterday’
(233) h_	/hũn-na-ɾa/	[ˈhũːˌnaːɾa]	‘it’s pink’
(234) l_	/alũ-su/	[aˈlũːsu]	‘tapir’
(235) n_	/a-nũ-su/	[ˌaːˈnũːsu]	‘people’
(236) kʰ_	/kʰũn-a/	[ˈkʰũːna]	‘wolf apple’
(237) ˀt_	/a-ḭṵ̃-si-ˀtũ-su/	[ˌaːˈj̰ṵ̃ːsiˈɗũːsu]	‘heel’

The coda segments that may follow /ũ/ are /t, h, n, l/:

(238) _t	/uatũt-su/	[waˈtũːtsu]	‘tadpole’
(239) _h	/ũh-sul-sa-na-ɾa/	[ũhˈsuːʰl̥aˌnaːɾa]	‘he’s beating’
(240) _n	/hũn-na-ɾa/	[ˈhũːˌnaːɾa]	‘it’s pink’
(241) _l	/haˀnũl-su/	[haˈˀnũːʰl̥u]	‘pineapple, sp.’

3.1.4.2 Nasal Creaky Vowels

Nasal creaky voice vowels display both nasal and creaky voice features simultaneously. They are the least frequently attested vowels in the data, probably because they are very marked segments. There are four nasal creaky vowels, namely /ḭ̃, ḛ̃, ã̰, ṵ̃/, of which /ḛ̃/ is the rarest, with very few occurrences in the data. Generally, nasal creaky voice vowels occur in stressed syllables. Whenever they occur in unstressed positions, it is mostly by means of reduplication[74]. The simultaneous nasal and creaky voice features also seem to posit phonotactic constraints regarding which segments they follow, and which segments are followed by them within the syllable. They may follow all consonants, except for /p, pʰ, tʰ, kʰ, ʰn, hˀ, ˀl/. Only four segments, namely /t, s, l, n/, are licensed to follow nasal creaky voice vowels in the coda. Consequently, syllables whose nucleus is a nasal and creaky vowel display the most restrictive phonotactic constraints for the coda.

3.1.4.2.1 *ḭ̃/*

/ḭ̃/ is a high front unrounded nasal and creaky voice vowel. The allophones of /ḭ̃/ are [ḭ̃] and [ḭ̃ː].

Phonotactics

/ḭ̃/ is attested following consonants /t, k, s, h, n, ˀk/. It occurs exclusively in stressed positions within a word. /ḭ̃/ occurs word-initially (243) and medially (244), and it is also found in syllables on its own (242).
When followed by a low vowel /a/, /ḭ̃/ is never realized phonetically as a palatal nasal and creaky glide [j̰̃], as shown in (242). The allophone [ḭ̃] only occurs if /ḭ̃/ is followed by a voiceless glottal plosive [ʔ] (244). /ḭ̃/ is not reduplicated:

(242) #_	/ḭ̃-a-tu-ua/	[ˈḭ̃ːˌaːˈtuːwa]	‘I’ll plant (it)’
(243) t_	/tḭ̃-a-tu-ua/	[ˈtḭ̃ːˌaːˈtuːwa]	‘I’ll approach’
(244) k_	/a-nekḭ̃s-su/	[ˌaːneˈkḭ̃ʔᵗsu]	‘hair’
(245) s_	/sḭ̃-su/	[ˈsḭ̃ːsu]	‘storm’
(246) h_	/hḭ̃-na-ɾa/	[ˈhḭ̃ːˌnaːɾa]	‘it’s sticky’
(247) n_	/a-nḭ̃t-ẽn-su/	[aˈnḭ̃ːˌtẽːᵈzu]	‘thorax’
(248) ˀk_	/ˀkḭ̃-su/	[ˀkḭ̃ːsu]	‘hawk, sp.’

[74] Creaky voice and nasal vowel features, however, are not always reduplicated.

The coda segments that may follow /ḭ̃/ are /t/ and /s/:

(249) _t	/a-nḭ̃t-ẽn-su/	[aˈnḭ̃ːˌtẽːᵈzu]	‘thorax’
(250) _s	/a-nekḭ̃s-su/	[ˌaːneˈkḭ̃ʔᵗsu]	‘hair’

3.1.4.2.2 /ḛ̃/

/ḛ̃/ is a mid-front unrounded nasal and creaky voice vowel. The allophone of /ḛ̃/ is [ḛ̃ː].

Phonotactics

/ḛ̃/ is attested following consonants /t, l, n, ˀt, ˀn/. It only occurs in stressed positions within a word. Note that /ḛ̃/ is not reduplicated as illustrated in (251). /ḛ̃/ is attested word-initially (254) and medially (255). It is not attested within syllables on its own:

(251) t_	/uatḛtḛ̃-su/	[wadḛˈdḛ̃ːsu]	‘butterfly’
(252) l_	/a-kilḛ̃l-su/	[ˌaːkiˈlḛ̃ːɾʰu]	‘sting’
(253) n_	/ianal-a-nḛnḛ̃-su/	[jaˌnaːlanẽˈnḛ̃ːsu]	‘cougar’
(254) ˀt_	/ˀtḛ̃ˀl-su/	[ˈdḛ̃ːɾʰṵ]	‘fly (general)’
(255) ˀn_	/a-ˀnḛ̃ˀk(i)-su/	[aˈˀnḛ̃ːˀkisu]	‘wing’

The only coda segments attested in the data following /ḛ̃/ are /l, ˀl/:

(256) _l	/a-kilḛ̃l-su/	[ˌaːkiˈlḛ̃ːɾʰu]	‘sting’
(257) _ˀl	/ˀtḛ̃ˀl-su/	[ˈdḛ̃ːɾʰṵ]	‘fly (general)’

3.1.4.2.3 /ã̰/

/ã̰/ is a low central unrounded nasal and creaky voice vowel. The allophones of /ã̰/ are [ã̰] and [ã̰ː].

Phonotactics

/ã̰/ is attested following consonants /l, n, ˀt, ˀk/. It occurs in stressed positions within a word. Moreover, /ã̰/ is also attested in syllables on its own, as in (258). [ã̰] is most frequently found if the nasal coda /n/ is phonetically realized, as in (261):

(258) #_	/ã̰ˀli-na-ɾa/	[ˈã̰ːˀliˌnaːɾa]	‘it’s different’
(259) l_	/ĩãlã̰son-na-ɾa/	[j̃ãlã̰ˈsodˌnaːɾa]	‘he’s thin’
(260) n_	/nã̰-su/	[ˈnã̰ːsu]	‘otter’
(261) ˀt_	/ˀtã̰n-na-ɾa/	[ˈdã̰ːˌnaːɾa] ~ [ˈdã̰nˌnaːɾa]	‘it’s trapped’
(262) ˀk_	/ta̰ˀkã̰ta̰ˀkã̰-su/	[ta̰ˌˀkã̰ːta̰ˈˀkã̰ːsu]	‘hawk, sp.’

The only coda segment attested in the data following /ã̰/ is /n/:

(263) _n	/ˀtã̰n-na-ɾa/	[ˈdã̰ːˌnaːɾa] ~ [ˈdã̰nˌnaːɾa]	‘it’s trapped’

3.1.4.2.4 /ṵ̃/

/ṵ̃/ is a high back rounded nasal and creaky voice vowel. The allophones of /ṵ̃/ are [ṵ̃] and [ṵ̃ː].

Phonotactics

/ṵ̃/ is attested following consonants /t, k, s, h, l, n, ˀt, sˀ/. It only occurs in stressed positions within a word. /ṵ̃/ occurs only word-initially (266) and medially (269), and it is also found in syllables on its own, as in (264). When followed by a nasal /n/, /ṵ̃/ is realized as [ṵ̃] if the nasal is phonetically realized. It is never realized phonetically as labial-velar nasal and creaky voice glide [w̰̃] when it is followed by a low central vowel /a/, as shown in (270):

(264) #_	/ṵ̃-su/	[ˈṵ̃ːsu]	‘bee, sp.’
(265) t_	/ĩ-tṵ̃n-na-ɾa/	[ĩˈtṵ̃ːˌnaːɾa]	‘he licks’
(266) k_	/kṵ̃n-su/	[ˈkṵ̃nᵈzu]	‘cotton, *timbó*’
(267) s_	/sṵ̃n-a/	[ˈsṵ̃ːna]	‘grandfather, god’
(268) h_	/hṵ̃n-na-ɾa/	[ˈhṵ̃ːˌnaːɾa]	‘it looks like’
(269) l_	/kalṵ̃-na-ɾa/	[kaˈlṵ̃ːˌnaːɾa] ‘	‘it’s sprouting’
(270) n_	/a-nṵ̃-a/	[aˈnṵ̃ːa]	‘dough’
(271) ˀt_	/ˀtṵ̃n-na-ɾa/	[ˈɗṵ̃ːˌnaːɾa] ~ [ˈdṵ̃ːˌnaːɾa]	‘it’s sucking’
(272) sˀ_	/sˀṵ̃n-na-ɾa/	[ˈsˀṵ̃ːˌnaːɾa]	‘it’s tasteless’

The only coda segment attested in the data following /ṵ̃/ is /n/:

(273) _n	/ˀtṵ̃n-na-ɾa/	[ˈɗṵ̃ːˌnaːɾa] ~ [ˈdṵ̃ːˌnaːɾa]	‘it’s sucking’

3.1.5 Summary of Vowel Distribution

Table 40 summarizes the vowel distribution in relation to syllable structure. Note that, even though vowels may share one same feature, such as height, they follow a particular distributional pattern, which defines phonotactic constraints for each of them:

Table 40:Vowel distribution in relation to syllable structure.

Vowel			Onset	Coda
front	high	/i/	/p, t, k, ʔ, s, h, l, n, pʰ, tʰ, kʰ, ʰn, ˀt, ˀk, sˀ, hˀ, ˀl, ˀn/	/t, k, s, h, n, l, ˀt, hˀ, ˀn/
		/ḭ/	/t, k, h, l, ˀp, ˀt/	/t, s, h, l, n/
		/ĩ/	/t, k, s, h, l, n, tʰ, ˀt, ˀl, ˀn/	/s, h, n, l, ˀl, ˀn/
		/ḭ̃/	/t, k, s, h, n, ˀk/	/t, s/
	mid	/e/	/t, k, s, h, l, n, tʰ, kʰ, ʰn, ˀt, ˀk, sˀ, ˀl, ˀn/	/t, ʔ, h, n, l, hˀ/
		/ḛ/	/t, h, n, ˀp, ˀk, ˀn/	/t, s, l, ˀk/
		/ẽ/	/t, k, s, n, l, tʰ, ˀn/	/h, n/
		/ḛ̃/	/t, l, n, ˀt, ˀn/	/l, ˀl/
central	low	/a/	/p, t, k, ʔ, s, h, l, ɾ, n, pʰ, tʰ, kʰ, ʰn, ˀt, ˀk, sˀ, hˀ, ˀl, ˀn/	/t, k, ʔ, h, n, l, ˀt, ˀk, hˀ, ˀn/
		/a̰/	/t, k, s, h, l, n, ˀp, ˀt/	/t, l, n/
		/ã/	/p, t, k, ʔ, s, h, n, ˀp, ˀt, ˀn/	/ʔ, s, h, n, l/
		/ã̰/	/l, n, ˀt, ˀk/	/n/

<table>
<tr><th colspan="3">Vowel</th><th>Onset</th><th>Coda</th></tr>
<tr><td rowspan="6">back</td><td rowspan="2">mid</td><td>/o/</td><td>/p, t, k, s, h, l, n, p^{h}, t^{h}, k^{h}, ${}^{ʔ}t$, ${}^{ʔ}l$/</td><td>/t, ʔ, s, h, n, l, ${}^{ʔ}k$, $h^{ʔ}$/</td></tr>
<tr><td>/o̰/</td><td>/k, l, n, ${}^{ʔ}t$/</td><td>/l, n/</td></tr>
<tr><td rowspan="4">high</td><td>/u/</td><td>/t, k, s, h, l, n, t^{h}, k^{h}, ${}^{ʔ}t$, ${}^{ʔ}k$, $s^{ʔ}$, ${}^{ʔ}l$/</td><td>/t, s, h, n, l, ${}^{ʔ}t$, ${}^{ʔ}k$, $h^{ʔ}$/</td></tr>
<tr><td>/ṵ/</td><td>/t, l, ${}^{ʔ}t$/</td><td>/t, l/</td></tr>
<tr><td>/ũ/</td><td>/t, k, s, h, l, n, k^{h}, ${}^{ʔ}t$/</td><td>/t, h, n, l/</td></tr>
<tr><td>/ṵ̃/</td><td>/t, k, s, h, l, n, ${}^{ʔ}t$, $s^{ʔ}$/</td><td>/n/</td></tr>
</table>

According to Table 40, you can see that the consonants in the coda are usually a subset of the onset consonants. In other words, segments that occur in the coda after a vowel are usually also allowed to occur in the onset. However, if a segment precedes a vowel in the onset, it does not imply that it is licensed to occur in the other edge of the syllable, namely the coda.

3.2 Vowel Sequences

One of the challenges in the description of the Kithãulhu vowel system is the issue of how to address vowel sequences and analyze them in the underlying representation. As seen so far, Kithãulhu displays, at least in the surface representation, vowel + glide [VG], glide + vowel [GV], as well as glide + vowel + glide [GVG] sequences.

We have also seen that lengthened and non-lengthened vowels are phonetically distinguished in stressed syllables. The stressed position within a word provides the phonetic environment for short vowels to be realized as lengthened vowel allophones, mainly in sequences of open syllables within a single polysyllabic morpheme (e.g. the root and certain suffixes) or across morphemes, even if monosyllabic, at morpheme boundaries.

To shed light upon this issue of how to describe and phonologically analyze vowel-glides and related sequences, we turn to Culhane (2023), who addresses the topic of how to phonologically analyze phonetic diphthongs, phonetic vowel + glide sequences, and long vowels, in the case that length is distinctive at the phonological level.

In this section I will address how sequences of two or more vowels are analyzed in the underlying representation, which, in turn, will be a relevant topic to stress assignment, presented in Chapter 4.

As I have demonstrated, vowel sequences are distinguished and classified into two main categories: heterosyllabic, i.e., vowels which belong to different syllables, and monosyllabic, which denotes at least two vowels pertaining to a single unit, namely the nucleus of an underlying syllable. Glides, such as [w, j] do occur in the surface representation, but they are analyzed as underlying high vowels, which are phonetically realized as on- and off-glides at syllable edges, in subsequent sections of this work.

3.2.1 Complex Vowel Phenomena

In her analytical typological study, Culhane (2021: 54) points out that languages differ in terms of how they are analyzed regarding the occurrences of phonetic diphthongs and phonetic sequences of vowels and glides. This topic is especially relevant in determining whether a given language is classified as having weight-sensitive feet, for instance. As the author remarks based on Sands (2004), Crystal (2008), and Rehg (2007), in the literature, diphthongs are usually referred to as a vocalic phenomenon, in which vowels change at syllable boundaries, becoming then more gliding and, consequently, less sonorous.

From this theoretical assumption, the same transcription of a vowel glide sequence [VG] may be analyzed differently with regard to its phonological input, as shown in Table *41*:

Table 41: Different analyses for the same transcribed vowel – glide sequence, adapted from and based on Culhane (2021: 50).

Representation		**Description**	**Classification (Analysis)**
Surface	**Underlying**		
[VG]	/V_1V̯$_2$/	a single unit diphthong, weight-sensitive or not	True diphthong analysis
	/V/ + /G/, /VG/	a sequence of a vowel + glide	Vowel + Glide sequence analysis
	/V_1/ + /V_2/, /V_1V_2/	a sequence of two vowels, with both vowels belonging to the same syllable	Monosyllabic Vowel sequence analysis
	/V_1/ + /V_2/, /$V_1.V_2$/	a sequence of two vowels, with each vowel belonging to a different syllable	Disyllabic Vowel sequence analysis

According to Table *41*, transcriptions of [VG] sequences may be analyzed in four different ways in the underlying representation: a single unit diphthong, a sequence of a vowel + glide, a sequence of two vowels with both vowels belonging to the same syllable and a sequence of two vowels with each vowel belonging to a different syllable. Since the very same transcription may render different possibilities for analysis, Culhane (2021: 50) refers to this phenomenon using the term “complex vocalic phenomena.”

This term will be used in this dissertation to encompass under the same umbrella a phonetic diphthong or sequence of vowels, regardless of whether they are tauto- or heterosyllabic. Overall, I show that Kithãulhu distinguishes between two types of vowel sequences described in Culhane’s framework, namely: heterosyllabic (disyllabic), i.e., vowels which belong to different syllables, corresponding to Culhane’s disyllabic vowel sequence analysis; and monosyllabic, which denotes at least two vowels pertaining to a single phonological unit, namely the syllable. Both vowel sequences may be classified according to a set of criteria, mainly based on morphophonological structures and constraints, discussed in the following sections.

3.2.1.1 How Monosyllabic and Heterosyllabic Vowel Sequences are Distinguished in the Phonological Representation

To illustrate how vowel sequences are patterned and classified, it is necessary to understand the basics of Kithãulhu’s morphophonological structure, which will be covered in depth in Chapters 4 and 5. For the time being, I will address vowel lengthening, as well as nasality and phonation values, and correlate them with complex vowel phenomena, to posit the criteria to distinguish monosyllabic and heterosyllabic vowels in the phonological representation.

3.2.1.1.1 Vowel Lengthening

As seen so far, long vowels are allophones of underlying short vowels, mostly conditioned by a specific phonological environment, namely the stressed syllable, and mostly if its host syllable is underlying open. Vowel lengthening typically takes place at morpheme boundaries, as shown below:

(274) /alu-a/ [aˈl**u**ːa] ‘mouse (general)’

(275) /^{ʔ}ta-nũ-a/	[ˌɗ**a**ːˈn**ũ**ːa]	‘my people’
(276) /ĩ-na-ɾa/	[ˈ**ĩ**ːˌn**a**ːɾa]	‘he sees’

Vowel lengthening is also dependent on morphological structure and loss of coda material via syllabification or elision.

a) Coda resyllabification:

(277) /il-a/	[ˈ**i**ːɾa]	‘howler monkey’
(278) /tẽn-a/	[ˈt**ẽ**ːna]	‘drum’
(279) /hos-a/	[ˈh**o**ːsa]	‘monkey (general)’
(280) /hoh-a/	[ˈh**o**ːha]	‘tinamou (general)’

b) Elision followed by compensatory lenghthening:

(281) /kanah-su/	[kaˈn**a**ːsu] ~ [ka ˈ n**a**ː^{h}su], but *[kaˈnaː**h**su]	‘woodpecker, sp.’
(282) /tãn-su/	[ˈt**ã**ː^{d}zu]	‘frog, sp.’

Vowel lengthening also seems to be used to establish boundaries between sequences of vowels which belong to different morphemes. Not only is lengthening employed to provide extra weight to a syllable or maintain the syllable weight after coda material is lost, but also to distinguish syllables belonging to different adjacent morphological structures.
In complex vowel phenomena, lengthening is also employed to distinguish vowels and glides belonging to different morphemes in the surface representation. Note that, whenever lengthening takes place at morpheme boundaries, there is no syllabification, as expected with consonantal coda material as seen in (277) - (280):

a) VG#V

(283) /alai-a/	[aˈl**aj**ː**a**]	*[aˈlaː**ja**]	‘sloth’
(284) /ialau-a/	[jaˈl**aw**ː**a**]	*[jaˈlaː**wa**]	‘ring’

b) GV#V

(285) /ũ̯ĩ̯-a/	[ˈ**w̰̃ḭ̃**ː**a**]	*[ũ̯ˈ**j̃a**ː]	‘frog, sp.’
(286) /ũẽ-a/	[ˈ**w̃ẽ**ː**a**]	*[ũˈ**ẽ̃**ːa]	‘dove, sp.’
(287) /ĩũ-a/	[ˈ**j̃ũ**ː**a**]	*[ĩˈ**w̃a**ː]	‘tick (general)’

c) V#V

(288) /i-a-tu-ua/	[ˈ**i**ː**a**ˌtuːwa]	*[ˈ**ja**ːˌtuːwa]	‘I’ll fetch (it)’
(289) /ũ̯-a/	[ˈ**ṵ̃**ː**a**]	*[ˈ**w̰̃a**ː]	‘bee, sp.’

d) GVG#V

(290) /ũãĩ-ẽn-su/	[ˈ**w̃ãj̃**ːˌ**ẽ**ː^{d}zu]	*[ˈ**w̃ã**ːˌ**j̃ẽ**ː^{d}zu]	‘anteater hole’
(291) /ahũl-i̯a̯u̯-a/	[aˈhũːˌl**j̰a̰w̰**ː**a**]	*[aˈhũːˌl**j̰a̰**ː**w̰a**]	‘water’

Examples above on a), b), c), and d) show that vowel lengthening is also used to distinguish sequences of vowels belonging to different syllables, as well as a strategy to keep glides from being resyllabified, even when the morphophonological environment offers optimal conditions for resyllabification. Vowel lengthening is also a crucial phonetic implementation rule to assign stress to the syllable of a polysyllabic root, which shares sequences of light syllables in the underlying representation, as I show in Chapter 4.

Table *42* shows the morphophonological environments in which lengthened vowels occur:

Table 42: Morphophonological environments in which lengthened vowels occur.

<table>
<tr><th colspan="4">Lengthened Vowel (Phonetic)</th></tr>
<tr><th>Morphological Structure</th><th>Type</th><th>Morphophonological Environment</th><th>Obligatoriness</th></tr>
<tr><td rowspan="2">Root</td><td>monosyllabic</td><td>before mandatory suffix, if syllable is light underlyingly</td><td>obligatory</td></tr>
<tr><td>polysyllabic</td><td>rightmost syllable before mandatory suffix if all syllables are light underlyingly.</td><td>obligatory</td></tr>
<tr><td rowspan="2">Affixes</td><td>possessive prefix</td><td>before root</td><td>optional</td></tr>
<tr><td>suffix</td><td>penultimate syllable within the verbal string before Aspect /Gender morpheme</td><td>obligatory</td></tr>
</table>

As illustrated in Table *42*, lengthened vowels fall into two different categories according to morphological structure, namely 1) roots and 2) affixes. In all cases, vowel lengthening occurs across morphemes, and is mostly obligatory within the root. If the root is monosyllabic, its only vowel will become lengthened if no coda material is found in the surface representation. In case it is polysyllabic, the rightmost syllable becomes lengthened if all syllables are light underlyingly. However, certain affixes are also eligible to be lengthened, namely the possessive prefixes, in the case of nouns, and the penultimate syllable within the verbal string, which is lengthened due to the penultimate syllable sentence stress rule, discussed in Chapter 4.

3.2.1.1.2 Values for Nasality and Phonation Type

Another relevant criterion to distinguish vowel sequences belonging to the same syllabic unit from the ones pertaining to different syllabic sequences is the values for nasality and phonation type. As illustrated in examples (292) - (295), Kithãulhu allows different values for nasality and phonation type within the same morpheme. In other words, the same polysyllabic morphological structure may display nuclei with [+ nasal] and [-nasal] as well as [+ creaky voice] and [-creaky voice] vowels:

(292) /alũ-su/	[**a**ˈl**ũ**ːsu]	'tapir'
(293) /kalṵ̃-na-ɾa/	[k**a**ˈl**ṵ̃**ːˌnaːɾa]	'it's sprouting'
(294) /tа̰ˀkã̰tа̰ˀkã̰-su/	[t**а̰**ˌˀk**ã̰**t**а̰**ˈˀk**ã̰**ːsu]	'hawk, sp.'
(295) /iaˀpãn-su/	[j**a**ˈɓ**ã**n^{d}zu]	'*taioba*'

In polysyllabic morphemes, the ultimate syllable displaying a creaky voice vowel implies that the vowel of the penultimate syllable is also creaky, as in (296):

(296) /а̰lṵt-su/	[**а̰**ˈl**ṵ**ːtsu]	'armadillo, sp.'

In contrast, a nasal vowel in an ultimate syllable of a morpheme does not require the vowel of the penultimate syllable to have the same value for nasality, even if the ultimate vowel within the morpheme also displays a simultaneous creaky phonation, as illustrated in (297) and (298), respectively:

(297) /alã-a/ [**a**ˈ**lã**ːa] ~ [aˈlãːː] ‘macaw (general)’
(298) /kalṵ̃-na-ɾa/ [**ka**ˈ**lṵ̃**ːˌ**na**ː**ɾa**] ‘it’s sprouting’

For reduplicated morphemes whose ultimate syllable has a nasal creaky voice vowel, the nucleus of the penultimate syllable must be creaky when reduplicated, as shown in (294). The issue of shared features of vowels is crucial in understanding how heterosyllabic vowels can be distinguished in terms of different values for nasality and phonation type, even if it involves a high vowel followed by a low vowel (300), as illustrated below:

(299) /ḛ-a/ [ˈ**ḛ**ːa] ‘swallow’
(300) /ũ-a/ [ˈ**ũ**ːa] *[ˈw̃aː] ‘capybara’

As shown in examples (299), even if vowels in both syllables share the value for nasality, but differ regarding the phonation type, resyllabification does not take place. To illustrate that both phonation type and values for nasality must be considered in determining whether two or more adjacent vowels belong to the same syllable, we can turn to example (301). In this example, all vowels display the [+nasal] feature. Note that, regardless of sharing the same value for nasality, vowels belonging to different simultaneous syllables are not resyllabified, as they do not share the same phonation type:

(301) /ṵ̃ḭ̃-ẽn-su/ [ˈ**w̰̃ḭ̃**ːˌ**ẽ**ː^{d}zu] *[ṵ̃ˈ**j̰̃ẽ**ː^{d}zu] ‘frog hole’

3.2.1.1.3 Morphological Structure

Morphological structure must also be considered to distinguish vowels belonging to different syllables. Example (302) shows that, even if both vowels share the same value for nasality and phonation type, they are never resyllabified because they belong to separate morphological and phonological structures:

(302) /alũ-ẽn-su/ [aˈl**ũ**ː**ẽ**ː^{d}zu] *[aˈl**w̃ẽ**ː^{d}zu] ‘tapir hole’

3.2.1.1.4 Sequences of High Vowels /ii/ and /uu/

Another crucial point regarding the phonetic realization of vowel sequences concerns the phonetic realizations of sequences containing the same vowels, such as /ii/ and /uu/. In such scenario, homorganic heterosyllabic high vowels will be phonetically realized as [GV] in unstressed positions and as [GVː] or [GVC] in stressed positions (the latter case, if the ultimate syllable within the morpheme has a coda which was not resyllabified). Once again, a high and low vowel sequence [iːa] is never realized as [jaː], as in shown in (303):

(303) /uaii-a/ [waˈ**ji**ːa] *[**waj**ˈ**i**ːa] *[**waj**ˈ**ja**ː] ‘palm tree, sp.’
(304) /uaḭ̃ḭ̃ˀl-su/ [waˈ**jḭ̃**ːˀɾu] *[**waj**ˈ**ḭ̃**ːˀɾu] ‘ant, sp.’
(305) /uuuun-na-ɾa/ [**wu**ˈ̃**wu**dˌnaːɾa]̃ ‘he’s clumsy’

Note that if two high vowels belong to different morphological structures, they are not realized within the same syllable:

(306) /i-i-ɾa/ [ˈ**i**ːˌ**i**ːɾa] *[ˈ**j̰i**ːɾa] ‘you’re fetching’

Table *43* summarizes the criteria used to distinguish heterosyllabic from monosyllabic vowel sequences.

Table 43: Main criteria to distinguish heterosyllabic from monosyllabic vowel sequences.

Vowel Sequences	
Heterosyllabic	**Monosyllabic (Diphthongs and Triphthongs)**
May share the same value for nasality.	Share the same value for nasality. Thus: V_1[+nasal], V_2 [+ nasal] V_1[-nasal], V_2 [-nasal]. However: *V_1[-nasal] V_2[+nasal], * V1[+nasal] V_2[-nasal].
Occur across morphemes boundaries.	Occur within the same morpheme.
May share the same phonation type (creaky voice or modal phonation).	Share the same phonation type (creaky voice or modal phonation).
May share the same value for height, roundness and backness.	Usually do not share the same value for height, but roundness and backness may be shared.
If first or last vocalic segment is a high vowel at morpheme boundaries, it is never phonetically realized as a glide.	If first or last segment is a high vowel, it is always phonetically realized as a glide.
Are distinguished from other heterosyllabic vowels in terms of vowel duration in the surface representation.	Are distinguished from other heterosyllabic vowels in terms of vowel duration in the surface representation.

Based on the information in Table *43*, we can distinguish diphthongs and triphthongs (monosyllabic vowel sequences) from heterosyllabic vowel sequences. In this analysis, glides are assumed to be phonetic realizations of monosyllabic underlying high vowels at the syllable edges, whereby they become less sonorous in the onset and offset of an adjacent vowel within the same syllabic unit. In other words, diphthongs are phonetically realized as glide – vowel, vowel – glide, whereas glide – vowel – glide sequences are derived from triphthongs. In diphthongs and triphthongs, every vowel must share the same value for nasality and phonation type. This criterion should be taken into consideration to determine whether sequences of vowels belong to the same or different syllabic units in the underlying representation. Phonetic cues are also employed to determine whether vowels belong to different syllabic units, and the most relevant for this analysis is lengthening. Furthermore, when lengthening is used to determine the assignment of vowels to different syllables, the morphological structure should also be accounted for, as lengthened vowels predominantly occur across morphemes, to set boundaries between them. The morphological structure is also employed to explain why glides and vowels are never patterned with adjacent vowels if they belong to distinct morphemes. In this point of view, Kithãulhu is analyzed under the assumption that vowels may be patterned in sequences of two or three vowels (monosyllabic/ true diphthong analysis) and that sequences of two or more vowels may also belong to different adjacent syllables, usually across morphemes (heterosyllabic analysis).

3.2.2 Heterosyllabic Vowel Sequences

Heterosyllabic vowel sequences involve two vocalic segments, whose second element is usually a low vowel. Sequences of vowels, whose segment is any vowel other than a low vowel, also occur, but less frequently. In heterosyllabic vowel sequences, every vowel is interpreted as an independent syllable structure pertaining to different morphemes. As discussed, such vowels can be easily identified in terms of vowel duration, as well as whether they share the

same values for nasality and phonation type. Heterosyllabic vowels occur most predominantly across morphemes, but sequences of heterosyllabic vowels are also attested within the same morpheme, in case it is polysyllabic (e.g., roots/stems).
The following subsections show five subsets in which heterosyllabic vowels are attested. They are classified according to vowel height to illustrate the permissible vowel sequences in the language.

a) Subset 1: Vowel + Low Vowel

In this first subset, the vowel of the ultimate syllable of a root is followed by a low vowel of an attached suffix:

(307) /i-a-tu-ua/	[ˈ**i**ː**a**ˌtuːwa]	‘I’m fetching (it)’
(308) /e-a-tu-ua/	[ˈ**e**ː**a**ˌtuːwa]	‘I’ll speak’
(309) /a-ta-a/	[ˌaːˈt**a**ː**a**] ~ [ˌaːˈtaː]	‘evil spirit’
(310) /halo-a/	[haˈl**o**ː**a**]	‘field’
(311) /alu-a/	[aˈl**u**ː**a**]	‘mouse (general)

Note that vowels share the same phonation type and value for nasality, but the first vocalic segment in (307) and (308) contrast in duration with the second vocalic segment in the surface representation since length is not contrastive underlyingly. If a root ends up with a low central vowel /a, a̰, ã, ã̰/, and the following morpheme is low vowel initial, the low vowel of the following morpheme can be elided, as illustrated in (309).
As in (307), sequences comprised of high vowel /i/ and low vowel /a/ are not phonetically realized as [ja]. However, both [ja] and [tja] are attested, as in (312) and (313), respectively[75]:

(312) /ian-na-ɾa/	[ˈ**ja**dˌnaːɾa]	‘he’s eating’
(313) /te-iahlo-a/	[ˈtʃahla] [ˈ**tja**ː^{h}la] [ˈtʃ**ja**ː^{h}la]	‘he’

Therefore, the phonetic realizations described in (314) and (315) never occur:

(314) /i-a-tu-ua/	*[ˈ**ja**ːˌtuːwa]	‘I’ll fetch it’
(315) /ian-na-ɾa/	*[**i**ˈ**a**dˌnaːɾa]	‘he’s eating’

b) Subset 2: High Vowel + High Vowel

Subset 2 occurs whenever a high vowel of a root is followed by another high vowel from a suffix. It is not as frequently attested as subset 1:

(316) /i-i-ɾa/	[ˈ**i**ːˌ**i**ːɾa] *[ˈ**ji**ːɾa]	‘you are fetching (it)’

c) Subset 3: High Vowel + Mid Vowel

Subset 3 is comprised of a high vowel occurring in the root, which is followed by a suffix with an initial mid vowel. Note that both vowels are at morpheme boundaries and share the same phonation type and value for nasality, but they are not phonetically realized as a glide + vowel sequence.

[75] Examples with [swa] and [lwa] are not given because they are not attested due to phonotactic constraints, discussed in Chapter 4 on the syllable structure.

(317) /alũ-ẽn-su/ [aˈl**ũ**ː**ẽ**ː^{d}zu] *[aˈl**w̃ẽ**ː^{d}zu] ‘tapir hole’

d) Subset 4: Mid Vowel + Mid Vowel

Subset 4 is not frequently attested, but it encompasses sequences of mid-vowels at morpheme boundaries.

(318) /alo̰-ẽn-su/ [aˌl**o̰**ːˈ**ẽ**ː^{t}su] *[aˈl**o̰ẽ**ː^{t}su] ‘*tucumã* hole’

e) Subset 5: High Vowel + Diphthong

Another subset of heterosyllabic vowels is comprised of a high back rounded vowel /u/ followed by a rising diphthong /ua/, a monosyllabic vowel sequence which is phonetically realized as [wa]:

(319) /sul-sa-tu-ua/ [ˈsuː^{h}l̥aˌ**tu**ːwa] ‘I’ll beat (it)’
(320) /e-a-tu-ua/ [ˈeːaˌ**tu**ːwa] ‘ ‘I’ll speak’

Heterosyllabic vowel sequences are avoided if the rightmost syllable of a root is unstressed. In such cases, vowel /a/ belonging to suffix {-a} is resyllabified:

(321) /iahlo-a/ [ˈjahl**a**] *[jahl**oa**] ‘old man’
(322) /tĩhno-a/ [ˈtĩhn**a**] *[tĩhn**oa**] ‘road’

More information on syllabification can be found in Chapter 4.

3.2.3 Monosyllabic Vowel Sequences: Diphthongs and Triphthongs

Diphthongs and triphthongs are monosyllabic vowel sequences comprised of two or more adjacent and consecutive vowels, which belong to the same phonological unit (the syllable). Both diphthongs and triphthongs are categorized according to the following observations:

a) They are comprised of an initial or a final high vowel (or both, in the case of triphthongs), which is phonetically realized as a glide.
b) All vowels belonging to a diphthong or triphthong share the same value for nasality and phonation type. Therefore, phonetic glides occurring in the peripherical edges of syllables may be realized as oral, nasal, creaky, or nasal creaky depending on the vowel they follow or are followed. Hence, diphthongs such as */ãu/, and */ḭẽ/ are not attested since the vowels in both examples differ in relation to phonation type and/or nasality value.
c) Whenever reduplicated, all vowels belonging to the sequence are copied.

Although rare, minimal pairs between monophthongs and diphthongs are attested, as illustrated in the example /a/ x /ai/. Some monophthongs and diphthongs are also contrastive in analogous environments:

/a/, /ai/

[ˈh**a**dˌnaːɾa] ‘it’s bright’
[ˈh**aj**ᵈnˌnaːɾa] ‘he’s singing’

/a/, /ua/

[k**a**ˈlãj̃ːsu] ‘beetle’ (general)
[k**wa**ˈlajːsu] ‘spider’ (general)

/i/, /ui/

[ˈ**i**ːɾʰu] ‘howler monkey’
[saˈ**wi**ːɾʰu ˈ] ‘parakeet’

/a̰/, /ã̰ṵ̃/

[ˈ**ã̰w̰̃**ːʰl̥u] ‘parrot’
[ˈ**a̰**ːʰl̥u] ‘armadillo, sp.’

Diphthongs are very frequently attested in opposition to other diphthongs, as illustrated below.

Diphthong Oppositions

/ue/, /ũẽ/, /ṵ̃ḛ̃/, /ũĩ/

[ˈ**we**ːna] ‘*bacava*’
[ˈ**w̃ẽ**ːna] ‘*várzea* forest’
[ˈ**w̰̃ḛ̃**ːna] ‘grass, sp.’
[ˈ**w̃ĩ**ːna] ‘father’

/ie/, /ḭ̃ḛ̃/

[aˈ**je**ːtsu] ‘nest’
[aˈ**j̰̃ḛ̃**ːsu] ‘thorn’

/ṵḭ/, /ṵ̃ḭ̃/

[aˈ**w̰ḭ**ːsu] ‘his tooth’
[aˈ**w̰̃ḭ̃ːsu**] ‘his frog’

/ie/, /ḭḛ/

[aˈ**je**ːɾa] ‘his bladder’
[aˈ**j̰**ḛːa] ‘his scream’

/ui/, /uo/, /uu/

[**wi**ˈ**wi**dˌnaːɾa] ‘it’s blue’
[woˈ**wo**dˌnaːɾa] ‘it’s hurting’
[wuˈ**wu**dˌnaːɾa] ‘it’s clumsy’

/ia/, /ḭa̰/

[**ja**ˈteːɾa] ‘fish, sp.’
[**j̰a̰**ˈtḛːta] ‘tick, sp.’

/ua/, /ũã/

[**wa**ˈkodˌnaːɾa] ‘he’s working’
[**w̃ã**ˈkodˌnaːɾa] ‘it’s leftover’

/ḭo̰/ /ḭṵ/

[aˈ**jo̰**ːˀkisu] ‘intestine, guts’
[aˈ**j̰̃ṵ**ːˀkisu] ‘foot’

/ṵ̃ã̰/, /ṵ̃ḛ̃/, /ui/

[ˌaːsaˈ**w̰̃ã̰**ːˀna] ‘his ant, sp.’
[ˌaːsaˈ**w̰̃ḛ̃**ːɾa] ‘his tail’
[ˌaːsaˈ**wi**ːɾa] ‘his parakeet’

/iu/, /ĩũ/

[ˈ**ju**ːsu] ‘bee, sp.’
[ˈ**j̃ũ**ːsu] ‘tick (general)’

/ṵḛ/, /ie/

[aˈ**je**ːta] ‘nest’
[aˈ**w̰ḛ**ːta] ‘body hair’

/ii/, /ḭḭ/

[waˈ**ji**ːɾa] ‘hawk, sp.’
[waˈ**j̰ḭ**ːɾa̰] ‘ant, sp.’

/ai/, /ãĩ/ | **/ãũ/, /a̰ṵ/**

[kaˈl**ãj̃**ːsu] ‘beetle’ (general) | [ˈh**ãw̃**ːsu] ‘*lambari*, sp.’
[kwaˈl**aj**ːsu] ‘spider’ (general) | [ˈh**a̰w̰**ːsu] ‘maned wolf’

/ai/, /ã̰ḭ̃/ | **/au/, /ã̰ṵ̃/**

[ˈh**aj**ʔ^{t}su] ‘warrior, war, grass’ | [yaˈl**aw**ːsu] ‘ring’
[ˈh**ã̰j̰̃**ːɾ^{h}u] ‘ball’ | [yaˈl**ã̰w̰̃**ːsu] ‘palm tree, sp.’

3.2.3.1 Diphthongs

Diphthongs are classified according to the nasalization value and phonation type of vowels. Table 44 and Table 45 show [-nasal] diphthongs attested in the language. Table 44 displays modal phonation, while Table 45 shows creaky voice phonation:

Table 44: Oral diphthongs.

V1↓	i	e	a	o	u	←V2
i	ii	ie	ia	io	iu	
e						
a	ai				au	
o						
u	ui	ue	ua	uo	uu	

Table 45: Creaky voice diphthongs.

V1↓	ḭ	ḛ	a̰	o̰	ṵ	←V2
ḭ	ḭḭ	ḭḛ	ḭa̰	ḭo̰	ḭṵ	
ḛ						
a̰	a̰ḭ				a̰ṵ	
o̰						
ṵ	ṵḭ	ṵḛ	ṵa̰			

As illustrated in Table 44 and Table 45, [-nasal] diphthongs series are asymmetric, since */ṵo̰/ and /ṵṵ/ are not attested. Amongst the diphthongs, /uo/ is one of least frequently attested with just three samples in the data followed by /uu/ with just one occurrence.
The [+nasal] diphthongs are presented below. Once again, they are separated in terms of phonation type in Table 46 and Table 47:

Table 46: Nasal diphthongs.

V1↓	ĩ	ẽ	ã	ũ	←V2
ĩ			ĩã	ĩũ	
ẽ					
ã	ãĩ			ãũ	
ũ	ũĩ	ũẽ	ũã		

Table 47: Nasal creaky diphthongs.

V1↓	ḭ̃	ẽ	ã̰	ṵ̃	←V2
ḭ̃		ḭ̃ḛ̃			
ḛ̃					
ã̰	ã̰ḭ̃			ã̰ṵ̃	
ṵ̃	ṵ̃ḭ̃	ṵ̃ḛ̃	ṵ̃ã̰		

Just like the [-nasal] diphthongs, [+nasal] diphthongs also comprise two asymmetric sets. The asymmetry is given due to the absence of */ĩẽ/, */ḭ̃ã̰/, and */ḭ̃ṵ̃/, which are not attested. As shown in Table 47, nasal creaky diphthong /ḭ̃ḛ̃/ is attested, but it is the least frequent diphthong in the data, with just one sample. Based on the information in the tables in this section, it is possible to argue that there are 35 diphthongs in the language.
Diphthongs are also classified into two categories, namely falling, and rising, which are distinguished in terms of vowel quality prominence (high pitch) at the syllable edges. In the phonetic representation, falling diphthongs display a low central vowel followed by a glide [w, j], which has a less prominent degree and always assimilates the phonation type and value for

nasality of the preceding vowel. In contrast to falling diphthongs, rising diphthongs display an initial glide [w, j] followed by a vowel with a high prominence degree, which determines the phonation type and value for nasality of the glide they follow. Thus, there are eight falling diphthongs /ai, au, a̰ḭ, a̰ṵ, ãĩ, ãũ, ã̰ḭ̃, ã̰ṵ̃/ and 27 rising diphthongs /ii, ie, ia, io, iu, ḭḭ, ḭḛ, ḭa̰, ḭo̰, ḭṵ, ĩã, ĩũ, ḭ̃ḛ̃, ui, ue, ua, uo, uu, ṵḭ, ṵḛ, ṵa̰, ũĩ, ũẽ, ũã, ṵ̃ḭ̃, ṵ̃ḛ̃, ṵ̃ã̰/.
As I demonstrate in the following sections, diphthongs have a different distribution in relation to monophthongs. One of the most salient distributional differences is related to the consonants they may follow. In contrast with monophthongs, diphthongs may follow a small set of consonants, a fact motivated by phonotactic constraints.
In general, falling diphthongs may follow all consonants licensed to occur in the onset, except for /ɾ, ˀp, hˀ/. Rising diphthongs can follow consonants, which usually share the same place of articulation, e.g. [+coronal] vowel follows [+ coronal} consonant. Hence, high front vowel initial diphthongs, such as /ii, ia, ie, ĩũ/ are only attested following voiceless coronal plosive /t/.
However, phonetic realizations such as [hja], [hjo], and [nji] occur whenever the coda of a prefix is resyllabified. Such syllables are not permissible in the underlying representation. Rising diphthongs with creaky phonation type such as /ḭḭ, ḭḛ, ḭa̰, ḭo̰, ḭṵ, ĩã, ĩũ, ḭ̃ḛ̃ /do not follow any onset consonants in the underlying representation.
Other rising diphthongs starting with a high back vowel, namely /ue, ua, ṵḭ, ṵḛ, ṵa̰, ũĩ, ũẽ, ũã, ṵ̃ḭ̃, ṵ̃ḛ̃, ṵ̃ã̰/ can only follow velar consonants, such as /k, k^h, ˀk/. An exception to this observation is given by /uo/, which is only attested on its own, or followed by coda /n/. Another difference between monophthongs and diphthongs lies in the consonantal segments that may follow them in the syllable coda. There are attestations of diphthongs followed by consonants /t, k, ʔ, s, h, l, n, ˀt, ˀk, sˀ, ˀl, ˀn/.
Diphthongs typically have two allophones, whose distribution is dependent on stress. In stressed positions within a word, diphthongs are phonetically realized as a glide + lengthened vowel sequences [GVː], in the case of rising diphthongs; and vowel + a lengthened glide [VGː], in the case of falling diphthongs[76]. Falling and rising diphthongs are phonetically realized as [VG] and [GV], respectively, in unstressed positions, or whenever a coda consonant is phonetically realized.

3.2.3.1.1 Oral Diphthongs

There are 12 oral diphthongs, of which two are falling and ten are rising, namely /ai, au/ and /ii, ie, ia, io, iu ui, ue, ua, uo, uu/, respectively. Oral diphthongs comprise the most numerous sets of diphthongs in the data. Amongst all sets of diphthongs, oral diphthongs are the most likely to be reduplicated. Syllables with diphthongs are often onsetless, but /ii, ie, ia/ are attested following alveolar plosive /t/. Additionally, some diphthongs with initial back high vowels, namely, /ui, ue, ua/ can follow velar plosives. Oral diphthongs /ai, au/ follow most consonants, except /ɾ, ˀp, hˀ, ˀn, ˀl/. In contrast to /ai/, /au/ does not follow /sˀ/. As for the codas, oral diphthongs are only attested followed by /t, k, ʔ, s, h, l, n, ˀt, sˀ, ˀn/.

3.2.3.1.1.1 /ii/

/ii/ is a rising diphthong. The allophone of /ii/ is [jiː].

[76] A more detailed phonetic analysis also points out that falling diphthongs can be phonetically realized as a long vowel followed by a glide, i.e. [VːG]. Since occurrences of [VːG] are less frequently attested in comparison with the occurrences of [GVː], they are not described in the following sections.

Phonotactics

/ii/ is attested in word-medial position in stressed syllables. Allophone [jiː] occurs in stressed positions within a word, as in (325). [ji] can follow voiceless alveolar plosive /t/, as in (326), and be followed by alveolar liquid /l/ in the coda, as in (324):

(323) /uaii-su/	[waˈjiːsu]	‘palm tree, sp.’
(324) /uaiil-a/	[waˈjiːɾa]	‘hawk, sp.’
(325) /an-ii-tu-ɾa/	[aˈnjiːˌtuːɾa]	‘stop!’ (command)
(326) /heh-ˀna-ʔ-na-tii-ʔa/	[ˈhehˀnaˀnaːˌtʃiːʔa]	‘aren’t you hungry?’

3.2.3.1.1.2 /ie/

/ie/ is a rising diphthong. The allophones of /ie/ are [je] and [jeː].

Phonotactics

/ie/ is attested in word-initial (328) and medial (329) positions, in stressed (330) and unstressed (328) syllables. [je] occurs in unstressed positions within a word (328), whereas [jeː] is restricted to stressed syllables, as in (328). /ie/ may be followed by coda /t/ (329), /k/ (327), /l/ (330) and /n/ (331):

(327) /a-iek(i)-ki-su/	[aˈjeːkikisu]	‘eye’
(328) /ie-han-na-ɾa/	[jeˈhadˌnaːɾa]	‘he’s blind’
(329) /a-iet-a/	[aˈjeːta]	‘nest’
(330) /a-iel-a/	[aˈjeːɾa]	‘his bladder’
(331) /uien-a-ki-su/	[ˌuːˈtʃeːnakisu] ~ [ˌuːˈtjeːnakisu]	‘sun’

3.2.3.1.1.3 /ia/

/ia/ is a rising diphthong. The allophones of /ia/ are [ja] and [jaː].

Phonotactics

/ia/ is attested in word-initial (332) and medial (334) positions, in stressed (334) and unstressed syllables (335). [ja] occurs in unstressed positions, whereas [jaː] is restricted to stressed syllables, other than the ones with a coda if it is not resyllabified or assimilated. /ia/ may be followed by coda /ʔ/, /h/ and /n/, as in (336), (332) and (333), respectively:

(332) /iahlo-su/	[ˈjahlosu]	‘old man’
(333) /ian-su/	[ˈja^{d}n^{t}su]	‘jenipap’
(334) /te-iahlo-a/	[ˈtʃahla] [taˈt^{j}aːhla] [ˈtʃjaːhla]	‘he’
(335) /iatel-a/	[jaˈteːɾa]	‘fish, sp.’
(336) /iaʔual-a-uih-ẽn-su/	[jaʔˈwaːlaˈwiːˌhẽː^{d}zu]	‘possum, sp.’

3.2.3.1.1.4 /io/

/io/ is a rising diphthong. The allophones of /io/ are [jo] and [joː].

Phonotactics

/io/ is attested in word-initial (337), medial (339), and final (338) positions, in stressed (337) and unstressed (339) syllables. [jo] occurs in unstressed positions, whereas [joː] is restricted to stressed syllables, other than the ones with a nasal coda /n/. It may be followed by coda /k/ (337) and /n/ (340):

(337) /iok-a-nek(i)-su/	[ˌjoːkaˈneːkisu]	‘tree, sp.’
(338) /haio/	[haˈjoː]	‘hi’
(339) /ĩ-ioli-na-ɾa/	[ĩjoˈliːˌnaːɾa]	‘he’s swallowing’
(340) /uaioion-na-ɾa/	[wajoˈjodˌnaːɾa]	‘it’s wide’

3.2.3.1.1.5 /iu/

/iu/ is a rising diphthong. Since /iu/ is only attested in the data in stressed positions, its only allophone is [juː].

Phonotactics

/iu/ is only attested in word-initial positions, in stressed syllables. It may be followed by coda /l/, as in (342):

(341) /iu-su/	[ˈjuːsu]	‘worm’
(342) /iul-su/	[ˈjuːʰl̥u]	‘mouse, sp.’

3.2.3.1.1.6 /ai/

/ai/ is a falling diphthong. The allophones of /ai/ are [aj] and [ajː].

Phonotactics

/ai/ is attested in word-initial (343) and medial (350) positions in stressed (344) and unstressed syllables (351). [aj] occurs most frequently in unstressed (351) positions, except if followed by coda /n, s/ in stressed syllables, as in (346) and (348). On the other hand, [ajː] is restricted to stressed syllables, other than the ones with a coda /n, s, h/. /ai/ may be followed by coda /s/ (346), /h/ (344), /l/ (349), /n/ (348), /ˀt/ (345), and /sˀ/ (347):

(343) /ail-a-ua/	[ˈajːˌɾaːwa]	‘I’m hunting’
(344) /haih-na-ɾa/	[ˈhajhˌnaːɾa]	‘it’s copulating’
(345) /haiˀt(i)-su/	[ˈhajːɗisu]	‘matchsticks’
(346) /hais-su/	[ˈhajʔtsu]	‘war’
(347) /haisˀ-a/	[ˈhajːsˀa] ~ [ˈhajːsa̰]	‘crop’
(348) /hain-na-ɾa/	[ˈhajdˌnaːɾa]	‘he’s singing’
(349) /sa-sail-sã/	[saˈsajːɾʰã]	‘to shoot’
(350) /kualai-su/	[kwaˈlajːsu]	‘spider’ (general)
(351) /pʰaipʰail-su/	[pʰajˈpʰajːɾʰu]	‘frog, sp.’
(352) /tʰaili-ˀki-su/	[ˈtʰajːɾiˀkisu]	‘necklace’
(353) /ˀtai(li)-na/	[ˈɗajːna] ~ [ˈdajːnã]	‘I’
(354) /ˀkainãntṵ/	[ˀkajˈnãːdṵ] ~ [kajˈnãːdṵ]	‘if’

3.2.3.1.1.7 /au/

/au/ is a falling diphthong. The allophones of /au/ are [aw] and [aw:].

Phonotactics

/au/ is attested in word-initial (355) and medial (360) positions, in stressed (357) and unstressed reduplicated syllables (355). The allophone [aw] occurs most frequently in unstressed positions (355), except if followed by coda /n/ in stressed syllables (355). The allophone [aw:] is restricted to stressed syllables, other than the ones with a nasal coda /n/. /au/ may be followed by coda /t/ (357), /n/ (355), and /ˀt/ (359):

(355) /paupaun-na-ɾa/	[pawˈpaw^{b}mˌnaːɾa]	it’s flattened’
(356) /p^{h}aup^{h}aun-na-ɾa/	[p^{h}awˈp^{h}aw^{b}mˌnaːɾa]	‘it’s gray, dusty, grainy, floury’
(357) /taut-su/	[ˈtaw:tsu]	‘hawk (general)’
(358) /ialau-su/	[yaˈlaw:su]	‘ring’
(359) /hauˀt(i)-su/	[ˈhawːˀtisu] ~ [ˈhawːɗisu]	‘arrow’
(360) /a-ne-ˀtau-su/	[ˌaːneˈɗawːsu] ~ [ˌaːneˈdawːsu]	‘horn, antler’

3.2.3.1.1.8 /ui/

/ui/ is a rising diphthong. The allophones of /ui/ are [wi] and [wiː].

Phonotactics

/ui/ is only attested in word-initial (361) and medial (362) positions, in stressed (363) and unstressed (364) syllables. The allophone [wi] is restricted to unstressed syllables, or stressed syllables, whose coda is /n/ (364), as long as /n/ is not resyllabified. The allophone [wiː] is restricted to stressed syllables. /ui/ may follow /k/ (365) and /k^{h}/ (366) and be followed by coda /t/ (361), /h/ (362), /l/ (363), /n/ (364), and /ˀn/ (367):

(361) /uit(i)-su/	[ˈwiːtisu]	‘curassow’
(362) /iaʔual-a-uih-ẽn-su/	[jaʔˈwaːlaˈwiːˌhẽːdzu]	‘possum, sp.’
(363) /uil-na-ɾa/	[ˈwiːˌnaːɾa]	‘she’s pretty’
(364) /uiuin-na-ɾa/	[wiˈwidˌnaːɾa]	‘it’s blue’
(365) /kuil-su/	[ˈkwiːɾ^{h}u]	‘catfish, sp.’
(366) /k^{h}uit-su/	[ˈk^{h}wiːtsu]	‘*gravatá*’
(367) /kuiˀn-a-ki-su/	[ˈkwiːˀnakisu] ~ [ˈkwiːn̰akisu]	‘bird, sp.’

3.2.3.1.1.9 /ue/

/ue/ is a rising diphthong. The allophones of /ue/ are [we] and [weː].

Phonotactics

/ue/ is attested in word-initial (368) and medial (370) positions, in stressed (370) and unstressed syllables. [we] is restricted to unstressed syllables, or stressed syllables whose coda is /n/, as long as /n/ is not resyllabified (370). [weː] is restricted to stressed syllables. /ue/ may be followed by coda /t/ (369) and /n/ (370):

(368) /sa-uet-a-tu-ua/	[saˈweːtaˌtuːwa]	‘I’ll do it’
(369) /uen-su/	[ˈweᵈnᵗsu]	‘*bacava*’
(370) /saʔuen-su/	[saʔˈweᵈnᵗsu]	‘jungle’

3.2.3.1.1.10 /ua/

/ua/ is a rising diphthong. The allophones of /ua/ are [wa] and [waː].

Phonotactics

/ua/ is attested in word-initial (371), medial (372), and final (374) positions, in stressed (372) and unstressed (373) syllables. [wa] is restricted to unstressed (371) syllables, or stressed syllables whose coda is /n/ (372), as long as /n/ is not resyllabified. [waː] is restricted to stressed syllables. It may be followed by coda /n/, as in (372):

(371) /uakon-na-ɾa/	[waˈkodˌnaːɾa]	‘he’s working’
(372) /uauuaun-na-ɾa/	[waˈwawᵇmˌnaːɾa]	‘it’s flat’
(373) /kuaḭ̯a̰ˀt-ḭ̯a̰ṵ̯-su/	[kaˌja̰ˈtʃa̰w̰ːsu] ~ [kwaˌja̰ˈtʃa̰w̰ːsu]	‘*chicha*’
(374) /uakon-a-tu-ua/	[waˈ̃koːˌnaːˈtuːwa]	‘I’ll work’

3.2.3.1.1.11 /uo/

/uo/ is a rising diphthong. The only allophone of /uo/ is [wo]. It is the second least frequently attested oral diphthong.

Phonotactics

/uo/ is attested in word-initial and medial positions, in stressed and unstressed syllables. It may be followed by coda /n/:

(375) /uouon-na-ɾa/	[woˈwodˌnaːɾa]	‘it’s hurting’

3.2.3.1.1.12 /uu/

/uu/ is a rising diphthong. The only allophone of /uu/ is [wu]. It is the least frequently attested oral diphthong in the data.

Phonotactics

/uu/ is attested in word-initial and medial positions, in stressed and unstressed syllables. It may be followed by coda /n/:

(376) /uuuun-na-ɾa/	[wuˈwudˌnaːɾa]	‘he’s clumsy’

3.2.3.1.2 Creaky Voice

There are nine creaky voice diphthongs. /a̰ḭ̯, a̰ṵ̯/ are falling diphthongs, whereas /ḭ̯ḛ, ḭ̯a̰, ḭ̯o̰, ḭ̯ṵ, ṵ̯ḭ, ṵ̯ḛ, ṵ̯a̰/ are rising diphthongs. Creaky voice diphthongs are not so frequently attested, but they are the second most numerous sets of diphthongs in the data. Moreover, they seldom follow consonants in the onset, especially if they have an initial /ṵ̯/. However, creaky diphthongs with initial /u̯/ may follow voiceless velar plosive /k/. Diphthongs with initial /i̯/ never follow consonants. In contrast with the other attested sets of diphthongs, creaky voice diphthongs may be followed by coda /t, ʔ, n, l/ but they are more often followed by glottalized consonants /ˀt, ˀk, ˀl/.

3.2.3.1.2.1 /ḭ̯ḭ/

/ḭ̯ḭ/ is a rising diphthong. The only allophone of /ḭ̯ḭ/ is [j̰ḭː]. It is the least frequently attested [-nasal] creaky voice diphthong.

Phonotactics

/ḭ̯ḭ/ is attested in word-medial position, followed by coda /ˀl/:

(377) /uaḭ̯ḭˀl-a/	[waˈj̰ḭːˀɾa] ~ [waˈj̰ḭːɾa̰]	‘ant, sp.’

3.2.3.1.2.2 /ḭ̯ḛ/

/ḭ̯ḛ/ is a rising diphthong. The allophones of /ḭ̯ḛ/ are [j̰ḛ] and [j̰ḛː].

Phonotactics

/ḭ̯ḛ/ is attested in word-initial (378) and medial (380) positions within stressed (379) and unstressed reduplicated (378) syllables. [j̰ḛː] occurs in stressed positions, while [j̰ḛ] is usually attested in unstressed syllables or stressed syllables in case the coda of its host syllable is not resyllabified, as in (378). /ḭ̯ḛ/ may be followed by coda /t/ or /n/, as in (380) and (378), respectively:

(378) /ḭ̯ḛḭ̯ḛn-na-ɾa/	[j̰ḛˈj̰ḛdˌnaːɾa]	‘he’s feeling sick’
(379) /a-ḭ̯ḛ-su/	[aˈj̰ḛːa]	‘his scream’
(380) /a-ḭ̯ḛt-a-kaˀt-su/	[aˈj̰ḛːtaˌka̰ʔtsu]	‘neck’

3.2.3.1.2.3 /ḭ̯a̰/

/ḭ̯a̰/ is a rising diphthong. The allophones of /ḭ̯a̰/ are [j̰a̰] and [j̰a̰ː].

Phonotactics

/ḭ̯a̰/ is attested in word-initial (381) and medial (382) positions, in stressed (382) and unstressed (381) syllables. [j̰a̰] occurs in unstressed positions, whereas [j̰a̰ː] is restricted to stressed syllables. It may be followed by coda /ˀt/, /ˀk/, /ˀl/, as in, (382), (384), and (383) respectively:

(381) /ḭ̯a̰tḛt-a/	[j̰a̰ˈtḛːta]	‘tick, sp.’
(382) /kuaḭ̯a̰ˀt-a/	[k̰aˈj̰a̰ːta] ~ [kwaˈj̰a̰ːta]	‘corn’
(383) /a-ḭ̯a̰ˀl-a/	[aˈj̰a̰ːˀla] ~ [ˌaːˈj̰a̰ːla̰]	‘friend’
(384) /ḭ̯a̰ˀk(i)-su/	[ˈj̰a̰ːˀkisu] ~ [ˈj̰a̰ːkisu]	‘mouse, sp.

3.2.3.1.2.4 /i̯o̯/

/i̯o̯/ is a rising diphthong. Since /i̯o̯/ is only attested in stressed syllables, its only allophone is [j̰o̰ː].

Phonotactics

/i̯o̯/ is attested in word-medial positions within stressed syllables, as in (385) and (386). /i̯o̯/ may be followed by coda /ˀk/ (386):

(385) /a-i̯o̯-su/	[aˈj̰o̰ːsu]	‘mouth’
(386) /a-i̯o̯ˀk(i)-su/	[aˈj̰o̰ːˀkisu]	‘intestine, guts’

3.2.3.1.2.5 /i̯u̯/

/i̯u̯/ is a rising diphthong. /i̯u̯/ is only attested in stressed syllables. The only allophone of /i̯u̯/ is [j̰ṵː].

Phonotactics

/i̯u̯/ is attested in word-initial (387) and medial (388) positions within stressed syllables. /i̯u̯/ may be followed by coda /ˀk/ (388) and /ˀl/ (387):

(387) /i̯u̯ˀl-a/	[ˈj̰ṵːla̰]	‘knife’
(388) /a-i̯u̯ˀk(i)-su/	[aˈj̰ṵːˀkisu]	‘foot’

3.2.3.1.2.6 /a̰i̯/

/a̰i̯/ is a falling diphthong. The allophones of /a̰i̯/ are [a̰j̰] and [a̰j̰ː].

Phonotactics

/a̰i̯/ is attested in word-initial (389) and medial (391) positions, in stressed (390) and unstressed reduplicated syllables (391). [a̰j̰] occurs most frequently in unstressed positions (391), except if followed by coda /n/ in stressed syllables, as in (389). The allophone [a̰j̰ː] is restricted to stressed syllables, other than the ones with a coda /n/. /a̰i̯/ may be followed by coda /n/ (389) and /ˀk/ (390):

(389) /a̰i̯n-su/	[ˈa̰j̰ᵈnᵗsu] ~ [ˈa̰j̰ʔtʰu]	‘fish (general)’
(390) /a̰i̯ˀk(i)-a/	[ˈa̰j̰ːˀka] ~ [ˈa̰j̰ːka̰]	‘bird (general)’
(391) /ta̰i̯ta̰i̯n-na-ɾa/	[ta̰j̰ˈta̰j̰ᵍŋ̩ˌnaːɾa]	‘he’s feeling cold’

3.2.3.1.2.7 /a̰u̯/

/a̰u̯/ is a falling diphthong. The allophones of /a̰u̯/ are [a̰w̰] and [a̰w̰ː].

Phonotactics

/a̰u̯/ is attested in word-initial positions within stressed syllables, as in (392). The allophone [a̰w̰] most frequently occurs if followed by coda /n/, as in (393). [a̰w̰ː] is restricted to stressed syllables, other than the ones with a coda /n/, as in (392). /a̰ṵ/ may be followed by coda /n/, as in (393):

(392) /ha̰ṵ-su/	[ˈha̰w̰ːsu] ~ [ˈho̰ːsu]	'maned wolf'
(393) /a̰ṵn-na-ɾa/	[ˈa̰w̰ᵇmˌnaːɾa]	'it festers'

3.2.3.1.2.8 /ṵḭ/

/ṵḭ/ is a rising diphthong. /ṵḭ/ is only attested in stressed syllables. The only allophone of /ṵḭ/ is [w̰ḭː].

Phonotactics

/ṵḭ/ is only attested in word-medial positions within stressed syllables. /ṵḭ/ may be followed by coda /ˀk/, as in (395):

(394) /a-ṵḭ-su/	[aˈw̰ḭːsu]	'tooth'
(395) /kṵḭkṵḭˀk(i)-su/	[ˌkw̰ḭˈkw̰ḭːˀkisu] ~ [ˌkw̰ḭˈkw̰ḭʔksu]	'hawk, sp.'

3.2.3.1.2.9 /ṵḛ/

/ṵḛ/ is a rising diphthong. /ṵḛ/ is only attested in stressed syllables. The only allophone of /ṵḛ/ is [w̰ḛː].

Phonotactics

/ṵḛ/ is only attested in word-medial positions within stressed syllables. The only coda identified following /ṵḛ/ is /t/:

(396) /a-ṵḛt-a/	[aˈw̰ḛːta]	'hair, fur'

3.2.3.1.2.10 /ṵa̰/

/ṵa̰/ is a rising diphthong. The allophones of /ṵa̰/ are [w̰a̰] and [w̰a̰ː].

Phonotactics

/ṵa̰/ is only attested in word-initial positions within stressed (397) and unstressed (398) syllables (398). [w̰a̰] is attested in unstressed positions, whereas [w̰a̰ː] occurs in stressed syllables without a coda. /ṵa̰/ may be followed by coda /ʔ/ and /l/, as in (398) and (399), respectively:

(397) /ṵa̰-su/	[ˈw̰a̰ːsu]	'frog, sp.'
(398) /ṵa̰ʔien-ti-su/	[w̰a̰ʔˈjeᵈndisu]	'hawk, sp.'
(399) /kʰṵa̰l-su/	[ˈkʰw̰a̰ːʰl̥u]	'pineapple, sp.'

3.2.3.1.3 Nasal Diphthongs

There are seven nasal diphthongs, of which two are falling and five are rising, respectively /ãĩ, ãũ/ and /ĩã, ĩũ, ũĩ, ũẽ, ũã/. Nasal diphthongs are very frequently attested, but they occur less frequently in comparison to oral diphthongs. Just like their oral counterparts, falling diphthongs /ãĩ, ãũ/ follow most consonants, except for /ɾ, ˀp, pʰ, sˀ, hˀ, ˀn, ˀl/. Rising diphthongs /ũẽ, ũã/ can follow onset /k/, and /ĩũ/ is the only nasal diphthong attested following onset /t/. Nasal diphthongs may be followed by coda /t, k, ʔ, s, h, l, n/.

3.2.3.1.3.1 /ĩã/

/ĩã/ is a rising diphthong. The allophones of /ĩã/ are [j̃ã] and [j̃ãː].

Phonotactics

/ĩã/ is attested in word-initial (401) and medial (400) positions, in stressed (400) and unstressed (401) syllables. [j̃ã] occurs in unstressed positions, whereas [j̃ãː] is restricted to stressed syllables. /ĩã/ may be followed by coda /k/ as in (400):

(400) /a-ĩãk(i)-su/ [aˈj̃ãːkisu] ~ [aˈɲãːgisu] ‘lung’
(401) /ĩãũãĩãũã-ˀki-na-ɾa/ [j̃ãˌw̃ãːj̃ãˈw̃ãːˀkiˌnaːɾa] ~ [ɲãˌw̃ãɲãˈw̃ãːˀkiˌnaːɾa] ‘it’s smooth’

3.2.3.1.3.2 /ĩũ/

/ĩũ/ is a rising diphthong. The allophones of /ĩũ/ are [j̃ũ] and [j̃ũː].

Phonotactics

/ĩũ/ is attested in word-initial (402) and medial (403) positions, in stressed and unstressed (403) syllables (404). [j̃ũ] occurs in unstressed positions, whereas [j̃ũː] is restricted to stressed syllables. /ĩũ/ may follow /t/, as in (405), and it may be followed by coda /n/ as in (404):

(402) /ĩũ-su/	[ˈj̃ũːsu]	‘tick (general)’
(403) /ĩũĩũ-ki-su/	[j̃ũˈj̃ũːkisu] ~ [ɲũˈɲũːgisu]	‘earthworm’
(404) /ĩũn-na-ɾa/	[ˈj̃ũːˌnaːɾa]	‘it has’
(405) /tĩũ-na-ɾa/	[ˈtʃũːˌnaːɾa]	‘it’s small’

3.2.3.1.3.3 /ãĩ/

/ãĩ/ is a falling diphthong. The allophones of /ai/ are [ãj̃] and [ãj̃ː].

Phonotactics

/ãĩ/ is attested in word-initial (406) and medial (408) positions, in stressed (409) and unstressed (407) syllables. [ãj̃] occurs in unstressed positions. The allophone [ãj̃ː] is restricted to stressed syllables. /ãĩ/ may be followed by coda /t/, as in (406):

(406) /kãĩt(i)-su/	[ˈkãj̃ːtisu]	‘mouse, sp.’
(407) /uatãĩtãĩ-na-ɾa/	[watãj̃ˈtãj̃ːˌnaːɾa]	‘it’s thin’
(408) /kalãĩ-su/	[kaˈlãj̃ːsu]	‘beetle (general)’
(409) /hahãĩn-te-su/	[haˈhãj̃ːdesu]	‘The Hahãĩntesu’

3.2.3.1.3.4 /ãũ/

/ãũ/ is a falling diphthong. The allophones of /ãũ/ are [ãw̃] and [ãw̃ː].

Phonotactics

/ãũ/ is attested in word-initial (410) and medial (411) positions, in stressed (410) and unstressed syllables (413). [ãw̃] occurs in unstressed reduplicated positions. The allophone [ãw̃ː] is restricted to stressed syllables. If /ãũ/ is followed by coda /n/, [ãw̃ː] just occurs if the coda is not assimilated (413). /ãũ/ may be followed by coda /ʔ/ (411), /l/ (412), and /n/ (413):

(410) /hãũ-su/	[ˈhãw̃ːsu]	‘lambari’
(411) /a-nãũʔ-a/	[aˈnãw̃ːʔa]	‘egg’
(412) /ˀtãũl-su/	[ˈɗãw̃ː^{h}l̥u]	‘lizard, sp.’
(413) /uatãũuatãũn-na-ɾa/ ‘it’s round’	[waˌtãw̃waˈtãw̃mˌnaːɾa] ~ [waˌtãw̃waˈtãw̃ˌnaːɾa]	

3.2.3.1.3.5 /ũĩ/

/ũĩ/ is a rising diphthong. Since it is only attested in stressed syllables, the only allophone of /ũĩ/ is [w̃ĩː].

Phonotactics

/ũĩ/ is attested in word-initial positions within stressed syllables. /ũĩ/ may be followed by coda /n/:

(414) /ũĩn-a/	[ˈw̃ĩːna]	‘daddy’

3.2.3.1.3.6 /ũẽ/

/ũẽ/ is a rising diphthong. The allophones of /ũẽ/ are [w̃ẽ] and [w̃ẽː].

Phonotactics

/ũẽ/ is attested in word-initial (415) and medial (418) positions, in stressed (416) and unstressed syllables (418). [w̃ẽ] occurs in unstressed positions, as in (418). Allophone [w̃ẽː] is restricted to stressed syllables (415). /ũẽ/ may follow /k/ as in (420). It may also be followed by coda /k/ (420), /s/ (416), /h/ (417), /l/ (418), /n/ (419):

(415) /ũẽ-su/	[ˈw̃ẽːzu]	‘dove, sp.’
(416) /ũẽs-a/	[ˈw̃ẽːsa]	‘child’
(417) /ũẽh-a-ĩ̯ãũ̯-a/	[ˈw̃ẽːhaˌj̃ãw̰̃ːʔã̰]	‘rain’
(418) /ũẽũẽl-su/	[w̃ẽˈw̃ẽːɾ̃^{h}u]	‘wasp, sp.’
(419) /ũẽn-su/	[ˈw̃ẽː^{d}zu]	‘*várzea* forest’
(420) /k^{h}ũẽk^{h}ũẽk(i)-su/	[k^{h}w̃ẽˈk^{h}w̃ẽːkisu]	‘fan’

3.2.3.1.3.7 /ũã/

/ũã/ is a rising diphthong. The allophones of /ũã/ are [w̃ã] and [w̃ãː].

Phonotactics

/ũã/ is attested in word-initial (421) and medial (426) positions, in stressed (422) and unstressed syllables (421). [w̃ã] occurs in unstressed positions (421), and it is the only nasal diphthong that is contrastive in unstressed positions within a word. The allophone [w̃ãː] is restricted to stressed syllables. /ũã/ may follow /k/ as in (427). It may also be followed by coda /t/ (422), /s/ (424), /l/ (425), and /n/ (423):

(421) /ũãkon-na-ɾa/	[w̃ãˈkodˌnaːɾa]	‘it’s leftover’
(422) /ũãt-na-ɾa/	[ˈw̃ãːtãːɾa]	‘he’s grilling’
(423) /ũãn-na-ɾa/	[ˈw̃ãːˌnaːɾa]	‘it’s burning’
(424) /ũãs-a/	[ˈw̃ãːsa]	‘hat’
(425) /ũãl-a/	[ˈw̃ãːla]	‘hill’
(426) /a-ũãl-a/	[aˈw̃ãːla]	‘skin’
(427) /kũãl-su/	[ˈkw̃ãː ʰl̥u]	‘bee, sp.’

3.2.3.1.4 Nasal Creaky Diphthongs

There are six nasal creaky diphthongs, of which two are falling, namely /ã̰ḭ̃, ã̰ṵ̃/, and four are rising, namely /ḭ̃ḛ̃, ṵ̃ḭ̃, ṵ̃ã̰, ṵ̃ḛ̃/. Nasal creaky diphthongs are the least frequently attested in the data, and they also stand out among the least numerous sets of diphthongs in the data. /ḭ̃ḛ̃/ is the rarest nasal creaky diphthong, whereas /ã̰ḭ̃, ã̰ṵ̃/ are the most frequently attested. The only nasal creaky diphthongs that may follow consonants are /ã̰ḭ̃, ã̰ṵ̃, ṵ̃ã̰/. Nasal creaky diphthongs may be followed by plain consonants /l, n/ and glottalized consonants /ˀk, ˀl, ˀn/ in the coda.

3.2.3.1.4.1 /ḭ̃ḛ̃/

/ḭ̃ḛ̃/ is a rising diphthong. The only allophone of /ḭ̃ḛ̃/ is [j̰̃ḛ̃ː] since it is only attested in stressed syllables.

Phonotactics

/ḭ̃ḛ̃/ is attested in word-medial positions within stressed syllables. No coda was attested following /ḭ̃ḛ̃/:

(428) /a-ḭ̃ḛ̃-su/	[aˈj̰̃ḛ̃ːsu]	‘thorn’

3.2.3.1.4.2 /ã̰ḭ̃/

/ã̰ḭ̃/ is a falling diphthong. The allophones of /ã̰ḭ̃/ are [ã̰j̰̃] and [ã̰j̰̃ː].

Phonotactics

/ã̰ḭ̃/ is attested in word-initial (430) and medial (429) positions, in stressed (430) and unstressed syllables (429). [ã̰j̰̃] occurs in unstressed positions. The allophone [ã̰j̰̃ː] is restricted to stressed syllables (431). /ã̰ḭ̃/ may also be followed by coda /l/, as in (431):

(429) /tã̰ḭ̃tã̰ḭ̃l-su/	[tã̰j̰̃ˈtã̰j̰̃ːɾʰu]	‘cricket, sp.’
(430) /kã̰ḭ̃-nṵ̃-a/	[ˈkã̰j̰̃ːˌnṵ̃ːʔa]	‘coffee’
(431) /hã̰ḭ̃l-su/	[ˈhã̰j̰̃ːɾʰu]	‘ball’

3.2.3.1.4.3 /ã̰ṵ̯̃/

/ã̰ṵ̯̃/ is a falling diphthong. The only allophone of /ã̰ṵ̯̃/ is [ã̰w̰̃ː] because it only occurs in stressed syllables.

Phonotactics

/ã̰ṵ̯̃/ is attested in word-initial (432) and medial (435) positions within stressed syllables. /ã̰ṵ̯̃/ may follow /k/, as in (434). As for the coda, /ã̰ṵ̯̃/ may be followed by /l/ or /ˀl/, as in (434) and (433):

(432) /ã̰ṵ̯̃-sa-ʰna-ua/	[ˈã̰w̰̃ːsaˌʰnaːwa]	‘I’m hungry for meat’
(433) /ã̰ṵ̯̃ˀl-a/	[ˈã̰w̰̃ːˀla] [ˈã̰w̰̃ːla̰]	‘parrot’ (general)
(434) /kã̰ṵ̯̃l-su/	[ˈkã̰w̰̃ːʰl̥u]	‘yam, sp.’
(435) /ialã̰ṵ̯̃-su/	[yaˈlã̰w̰̃ːsu]	‘palm tree, sp.’

3.2.3.1.4.4 /ṵ̯̃ḭ̃/

/ṵ̯̃ḭ̃/ is a rising diphthong. The only allophone of /ṵ̯̃ḭ̃/ is [w̰̃ḭ̃ː] because it only occurs in stressed syllables.

Phonotactics

/ṵ̯̃ḭ̃/ is attested in word-initial positions within stressed syllables. /ṵ̯̃ḭ̃/ is not attested followed by a coda:

(436) /ṵ̯̃ḭ̃-su/	[ˈw̰̃ḭ̃ːsu]	‘frog, sp., potato’

3.2.3.1.4.5 /ṵ̯̃ã̰/

/ṵ̯̃ã̰/ is a rising diphthong. The only allophone of /ṵ̯̃ã̰/ is [w̰̃ã̰ː] because it only occurs in stressed syllables.

Phonotactics

/ṵ̯̃ã̰/ is attested in word-initial (437) and medial positions (438) within stressed syllables. /ṵ̯̃ã̰/ may follow /k/, as in (437). Furthermore, /ṵ̯̃ã̰/ may be followed by coda /ˀk/ and /ˀn/, as in (437) and (438), respectively:

(437) /kṵ̯̃ã̰ˀk(i)-su/	[ˈkw̰̃ã̰ːɠisu] ~ [ˈkw̰̃ã̰ːˀkisu]	‘grave, tomb’
(438) /saṵ̯̃ã̰ˀn-a/	[saˈw̰̃ã̰ːˀna]	‘ant, sp.’

3.2.3.1.4.6 /ṵ̯̃ḛ̃/

/ṵ̯̃ḛ̃/ is a rising diphthong. The only allophone of /ṵ̯̃ḛ̃/ is [w̰̃ḛ̃ː] because it only occurs in stressed syllables.

/ṵ̃ḛ̃/ is attested in word-initial (440) and medial (439) positions within stressed syllables. /ṵ̃ḛ̃/ may be followed by coda /l/ and /n/, as in (440) and (439), respectively:

(439) /ṵ̃ḛ̃n-su/	[ˈw̰̃ḛ̃ː^{d}zu]	‘grass, sp.’
(440) /a-saṵ̃ḛ̃l-a/	[ˌaːsaˈw̰̃ḛ̃ːɾa]	‘tail’

3.2.3.2 Triphthongs

Triphthongs are a series of three consecutive vowels belonging to one single syllable unit /VVV/ (monosyllabic). In /VVV/ sequences, a high vowel is followed by a low back vowel, which is then followed by another high vowel. Like what happens in diphthongs, the high vowels in the syllable edges surrounding the low central vowels will be realized as on- and off-glides. In such sequences, the glides must share the same value for nasality as well as the same phonation type of the low central vowel within the core of the sequence. In contrast with diphthongs, triphthongs are more limited with regard to the consonants, with which they make up syllables.

Triphthongs starting with /u/ may follow velar consonants such as /k, k^{h}, ^{ʔ}k/, whilst triphthongs with an initial high front vowel are not attested following any consonants.

Occurrences of triphthongs followed by a coda are relatively rare. When occurring with a coda, triphthongs may be followed by /s, h, n, l/. In this study, I was able to identify one sample of a nasal creaky triphthong /ṵ̃ã̰ḭ̃/. However, other nasal creaky voice triphthongs, such as */ḭ̃ã̰ḭ̃/, */ḭ̃ã̰ṵ̃/ and */ṵ̃ã̰ṵ̃/ are not attested. In general, all triphthongs are phonetically realized as [GVGː], except for reduplicated unstressed syllables, which render [GVG] sequences, and stressed oral diphthongs, whose coda is /n/.

Triphthong Oppositions:

/uai/, /ṵa̰ḭ/, /ũãĩ/	/ḭa̰ḭ/, /ĩãũ/
[ˈ**waj**ːsu] ‘toad, sp.’	[ˈ**ja̰j**ːɾa] ‘bee, sp.’
[ˈ**w̰a̰j**ːsu] ‘the Kithãulhu’	[ãˈ**j̃ãw̃**ːsa] ‘flower’
[ˈ**w̃ãj̃**ːsu] ‘anteater, sp.’	
/ṵa̰ḭ/, /ṵ̃ã̰ḭ̃/	/uau/, /iai/
[ˈ**w̰a̰j**ːsaˌneːkisu] ‘tree, sp.’	[ˈ**waw**^{b}mdisu] ‘whirlwind’
[ˈ**w̰̃ã̰j̃**ːsaˌneːkisu] ‘*imbira*, sp.’	[ˈ**jaj**^{g}ŋdisu] ‘food’

The distribution of triphthongs is presented in the following sections, organized into four main categories exactly as the ones in the sections on vowels and diphthongs: oral, nasal, creaky, and creaky nasal.

3.2.3.2.1 Oral Triphthongs

There are four oral triphthongs: /iai, uai, iau, uau/. Overall, oral triphthongs may be followed by coda /t, k, s, l, n/ or be reduplicated.

3.2.3.2.1.1 /iai/

/iai/ occurs in word-initial (443) and medial positions (441). It is not attested following consonants, except in the surface representation, if a morpheme final coda is resyllabified, as in (445). /iai/ may be followed by coda /t/ and /n/, as in (445) and (446), respectively. It has two allophones: [jaj] and [jajː]. [jaj] only occurs in stressed positions followed by coda /n/, as long as /n/ is not resyllabified (443). As shown in (446), /iai/ may be reduplicated.

(441) /kaiai-su/	[kaˈjajːsu]	‘hawk, sp.’
(442) /uaiai-aˀli-su/	[waˈjajːaˀlisu]	‘rattlesnake’
(443) /iain-ˀti-su/	[ˈjajᵍŋdisu]	‘food’
(444) /iain-(t)ihno-su/	[ˈjajːˌnihnosu]	‘leech’
(445) /ũh-iait-na-ɾa/	[ˌũːˈʰjajːˌtãːɾa]	‘he’s feeding (an animal)’
(446) /ua.iai.iain.na.ɾa/	[waˌjajːˈjajᵍŋˌnaːɾa]	‘it’s roomy’

3.2.3.2.1.2 /iau/

/iau/ is attested in word-initial (447) and medial (448) positions. It is not attested following consonants, but it may be followed by coda /k/. The only allophone of /iau/ is [jawː]:

(447) /iauk(i)-a-ṵḭ-su/	[ˈjawːkaˌw̰ḭːsu]	‘grater’
(448) /ˀta-iauk(i)-a-ṵḭ-a/	[ˌɗaˈjawːkaˌw̰ḭːa]	‘my grater’

3.2.3.2.1.3 /uai/

/uai/ is attested in word-initial (449) and medial positions (452). It may follow the voiceless aspirated velar plosive /kʰ/ as well as be followed by coda consonants /t/ (452), /k/ (450), /s/ (451), and /l/ (449). /uai/ has two allophones: [wajː] and [waj]. [waj] is only attested in stressed syllables, following glottal stop [ʔ] (451):

(449) /uail-su/	[ˈwajːɾʰu]	‘thorn’
(450) /uaik-ki-su/	[ˈwajːˀkisu]	‘peanut’
(451) /kʰuais-su/	[ˈkʰwajʔᵗsu]	‘humming bird, sp.’
(452) /uaiuait-sã/	[ˌwajːˈwajːtsã]	‘to be narrow’

3.2.3.2.1.4 /uau/

/uau/ is attested in word-initial in (453) and medial (455) positions. It may be followed by coda /n/, as in (453), but it is not attested following any consonants. /uau/ has two allophones: [waw] and [wawː]. [waw] only occurs when followed by coda /n/, if the coda is not resyllabified, as in (453). As seen in (455), /uau/ may be reduplicated:

(453) /uaun-ˀti-su/	[ˈ wawᵇmdisu]	‘whirlwind’
(454) /uau-kalo-su/	[ˈwawːkaˌloːsu]	‘hoe’
(455) /uauuaun-sã/	[ˌwawːˈwawᵇmᵈzã]	‘to be flat’

3.2.3.2.2 Creaky Triphthongs

Creaky voice triphthongs also comprise a series of four monosyllabic vowel sequences, namely /ḭa̰ḭ, ḭa̰ṵ, ṵa̰ḭ, ṵa̰ṵ/. They may be followed by coda /h, l, n/, and attestations of creaky triphthongs following consonants are only phonetic, because of the resyllabification of codas across morphemes. Reduplication of creaky triphthongs is not attested in the data.

3.2.3.2.2.1 /i̯̰a̰i̯̰/

/i̯̰a̰i̯̰/ is attested in word-initial positions. It may follow coda /l/. The only attested allophone of /i̯̰a̰i̯̰/ is [j̰a̰j̰ː]:

(456) /i̯̰a̰i̯̰l-a/ [ˈj̰a̰j̰ːɾa] ‘bee, sp.’

3.2.3.2.2.2 /i̯̰a̰u̯̰/

/i̯̰a̰u̯̰/ is attested in word-initial (457) and medial (458) positions. The only attested allophone of /i̯̰a̰u̯̰/ is [j̰a̰w̰ː]:

(457) /i̯̰a̰u̯̰-kalo-su/ [ˈj̰a̰w̰ː.kaˌloːsu] ‘bench’
(458) /ahũl-i̯̰a̰u̯̰-su/ [aˈhũːˌlj̰a̰w̰ːsu ‘water’

3.2.3.2.2.3 /u̯̰a̰i̯̰/

/u̯̰a̰i̯̰/ is only attested in word-initial positions, following coda /h/. The allophones of /u̯̰a̰i̯̰/ are [w̰a̰j̰ː] and [w̰a̰j̰]. [w̰a̰j̰] is only attested if the coda is not elided:

(459) /u̯̰a̰i̯̰h-su/ [ˈw̰a̰j̰ːʰsu] ~ [ˈw̰a̰j̰hsu] ‘straw’

3.2.3.2.2.4 /u̯̰a̰u̯̰/

/u̯̰a̰u̯̰/ is only attested in word-initial positions, following coda /n/. The only attested allophone of / u̯̰a̰u̯̰ / is [w̰a̰w̰]:

(460) /u̯̰a̰u̯̰n-su/ [ˈw̰a̰w̰ᵍŋᵈzu] ‘scorpion, sp.’

3.2.3.2.3 Nasal triphthongs

Nasal triphthongs also comprise a series of four vowel sequences, namely /ĩ̯ãĩ̯, ĩ̯ãũ̯, ũ̯ãĩ̯, ũ̯ãũ̯/. They may be followed by coda /s, l, n, ˀl/, and high vowel /ĩ̯/ may be phonetically realized as [ɲ] once phonological rules take place. Moreover, nasal triphthongs may also be reduplicated. In this context, the rightmost glide of the unstressed syllable is not lengthened. Furthermore, triphthongs followed by the nasal stop /n/ or the glottal fricative /h/ are not lengthened.

3.2.3.2.3.1 /ĩ̯ãĩ̯/

/ĩ̯ãĩ̯/ is attested word-medially, in stressed positions within words. The allophones of /ĩ̯ãĩ̯/ are [j̃ãj̃ː] and [ɲãj̃ː], which are in free variation. /ĩ̯ãĩ̯/ does not follow any consonants, but it may be followed by coda /l/ and /n/, as in (461) and (463), respectively. As shown in (461) and (463), /ĩ̯ãĩ̯/ may be reduplicated.

(461) /taĩ̯ãĩ̯ĩ̯ãĩ̯l-su/ [taˌɲãj̃ːˈɲãj̃ːɾʰu] ~ [taˌɲãj̃ːˈɲãj̃ːɾʰu] ‘bird, sp.’
(462) /hatik-a-ĩ̯ãĩ̯-ki-su/ [haˈtiːkaˈj̃ãj̃ːgisu] ‘turtle, sp.’
(463) /saĩ̯ãĩ̯saĩ̯ãĩ̯n-na-ɾa/ [saˌɲãj̃ːsaˈɲãj̃ːˌnaːɾa] ~ [saˌj̃ãj̃ːsaˈj̃ãj̃ːˌnaːɾa] ‘it’s sticky’

3.2.3.2.3.2 /ĩãũ/

/ĩãũ/ is attested in initial and medial stressed positions within a word. The allophones of /ĩãũ/ are [j̃ãw̃ː] and [ɲãw̃ː], which are in free variation. /ĩãũ/ does not follow any consonants, but it may be followed by coda /s/ and /ˀl/, as in (465) and (466), respectively. Note that no reduplication of /ĩãũ/ is attested.

(464) /ĩãũ-kaˀt-su/	[ˈɲãw̃ːˌkaˀtisu]	‘spirit, reflection, shadow’
(465) /hi(s)-ĩãũs-a/	[ˌhiːˈj̃ãw̃ːsa] ~ [ˌhiːˈɲãw̃ːsa]	‘flower’
(466) /a-ne-ĩãũˀl-a/	[ˌaːneˈɲãw̃ːˀla] ~ [ˌaːneˈɲãw̃ːla̰]	‘gill’

3.2.3.2.3.3 /ũãĩ/

/ũãĩ/ is attested word-initially (467) and medially (469), in stressed positions within a word. It has only one allophone, namely [w̃ãj̃ː]. /ũãĩ/ may follow voiceless velar plosive /k/, and it may be followed by coda /l/, as in (468). Note that /ũãĩ/ can be reduplicated (469):

(467) /ũãĩ-su/	[ˈw̃ãj̃ːzu]	‘anteater’
(468) /ũãĩl-su/	[ˈw̃ãj̃ːɾʰu]	‘flute’
(469) /kũãĩkũãĩl-ahlo-su/	[ˌkw̃ãj̃ːˈkwãj̃ːˌɾahlosu]	‘widower’

3.2.3.2.3.4 /ũãũ/

/ũãũ/ is the least frequently attested nasal triphthong, with only one occurrence in the data. It only occurs in stressed positions within a word, and it may be followed by coda /n/ and be reduplicated. The attested allophones of /ũãũ/ are [w̃ãw̃ː] and [w̃ãw̃] – the latter occurs when followed by coda /n/:

(470) /ũãũũãũn-sã/	[ˌw̃ãw̃ːˈw̃ãw̃mᵈzã]	‘to be worn-out’

3.2.3.2.4 Nasal Creaky Triphthongs

There is just one nasal creaky triphthong attested in the data, namely /ṵ̃ã̰ḭ̃/.

3.2.3.2.4.1 /ṵ̃ã̰ḭ̃/

/ṵ̃ã̰ḭ̃/ is attested in stressed positions only. It may be followed by coda /s/ or /ˀl/, as in (471) and (472), respectively. It is phonetically realized as [w̰̃ã̰j̰̃ː], once coda is resyllabified into the following morpheme. /ṵ̃ã̰ḭ̃/ may follow /k/, as in (472):

(471) /ṵ̃ã̰ḭ̃s-a-nek(i)-su/	[ˈ**w̰̃ã̰j̰̃**ːsaˌneːkisu]	‘*imbira*, sp.’
(472) /kṵ̃ã̰ḭ̃ˀl-a/	[ˈk**w̰̃ã̰j̰̃**ːˀɾa] ~ [ˈk**w̰̃ã̰j̰**ːɾa̰]	‘alga, water plant’

3.3 Consonants

This section provides a description of the consonant inventory of Kithãulhu. Having the consonant phones as a starting point, I illustrate how vast and complex the phonetic realization of the language is, comprising 49 different phones overall. Some of the phones result from the coarticulation of speech sounds, be it either through means of phonological processes such as assimilation or even through the production of coarticulated/complex consonants, resulting in the phonetic pre-plosion of nasals [ᵇm, ᵈn, ᶢŋ] or even glottalized consonants [ˀp, ˀt, ˀk, sˀ, hˀ, ˀl, ˀn]. Other phones, such as the labiodental fricatives [f][77] and [v], are mostly attested in loanwords from Brazilian Portuguese.
Once the phonetic inventory is introduced, I will present the consonant oppositions, to illustrate how the phonology was organized in this descriptive study. Finally, a full description of the phonemes, along with their distribution, allophonic and non-allophonic forms are presented.

3.3.1 The Consonant Phones

The phonetic inventory comprises 49 consonants, all of which are classified according to seven places of articulation, namely labial, labiodental, alveolar, alveolopalatal, palatal, velar, and glottal. Some consonants are doubly articulated, i.e., they display two primary and simultaneous places of articulation, which fall upon the same manner, such as in the case of the glottalized stops, which are comprised of an initial glottal plosive followed by a heterorganic plosive (in this case, labial, alveolar, or velar). There are seven manners of articulation: plosives, ejectives, implosives, fricatives, affricates, nasals, lateral, and flaps (liquids). Plosives and nasals may be plain or aspirated, liquids may be plain, aspirated, or glottalized, and fricatives and nasals may be plain, aspirated, glottalized, or even pre-plodded. Table 48 illustrates the phonetic inventory. Phones only attested in borrowed words are shown in brackets:

Table 48: Kithãulhu's consonantal phonetic inventory.

		Labial		Labiodental		Alveolar		Alveolopalatal		Palatal		Velar		Glottal
plosive	plain	p	b			t	d					k	g	ʔ
	aspirated	pʰ				tʰ						kʰ		
ejective		ˀp				ˀt						ˀk		
implosive			ɓ				ɗ					ɠ		
fricative	plain	ɸ		f	(v)	s	z	ʃ	ʒ					h
	aspirated					ʰs								
	glottalized					sˀ								hˀ
	pre-plodded					ᵗs	ᵈz							
affricate								tʃ	dʒ					
nasal	plain		m				n				ɲ		ŋ	
	aspirated					ʰn̥	ʰn							

[77] In the fieldwork, however, two speakers drew attention to the existence of a Nambikwaran word that is pronounced with [f] or [ɸ], namely [ˈflaw:su] ~ [ˈɸlaw:su], a bird species. According to the speakers, this word stems from the way "this bird species speaks," i.e., it is an ideophone. Since it was the only word attested with an initial complex onset [fl], as well as the only word with a labiodental (or labial) voiceless fricative during the fieldwork sessions, it was not included in the phonology description. It is important to note that, although one may argue that [fl] may be borrowed from Brazilian Portuguese, as complex onset [fl] is attested in common Portuguese words, the referred bird species has a very different name in Brazilian Portuguese.

		Labial		Labiodental	Alveolar		Alveolopalatal	Palatal		Velar		Glottal
	glottalized					ˀn						
	pre-plodded		ᵇm			ᵈn				ᵍŋ		
lateral	plain				l̥	l						
	aspirated				ʰl̥				ʎ			
	glottalized					ˀl						
flap	plain					ɾ						
	aspirated					ɾʰ						
	glottalized					ˀɾ						

As illustrated in Table 48, phones are comprised of both pulmonic and non-pulmonic consonants. Non-pulmonic consonants are comprised of voiceless consonants (ejectives) and voiced consonants (implosives). There are also glottalized liquids and a glottalized nasal. As shown in the consonant oppositions below, most of the consonant phones are allophonic or non-allophonic realizations of consonant phonemes, which are mostly dependent on (morpho)phonological rules, described in Chapter 5.

Consonant Oppositions

/p/, **/pʰ/**

[**p**awˈ**p**awᵇmˌnaːɾa] 'it's flattened'
[**pʰ**awˈ**pʰ**awᵇmˌnaːɾa] 'it's gray, dusty, grainy, floury'

/t/, /tʰ/

[**t**aˈ**t**adˌnaːɾa] 'it's shallow (water)'
[**tʰ**aˈ**tʰ**adˌnaːɾa] 'it's flexible, soft'

/k/, /kʰ/

[ˈ**k**ajːɾʰu] 'ant, sp.'
[ˈ**kʰ**ajːsu] 'coati'

/k/, /ˀk/

[ˈ**k**ḭːsu] 'termite'
[ˈ**ˀk**ḭ̃ːsu] 'hawk, sp.'

/n/, /l/

[jaˈ**n**aː**l**a] 'jaguar'
[jaˈ**l**aː**n**a] 'toucan (general), sickle'

/n/, /ɾ/

[ˈnãːˌnaː**n**a] 'he's drinking' (speaking to a woman)
[ˈnãːˌnaː**ɾ**a] 'he's drinking' (speaking to a man)

/n/, /ˀn/

[aˈ**n**ãːtsu] ‘his tarantula’
[aˈ**ˀn**ãːtsu] ‘his leaf’

/ˀp/, /ˀt/, /ˀk/

[ˈ**ɓ**ḛːɾʰu] ‘melon’
[ˈ**ɗ**ḛ̃ːɾʰṵ] ‘fly (general)’
[ˈ**ˀk**ḛːɾʰu] ‘gall, urine’

/s/, /sˀ/

[ˈ**s**iːʰsu] ‘bullet ant’
[ˈ**sˀ**iːʰsu] ‘house’

/h/, /hˀ/

[ˈ**h**adˌnaːɾa] ‘it’s clear’
[ˈ**hˀ**adˌnaːɾa] ‘it’s left, it remains’

/l/, /ˀl/

[aˈ**l**uːsu] ‘mouse’
[aˈ**ˀl**uːsu] ‘mantis’

3.3.2 The Consonantal Phonemes

The consonantal phonemic inventory is comprised of 20 segments. The phonemes are articulated in four different manners (plosives, fricatives, nasals, and liquids), which also may be coarticulated in complex segments. In contrast to the available number of places of articulation in the phonetic inventory, phonemic consonants are classified according to four places of articulation, namely labial, alveolar, velar, and glottal. Table 49 illustrates the consonantal phonemes:

Table 49: Kithãulhu's Consonantal Phonemes

		Labial	**Alveolar**	**Velar**	**Glottal**
Plosives	plain	p	t	k	ʔ
	aspirated	pʰ	tʰ	kʰ	
	glottalized	ˀp	ˀt	ˀk	
fricatives	plain		s		h
	glottalized		sˀ		hˀ
nasals	plain		n		
	aspirated		ʰn		
	glottalized		ˀn		
liquid	plain		l		
	glottalized		ˀl		
	flap		(ɾ)		

As shown in Table 49, plosives and nasals are distributed into three categories: plain (unaspirated) /p, t, k, ʔ, n/, aspirated /pʰ, tʰ, kʰ, ʰn/, and glottalized /ˀp, ˀt, ˀk, ˀn/. Fricatives and liquids are only classified into two sets: plain (unaspirated) /s, h, l, ɾ/ and glottalized /sˀ, hˀ, ˀl/.

3.3.3 The Consonants

This section introduces the distribution and phonotactics of the 20 consonantal phonemes. Since the consonantal phonemes are classified into plain, aspirated, and glottalized segments, the consonant distribution and phonotactics will be presented according to these three main categories. In terms of frequency of occurrence, plain consonants are the most frequent set of consonantal segments, followed by the glottalized and the aspirated consonantal sets. Since there is a phonemic series of aspirated consonants, plain consonants are never phonetically aspirated, except for fricative /s/ and liquid /l/. Voiceless alveolar fricative /s/ may be pre-aspirated, whereas phonetic realizations of liquid /l/ may be pre- or post-aspirated due to morphophonological rules as well as phonotactic constraints. The claim of a consonantal system including a series of aspirated plosives contrasts with previous descriptions of the segmental system of Nambikwara, in which aspiration of consonants was seen as the allophonic realization of voiceless plosives (Netto 2018; Costa 2020).

3.3.3.1 Plain Consonants

Plain consonants, or simply unaspirated consonants, comprise nine simple segments. They fall into three different categories: plosives, comprised of four segments /p, t, k, ʔ/; fricatives, which encompass two segments /s, h/; liquids, consisting of a pair of segments /l, ɾ/; and nasals, which are represented by only one phoneme, /n/. Each plain consonant is described in the following subsections.

3.3.3.1.1 Plosives

The unaspirated plosives comprise a series of four voiceless segments. Except for the labial /p/ and the glottal /ʔ/ voiceless plosives, voiceless plosives can be phonetically realized as voiced in specific phonetic environments. The voicing of plosives is usually triggered by a preceding nasal consonant, or it occurs in intervocalic positions when the nucleus is a creaky voice vowel. As a rule, plosives may occur in the onset or coda of a syllable, except for /p/, which is only found in onsets.
The only plosive which may occur simultaneously in the onset and the coda of a given syllable is the voiceless alveolar plosive /t/. At morpheme boundaries, plosives may be realized as the first segment of a complex onset, which is always phonetic. Complex onsets with an initial plosive may also be the outcome of morphophonological rules, described in Chapter 5.

3.3.3.1.1.1 /p/

/p/ is a voiceless labial plosive. It is the most restrictedly distributed plosive. /p/ is often attested in borrowed words from Brazilian Portuguese, as in (474) and (475), but also used in native words for food (473) and in child-directed speech (477). The only allophone of /p/ is [p].

Phonotactics

/p/ is only attested in the onset of syllables whose nucleus is oral vowels /i, a, o/, as in (473), (474), and (475), nasal vowel /ã/ (476) or oral diphthong /au/ (477):

(473) _i	/pit-su/	[ˈpiːtsu]	‘gourd’
(474) _a	/pat-su/	[ˈpaːtsu]	‘duck’
(475) _o	/pon-su/	[ˈpo^{d}n^{t}su]	‘cattle’
(476) _ã	/pãpãn-na-ɾa/	[pãˈpãːˌnaːɾa]	‘it’s over’
(477) _au	/paupaun-na-ɾa/	[pawˈpaw^{b}mˌnaːɾa]	‘it’s flattened’

/p/ is frequently attested in word-initial positions, but it may also occur within syllables in word-medial positions as part of the reduplicated material, as in (477) and (476). /p/ is restricted to stressed syllables, except if reduplicated.

3.3.3.1.1.2 /t/

/t/ is a voiceless alveolar plosive. It is one of the most frequent consonants in the data. /t/ is followed by any vowels, except /o̰/ and /ã̰/. The allophones of /t/ are modal voiceless alveolar plosive [t] and voiced alveolar plosive [d].

Phonotactics

[t] is the most frequent allophone. It mostly occurs in the onset of syllables, in word-initial (479) and medial (480) positions within a word, or even occupying both positions simultaneously (481). [t] is found within stressed or unstressed syllables, as in (478) and (481), respectively, and it may also occur in the coda, as illustrated in (481). When [t] occurs in the coda, and the following morpheme starts with [s] in the onset, the underlying coda /t/ is resyllabified, forming the complex onset [ts], as in (487):

(478) _i	/a-tih-su/	[aˈtihsu]	‘blood’
(479) _e	/ten-na-ɾa/	[ˈtedˌnaːɾa]	‘he wants it’
(480) _a	/a-ta-su/	[aˈtaːsu]	‘evil spirit’
(481) _o	/totot-na-ra/	[toˈtoːˌtãːɾa]	‘it’s knocking’
(482) _u	/tuh-a-ta̰-su/	[ˈtuːhaˌta̰ːsu] ~ [ˈtuːhaˌta̰^{h}su]	‘bee, sp.’
(483) _ĩ	/uatĩtĩ-su/	[watĩˈtĩːsu]	‘dragonfly’
(484) _ẽ	/tẽn-su/	[ˈtẽː^{d}zu]	‘drums’
(485) _ã	/tãn-su/	[ˈtãː^{d}zu] ~ [ˈtãn^{d}zu]	‘frog, sp.’
(486) _ũ	/ialan-a-tũtũˀt-ki-su/	[jaˈlaːnatũˈtũːˀkisu]	‘*araçari*’
(487) _ḛ	/ḭa̰tḛt-su/	[ja̰ˈdɪ̰tsu] ~ [ja̰ˈdḛːtsu]	‘tick, sp.’
(488) _a̰	/ta̰n-na-ɾa/	[ˈta̰dˌnaːɾa]	‘it’s bitter’
(489) _ṵ	/ˀkainãntṵ/	[ˀkajˈnãːdṵ] ~ [kajˈnãːdṵ]	‘if’
(490) _ḭ̃	/tḭ̃-a-tu-ua/	[ˈtḭ̃ːaˌtuːwa]	‘I’ll approach’
(491) _ṵ̃	/ĩ-tṵ̃n-na-ɾa/	[ĩˈtṵ̃ːˌnaːɾa]	‘he licks’

[d] is in free variation with [t], but it tends to be realized in two specific phonetic environments: a) the final syllable of the previous morpheme has coda [n], which triggers voicing through progressive assimilation (492); b) intervocalic environment, whose nuclei are comprised of a creaky voice or nasal and creaky vowels, as in (493) and (494):

(492) _e	/hehen-te-su/	[heˈhe^{d}ndesu]	‘red’
(493) _ḭ	/tḭtḭn-na-ɾa/	[tḭˈtḭdˌnaːɾa] ~ [dḭˈdḭdˌnaːɾa]	‘it’s black’
(494) _ḛ̃	/uatḛtḛ̃-su/	[wadḛˈdḛ̃ːsu]	‘butterfly’

Note that, in the examples in this section, whenever creaky voice vowels follow /t/, they do not trigger glottalization.

3.3.3.1.1.3 /k/

/k/ is a voiceless velar plosive. The allophones of /k/ are the voiceless velar plosive [k] or the voiced velar plosive [g]. /k/ is the second most frequent plosive in the data, and it is often followed by the vowels /i, a/.

Phonotactics

[k] is the most frequent allophone of /k/. It is followed by any vowel, except for /ẽ/, /ḛ, ṵ/, and /ḛ̃, ã̰/. It occurs in word-initial (495), medial (496), and final positions (499) within a word, mostly in the onset. [k] is also attested in stressed (495) and unstressed syllables (496). Note that creaky voice vowels do not trigger glottalization of /k/, as shown in (503), (505), (506), and (507):

(495) _i	/kikin-na-ɾa/	[kiˈkidˌnaːɾa]	‘it has parallel stripes’
(496) _e	/ne-ke-ˀki-ʰna-na-ɾa/	[nekeˈˀkiːʰnaˌnaːɾa]	‘he’s thinking’
(497) _a	/kah-na-ɾa/	[ˈkahˌnaːɾa]	‘it’s sour’
(498) _o	/kol-su/	[ˈkoːʰl̥u]	‘medicine’
(499) _u	/kanaku/	[kaˈnaːku]	‘some’
(500) _ĩ	/kĩn-na-ɾa/	[ˈkĩːˌnaːɾa]	‘it’s tall’
(501) _ã	/kãn-ẽn-su/	[ˈkãːˌnẽːᵈzu][78]	‘pipe’
(502) _ũ	/kũ-nek(i)-su/	[kũˈneːkisu]	‘*sucupira*’
(503) _ḭ	/kḭ-su/	[ˈkḭːsu]	‘termite’
(504) _a̰	/uali(ˀn).ka̰l-su/	[waliˈka̰ːʰlu]	‘manioc, sp.’
(505) _o̰	/a-ko̰l-su/	[aˈko̰ːʰl̥u]	‘weapon’
(506) _ḭ̃	/a-nekḭ̃s-su/	[ˌaːneˈkḭ̃ʔtsu]	‘hair’
(507) _ṵ̃	/kṵ̃n-su/	[ˈkṵ̃ːnᵈzu]	‘cotton, *timbó*’

[k] can also be followed by diphthongs /ai/, /ãĩ/ and /ã̰ḭ̃, ṵ̃ã̰/, as in (508), (509), (510), and (511), respectively, and by triphthongs /ṵa̰ḭ/ and /ṵ̃ã̰ḭ̃/ as in (512) and :

(508) _ai	/kail-su/	[ˈkajːɾʰu]	‘ant, sp.’
(509) _ãĩ	/kãĩ-na-ɾa/	[ˈkãj̃ːˌnaːɾa]	‘he’s stealing’
(510) _ṵ̃ã̰	/kṵ̃ã̰t-su/	[ˈkw̰̃ã̰ːtsu]	‘beans’
(511) _ã̰ḭ̃	/kã̰ḭ̃t(i)-su/	[ˈkã̰j̰̃ːtisu]	‘mouse, sp.’
(512) _ṵa̰ḭ	/a-nãũkṵa̰ḭl-su/	[ˌaːnũˈkw̰a̰j̰ːɾʰu] ~ [ˌaːnãw̃ˈkw̰a̰j̰ːɾʰu]	‘chest’
(513) _ṵ̃ã̰ḭ̃	/kṵ̃ã̰ḭ̃ˀl-a/	[ˈkw̰̃ã̰j̰̃ːˀɾa] ~ [ˈkw̰̃ã̰jːɾa̰]	‘alga, water plant’

/k/ is also attested in the coda. However, coda [k] is usually not realized phonetically due to phonological rules, such as epenthesis, and resyllabification. Evidence of coda /k/ comes from morphological structure. At morpheme boundaries and followed by an s-initial morpheme, coda [k] undergoes resyllabification and is realized as the first segment in complex onset [ks], as in (514):

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[78] From Brazilian Portuguese ‘cano,’ [ˈkãno] ~ [ˈkãnʊ].

(514) a_	/tak(i)-su/	[ˈtaːkisu] ~ [ˈtaːksu]	‘grasshopper, sp.’
(515) i_	/hatik-a-ĩãũ-ki-su/	[haˈtiːkḁ̰ˌj̃ãj̃ːgisu]	‘turtle, sp.’
(516) ui_	/kuikuik(i)-su/	[kujˈkujːkisu]	‘hawk, sp.’

[g] occurs in two different phonetic environments. In the first phonetic environment, /k/ is followed by the nasal consonant /n/ when it becomes voiced:

(517) /a-naˀn-ẽn-kalo-su/	[ˌaːneˈnẽːgaˌloːsu] ~ [ˌaːnaˈˀnẽːgaˌloːsu]	‘ear’
(518) /hoʔi-sĩn-kit-na-ɾa/	[hoˈʔiːˈsĩŋgiˌtãːɾa]	‘we’re bathing’

In the second phonetic environment, /k/ must follow a nasal and creaky voice vowel, at morpheme boundaries. Then, it is realized as [g]:

(519) Ṽ̰#_	/ḭa̰-nṵ̃-ki-su/	[ˌja̰ːˈnṵ̃ː**g**isu]	‘ashes, charcoal’

3.3.3.1.1.4 /ʔ/

/ʔ/ is a voiceless glottal plosive. The only allophone of /ʔ/ is the voiceless glottal plosive [ʔ].

Phonotactics

[ʔ] occurs in the onset of syllables in word-medial (520) and final (521) positions. It is also found in stressed (520) or unstressed positions (521) within a word:

(520) _i	/ho-ʔi-na-ɾa/	[hoˈʔiːˌnaːɾa]	‘he’s bathing’
(521) _ã	/ĩãteta̰-tel-a-ʔã/	[ˈɲãːteta̰ˈdeːˌɾaːʔã]	‘what is it?’

/ʔ/ is also attested in syllable codas, but they are usually assimilated by surrounding segments. Consequently, it is never phonetically realized in this position due to phonotactic constraints. To determine if there is an underlying /ʔ/ in the coda of the final syllable of a given morpheme, it is necessary to place a vowel initial morpheme right after it. In this morphophonological environment, coda /ʔ/ will be phonetically realized as the onset of the following morpheme, as illustrated in (522) and (523):

(522) o_#	/saʔuen-a-tʰoʔ-a/	[saʔˈweːnaˌtʰoːʔa]	‘big fire in the forest’
(523) ãũ_#	/a-nãũʔ-a/	[aˈnãw̃ːʔa]	‘egg’

Note that, in examples (522) and (523), coda /ʔ/ may follow a monophthong or a diphthong.

3.3.3.1.2 Fricatives

The unaspirated fricatives comprise a series of two voiceless segments, namely /s, h/, which are articulated in two different places: alveolar and glottal. Fricatives may occur in the onset or coda of a syllable. In contrast with most plosives, both fricatives may occur simultaneously in the onset and the coda of a given syllable, as I show in the following sections. Whenever a fricative occurs both in the onset and in the coda of a syllable, it is found in word-initial or medial positions and its host syllable is stressed.

3.3.3.1.2.1 /s/

/s/ is a voiceless alveolar fricative. It is followed by any vowel, except for /ḭ, ḛ, o̰, ṵ/ and /ḛ̃, ã̰/. The allophones of /s/ are voiceless alveolar fricative [s] and voiced alveolar fricative [z], which only occur in the onset. For the coda realizations of /s/, see Chapter 5.

Phonotactics

Whenever /s/ occurs in the word-initial position, it is realized as the allophone [s]. [s] also occurs in word-medial and final positions, as in (528) and (534), respectively. It is also attested in stressed (524) and unstressed positions (525) within a word. [z] is restricted to word-final position, at morpheme boundaries when it follows a final morpheme syllable with coda /n/, as in (525) and (530). Note that, in this environment, [z] is in free variation with its voiceless counterpart [s]:

(524) _i	/sil-su/	[ˈsiːɾʰu]	'mouse, sp.'
(525) _e	/a-sen-su/	[ˌɐːˈseᵈnᵗsu] ~ [ˌɐːˈseᵈnᵈzu]	'footprint, trace'
(526) _a	/a-sahˀ-su/	[aˈsahsu] ~ [aˈsaːʰsu]	'penis'
(527) _o	/so-na-ua/	[ˈsoːˌnaːwa]	'I'm taking it'
(528) _u	/uasu-na-ɾa/	[waˈsuˌnaːɾa]	'it's fast'
(529) _ĩ	/a-sĩn-su/	[aˈsĩːᵗsu] ~ [aˈsĩnᵈzu]	'meat'
(530) _ẽ	/nṵ̃-sẽn-su/	[nṵ̃ːˈsẽnᵈzu] ~ [nṵ̃ːˈsẽːᵗsu]	'snake, sp.'
(531) _ã	/sãl-su/	[ˈsãːʰl̥u]	'bird, sp.'
(532) _ũ	/sũn-t(i)-a-t(e)-aitã/	[ˈsũːdaˌtajːtã]	'yesterday'
(533) _a̰	/ṵ̃ã̰ḭ̃s-a-sa̰l-su/	[ˌw̰̃ã̰j̰̃ːsaˈsa̰ːʰl̥u]	'imbira'
(534) _ḭ̃	/sḭ̃-su/	[ˈsḭ̃ːsu]	'storm'
(535) _ṵ̃	/sṵ̃n-a/	[ˈsṵ̃ːna]	'grandfather, god'
(536) _ai	/sa-sail-sa/	[saˈsajːɾʰa]	'to shoot'

/s/ also occurs in codas. However, due to phonotactic constraints, coda /s/ is not realized phonetically as [s], unless it is resyllabified. To illustrate the presence of a coda /s/ in the underlying representation, we can employ the very same morphophonological environment used to posit the existence of an underlying coda /ʔ/, described in section 3.3.3.1.1.4. Instead of the final suffix {-su}, we should test the phonetic realization of the morpheme final /s/ by attaching the final suffix {-a} to it. Note that, in examples (537), (538), (539), and (540), coda /s/ is realized as the onset of the following syllable since the following morpheme starts with a vowel. Once the coda segment is lost in the surface representation due to resyllabification, the nucleus undergoes compensatory lengthening:

(537) o_#	/hos-a/	[ˈhoːsa]	'monkey (general)'
(538) ũẽ_#	/ũẽs-a/	[ˈw̃ẽːsa]	'child'
(539) ũã_#	/ũãs-a/	[ˈw̃ãːsa]	'hat'
(540) ĩãũ_#	/hi-ĩãũs-a/	[ˌhiːˈj̃ãw̃ːsa] ~ [ˌhiːˈɲãw̃ːsa]	'flower'

Coda /s/ is never realized [s] phonetically before other consonants. The following examples (541), (542), (543), and (544) are comprised of the same roots as examples (537), (538), (539), and (540), respectively. Note, by comparing them, that coda /s/ is never phonetically realized as [s]:

(541) o_#	/hos-su/	[ˈhoʔᵗsu]	'monkey' (general)

(542) ũẽ_#	/ũẽs-su/	[ˈw̃ẽnᵈzu] ~ [ˈw̃ẽʔᵗsu]	‘child’
(543) ũã_#	/ũãs-su/	[ˈw̃ãnᵗsu] ~ [ˈw̃ãʔᵗsu]	‘hat’
(544) ĩãũ_#	/hi-ĩãũs-su/	[ˌhiːˈȷ̃ãw̃mᵈzu] ~ [ˌhiːˈȷ̃ãw̃ʔᵗsu] ~ [ˌhiːˈɲãw̃mᵗsu]	‘flower’

More information on the multiple realizations of /s/ in the coda is provided in Chapter 5.

3.3.3.1.2.2 /h/

/h/ is a voiceless glottal fricative. It is followed by all vowels, except for /o̰, ṵ/ and /ḛ̃, ã̰/. The only allophone of /h/ is the voiceless glottal fricative [h].

Phonotactics

[h] is attested in syllables in word-initial (547), medial (551), and final positions (568) within a word. [h] occurs in the onset, coda, or both, as in (545), (565) and (546), respectively:

(545) _i	/hi-ie-kalo-su/	[hiˈjeːkaˌloːsu]	‘vehicle’
(546) _e_	/heh-na-ɾa/	[ˈhehˌnaːɾa]	‘he’s hungry’
(547) _a	/han-na-ɾa/	[ˈhadˌnaːɾa]	‘it’s bright’
(548) _o_	/hoh-na-ɾa/	[ˈhohˌnaːɾa]	‘he’s wandering’
(549) _u	/huˀk(i)-su/	[ˈhuˀkisu] ~ [ˈhuˀksu]	‘bow’
(550) _ĩ	/hĩn-a/	[ˈhĩːna] ~ [ˈhĩːnã]	‘now’
(551) _ẽ	/ãũʔi-na-hẽ-ɾa/	[ˌãw̃ˈʔiːnaˌhẽːɾa]	‘he slept’
(552) _ã	/hãn-na-ɾa/	[ˈhãːˌnaːɾa]	‘it’s white’
(553) _ũ	/hũn-na-ɾa/	[ˈhũːˌnaːɾa]	‘it’s pink’
(554) _ḭ	/a-hḭl-su/	[aˈhḭːɾʰu]	‘liver’
(555) _ḛ	/hḛl-su/	[ˈhḛːɾʰu]	‘buriti’
(556) _a̰	/ha̰la̰t-su/	[ha̰ˈla̰ːtsu]	‘comb, pitomba’
(557) _ḭ̃	/hḭ̃-na-ɾa/	[ˈhḭ̃ːˌnaːɾa]	‘it’s sticky’
(558) _ṵ̃	/hṵ̃n-na-ɾa/	[ˈhṵ̃ːˌnaːɾa]	‘it looks like’
(559) _ai	/hain-na-ɾa/	[ˈhajdˌnaːɾa]	‘he’s singing’
(560) _ãĩ	/hãĩˀt(i)-su/	[ˈhãȷ̃ːˀtisu] ~ [ˈhãȷ̃ːdisu]	‘matchstick’
(561) _au	/hauˀt(i)-su/	[ˈhawːˀtisu] ~ [ˈhawːɗisu]	‘arrow’
(562) _ãũ	/hãũ-su/	[haˈlãw̃ːsu]	‘*lambari*’
(563) _a̰ṵ	/ha̰ṵ-su/	[ˈha̰w̰ːsu] ~ [ˈho̰ːsu]	‘maned-wolf’
(564) _ã̰ḭ̃	/hã̰ḭ̃l-su/	[ˈhã̰ȷ̰̃ːɾʰu]	‘ball’

Coda /h/ is usually elided, triggering compensatory lengthening of the nucleus or pre-aspiration of the following morpheme, whenever it starts with the voiceless fricative /s/, rendering [ʰs]. Note that, whenever coda /h/ is phonetically realized, the nucleus is not lengthened:

(565) a_	/ah-su/	[ˈahsu] ~ [ˈaːʰsu]	‘spider, (sp.)’
(566) u_	/uh-na-ɾa/	[ˈuhˌnaːɾa]	‘it’s digging’
(567) _o_	/hoh-su/	[ˈhohsu] ~ [ˈhoːsu]	‘tinamou’

If the morpheme’s final coda [h] is followed by a vowel, [h] is resyllabified and the vowel of its original host syllable is lengthened:

(568) a_	/ah-a/	[ˈaːha]	‘spider’

Note that /h/ is never followed by rising diphthongs. However, in morpheme boundaries, sequences such as [hj] and [hw] may occur, once the coda /h/ of a given morpheme is resyllabified into the following syllable, which starts with a rising diphthong:

(569) ũ_#	/ũh-ioli-na-ɾa/	[ˌũːhjoˈliːˌnaːɾa]	'he's cutting (it)'
(570) ũ_#	/ũh-uauh-na-ɾa/	[ˌũːˈhwawhˌnaːɾa]	'he's fetching water'

3.3.3.1.3 Liquids

The unaspirated liquids comprise a series of two voiced segments, namely a lateral /l/ and a flap /ɾ/, which have the very same place of articulation. Unlike other consonants, liquids never occur word-initially, and morphemes starting with a liquid are very rare. As I show in this section, /l/ or /ɾ/ may occur in the onset of a syllable. In general, liquids never occur in the coda in the surface representation due to morphophonological constraints. However, I provide evidence of coda /l/ in the underlying representation.

3.3.3.1.3.1 /l/

/l/ is an alveolar voiced lateral. /l/ occurs in word-medial positions, in stressed or unstressed syllables within a word. It is followed by all vowels, except for /ẽ/, /ḛ/, and /ḭ/. The allophones of /l/ are alveolar voiced lateral [l], and alveolar voiced flap [ɾ], which are in complementary distribution[79].

Phonotactics

[l] is the most frequent allophonic realization of /l/. [l] occurs mostly in stressed syllables and it usually follows a low central vowel [a] or [a̰]:

(571) _i	/tali-na-ɾa/	[taˈliːˌnaːɾa]	'it's thundering'
(572) _e	/taleh-su/	[taˈlehsu] ~ [taˈleːʰsu]	'parrot, sp.'
(573) _a	/kala-na-ɾa/	[kaˈlaːˌnaːɾa]	'he's climbing'
(574) _o	/a-lon-su/	[aˈloᵈnᵗsu]	'brother'
(575) _u	/alu-su/	[aˈluːsu]	'mouse' (general)
(576) _ĩ	/talĩ-su/	[taˈlĩːsu]	'woodpecker, sp.'
(577) _ã	/alã-su/	[aˈlãːsu]	'macaw (general)'
(578) _ũ	/alũ-su/	[aˈlũːsu]	'tapir'
(579) _ḭ	/ta̰lḭh-su/	[ta̰ˈlḭːsu] ~ [ta̰ˈlḭːʰsu]	'nanday parakeet'
(580) _a̰	/a̰la̰-su/	[a̰ˈla̰ːsu]	'guan' (general)
(581) _o̰	/alo̰-su/	[aˈlo̰ːsu]	'tucumã'
(582) _ṵ	/a̰lṵt-su/	[a̰ˈlṵːtsu]	'armadillo, sp.'
(583) _ḛ̃	/a-kilḛ̃l-su/	[aːkiˈlḛ̃ːʰl̥u]	'sting'
(584) _ã̰	/ĩãlã̰-son-na-ɾa/	[j̃ãlã̰ˈsodˌnaːɾa]	'he's thin'
(585) _ṵ̃	/kalṵ̃-na-ɾa/	[kaˈlṵ̃ːˌnaːɾa] '	'it's sprouting'

[l] is also followed by falling diphthongs:

[79] Although [l] and [ɾ] are in complementary distribution, elder speakers (over 60 years old) tend to rhotacize /l/ and realize it as [ɾ], regardless of the phonetic environment.

(586) _ai /alai-su/ [aˈlajːsu] ‘sloth’
(587) _ãũ /talãũ-su/ [taˈlãw̃ːsu] ‘lizard, sp.’
(588) _au /ialau-su/ [jaˈlawːsu] ‘ring’
(589) _ã̰ṵ̃ /ḭalã̰ṵ̃-su/ [j̰a̰ˈlã̰w̰̃ːsu] ‘arrowroot’

/l/ is never followed by rising diphthongs or triphthongs within the same morpheme, but occurrences of /l/ followed by rising diphthongs and triphthongs are attested across morphemes:

(590) /ahũl-ien-su/ [aˈhũːˌ**lj**eᵈnᵗsu] ~ [aˈhũːˌʎʲeᵈnːᵗsu] ‘lake
(591) /ahũl-ḭa̰ṵ-su/ [aˈhũːˌ**lj̰̃**a̰w̰ːsu] ~ [aˈhũːˌʎʲ̰a̰w̰ːsu] ‘water’

[ɾ] follows a front vowel. It may occur in stressed (592) or unstressed (593) syllables:

(592) i_ /kalilis-su/ [kaliˈɾiʔtsu] ‘cricket, sp.’
(593) e_ /heli-na-ɾa/ [ˈheːɾiˌnaːɾa] ‘he’s fighting’

[l] and [ɾ] are also in free variation when /l/ is in a stressed syllable and followed by a high vowel:

(594) /te-iahlo-a# huˀk(i)-a# talit-na-ɾa/ [ˈtʃaːʰla#ˈhuːˀka# taˈɾiːˌtãːɾa] ~ [ˈtʃaʰla#ˈhuːˀka# taˈliːˌtãːɾa] ‘he’s rubbing the bow’

/l/ is also attested in the coda. The underlying coda /l/ is only confirmed if the following morpheme is vowel-initial. If coda /l/ is followed by a consonant-initial morpheme, it undergoes morphophonological rules, which prevent it from being phonetically realized. Compare the examples below:

(595) _l# C /ail-na-ɾa/ [ˈajːˌnaːɾa] ‘he’s walking’
(596) _l# V /ail-a-ua/ [ˈajːˌɾaːwa] ‘I’m walking’

Note that in (595) the coda /l/ of the morpheme {ail-} is not phonetically realized before the suffix {-na}, which is a consonant-initial morpheme. In (596), coda /l/ in morpheme {ail-} is followed by morpheme {-a}. In this context, coda /l/ is realized in the onset of {-a}, as [ɾ], following the rule described in examples (592) and (593). See Chapter 5 for the phonological alternation of coda /l/.

3.3.3.1.3.2 /ɾ/

/ɾ/ is an alveolar voiced flap. It is included in the phonological system because the Kithãulhu, along with the Halotesu, Wakalitesu, and Sawentesu speakers simply do not accept that the final syllable /ɾa/, belonging to a portmanteau morpheme for aspect and gender, is pronounced as *[la]. Flap /ɾ/ is recognized as the standard and only possible pronunciation for morpheme {-ɾa} among the individuals belonging to the Savannah linguistic area. In contrast, Nambikwaran individuals belonging to the Guaporé Valley linguistic area are said to pronounce the final morpheme {-ɾa} as [la].[80]

[80] Although I did not included /ɾ/ in the phonology of Southern Nambikwara in my previous work (Netto 2018), I had already pointed out the dialectal differences between speakers belonging to the Guaporé Valley and the

The inclusion of /ɾ/ as a phoneme also considers that the phonetic realization of [ɾ] in the morpheme {-ɾa} would not follow the rule for the rhotic allophonic realization of /l/ described in 3.3.3.1.3.1. Hence, /ɾ/ is assumed to be under the process of phonologization in the Savannah area. The only allophone of /ɾ/ is [ɾ].

Phonotactics

/ɾ/ is attested in the onset of the syllable in word-final positions, whose nucleus is /a/:

(597)	_a	/ĩ-na-ɾa/	[ˈĩːˌnaːɾa] *[ˈĩːˌnaːla]	'he's biting'

As described in section 3.3.3.1.3.1 in this chapter, whenever liquid /l/ follows the low central vowel /a/, it is phonetically realized as [l]. Furthermore, /l/ is also realized as [l] if it follows back vowels. In example (597), note that, if the syllable /-ɾa/ were /-la/ in the underlying representation, it would be phonetically realized as /-la/*, which is never the case. Furthermore, when speakers were submitted to tests during the elicitation sessions, they claimed unanimously that /ɾa/ is the only correct/accepted realization. The same rhotacization rule described in section 3.3.3.1.3.1 would also have been applied in example (598) below. However, once again, it never takes place:

(598)	_u	/an-ii-tu-ɾa/	[ãˈnjiːˌtuːɾa] *[ãˈnjiːˌtuːla]	'stop!'

For a more detailed description and analysis of this phonological rule, check section 1.5.2.5.

3.3.3.1.4 Nasals

In contrast with other Nambikwaran languages, there is just one phonemic plain nasal consonant, the alveolar nasal /n/. /n/ has the largest allophonic variation amongst the consonantal phonemes, and may be realized phonetically as eight different segments, including a series of unaspirated nasals [n, m, ŋ], a series of pre-plodded nasals [ᵇm, ᵈn, ᵍŋ], and the plosives [d, ʔ]. Despite the large number of allophones, the phonetic realizations of /n/ are very predictable, as described below.

3.3.3.1.4.1 /n/

Nasal /n/ is a very frequent phoneme. It is realized very distinguishably according to the position of the syllable it surfaces.

Phonotactics

In the onset, the only allophone of /n/ is [n]. [n] occurs in the onset (599), coda (635) or both positions within a syllable (611), in stressed (599) or unstressed positions (600). It is followed by all vowels, except for /ṳ/, rising diphthongs or triphthongs:

(599)	_i	/nik(i)-su/	[ˈniːkisu]	'*breu*, candle'
(600)	_e	/a-nekḭ̃s-a/	[ˌaːneˈkḭ̃ːsa]	'hair'
(601)	_a	/ianal-su/	[jaˈnaːʰl̥u]	'jaguar'

Savannah areas. Costa (2020) included /ɾ/ as part of her phonological description, and my current analysis supports her claim.

(602) _o	/iain-ihno-su/	[ˈjajˌnihnosu]	‘leech’
(603) _u	/nanuh-a/	[naˈnuːha]	‘slug’
(604) _ĩ	/nĩ^{ʔ}n-a/	[ˈnĩː^{ʔ}na] ~ [ˈnĩːna̰]	‘skunk’
(605) _ẽ	/a-nẽk(i)-a/	[ˌaːˈnẽːka]	‘head’
(606) _ã	/nãs-a/	[ˈnãːsa]	‘tarantula’
(607) _ũ	/a-nũ-a/	[ˌaːˈnũːa]	‘people’
(608) _ḭ	/aniḭli-na-ɾa/	[ˌjaˈnḭːɾiˌnaːɾa]	‘he wishes’
(609) _ḛ	/nḛ-su/	[ˈnḛːsu]	‘the Manduca’
(610) _a̰	/iana̰l-su/	[jaˈna̰ː^{h}l̥u]	‘lizard, sp.’
(611) _o̰	/no̰n-ḭa̰ṵ-a/	[ˈno̰^{d}nˌdʒ^{j}a̰w̰ːa]	‘noise’
(612) _ḭ̃	/a-nḭ̃t-ẽn-su/	[ˌaːˈnḭ̃ːˌtẽː^{d}zu]	‘thorax’
(613) _ḛ̃	/ianal-a-nḛnḛ̃-su/	[jaˌnaːlanẽˈnḛ̃ːsu]	‘cougar’
(614) _ã̰	/nã̰-su/	[ˈnã̰ːsu]	‘otter’
(615) _ṵ̃	/a-nṵ̃-su/	[ˌaːˈnṵ̃ːsu]	‘dough’
(616) _ãũ	/a-nãũʔ-su/	[ˌaːˈnãw̃ːsu]	‘egg’

The Coda /n/

In the coda, /n/ may be phonetically realized as eight allophones: [d, ʔ, n, m, ŋ, ^{b}m, ^{d}n, ^{g}ŋ], whose distribution is described below. Although this variation may seem very extensive, other Nambikwaran languages, such as Mamaindê (Eberhard 2009: 85 – 91), also display multiple phonetic realizations of a nasal segment in the coda[81]. Note that the large number of allophones of the coda /n/ occur in stressed syllables[82] only and are highly predictable, as their realization depends on the features of adjacent segments, such as the vowel it follows or the onset of a following morpheme.

The pre-plodded alveolar nasal [^{d}n] follows an oral vowel or a creaky voice vowel, if the following morpheme is not /n/ initial:

(617) e_	/ten-sã/	[ˈte$^{\mathbf{d}}$**n**^{t}sã]	‘to want’
(618) a_	/kualan-su/	[kwaˈla$^{\mathbf{d}}$**n**^{t}su]	‘armlet’
(619) o_	/a-lon-su/	[aˈlo^{t}su]	‘brother’
(620) i_	/in-sã/	[ˈi$^{\mathbf{d}}$**n**^{t}s$^{\mathbf{d}}$**n**ã]	‘to fly’
(621) u_	/tun-sã/	[ˈtu$^{\mathbf{d}}$**n**^{t}sã]	‘to be violet’
(622) a̰ḭ_	/a̰ḭn-su/	[ˈa̰j̰$^{\mathbf{d}}$**n**^{t}su] ~ [ˈa̰j̰^{g}ŋ^{d}zu]	‘fish (general)’

The pre-plodded velar nasal [^{g}ŋ] also follows oral vowels. However, /n/ must be followed by a morpheme with the initial velar consonant /k/, as in (623). [^{g}ŋ] may also occur following diphthongs /ai/ and /a̰ḭ/, with no following morpheme with a velar initial consonant. In such cases, [^{g}ŋ] is in free variation with [^{d}n], as shown in (624) and (625):

(623) _k, g /kuaia^{ʔ}t-a-tun-ki-a/
[kwaˈjaːta̰ˌtu$^{\mathbf{g}}$**ŋ**gisu] ~ [kwaˈjaːta̰ˌtu$^{\mathbf{g}}$**ŋ**kisu]
‘purple corn seed’

(624) ai_ /ialan-a-hain-ḭa̰ṵ-su/
[jaˈlaːnaˌhaj$^{\mathbf{g}}$**ŋ**ˈtʃ^{j}a̰w̰ːsu] ~ [jaˈlaːnaˌhaj$^{\mathbf{g}}$**ŋ**ˈdʒ^{j}a̰w̰ːsu]
‘toucan, sp.’

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[81] In Mamaindê, however, the nasal segment in the coda is referred to as “a segment underspecified for place or an ‘empty’ nasal segment, the /N/” (Eberhard 2009: 85).

[82] Syllables with coda /n/ tend to occur in stressed positions within a word. For more details on stress, see Chapter 4.

(625) a̰ḭ_ /a̰ḭn-su/
['a̰j̰^{g}**ŋ**^{t}su] ~ ['a̰j̰^{d}n^{t}su]
'fish (general)'

The pre-plodded labial nasal [^{b}m] follows a diphthong or triphthong with a final high back vowel /u, ṵ/. In this context, /n/ may also be realized phonetically as [^{g}ŋ], assimilating the velar feature of [w̰], as in (567). Although [^{b}m] is more often observed, it is in free variation with [^{g}ŋ] after /ṵ/:

(626) au_ /halaun-na-ɾa/ [ha'law^{b}**m**ˌnaːɾa] 'it's shelly'
(627) ṵa̰ṵ_ /ṵa̰ṵn-su/ ['w̰a̰w̰^{b}**m**^{d}zu] ~ ['w̰a̰w̰^{g}ŋ^{d}zu] 'scorpion, sp.'

The voiced alveolar plosive [d] occurs when the following morpheme starts with an [n]. In this context, /n/ is dissimilated and realized as [d] due to the Obligatory Contour Principle (OCP):

(628) i_#n /in-na-/ ['i**d**ˌnaːɾa] 'it's flying'
(629) o_#n /on-na-/ ['o**d**ˌnaːɾa] 'it's been left, it remains'

Note that, when the following morpheme is not /n/ initial, the pre-plosion rule does not take place. Compare (630) and (631):

(630) a_#n /an-na-ɾa/ ['a**d**ˌ**n**aːɾa] 'he's shooting'
(631) a_ /an-tu-ua/ ['a^{d}**n**ˌ**d**uːwa] 'I will shoot'

The labial nasal [m] follows creaky nasal triphthongs /ḭ̃ã̰ṵ̃/ and /ṵ̃ã̰ṵ̃/ as well as nasal diphthong /ãũ/, as in (634):

(632) ḭ̃ã̰ṵ̃_ /ḭ̃ã̰ṵ̃n-na-ɾa/ ['j̰̃ã̰w̰̃**m**ˌnaːɾa] 'he denies it'
(633) ṵ̃ã̰ṵ̃_ /ũãũũãũn-na-ɾa/ [w̃ãw̃'w̃ãw̃**m**ˌnaːɾa] 'it's worn out'
(634) ãũ_ /uatãũuatãũn-na-ɾa/ [waˌtãw̃ːwa'tãw̃**m**ˌnaːɾa] 'it's round'

The alveolar nasal [n] follows a nasal or a nasal and creaky voice vowel. In this environment, [n] is usually assimilated by the vowel it follows, which becomes then lengthened:

(635) ṵ̃_ /nṵ̃n-su/ ['nṵ̃**n**^{t}su] ~ ['nṵ̃ː^{d}zu] ~ ['nṵ̃ːn^{d}zu] 'armadillo, sp.'

The velar nasal [ŋ] follows a nasal vowel and is followed by a velar consonant:

(636) ũẽ_k /kũẽnki-a/ ['kw̃ẽŋka] 'year'

The voiceless glottal plosive [ʔ] allophone is in free variation with the other pre-plodded realizations of /n/. It is particularly observed in the speech production of younger speakers, who sometimes avoid the pre-plosion. Note that once /n/ is phonetically realized as [ʔ], epenthetic [t] is added. In this phonetic environment, [t] may coalesce into [t^{h}]:

(637) a̰ḭ_ /a̰ḭn-su/ ['a̰j̰**ʔ**^{t}su] ~ ['a̰j̰**ʔ**t^{h}u] ~ ['a̰j̰^{d}n^{t}su] ~ ['a̰j̰^{g}ŋ^{t}su]
'fish (general)'

It is also important to note that, if coda /n/ is resyllabified as the onset of the following vowel-initial morpheme, it will be necessarily realized as [n]. Compare the examples below, in which root final /n/ is followed by the referential morphemes {-su} and {-a}:

(638) a_#s	/ialan-su/	[jaˈla**ᵈn**ᵗsu]	‘toucan (general)’
(639) a_#V	/ialan-a/	[jaˈlaː**n**a]	‘toucan (general)’
(640) a_#V	/u̯̰a̰u̯̰n-su/	[ˈw̰a̰w̰ː**ᵇm**ᵗsu]	‘scorpion, sp.’
(641) a_#s	/u̯̰a̰u̯̰n-a/	[ˈw̰a̰w̰ː**n**a]	‘scorpion, sp.’

As illustrated in (639) and (641), whenever coda /n/ is followed by a vowel initial morpheme, no pre-plosion is attested because of resyllabification. Note that after resyllabification of/n/, the nucleus of its original host syllable becomes lengthened.

3.3.3.2 Aspirated Consonants

Aspirated consonants comprise a lesser set of phonemes, with only four segments: /pʰ, tʰ, kʰ, ʰn/. They are classified into only two different manners, namely, plosives and nasals, which in turn are articulated in only three places: labial, alveolar, and velar. The aspiration of such segments can also be categorized according to the location in which it takes place. Whereas plosives are aspirated after the closure phase, i.e., post-aspirated, the nasal is pre-aspirated, i.e., the aspiration takes place before the closure phase.

3.3.3.2.1 Aspirated Plosives

The aspirated plosives constitute a series of three voiceless segments, namely /pʰ, tʰ, kʰ/. Each of these segments only display one phonetic realization, which is restricted to the syllable onset. One striking difference between plain and unaspirated plosives is related to voicing: although voiceless unaspirated plosives may become voiced depending on surrounding segments, aspirated plosives never become voiced. Furthermore, aspirated plosives never occur in syllables whose nucleus is a creaky voice or nasal and creaky voice vowel, except for /kʰ/, which may co-occur with creaky and nasal and creaky vowels.
As a rule, aspirated plosives only occur in stressed syllables, which are mostly attested in word-initial position, except if syllables are reduplicated. Reduplication and compounding would also allow aspirated consonants to occur in syllables in word-medial and unstressed positions within a word.

3.3.3.2.1.1 /pʰ/

/pʰ/ is an aspirated voiceless labial plosive. Just like its unaspirated counterpart, it is the rarest aspirated plosive, and it figures as one of the rarest phonemes in the system. The only allophone of /pʰ/ is [pʰ].

Phonotactics

/pʰ/ is only attested in syllables whose nucleus is a high front vowel /i/, as in (642), mid back vowel /o/, as in (643), or falling diphthongs /ai/ and /au/, as shown in (644) and (645), respectively:

(642) _i	/pʰipʰin-na-ɾa/	[pʰiˈpʰidˌnaːɾa]	‘it’s chubby’
(643) _o	/pʰopʰon-na-ɾa/	[pʰoˈpʰodˌnaːɾa]	‘it’s pot-bellied’

(644) _ai	/pʰaipʰail-su/	[pʰajˈpʰajːɾʰu]	‘frog, sp.’
(645) _au	/pʰaupʰaun-na-ɾa/	[pʰawˈpʰawᵇmˌnaːɾa]	‘it’s dusty, grainy, floury’

As illustrated in the examples above, /pʰ/ is only attested in reduplicated syllables. Therefore, it may occur in syllables in both word-initial and medial positions, in stressed and unstressed syllables within a word.

3.3.3.2.1.2 /tʰ/

/tʰ/ is an aspirated voiceless alveolar plosive. Just like its unaspirated counterpart, it is the most frequent aspirated plosive in the language. The only allophone of /tʰ/ is [tʰ].

Phonotactics

/tʰ/ is only attested in syllables whose nucleus is any oral vowel, i.e. /i, e, a, o, u/, as in (646) - (650), or a falling oral diphthong /ai/, as in (651):

(646) _a	/tʰatʰan-na-ɾa/	[tʰaˈtʰadˌnaːɾa]	‘it’s flexible, soft’
(647) _e	/tʰetʰen-na-ɾa/	[tʰeˈtʰedˌnaːɾa]	‘it’s flaccid, soft’
(648) _i	/ṵa̰-tʰinˀki-na-ɾa/	[w̰a̰ˈtʰiᵍŋɠiˌnaːɾa]	‘he’s shooting’
(649) _o	/saʔuen-a-tʰoʔ-a]	[saʔˈweːnaˌtʰoːʔa]	‘big fire in the jungle’
(650) _u	/tʰutʰun-na-ɾa/	[tʰuˈtʰudˌnaːɾa]	‘it’s crooked, bent’
(651) _ai	/tʰaili-ˀki-su/	[ˈtʰajːɾiˀkisu]	‘necklace’

The nasal vowels /ĩ, ẽ/, as well as the nasal diphthongs /ãĩ, ãũ/ are also attested in syllables with /tʰ/, as illustrated in (652), (653), (654), and (655), respectively:

(652) _ĩ	/saʔuen-tʰĩn-a/	[saʔˈweːˌtʰĩːna]	‘village’
(653) _ẽ	/tʰẽ-kaˀt-su/	[ˈtʰẽːˌkaːˀtisu]	‘tree, sp.’
(654) _ãĩ	/tʰãĩl-su/	[ˈtʰãȷ̃ːɾʰu]	‘banana leaf’
(655) _ãũ	/tʰãũl-su/	[ˈtʰãw̃ːʰl̥u]	‘quince’

3.3.3.2.1.3 /kʰ/

/kʰ/ is an aspirated voiceless velar plosive. It is the second most frequently attested aspirated consonant in the data. The only allophone of /kʰ/ is [kʰ].

Phonotactics

/kʰ/ is attested in syllables with any oral vowel, /i, e, a, o, u/, as in (656) - (660), as well as with the nasal vowel /ũ/, as in (661):

(656) _i	/haia-kʰin-na-ɾa/	[haˌjaːˈkʰidˌnaːɾa]	‘he’s tired’
(657) _e	/kʰe-na-ɾa/	[ˈkʰeːˌnaːɾa]	‘he’s a good hunter’[83]
(658) _a	/kʰakʰan-na-ɾa/	[kʰaˈkʰadˌnaːɾa]	‘it’s soft’

[83] The verb {kʰe-} is also employed to describe an auspicious moment to go hunting or to denote someone who is blessed with luck while hunting.

(659) _o	/kʰon-na-ɾa/	[ˈkʰodˌnaːɾa]	‘it’s broken’
(660) _u	/kʰuːʰl̥u/	[ˈkʰuːʰl̥u]	‘turmeric’
(661) _ũ	/kʰũn-su/	[ˈkʰũnᵈzu] ~ [ˈkʰũːᵈzu]	‘wolf apple’

The diphthongs /ui/, /ṵa̰/, /ãĩ/, and /ũẽ/, as well as the triphthong /uai/ are also attested in syllables with /kʰ/, as illustrated in (662), (663), (664), (665), and (666) respectively:

(662) _ui	/kʰuiˀt(i)-su/	[ˈkʰwiːˀtisu] ~ [ˈkʰwiːdi̯su]	‘deer, sp.’
(663) _ṵa̰	/kʰṵa̰l-su/	[ˈkʰw̰a̰ːʰl̥u]	‘pineapple, sp.’
(664) _ãĩ	/kʰãĩh-aˀli-su/	[ˈkʰãȷ̃ːhaˀlisu]	‘*pacu*’
(665) _ũẽ	/kʰũẽkʰũẽk(i)-su/	[kʰw̃ẽˈkʰw̃ẽːkisu]	‘fan’
(666) _uai	/kʰuais-su/	[ˈkʰwajʔᵗsu]	‘hummingbird, sp.’

3.3.3.2.2 Nasals

The aspiration of the nasal consonant in /ʰn/ is one of the challenges in the description and analysis of the phonological system. Apart from the difficulty of finding a minimal pair with other nasal segments, namely /n/ and /ˀn/, which may be simply because the occurrences of aspirated consonants are very rare, other closely related Nambikwaran languages do not display aspirated nasal consonants in their phonological systems.

Since the aspirated nasal consonant is frequently attested in a very specific environment, namely the verbal strings, in medial position within the word, one may argue at first that / ʰn/ is the outcome of morphophonological rules (such as the cases of [ɾʰ] and [ʰl̥], which emerge in morpheme boundaries because of the interaction of coda material within the last syllable of a given morpheme and the segment in the onset of the first syllable of subsequent morpheme after juxtaposition).

However, when analyzing the data, I was not able to find substantial evidence which would provide a specific morphophonological rule to explain why the nasal segment is aspirated and support the claim that it is underlyingly the plain nasal segment /n/, such as the cases described for the aspiration of liquids in section 3.3.3.1.3.1. The decision to include /ʰn/ as a phoneme per se is also based on three other criteria:

a) Systematicity: just like the other aspirated consonants, /ʰn/ is categorically realized as aspirated in all examples. /ʰn/ also follows the same phonotactic constraints of aspirated consonants: it never occurs in syllables with creaky voice or nasal and creaky voice vowels.
b) Position within a word: occurrences of /ʰn/ are not restricted to the verbal strings: they also occur in word-initial position in short utterances collected in isolation during elicitation sessions. This environment and context would corroborate the claim that /ʰn/ is phonemic, instead of the phonetic outcome of a morphophonological rule.
c) Acceptability: during the fieldwork sessions, I tested how acceptable it was to pronounce / ʰn/ as the unaspirated nasal [n]. In all cases, speakers simply did not accept this alternation.

The distribution of /ʰn/ is given below.

3.3.3.2.2.1 /ʰn/

/ʰn/ is an aspirated alveolar nasal. The allophones of / ʰn/ are [ʰn], and [ʰn̥].

Phonotactics

/ʰn/ is attested in syllables with oral vowels /i/, /e/, or a/, as shown in (667), (668), and (669), respectively. Note that [ʰn] and [ʰn̥] are in free variation (669):

(667) _i /an-ʰnit-a-ua/ [ãˈʰniˌtaːwa] 'I'm following (the trail)'
(668) _e /ʰnekain-na-ɾa/ [ʰneˈkajdˌnaːɾa] 'it's disseminating'
(669) _a /ten-sa-ʰna-ua/ [ˈteᵈnᵗsaˌʰnaːwa] ~ [ˈteᵈnᵗsaʰn̥aːwa] 'I want (it)'

As shown, occurrences of /ʰn/ are attested in syllables in word-initial (668) and medial positions within a word, as in (667) and (669), respectively, as well as in stressed (667) and unstressed (668) syllables.

3.3.3.3 Glottalized Consonants

Glottalized consonants, or glottalic consonants, are an important characteristic of the phonological system. They are arranged into sets of four different manners of articulation, namely plosives, fricatives, liquids, and nasals, and emerge from the closure or movement of the glottis, which results in the coarticulation of a glottal plosive.

During phonation, the glottalic airflow mechanism may be, on one hand, ingressive, producing implosives and glottalized sonorants (nasals and liquids), and on the other hand, egressive, producing pre- and post-glottalized consonants. Previous works on the phonology of Nambikwara, such as Kroeker (2001) and Costa (2020) addressed and interpreted glottalized plosives as ejective consonants. Since such complex segments are characterized by the coarticulation of a glottal plosive in the first stage of the segments, they are addressed in this dissertation as glottalized.

As I demonstrate in the sections below, glottalization plays an important role in the phonological system and enables the realization of more complex consonants, with two different points of articulation simultaneously, which may be either heterorganic consonant, in the case of complex segments involving a glottal plosive plus heterorganic plosives, liquids and nasals, or homorganic, in the case of the voiceless glottal fricative.

3.3.3.3.1 Glottalized Plosives

Glottalized plosives are comprised of a series of three complex segments, namely /ˀp/, /ˀt/, and /ˀk/. Whereas /ˀp/ and /ˀt/ are more often phonetically realized in the onset of word-initial syllables as implosives [ɓ] and [ɗ], respectively, especially in the speech production of more mature speakers, /ˀk/ is never imploded as [ɠ] in this position. However, implosive [ɠ] is also attested in the data in other positions within a word.

Glottalized segments /ˀp/ and /ˀt/ may also be phonetically realized as pulmonic voiced consonants [b] and [d], respectively, but the former is less frequently attested than the latter. In contrast with non-aspirated plosives, the same glottalized consonant is not allowed to occur simultaneously in the onset and in the coda of the same syllable.

3.3.3.3.1.1 /ˀp/

/ˀp/ is a pre-glottalized voiceless labial plosive. It is the least frequent phoneme attested in the data, with just four tokens. /ˀp/ has three allophones: two of which are non-pulmonic, namely [ˀp] and the voiced labial implosive [ɓ]; and one is pulmonic, the labial voiced plosive [b]. Occurrences of allophone [ˀp] are extremely rare, although they occur in free variation with implosive [ɓ], which is preferred (671). Voiced labial plosive [b] is also in free variation with its non-pulmonic form [ɓ], but it is more often observed in the speech of younger speakers (670). /ˀp/ was also included in the phonological system in view of the symmetry given by the three series of plosives: non-aspirated, aspirated, and glottalized.

Phonotactics

/ˀp/ is only attested in syllable onsets, whose nucleus is often a creaky voice vowel: high front vowel /ḭ/, mid front vowel /ḛ/ and low central vowel /a̰/, as in (670), (671), and (672), respectively. Although one may argue that the glottalization of the voiceless labial plosive is due to the creaky voice feature of the nucleus of its host syllable, /ˀp/ is also followed by nasal low central vowel /ã/, i.e., without the creaky voice phonation, as in (673):

(670) _ḭ	/ˀpḭˀpḭt-aˀli-su/	[ɓḭˈɓḭːtaˀlisu] ~ [bḭˈbḭːtalḭsu]	‘finch, sp.’
(671) _ḛ	/ˀpḛl-su/	[ˈɓḛːɾʰu] ~ [ˈˀpḛːɾʰu]	‘melon’
(672) _a̰	/ˀpa̰l-su/	[ˈɓa̰ːʰl̥u]	‘Leishmaniasis’
(673) _ã	/iaˀpãn-su/	[jaˈɓãnᵈzu]	‘*taioba*’

/ˀp/ is more often attested in word-initial positions, as in (671) and (672). However, it may also occur in word-medial positions, as in (673) or in both word-initial and medial positions if reduplicated (670). Except for unstressed reduplicated syllables, /ˀp/ is restricted to stressed syllables.

3.3.3.3.1.2 /ˀt/

/ˀt/ is a pre-glottalized voiceless alveolar plosive. It has three allophones: [ˀt], voiced alveolar implosive [ɗ], and voiced alveolar plosive [d]. It is the most frequently attested glottalized consonant.

Phonotactics

[ɗ] and [d] are the most frequent allophones and are in free variation. [ɗ] and [d] occur in the onset of syllables in word-initial and medial positions within a word. Both allophones may be followed by most vowels, except for /ẽ, ḛ, ḭ̃/.

(674) _i	/ˀtihˀ-su/	[ˈɗihsu] ~ [ˈdḭːʰsu]	‘snake (general)’
(675) _e	/ˀteh-su/	[ˈɗehsu] ~ [ˈɗeːʰsu]	‘bee, sp.’
(676) _a	/ˀta-ũĩn-a/	[ˌɗaːˈw̃ĩːna]	‘my father’
(677) _o	/ˀton-sã/	[ˈɗoᵈnᵗsã]	‘to grow, to build’
(678) _u	/ˀtuhˀ-a/	[ˈɗuhʔa]	‘achiote’
(679) _ĩ	/aˀtĩ-su/	[aˈɗĩːsu]	‘ani, sp.’
(680) _ã	/ˀtãn-na-ɾa/	[ˈɗãːˌnaːɾa]	‘it’s tight’
(681) _ũ	/a-ḭṵ-si-ˀtũ-su/	[aˌj̰ṵːsiˈɗũːsu]	‘heel’
(682) _ḭ	/a-ˀtḭ-su/	[ˌaːˈɗḭːsu] ~ [ˌaːˈdḭːsu]	‘belly, abdomen’

(683) _a̰ /ˀta̰-su/ [ˈɗa̰ːsu] ‘rhea’
(684) _o̰ /ˀto̰l-sã/ [ˈɗo̰ːʰl̥ã] ‘to feel cold’
(685) _ṵ /ˀtṵl-su/ [ˈɗṵːʰl̥u] ‘agouti’
(686) _ḛ̃ /ˀtḛ̃ˀl-su/ [ˈɗḛ̃ːɾʰṵ] ‘fly (general)’
(687) _ã̰ /ˀtã̰n-na-ɾa/ [ˈɗã̰ːˌnaːɾa] ‘it’s trapped’
(688) _ṵ̃ /ˀtṵ̃n-na-ɾa/ [ˈɗṵ̃ːˌnaːɾa] ~ [ˈdṵ̃ːˌnaːɾa] ‘it’s sucking’
(689) _ai /ˀtai(li)-na/ [ˈɗajːna] ~ [ˈdajːnã] ‘I’
(690) _au /a-ne-ˀtau-su/ [ˌaːneˈɗawːsu] ~ [ˌaːneˈdawːsu]‘horn, antler’
(691) _ã̰ṵ̃ /ˀtã̰ṵ̃l-su/ [ˈɗã̰ṵ̃ːʰl̥u] ‘lizard, sp.’

[ˀt] is also attested in the coda. When followed by a syllable with an initial voiceless consonant, it undergoes resyllabification:

(692) _ˀt# /ũãl-a-kaˀt-su/ [ˈw̃ãːlaˌkaʔtsu] ‘hill’
(693) _ˀt# /iˀt-su/ [ˈiʔtsu] ~ [ˈiʔtisu] ‘wind’

3.3.3.3.1.3 /ˀk/

/ˀk/ is a pre-glottalized voiceless velar plosive. /ˀk/ has four allophones: [ˀk], plain voiceless velar plosive [k], voiced velar implosive [ɠ] and voiced velar plosive [g]. It is the second most frequently attested glottalized consonant.

Phonotactics

[ˀk] is attested in the onset of syllables in word-initial or medial positions within a word, as shown in (697) and (704). It is followed by oral /i, e, a/, creaky voice /ḛ/, and nasal and creaky voice vowels /ã̰, ḭ̃/, as in (694) - (699). When /ˀk/ occurs in the onset of a stressed syllable, it is not realized as [k]:

(694) _i /uˀki-na-ɾa/ [uˈˀkiːˌnaːɾa] ‘he’s going down’
(695) _e /saˀke-sã/ [saˈˀkeːsã] ‘to get worse’
(696) _a /ĩhneˀkaḭa̰ntita̰/ [ˌĩhneˀkaˈja̰ᵈndita̰] ‘what for’
(697) _ḛ /ˀkḛl-su/ [ˈˀkḛːɾʰu] ‘urine, gall’
(698) _ḭ̃ /ˀkḭ̃-su/ [ˀkḭ̃ːsu] ‘hawk, sp.’
(699) _ã̰ /ta̰ˀkã̰ta̰ˀkã̰-su/ [ta̰ˌˀkã̰ta̰ˈˀkã̰ːsu] ‘hawk, sp.’

[ˀk] may also occur in the coda, although it is relatively rare in this position, especially due to epenthesis, which tends to keep a certain group of plosives from being phonetically realized in the coda at morpheme boundaries if the following morpheme starts with a consonant. Once paragoge takes place, [ˀk] is in free variation with [k]. Coda [ˀk] may follow an oral or a creaky voice vowel, a creaky voice diphthong or even a nasal and creaky voice diphthong, as shown in (700), (701), (702) and (703):

(700) o_ /takoˀk(i)-su/ [taˈkoʔksu] ~ [taˈkoːˀkisu] ~ [taˈkoːkisu] ‘forest’
(701) a̰ḭ_ /a̰ḭˀk(i)-su/ [ˈa̰j̰ːkisu] ~ [ˈa̰j̰ʔksu] ‘bird’
(702) ṵḭ_ /kṵḭkṵḭˀk(i)-su/ [ˌkw̰ḭːˈkw̰ḭʔksũ] ~ [ˌkw̰ḭːˈkw̰ḭˀkisu] ‘hawk, sp.’
(703) ṵ̃ã̰_ /kṵ̃ã̰ˀk(i)-su/ [ˈkw̰̃ã̰ʔkisu] ~ [ˈkw̰̃ã̰ːɠisu] ‘grave’

At the phonetic level, [ˀk] is also attested with nasal vowel [ẽː], if it is resyllabified:

(704) _ẽ /hos-a-ˀki-ẽh-su/ [ˌhoːsaˈ**ˀkẽː**ʰsu] ~ [ˌhoːsaˈˀkẽːsu] ‘monkey teeth necklace’

[ɠ] is the rarest allophone of /ˀk/ and it may occur in two environments. In the first environment, the syllable nucleus is a nasal vowel and epenthesis has taken place. Note that it is in free variation with [g] and [ˀk]:

(705) ṵ̃ã̰_ /ˈkṵ̃ã̰ˀk(i)-su/ [ˈkw̰̃ã̰**ɠ**isu] ~ [ˈkw̰̃ã̰gisu] ~ [ˈkw̰̃ã̰ˀkisu] ‘grave’

In the second environment, implosive [ɠ] occurs at morpheme boundaries, whenever it follows a nasal coda /n/. It is also in free variation with plain [g]:

(706) /ṵa̰-tʰinˀki-na-ɾa/ [w̰a̰ˈtʰiᵍŋ**ɠi**ˌnaːɾa] ~ [w̰a̰ˈtʰiᵍŋ**gi**ˌnaːɾa] ‘he’s shooting’

3.3.3.3.2 Glottalized Fricatives

Glottalized fricatives are relatively rare. They are produced in two different places of articulation and are classified into alveolar /sˀ/ and glottal /hˀ/. In contrast with the glottalized plosives, the glottalized fricatives display their glottal phase after the fricative, i.e., they are post-glottalized. This observation is in accordance with Kroeker (2001). In general, glottalized fricatives are usually restricted to the syllable onset, but they are also attested in the coda. Furthermore, they mostly occur in stressed syllables, except if reduplicated. Glottalized fricatives may be followed by either oral vowels or nasal creaky voice vowels, so it is not one hundred percent accurate to argue that the glottalization of fricatives is triggered by an adjacent creaky voice vowel.
During the revision of transcriptions sessions in the fieldwork, native speakers argued that both /sˀ/ and /hˀ/ are phonemes per se, when sequences such as /sV̰/ x /sˀV/ as well as /hV̰/ x / hˀV/ were contrasted, as in examples below:

(707) [aˈ**hḭ**ːɾʰu] *[ˌaːˈ**hˀ**iːɾʰu] ‘liver’
(708) [**ha̰**ˈla̰ːtsu] *[**hˀ**aˈla̰ːtsu] ‘comb, *pitomba’*

(709) [ˌw̰̃ã̰j̰̃ːsaˈ**sa̰**ːʰl̥u] *[ˌw̰̃ã̰j̰̃ːsaˈ**sˀ**aːʰl̥u] ‘*imbira’*
(710) [ˈ**sṵ̃**ːna] *[**sˀ**ũːna] ‘grandfather, god’

In examples (707), (708), (709) and (710), native speakers distinguish what they call a “heavy” (creaky voice) from a light (anything other than a creaky voice) vowel. Furthermore, native speakers also state that [hˀ] in (708) “is not supposed to be there.” As one may notice in the following sections, /hˀ/ is only attested in stressed syllables. Following such arguments and based on acoustic analysis and perception tasks performed in *Praat*, in which native speakers were asked to hear samples, describe them, and then aid in the transcription of words, I decided to include /sˀ/ and / hˀ/ as distinctive phonemes, instead of phonetic realizations of /s/ and /h/, whose syllable nucleus is a creaky voice vowel. It is important to note, however, that /s/ and /h/ rarely occur with creaky voice vowels, as shown in sections 3.3.3.1.2.1 and 3.3.3.1.2.2. Moreover, /sˀ/ and /hˀ/, just like other glottalized consonants, may be phonetically realized as plain consonants, namely [s] and [h], respectively. In this context, the nucleus of the syllable in which they appear will be necessarily creaky. This would make it difficult to provide a clearcut explanation as to whether the glottalization phase within the fricatives is from the consonant itself or if it is triggered by the creaky voice vowel they follow.

3.3.3.3.2.1 /sˀ/

/sˀ/ is a pre-glottalized voiceless alveolar fricative. The allophones of /sˀ/ are glottalized [sˀ], voiceless alveolar fricative [s], and voiceless glottal plosive [ʔ].

Phonotactics

Glottalized voiceless alveolar fricative /sˀ/ is followed by oral vowels /i, e, a, u/ and nasal and creaky voice vowel /ṵ̃/. [sˀ] occurs within the onset of stressed (711) or unstressed syllables (712) if reduplicated. It is in free variation with plain voiceless alveolar fricative [s], but whenever /sˀ/ is realized as [s], the nucleus of its host syllable becomes creaky, as in (711).

(711) _i	/sˀih-su/	[ˈ**sˀ**ihsu] ~ [ˈsḭːʰsu]	‘house’
(712) _e	/sˀesˀek(i)-su/	[**sˀ**eˈ**sˀ**eːkisu]	‘scorpion, sp.’
(713) _a	/sˀah-na-ɾa/	[ˈ**sˀ**ahˌnaːɾa] ~ [ˈ**sˀ**aːˌnaːɾa]	‘he’s laid’
(714) _u	/sˀul-su/	[ˈ**sˀ**uːʰl̥u]	‘mouse, sp.’
(715) _ṵ̃	/sˀṵ̃n-na-ɾa/	[ˈ**sˀ**ṵ̃ːˌnaːɾa]	‘it’s tasteless’

/sˀ/ also occurs in the coda. In this position, it may be realized as [sˀ], [s] and [ʔ], depending on the initial segment of the following morpheme. If the following morpheme starts with a vowel, /sˀ/ is realized as [sˀ] or [s], in free variation, after becoming resyllabified. If [s] is the phonetic form, it triggers the following vowel to be realized as creaky. However, if the following morpheme is s-initial, /sˀ/ is realized as [ʔ], as in (717):

(716) /haisˀ-a/	[ˈhajː**sˀ**a] ~ [ˈhajːsa̰]	‘crop’
(717) /haisˀ-su/	[ˈhaj**ʔ**ᵗsu]	‘crop’

3.3.3.3.2.2 /hˀ/

/hˀ/ is a glottalized voiceless glottal fricative. The allophones of /hˀ/ are [hˀ] and [h], which are in free variation. When /hˀ/ is realized as [h], it triggers the following vowel to be realized as creaky.

Phonotactics

[hˀ] may occur at any edge of a syllable. When it occurs in the onset, it can be followed by oral vowels [i] and [a], as in (718) and (719). It is attested in syllables in word-initial (719) or medial positions (718):

(718) _i	/a-hˀiˀk(i)-su/	[ɐːˈ**hˀ**iːˀksu] ~ [aːˈhḭːˀkisu]	‘hand’
(719) _a	/hˀan-na-ɾa/	[ˈ**hˀ**adːˌnaːɾa]	‘it’s over’

As shown in section 3.3.3.1.2.2, plain voiceless glottal fricative is also attested in the coda. In this position, /h/ and /hˀ/ are also contrastive, as shown in the examples below:

(720) /ˀtuh-su/	[ˈɗuːsu] ~ [ˈɗuhsu]	‘woman’
(721) /ˀtuhˀ-su/	[ˈɗuhsu]	‘*urucum*’

Due to morphophonological constraints, the coda /hˀ/ may be phonetically realized as [h], before the suffix {-su}, as shown in the examples above. Hence, to confirm the presence of /hˀ/

in the underlying representation, speakers were given a set of tasks in which different suffixes with different syllable structures were added to the same morpheme. To illustrate one task, I will use the roots for woman /ˀtuh-/ and *urucum* /ˀtuhˀ-/ from examples (720) and (721), and attach to them referential suffix {-a}, which is onsetless. As a result, the following phonetic realizations were observed:

(722) [ˈɗuː**ha**] ‘woman’
(723) [ˈɗu**hʔa**] ~ [ˈɗu**hʔa̰**] ‘*urucum*’

In (722), we see that the coda [h] is resyllabified and that {-a} is phonetically realized as an oral vowel. In contrast, (723) shows two possible phonetic realizations. In the first one, a glottal plosive is placed between a coda [h] and the referential suffix. On the second realization, note that /a/ is phonetically realized as [a̰]. As illustrated in this chapter, glottalized consonants are very frequently realized as plain consonants and when this occurs, their glottal phase usually triggers the glottalization (laryngealization) of the following vowel. In the case of (723), the glottal phase of / hˀ / is resyllabified as the onset of the following morpheme {-a}, which renders a phonetic [ʔa] syllable. As discussed in Chapter 4, CV syllables are the preferred syllable type by the phonology.
My initial analysis pointed out the complex coda /hʔ/, but this analysis would make the syllable structure more complex and present a gap in the occurrences of glottalized consonants in the coda. Including /hˀ/ would contribute to the symmetry of the distribution of glottalized consonants, since all other glottalized consonants are attested following the nucleus. Some examples in which /h/ and /hˀ/ are found in analogous environments in the coda are shown below:

a) Coda /h/

Key characteristics: no glottal plosive between the stem and referential suffix {-a}.

(724) ih#	/a-tih-a/	[aˈtiː**h**a]	*[aˈti**hʔ**a]	‘blood’
(725) ẽh#	/huˀk(i)-ẽh-a/	[ˌhuˈˀkẽː**h**a]	*[ˌhuˈˀkẽ**hʔ**a]	‘vine’
(726) oh#	/hoh-a/	[ˈhoː**h**a]	*[ˈho**hʔ**a]	‘tinamou’

b) Coda /hˀ/

Key characteristics: glottal plosive between the stem and the referential suffix {-a}, as a consequence of the resyllabification of the glottal phase of /hˀ/.
suffix {-a} may be phonetically realized as [a̰].

(727) ih_# (general)	/ˀtihˀ-a/	[ˈɗih**ʔ**a] ~ [ˈdḭh**ʔ**a] ~ [ˈdḭh**ʔ**a̰]	*[ˈɗiːha]	‘snake’
(728) eh_#	/ehˀ-a/	[ˈeh**ʔ**a] ~ [ˈeh**ʔ**a̰]	*[ˈeːha]	‘ax’
(729) oh_#	/ohˀ-a/	[ˈoh**ʔ**a] ~ [ˈoh**ʔ**a̰]	*[ˈoːha]	‘sky’

3.3.3.3.3 Glottalized Liquids

One of the challenges to including a glottalized liquid in the phonological system is the fact that, just like the plain voiced alveolar lateral /l/, it is never attested in word initial positions and only occurs across syllables. Therefore, at first glance, it is not clear whether the glottal plosive belongs to the coda of the previous syllable (in case both syllables of the root are heavy) or if the glottalization of the liquid is related to the metathesis of the previous vowel, which, in this case, would be creaky voice in the underlying representation.

Evidence of the phonemic status of a glottalized liquid consonant is based on four arguments: 1) one minimal pair provided in the section on consonantal oppositions in this chapter, namely [aˈ**ˀl**uːsu], ‘mantis’ x [aˈ**l**uːsu], ‘mouse’; 2) morphological structure; 3) syllable structure and how it is related to stress assignment, as discussed in Chapter 4; and 4) distributional similarities with other glottalized consonants. The inclusion of a glottalized liquid also contributes to the symmetry of the segmental system in relation to the glottalized versus plain consonants.

3.3.3.3.3.1 /ˀl/

/ˀl/ is a glottalized voiced alveolar lateral. The allophones of /ˀl/ are the glottalized voiced alveolar lateral [ˀl], the plain voiced alveolar lateral [l], as well as the glottalized voiced alveolar flap [ˀɾ] and plain voiced alveolar flap [ɾ].

Phonotactics

[ˀl] occurs in the syllable onset, in word-medial positions within a word. It may be followed by the oral vowels /i, e, a, o, u/, as in (730) - (734), and nasal vowel /ĩ/, as in (735), as long as it is preceded by low vowels /a/ or /a̰/. [ˀl] is in free variation with plain [l]. Note that in the examples in which /ˀl/ is realized as [l], the following vowel is phonetically realized as creaky:

(730) _i	/uai-aˀli-su/	[ˈwajːalḭsu] ~ [ˈwajːa**ˀl**isu]	‘dog’
(731) _e	/kaˀlen-su/	[kaˈ**ˀl**e^{d}n^{t}su] ~ [ka̰ˈ**ˀl**e^{d}n^{t}su]	‘frog (general)’
(732) _a	/kaˀla-na-ɾa/	[kaˈ**ˀl**aːˌnaːɾa] ~ [ka̰ˈ**ˀl**aːˌnaːɾa]	‘they’re many’
(733) _o	/ṵa̰ˀloh-su/	[w̰a̰ˈ**ˀl**ohsu] ~ [w̰a̰ˈ**ˀl**oː^{h}su]	‘snail’
(734) _u	/aˀlu-su/	[a̰ˈ**ˀl**uːsu] ~ [aˈ**ˀl**ṵːsu]	‘mantis’
(735) _ĩ	/kuaˀlĩs-su/	[kwaˈ**ˀlĩ**ʔ^{t}su]	‘*lambari*, sp.’

/ˀl/ is also attested in the syllable coda, following the nasal vowel /ĩ/ (736) or the creaky voice diphthong /ḭa̰/ (737). Note that the high vowel [ĩ] triggers the rhotacism of /ˀl/, which is phonetically realized as the glottalized [ˀɾ] or plain [ɾ] flap. Once again, whenever /ˀl/ is realized as [ˀɾ], the following vowel becomes creaky:

(736) _ˀl#	/a-ĩˀl-a/	[aːˈĩː**ˀɾ**a] ~ [aːˈĩːɾa̰]	‘name’
(737) _ˀl#	/a-ḭa̰ˀl-a/	[aˈj̰a̰ː**ˀl**a]	‘friend’

3.3.3.3.4 Glottalized Nasals

There is one glottalized nasal, the /ˀn/. The glottalization in /ˀn/ always precedes the nasal consonant. Nasal segments pertain to a symmetric system along with other plosives, i.e., apart from its glottalized form, it may also be unaspirated (plain) or aspirated as described in sections 3.3.3.1.4.1 and 3.3.3.2.2.1.

3.3.3.3.4.1 /ˀn/

/ˀn/ is a glottalized alveolar nasal. It has three allophones, namely the glottalized alveolar nasal [ˀn] and the plain alveolar nasal [n], which are in free variation, and [^{d}n], which is only attested in the coda.

/ˀn/ is attested in the syllable onset, followed by the oral vowels /i/ and /e/, as in (738) and (738). It may also be followed by the nasal vowels /ĩ, /ẽ/, /ã/ or /ũ/, as in (740) - (743), creaky voice vowel /ḛ/ (744), nasal and creaky voice vowel /ḛ̃/ (744), and the diphthong /ãũ/ (746). Note that /ˀn/ is attested in stressed syllables. It also occurs in syllables in word-initial (738), or medial (740) positions within a word:

(738) _i /kaˀni-na-ɾa/ [kaˈ**ˀni**ːˌnaːɾa] ‘he’s getting off’
(739) _e /ˀne-na-ɾa/ [ˈ**ˀne**ːˌnaːɾa] ‘it’s like that’
(740) _ĩ /uaˀnĩn-na-ɾa/ [waˈ**ˀnĩ**ːˌnaːɾa] ‘he’s practicing pajelança’[84]
(741) _ẽ /a-ˀnẽ-su/ [ˌaːˈ**ˀnẽ**ːsu] ‘noise’
(742) _ã /a-ˀnãn-su / [ˌaːˈ**ˀnã**ːᵗsu] ‘leaf’
(743) _ũ /haˀnũl-su/ [haˈ**ˀnũ**ʰl̥u] ‘pineapple, sp.’
(744) _ḛ /a-ˀnḛˀk(i)-su/ [aˈ**ˀnḛ**ːˀkisu] ‘leg, thigh’
(745) _ḛ̃ /a-ˀnḛ̃ˀk(i)-su/ [aˈ**ˀnḛ̃**ːˀkisu] ‘wing’
(746) _ãũ /haˀnãũl-su/ [haˈ**ˀn**ãw̃ːʰl̥u] ‘fish, sp.’

/ˀn/ is also attested in the syllable coda, following the oral vowels /i/ or /a/, as in (747) and (748), oral diphthong /ui/ (750), nasal vowel and nasal and creaky voice diphthongs /ṵ̃ã̰/ (751):

(747) i_ /ualiˀn-a/ [waˈliː**ˀn**a] ~ [waˈliːna̰] ‘manioc’
(748) a_ /a-naˀn-ẽn-su/ [anaˈ**ˀn**ẽːᵈzu] ‘ear’
(749) ĩ_ /nĩˀn-a/ [ˈnĩː**ˀn**a] ~[ˈnĩːna̰] ‘skunk’
(750) ui_ /kuiˀn-a-ki-su/ [ˈkwiː**ˀn**akisu] ~ [ˈkwiːna̰kisu] ‘bird, sp.’
(751) ṵ̃ã̰_ /saṵ̃ã̰ˀn-a/ [saˈw̰̃ã̰ː**ˀn**a] ‘ant, sp.’

If coda /ˀn/ follows an oral vowel and is followed by an /s/ initial morpheme, it becomes the preploded alveolar nasal [ᵈn]:

(752) i_ /ualiˀn-su/ [waˈli**ᵈn**ᵗsu] ~ [waˈli**ᵈn**ᵈzu] ‘manioc’

3.3.4 Allophonic Distribution of Consonants

Table 50 summarizes the allophonic distribution of the onset consonants:

Table 50: Allophonic distribution of the onset consonants.

		Labial	**Alveolar**	**Velar**	**Glottal**
plosive	plain	p [p]	t [t, d]	k [k, g]	ʔ [ʔ]
	aspirated	pʰ [pʰ]	tʰ [tʰ]	kʰ [kʰ]	
	glottalized	ˀp [ˀp, ɓ, b]	ˀt [ˀt, d, ɗ]	ˀk [ˀk, ʛ, k, g]	
fricative	plain		s [s, z]		h [h]
	glottalized		sˀ		hˀ

[84] *Pajelança* is a ceremonial act, usually with spiritual and healing purposes, practiced by the *pajé*.

		Labial	Alveolar	Velar	Glottal
			[sˀ, s]		[hˀ, h]
nasal	plain		n [n]		
	aspirated		(ʰn) [ʰn, ʰn̥]		
	glottalized		ˀn [ˀn, n]		
liquid	plain		l [l, ɾ]		
	glottalized		ˀl [ˀl, l]		
	flap		(ɾ) [ɾ]		

As shown in Table *50*, the onset is the only position within the syllable in which all consonants may occur. To illustrate the distributional differences of consonants in the coda, we can turn to Table 51, which shows the allophonic distribution of consonants in this position. Note that, in contrast with the consonantal distribution in the onset, only 13 consonants are licensed to occur in the coda, namely the plosives /t, k, ʔ/, nasal /n/, fricatives /s, h/, liquid /l/, and glottalized consonants /ˀt, ˀk, sˀ, hˀ, ˀn, ˀl/:

Table 51: Allophonic distribution in the coda.

		Labial	Alveolar	Velar	Glottal
plosive	plain		t [t]	k [k]	ʔ [ʔ]
	glottalized		ˀt [ˀt]	ˀk [ˀk]	
fricative	plain		s [ʔ]		h [h]
	glottalized		sˀ [ʔ]		hˀ [h]
nasal	plain		n [n, m, ŋ, ᵇm, ᵈn, ᶢŋ, d, ʔ]		
	glottalized		ˀn [ᵈn]		
liquid	plain		l [∅]		
	glottalized		ˀl [∅]		

As shown in Table *51*, plosives and fricatives are never voiced in the coda. The only voiced segment which is allowed to occur in the coda are the allophones of nasal consonant /n/, comprised of plain, pre-plodded, and glottalized nasals, as well as voiced alveolar stop [d]. This observation shows that plain nasal /n/ has the largest allophonic realizations in the coda. In contrast with this observation, Table *51* also shows that plain and glottalized liquids are never attested within the coda position in the surface representation, as it is usually assimilated or resyllabified. For resyllabification of coda segments, check chapter 4.

Chapter Summary

This chapter provided an overview of Kithãulhu segmental phonology. As shown in 3.1.2, there are 18 phonemic vowels, namely /i, ḭ, ĩ, ḭ̃, e, ḛ, ẽ, ḛ̃, a, a̰, ã, ã̰, o, o̰, u, ṵ, ũ, ṵ̃/, which are organized into four sets, according to the phonation type (modal and creaky) and the value for nasality, namely oral, creaky voice, nasal and simultaneous nasal and creaky voice. Despite phonation types and the value for nasality, mid-vowels are, overall, the least frequent vowels in the language. Also, with regard to mid-vowels, it is important to remark that they never become nasalized. The current description confirms that there are no phonemic long vowels in the phonological system. Underlying short vowels are lengthened in stressed positions within a word under two conditions: 1) phonetic implementation of the nucleus of open underlying syllables, and 2) compensatory lengthening of an underlying heavy syllable, after coda material was lost, usually due to resyllabification. Vowel sequences are distinguished between monosyllabic and heterosyllabic. Monosyllabic vowel sequences are classified into two main categories: diphthongs and triphthongs. Heterosyllabic vowels may occur within or across morphemes and are usually distinguished from one another, considering criteria such as morphological structure, values for nasality or phonation type, as well as reduplication.

As for the consonants, the current description points out 20 phonemes due to contrastive coarticulation, such as aspiration and glottalization. Consonantal phonemes are classified according to four manners (plosives, fricatives, nasal, and liquids) and four places of articulation (labial, alveolar, velar, and glottal), they are: /p, t, k, ʔ, s, h, l, ɾ, n, pʰ, tʰ, kʰ, ʰn, ˀp, ˀt, ˀk, ˀn, sˀ, hˀ, ˀl/. Nasals and plosives, except for voiceless glottal plosive /ʔ/, display contrastive aspiration and glottalization with their plain forms. Fricatives and liquids, however, only distinguish between plain and glottalized segments. Aspiration of fricatives and liquids does occur in the data, resulting from (morpho)phonological rules. Aspiration occurs after the closure phase in the case of plosives, but it precedes the nasal consonants, which may indicate that the aspiration of nasals is not phonemic. However, no aspiration rule could be deducted from the samples in the data to justify such a claim. Moreover, aspirated nasal /ʰn/ also occurs word-initially, which would suggest that it does not result from morphophonological rules such as in the case of the plain voiceless alveolar fricative /s/ and plain voiced alveolar lateral /l/. The coda is the most complex syllable component, as it is prone to phonotactic constraints. Nasal /n/ has the largest allophonic variation in this position. All consonants may occur in the onset. However, the coda may only be filled by 13 consonantal segments, which may be plain /t, k, ʔ, s, h, l, n/ or glottalized /ˀt, ˀk, sˀ, hˀ, ˀn, ˀl/ consonants.

Chapter 4: The Syllable and Stress System

Introduction

This chapter introduces the syllable structure in Kithãulhu and relates it to the stress system. First, I provide an overview of theoretical assumptions on the syllable followed by the discussion on the syllable structure of Kithãulhu, based on autosegmental phonology. Then I propose the syllable template (lexical) and show that segmental features are selected according to different positions within the syllables (i.e. the onset, nucleus, and coda). Thereafter, I show how many segments every syllabic constituent may encompass to illustrate that each consonant occurring on the syllable edges is selected based on a particular set of features. Furthermore, specifiable internal syllable structures are presented, and I show that lexical and surface representation of syllables are asymmetric, covering the changes in the surface representation caused by phonotactic constraints and mapping which surface forms can be derived from a given lexical form. I will also claim that there are no complex codas, but complex segments (such as glottalized consonants) are well-attested in this position. In the final sections of the chapter, I address the stress system and show that stress is mostly predictable based on phonological structure (syllable weight) and morphological structure (morpheme type, as well as position within the morpheme).

4.1. Theoretical Assumptions about the Syllable

A syllable is commonly regarded as a unit in which sequences of available sounds are organized in a language. Syllables are usually viewed as rhythmic units within a word and utterance, as they can be either stressed or unstressed, depending on the content of their structure or position within a word. Furthermore, they serve as “the ‘anchor points’ for tones in tonal systems and in intonation” (Hayes 1989: 250). As a building block for words and additional structures, the syllable is also a unit to which many generalizations on the language structure are referred. It is through the division of the speech stream into syllables that one can have access to the “higher levels of organization which are used in the cognitive processes by which speech is planned and perceived” (Easterday 2019: 01).

Overall, there is considerable variety in the way languages organize segments into syllables. In the syllable domain, the syllable constituents select the segments available for speech production, attributing specific positions to them at their core or edges and regulating them. Every syllable has an internal constituency, and “several universal properties of phonological structure (markedness) require reference to syllable constituency” (Goldstein et al. 2007: 228). According to Goldstein et al. (2007), the following typological properties are related to the syllable:

1. CV syllables are the only type found universally.
2. Onsets combine relatively freely with nuclei, while combination is likely to be more constrained within onsets, within codas, and between nuclei and codas.
3. Coda consonants are frequently weight-bearing (moraic) and can therefore influence metrical patterning, while onset consonants only rarely bear weight. (Goldstein et al. 2007: 241)

Based on the properties observed by Goldstein et al. (2007), we can see that some properties of syllables are universal. Others, however, are (partly) language specific. For instance, every language has a particular way of displaying the arrangements of sound patterns within the syllable, based on its internal constituency. Consequently, languages differ not only regarding the segmental inventory available for the syllable structure, but also in relation to the internal constituency of their permissible syllables.

As such, the syllable constituents reflect different degrees of complexity in their syllable structures, which are not only related to how segments are strung together, but also to how many segments may be hosted within the same syllabic unit. It is also up to the syllable node to determine which segments it may encompass, how they are sequenced within it, and which segmental sequences or features are permissible.

In general, some of the properties applied to describe the syllable structure include sonority, general phonotactics, feature-specific phonotactics, and weight (Blevins 2006). Other properties related to the description of syllables, which are also used to provide evidence for syllable structures in other languages, are summarized by Hyman (2011) when discussing how Gokana (Niger-Congo, Ogoni) lacks phonological syllable units:

> a. distributional constraints conditioned by syllable structure,
> b. phonological rules conditioned by syllable structure,
> c. morphological rules or allomorphy conditioned by syllable structure,
> d. prosodies or word-stress targeting the syllable as a feature-bearing unit,
> e. prosodic grouping of syllables into higher order constituents, e.g., feet. (Hyman 2011: 100)

Hyman's summary on the syllable structure accounts for how syllables are also related to prosodic features, such as stress, prosodic constituency, and morphological structure – the latter relation had already been claimed by Goldsmith (1990). According to the latter author, syllable structure is partly dependent on the segments of which morphemes are made (Goldsmith 1990). Consequently, word morphology should be considered for describing syllables across languages.

Another crucial assumption about the syllable lies on how syllables and segments are associated. For Gussenhoven (2011), the relational association between the syllable and segments of a language is not directly given; it is assumed that there is an intermediate structural level between them. According to Clements & Keyser (1983), the intermediate structure that dominates the segments associated with the syllable is the skeletal slots. The association of duration, attribution of syllabicity of segments, as well as aiding in the representation of morphemes are three crucial roles of the skeletal slots.

Clements & Keyser (1983) also claim that there are two types of skeletal slots: V, which represents the nucleus (or peak of sonority) of a syllable and C, which encompasses the least sonorous syllable edges, namely the onset and the coda. According to the authors, CV slots also differ with relation to the way segments are associated with them. Vowels are assumed to be lexically associated with the V slots, whereas consonants have their associations with the C slot according to a set of rules.

A further essential assumption related to the CV slots is how duration and syllabicity are associated with the segments dominated by it. Whenever a segment is designated to each of the CV slots, they are also assigned the feature [±syllabic] and their respective duration. If consonants and vowels are short, they are associated with only one slot. In turn, long vowels, and consonants (geminate) are linked to two simultaneous slots in the CV representation. As the intermediate structure between the segments and the syllable, CV slots are directly dominated by the syllabic node (σ), a phonological constituent.

4.2. Licensers

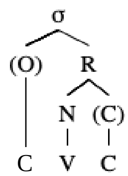
In autosegmental phonology, licensers are prosodic structures determined by the grammar of the language. They are ascribed to regulate and specify the set of phonological features – specifically the autosegments – in the phonological structure (Goldsmith 1990: 123). Licensing

conditions will determine whether or how much conditioning can be associated with specific nodes within points in the skeletal tier.
Thus, autosegmental licensing also provides specifications on the permitted associations of autosegments within the phonological structure, endowing thereby the ability to posit generalizations on the building blocks intrinsic to the phonology. With this theoretical framework, the syllable node is a primary licenser because it is under this node that one finds all distinctive features occurring in a language. As the main licenser, it is up to the syllable node to encompass all permissible distinctive features occurring in the language. Moreover, it also functions as a multidirectional pathway, which interconnects all units at upper and lower levels associated with it.
In languages which allow syllables with a coda, the coda is regarded as a secondary licenser, serving “as the point of origin of a licensing path down to the skeleton” (Goldsmith 1990: 127). As a secondary licenser, the coda is hierarchically found under the syllable domain. Due to the coda’s secondary nature as a licenser, it is theoretically assumed that every language typically assigns a smaller set of available features associated to it.
Although both the syllable node (primary licenser) and the coda (secondary licenser) are language specific, the former displays the most fundamental (primary) role in determining the autosegmental materials that are distributed in the domains beneath it. Furthermore, the syllable node also has the primary role of licensing two other types of association, namely tones and morae. Mora and tone can also be licensed by the coda in the languages, which allow codas to license such associations. We will resort to this concept when later addressing both stress and tone subsystems. In the following sections, I make a clear distinction between lexical and surface forms of syllables and show evidence of how phonetic forms are derived from the base form.

4.3. The Kithãulhu Syllable Structure

Kithãulhu maximal syllable structure is (C)V$^{(V)(V)}$(C)[85] at the lexical level, as all other phonetic forms, such as complex onsets, can be explained based on phonotactic constraints mostly found on the syllable edges at morpheme boundaries. The representation of the maximal syllable structure is illustrated in Figure *3*:

Figure 3: Kithãulhu syllable structure (lexical).



syllabic tier

segmental tier

In Figure *3*, σ represents the syllable node (main licenser), (O) the onset, R the rhyme and (C) the coda. The onset and the rhyme (the nucleus and coda) belong to the syllabic tear. At this level, (C) is the secondary licenser. The segmental tier is represented by C and V – the consonants and vowels (monophthongs, diphthongs, and triphthongs), respectively. C under the onset node (O) encompasses all consonants of the phonological system. There is just one

[85] In this skeletal tier, C stands for consonants and V for vowels. Parentheses indicate which constituents are optional. Current (C)V$^{(V)(V)}$(C) maximal syllable structure analysis contrasts with other proposals for the syllable structure in Southern Nambikwara (Lowe 1999: 272; Kroeker 2001: 82; Netto 2018: 163; Costa: 2020: 76).

C in the rhyme because Kithãuhu does not allow complex codas[86]. As discussed in Chapter 3, coda consonants are a subset of the onset consonants. The syllable structure represented in Figure *3* can deliver four syllable types, namely /V/, /CV/, /VC/, /CVC/. All four syllable types are attested.

Overall, the syllable edges, i.e. the onset and the coda, favor obstruents over sonorants. Furthermore, the coda in particular serves as an environment for both morphological and phonological rules to take place, especially at morpheme boundaries. As I illustrate in the following sections, surface and underlying syllable structures are asymmetric, and the asymmetry is usually related to the phonetic realization of complex segments such as diphthongs, triphthongs, and glottalized consonants. Despite the asymmetry between lexical and surface syllables, it is possible to predict which syllables types can be derived from the lexical representation.

The syllable is also an important domain to determine phonological rules. For instance, we have seen in Chapter 3 that voiceless stops may become voiced in the onset only, as the coda does not allow any [+voice] segments to occur within in the phonetic representation, except for nasals, their allophones, and glides. Let us now turn to the syllable constituents.

4.3.1. The Onset

You may recall from Chapter 3 that vowels can occur without an onset. Therefore, onsets are optional syllable constituents because Kithãulhu allows null onsets. Despite the non-obligatoriness of onsets, onset syllables are favored over onsetless ones. The onset is under the main licenser domain and allows all available consonants to be associated with it. Figure *4* shows the consonantal associations with the onset tier:

Figure 4: Consonantal associations with the onset tier.

CV tier (C) V (C)

/p, t, k, ʔ/
/s, h/
/n/
/l, ɾ/
/pʰ, tʰ, kʰ/
/ʰn/
/ˀp, ˀt, ˀk/
/sˀ, hˀ/
/ˀn/
/ˀl/

Based on Figure *4*, I argue that the onset only licenses maximally one position, which is filled by any one of the 20 consonantal phonemes: /p, t, k, ʔ, s, h, l, ɾ, n, pʰ, tʰ, kʰ, ʰn, ˀp, ˀt, ˀk, sˀ, hˀ, ˀl, ˀn/ in the underlying representation. Syllables with initial obstruents /ʔ/, /ˀp/, /sˀ/, and /hˀ/ are relatively rare. When occurring, some of these consonant initial syllables are restricted to

[86] This analysis contrasts with the ones suggested by Netto (2018) and Costa (2020) for Nambikwara do Campo, which assume that complex codas are allowed. In her more recent investigation, Costa (2020) argues that there are two types of complex codas, the coronal sequence /ns/, only attested in the root of the word for 'child' {ũẽns-} and the glottal sequence /hʔ/, which is attested in a couple of morphemes. In this dissertation, complex codas are assumed to be derived phonologically.

specific positions within a word, such as the ones with an initial glottal plosive /ʔV/, which are never attested word initially. With regard to the features, onsets are predominantly [-voice], except for [+voice] segments /l, ɾ, n, ʰn, ˀl, ˀn/. The features for place of articulation can be [+labial], [+coronal], [+dorsal], and [+glottal]. Onsets can also contrast [±constricted] and [±spread] consonants, due to the series of plain, aspirated, and glottalized consonants. Finally, consonants are also distinguished in terms of the features [±continuant] and [±sonorant].

4.3.2. The Rhyme

The rhyme admits the nucleus, also regarded as the peak of the syllable, and the coda – consonants, which follow the nucleus. It is licensed to be occupied by up to two positions, as described below.

4.3.2.1. The Nucleus

The nucleus is the only mandatory constituent of the internal syllable structure. It occupies the first position within the rhyme. In the underlying representation, the nucleus may be filled by any attested monophthongs, diphthongs, triphthongs, or the syllabic nasal consonant /n̩/[87]. A visual representation of the segments allowed to occur in the nucleus is given in Figure *5*:

Figure 5: Segmental association with the nucleus.

CV tier (C) $V^{(V)(V)}$ (C)

/i, e, a, o, u/
/i̯, e̯, a̯, o̯, u̯/
/ĩ, ẽ, ã, ũ/
/ĩ̯, ẽ̯, ã̯, ũ̯/
/ii, ie, ia, io, iu/
/i̯i̯, i̯e̯, i̯a̯, i̯o̯, i̯u̯/
/ĩẽ, ĩã, ĩũ/
/ĩ̯ẽ̯/
/ui, ue, ua, uo, uu/
/u̯i̯, u̯e̯, u̯a̯/
/ũĩ, ũẽ, ũã/
/ũ̯ĩ̯, ũ̯ẽ̯, ũ̯ã̯/
/ai, au/
/a̯i̯, a̯u̯/
/ãĩ, ãũ/
/ã̯ĩ̯, ã̯ũ̯/
/iai, iau, uai, uau/
/i̯a̯i̯, i̯a̯u̯, u̯a̯i̯, u̯a̯u̯/
/ĩãĩ, ĩãũ, ũãĩ, ũãũ/
/ũ̯ã̯ĩ̯/
/n̩/

87 Syllabic nasal /n̩/ is usually regarded by the Kithãulhú as the glottalized alveolar nasal /ˀn̩/. However, no acoustic evidence of the glottal phase in /ˀn̩/ was found on *Praat* during the acoustic analysis phase of this investigation.

The inclusion of a segment like /n̩/ as a nucleus may suggest that "then any segment of greater sonority can also serve as a syllabic nucleus" (Blevins 2006: 335). Despite this observation, liquids are not allowed to occupy the nucleus in Kithãulhu. Other world's languages, such as the ones belonging to the Bantu[88] language family are also an exception to this rule. As Blevins (2006: 335) states, "if evidence comes to light that syllabic liquids are systematically excluded in languages of this type, then the universal role of the sonority scale in defining possible syllable peaks will have to be reevaluated."

4.3.2.2. The Coda

The coda is another optional constituent of syllables. It is licensed to occupy up to one position within the rhyme, as complex codas are not allowed. As a secondary licenser, the coda is associated with a particular set of features. Furthermore, it is the syllable constituent, which is more susceptible to undergoing rules in the surface representation. This susceptibility is not strictly phonologically derived but also motivated by the highly concatenative nature of Kithãulhu polysynthetic morphology, whereby multiple morphemes are strung together. Hence, it is practically inconceivable to describe the Kithãulhu syllable structure, without constantly referring to its morphology and phonology interface.

In general, the coda is the position in which most phonotactic constraints that are ruled by the syllable node operate. In the underlying representation, codas are attested in two overarching syllable types, depending on whether syllables have an onset or not, namely /VC/ and /CVC/. Onsetless syllables with a coda, or /VC/, are relatively rare in contrast with onset syllables with a coda, /CVC/. Overall, /VC/ and /CVC/ are more likely to attract stress, as described in section 4.8.

As shown in section 3.3., the coda consonants are a subset of the onset consonants. In the underlying representation, the coda position admits both obstruents (plosives and continuants) and sonorants. According to Clements (1990: 301), languages which admit both obstruents and sonorants tend to display a smaller set of syllable-final permissible obstruents. Kithãulhu is an example of a language that escapes the tendency to favor sonorants over obstruents. The coda may be filled by one of the following 13 consonants, most of which are obstruents: /t, k, ʔ, s, h, l, n, ˀt, ˀk, sˀ, hˀ, ˀl, ˀn/. Figure *6* illustrates all features associated with the coda:

Figure 6: Consonantal associations under the simple coda tier.

CV tier	(C)	V	(C)
			/t, k, ʔ/
			/s, h/
			/l/
			/n/
			/ˀt, ˀk/
			/sˀ, hˀ/
			/ˀl/
			/ˀn/

[88] As shown in Chapter 1, Nambikwaran groups had contact and lived with runaway enslaved Africans of Bantu ethnicity. The similarity observed in Kithãulhu and Bantu languages may be caused by mere chance, but it may also suggest that language contact had effects on the languages belonging to the Nambikwaran language family.

As shown in Figure *6*, the coda does not admit features such as [+spread] in the laryngeal tier and [+labial] in the place tier, and this is why we see no labial plosives or aspirated consonants in this position. Sonorants and obstruents are also attested in the coda in the underlying representation. At the surface level, however, most obstruents and sonorants in the codas are avoided. Consequently, lexical and surface level syllable structures are usually asymmetric. Except for voiceless glottal plosive /ʔ/, which is usually elided at morpheme boundaries, all plosives occurring in the coda tend to be resyllabified at morpheme boundaries. Furthermore, coda nasal sonorants are usually elided if the nucleus of their host syllables displays the [+nasal] feature.

As described in Chapter 5, the coda is one of the domains in which phonological rules take place. In general, coda [+continuant] segments, such as the voiceless alveolar fricative /s/ and glottalized voiceless alveolar fricative /sˀ/ are never phonetically realized as [s] or [sˀ], respectively, in the coda due to phonotactic constraints. As described in Chapter 3, evidence for these segments in the coda is provided based on the segmental structure of the following morpheme. Glottal fricative /h/ is the only fricative that is realized in the coda in the surface representation, although it is usually elided. A common strategy to avoid segments such as plosives and glottalized consonants such as /t, k, l, ˀt, ˀk, ˀl/ from being phonetically realized in the coda is through the epenthesis of high front vowel [i] after such segments, as described in Chapter 5. This strategy renders [Ci] syllables, which also contributes to the claim that /CV/ syllables are the most frequently attested syllable type in the language. Mamaindê, a closely related language, uses a similar strategy to avoid certain consonants being phonetically realized in the coda. According to Eberhard (2009: 132-133), Mamaindê speakers employ an underspecified epenthetic vowel V to keep continuant /h/ from being phonetically realized in the coda, as Mamaindê specifies only non-continuants to occur in this position at the surface level. As for Kithãulhu, occurrences of syllable codas are also determined by word position. For instance, Kithãulhu does not allow any coda consonants to appear word finally[89].

Based on the information provided in Figure *4* and Figure *6*, it is possible to describe how different nodes within the syllable structure are associated with specific sets of features. Onsets and codas, for instance, are easily distinguished by the features [+labial] and [+spread], which are allowed to occur in the former and prohibited in the latter. Table *52* shows all segments which are licensed to occur in the syllable structures at the lexical level:

Table 52: Internal syllabic structure (lexical).

/σ/		
	Rhyme	
Onset	**Nucleus**	**Coda**
(C)	**V**	**(C)**
/p, t, k, ʔ/ /pʰ, tʰ, kʰ/ /ˀp, ˀt, ˀk/ /s, h/ /sˀ, hˀ/ /l, ɾ/ /ˀl/ /n/ /ʰn/ /ˀn/	/i, e, a, o, u/ /ḭ, ḛ, a̰, o̰, ṵ/ /ĩ, ẽ, ã, ũ/ /ḭ̃, ḛ̃, ã̰, ṵ̃/ /ii, ie, ia, io, iu, ai, au, ui, ue, ua, uo, uu/ /ḭḭ, ḭḛ, ḭa̰, ḭo̰, ḭṵ, a̰ḭ, a̰ṵ, ṵḭ, ṵḛ, ṵa̰/ /ĩã, ĩũ, ãĩ, ãũ, ũĩ, ũẽ, ũã/ /ḭ̃ḛ̃, ã̰ḭ̃, ã̰ṵ̃, ṵ̃ḭ̃, ṵ̃ḛ̃, ṵ̃ã̰/ /iai, uai, iau, uau/ /ḭa̰ḭ, ḭa̰ṵ, ṵa̰ḭ, ṵa̰ṵ/ /ĩãĩ, ĩãũ, ũãĩ, ũãũ/ /ṵ̃ã̰ḭ̃/ /n̩/	/t, k, ʔ/ /ˀt, ˀk/ /s, h/ /sˀ, hˀ/ /l/ /ˀl/ /n/ /ˀn/

[89]Particles such as /ˀpa/ may be phonetically realized with a final aspiration [ɓaʰ].

It is important to note that Table 52 does not illustrate which segments are strung within the same syllable, as it only provides an overview of the segments allowed in each constituent under the syllable domain. This is true for the co-occurrences of consonantal phonemes in the case of onset closed syllables, and for how the nucleus is strung with segments preceding or following it. For instance, we have seen in Chapter 3 that most glottalized consonants are not allowed to co-occur within the same syllable with other glottalized consonants, usually if they belong to the same class, e.g. plosives. Hence, syllable */ˀpḛˀt/ is not permissible, as it violates this phonotactic constraint, even though /ˀp/ may occur in the onset, /ḛ/ in the nucleus, and /ˀt/ in the coda, as shown in Table *52*. The information provided in Table *52* also provides a visual representation of the claim that the consonants allowed to occur in the coda are a subset of the consonants in the onset, as previously discussed.

4.4. Syllable Types (Lexical)

4.4.1. Open Syllables

Kithãulhu allows two types of open syllables at the lexical level, due to the onset non-obligatoriness. They are /V/ and /CV/. In general, open syllables are usually attested in unstressed positions, but they can also occur in stressed positions, as described below.

4.4.1.1. /V/

/V/ is a null onset open syllable. It is most frequently attested in word-initial positions, and, sporadically, word medially, and finally. This syllable type often corresponds to monosyllabic affixes, which are frequently unstressed, but roots are also possible, as in (753). Note that /V/ syllables can be comprised of monophthongs (754), diphthongs (762), triphthongs (763), and syllabic nasal /n/ (765). Whenever they occur in polysyllabic morphemes, /V/ syllables occupy unstressed positions and are likely followed by a /CV/ syllable, as shown in (756) and (761):

(753)	/**i**.sã/	[ˈiː.sã]	‘to fetch’
(754)	/**ḛ**.su/	[ˈḛː.su]	‘swallow, sp.’
(755)	/**ẽ**.ˀki.na.ɾa/	[ˈẽː.ˀkiˌnaː.ɾa]	‘it’s heating up’
(756)	/**a̰.**la̰.su/	[a̰ˈla̰ː.su]	‘guan’ (general)
(757)	/**a**.naˀn.ẽn.ka.lo.su/	[a.naˈˀnẽː.gaˌloː.su]	‘ear’
(758)	/**a**.sĩn.**a**/	[aˈsĩː.na]	‘meat’
(759)	/**ũ**.**a**/	[ˈũː.a]	‘capybara’
(760)	/**ṵ̃.**su/	[ˈṵ̃ː.su]	‘bee, sp.’
(761)	/**ia**lau-a/	[jaˈlawː.a]	‘ring’
(762)	/**ũẽ**-a/	[ˈw̃ẽː.a]	‘dove, sp.’
(763)	/**ũãĩ.**a/	[ˈw̃ãȷ̃ː.a]	‘anteater, sp.’
(764)	/**ua**.**ii**.**a**/	[waˈjiː.a]	‘hawk, sp.’
(765)	/**n̩**.na.ɾa/	[ˌnːˈnaː.ɾa]	‘I agree’

4.4.1.2. /CV/

/CV/ is an onset open syllable. It is by far the most frequent syllable at the lexical level. It may occur word initially, medially, and finally, in both stressed and unstressed positions within a word. /CV/ syllables admit all consonants to occur in the C tier, as shown below:

C = any plain consonant:

(766)	**p**V	/**pã**.pãn.na.ɾa/	[pãˈpãːˌnaː.ɾa]	'it's over'
(767)	**t**V	/a.**ta**.su/	[aˈtaː.su]	'evil spirit'
(768)	**k**V	/**ki**.kin.na.ɾa/	[kiˈkidˌnaː.ɾa]	'it has parallel stripes'
(769)	**ʔ**V	/ho.**ʔ**i.na.ɾa/	[hoˈʔiːˌnaː.ɾa]	'he's bathing'
(770)	**s**V	/**so**.na.ua/	[ˈsoːˌnaː.wa]	'I'm taking it'
(771)	**h**V	/**hi**.ie.ka.lo.su/	[hiˈjeː.kaˌloː.su]	'vehicle'
(772)	**l**V	/ka.**la**.na.ɾa/	[kaˈlaːˌnaːɾa]	'she's climbing'
(773)	**n**V	/**nḛ**.su/	[ˈnḛː.su]	'the Manduca'
(774)	**ɾ**V	/ka.to.na.**ɾa**/	[kaˈtoːˌnaː.ɾa]	'it's ripe'

C = any aspirated consonant:

(775)	**pʰ**V	/**pʰo**.pʰon.na.ɾa/	[pʰoˈpʰodˌnaː.ɾa]	'it's pot-bellied'
(776)	**tʰ**V	/**tʰẽ**.kaˀt(i).su/	[ˈtʰẽː.ˌkaː.ˀti.su]	'tree, sp.'
(777)	**kʰ**V	/**kʰe**.na.ɾa/	[ˈkʰeːˌnaː.ɾa]	'he's a good hunter'
(778)	**ʰn**V	/**ʰne**.kain.na.ɾa/	[ʰneˈkajdˌnaː.ɾa]	'it's disseminating'

C = any glottalized consonant:

(779)	**ˀp**V	/**ˀpḭ**.ˀpḭt.a.ˀli.su/	[ɓḭˈɓḭː.taˀli.su] ~ [bḭˈbḭː.ta.ˀli.su]	'finch, sp.'
(780)	**ˀt**V	/a.**ˀtĩ**.su/	[aˈɗĩː.su]	'ani, sp.'
(781)	**ˀk**V	/sa.**ˀke**.sã/	[saˈˀkeː.sã]	'to get worse'
(782)	**sˀ**V	/**sˀe**. sˀek(i).su/	[sˀeˈsˀeː.ki.su]	'scorpion, sp.'
(783)	**hˀ**V	/a.**hˀi**ˀk(i).su/	[ˌɐːˈhˀiː.ˀki.su]	'hand'
(784)	**ˀl**V	/ka.**ˀla**.na.ɾa/	[kaˈˀlaːˌnaː.ɾa]	'they're many'
(785)	**ˀn**V	/**ˀne**.na.ɾa/	[ˈˀneːˌnaː.ɾa]	'it's like that'

4.4.2. Closed Syllables

There are two types of closed syllables at the lexical level, depending on whether the syllable has an onset: /VC/ and /CVC/.

4.4.2.1. /VC/

/VC/ is a null onset closed syllable. This syllable type is attested word initially and medially, only in stressed positions within a word – unless ambisyllabic consonants are considered, as discussed in section 4.7.2. The coda in /VC/ syllables does not seem to favor dorsal obstruent /k/ if nucleus is a monophthong, but occurrences of coda /k/ are attested if nucleus is a diphthong, as shown in (787). Glottalized consonants /ˀk, ˀs, ˀn/ are not attested within this syllable type. As illustrated in (786) - (794), /VC/ syllables occur in stressed positions, strictly at morpheme boundaries. Although syllable node licenses creaky and nasal vowels to be followed by a coda, no creaky and nasal monophthongs are attested followed by a coda in this syllable type[90].

(786)	V**t**	/**et**.na.ɾa/	[ˈeː.ˌtãː.ɾa]	‘he’s grating’
(787)	V**k**	/a.**ĩãk(i)**.su/	[aˈj̃ãː.ki.su] ~ [aˈɲãː.gi.su]	‘lung’
(788)	V**s**	/**us**.a/	[ˈuː.sa]	‘tayra’
(789)	V**h**	/**ah**.su/	[ˈah.su] ~ [ˈaː.ʰsu]	‘spider, ant (sp.)’
(790)	V**l**	/**ol**.sã/	[ˈoː.ʰl̥a]	‘to get startled’
(791)	V**n**	/**o̰n**.na.ɾa/	[ˈo̰d.ˌnaː.ɾa]	‘it’s burning’
(792)	Vˀ**t**	/**iˀt**.su/	[ˈiʔ.tsu] ~ [ˈiʔ.ti.su]	‘wind’
(793)	V**hˀ**	/**ohˀ**.a/	[ˈoh.ʔa]	‘sky’
(794)	Vˀ**l**	/a.**ĩˀl**.a/	[aːˈĩː.ɾa̰]	‘name’

Table *53* is built upon the information presented in section 4.3.2.2. and it shows the segmental distribution in the coda of /VC/ syllables, according to the nucleus types (monophthongs, diphthongs, and triphthongs) and vowel features, namely [±nasal] and [±constricted]. Note that there are no attestations of the voiceless glottal plosive /ʔ/ and glottalized alveolar fricative /sˀ/ occurring in the coda of this syllable type:

Table 53: Segmental distribution in the coda of /VC/ syllables, according to vowel types.

Monosyllabic vowel Types			**Rhyme in VC syllables**		
			Nucleus	**Coda**	
	Features			**Permissible**	**Non-permissible**
Monophthongs	[-nasal]	[-constricted]	V	/t, s, h, l, n, ˀt, hˀ/	*/k/, */ʔ/, */ˀk/, */sˀ/, */ˀl/, */ˀn/
		[+constricted]	V̰	/s, l, n/	*/t/, */k/, */ʔ/, */h/, */ˀt/, */ˀk/, */sˀ/, */hˀ/, */ˀl/, */ˀn/
	[+nasal]	[-constricted]	Ṽ	/n, ˀl/	*/t/, */k/, */ʔ/, */s/, */h/, */l/, */ˀt/, */ˀk/, */sˀ/, */hˀ/, */ˀn/
		[+constricted]	Ṽ̰	∅[91]	*/t/, */k/, */ʔ/, */s/, */h/, */l/, */n/, */ˀt/, */ˀk/, */sˀ/, */hˀ/, */ˀl/, */ˀn/
Diphthongs	[-nasal]	[-constricted]	VV	/t, k, ʔ, h, l, n/	*/h/, */ˀt/, */ˀk/, */sˀ/, */hˀ/, */ˀl/, */ˀn/
		[+constricted]	V̰V̰	/t, ʔ, n, ˀt, ˀk, ˀl/	*/k/, */s/, */h/, */l/, */sˀ/, */hˀ/, */ˀn/
	[+nasal]	[-constricted]	ṼṼ	/t, k, s, h, l, n/	*/ʔ/, */ˀt/, */ˀk/, */sˀ/, */hˀ/, */ˀl/, */ˀn/
		[+constricted]	Ṽ̰Ṽ̰	/l, n, ˀl, ˀn/	*/t/, */k/, */ʔ/, */s/, */h/, */ˀt/, */ˀk/, */sˀ/, */hˀ/
Triphthongs	[-nasal]	[-constricted]	VVV	/t, k, s, l, n/	*/ʔ/, */h/, */ˀt/, */ˀk/, */sˀ/, */hˀ/, */ˀl/, */ˀn/
		[+constricted]	V̰V̰V̰	/h, l, n/	*/t/, */k/, */ʔ/, */s/, */ˀt/, */ˀk/, */sˀ/, */hˀ/, */ˀl/, */ˀn/

[90] An example of a nasal and creaky voice diphthong followed by a coda is /ã̰ṵ̃ˀl-a/, phonetically realized as [ˈã̰w̰̃ː.la̰], ‘parrot’ (general).
[91] In words such as [aˌneːˈkḭ̃sa], ‘hair,’ if syllables are parsed as /a.nek.ḭ̃s.a/, creaky voice vowel /ḭ̃/ is followed by coda /-s/ at the lexical level. In this view, morphemes may be parsed as a-nek-ḭ̃s-a, and glossed as INAL-head-hair?-REF. It is not clear, however, if syllable /ḭ̃s/ is a well-attested morpheme.

	[+nasal]	[-constricted]	ṼṼṼ	/s, l, n, ˀl/	*/t/, */k/, */ʔ/, */h/, */ˀt/, */ˀk/, */sˀ/, */hˀ/, */ˀn/
		[+constricted]	Ṽ̰Ṽ̰Ṽ̰	/s/	*/t/, */k/, */ʔ/, */h/, */l/, */n/, */ˀt/, */ˀk/, */sˀ/, */hˀ/, */ˀl/, */ˀn/

As one can see in Table *53*, [-constricted] vowels are followed by a large set of coda consonants. Conversely, [+constricted] vowels can be followed by a larger set of [+constricted] consonants. Except for nasal creaky triphthongs[92], /n/ is the only coda consonant that is available to follow all vowels that allow a coda, a fact which is in accordance with the claim, which states that nasal codas are more preponderant in the world's languages (Blevins 2004). Figure *7* is built upon the information displayed in Table *53*. It shows a continuum with the degree of likelihood for segmental occurrences attested in the coda of /VC/ syllables:

Figure 7: Continuum showing the degree of likelihood for segmental occurrences attested in the coda of /VC/ syllables.

more likely ⟵⟶ less likely

n > l > h > s > t > k > ˀl > ˀt > ˀn > hˀ

According to Figure *7*, certain classes of consonants are more likely to occur in the coda of /VC/ syllables. Overall, sonorants are preferred over continuants. Continuants are preferred over plosives, which, in turn, are more frequent than glottalized consonants.

4.4.2.2. /CVC/

/CVC/ is an onset closed syllable with a simple coda. It is the most frequent closed syllable at the lexical level. /CVC/ syllables are attested in word-initial (795) and medial (797) positions and this syllable type tends to attract stress. Unstressed /CVC/ are also attested, as shown in (797). This syllable type allows all 12 consonantal segments licensed to occur in the coda, namely /t, k, ʔ, s, h, l, n, ˀt, ˀk, sˀ, hˀ, ˀl, ˀn/ to follow the nucleus. As onsets allow all phonemic consonants to occur before the nucleus regardless of the onset syllable types, focus is given to the segments following the nucleus:

Coda = a plain stop:

(795) CV**t** /**pit**.a/ [ˈpiː.ta] 'gourd'
(796) CV**k** /**tak(i)**.su/ [ˈtaː.ki.su] ~ [ˈtaː.ksu] 'grasshopper, sp.'
(797) CV**ʔ** /**saʔ**.uen.a.**tʰoʔ**.a/ [saʔˈweː.naˌtʰoː.ʔa] 'big fire in the forest'

Coda = a plain continuant:

(798) CV**s** /**sis**.su/ [ˈsiʔtsu] 'grass (general)'
(799) CV**h** /**hoh**.sã/ [ˈhoːʰsã] 'to wander'

[92] It is possible that nasal creaky triphthongs are followed by nasal consonants in the coda. As illustrated in Chapter 3, this type of triphthong is very rare, with just 3 tokens in the data. Further investigation should be carried out to confirm, whether there are occurrences of nasal creaky triphthongs followed by a tautosyllabic nasal consonant.

Coda = a plain sonorant:

(800)	CV**l**	/**kʰul**.su/	[kʰuː.ʰl̥u]	‘turmeric’
(801)	CV**n**	/a.**lon**.su/	[aˈloᵈnᵗsu]	‘brother’

Coda = a glottalized consonant:

(802)	CV**ˀt**	/ũãl.a.**kaˀt**.su/	[ˌw̃ãːlaˈka̰ʔ.tsu]	‘hill’
(803)	CV**ˀk**	/**huˀk**(i).su/	[ˈhu.ˀki.su] ~ [ˈhuˀk.su]	‘bow’
(804)	CV**sˀ**	/**haisˀ**.a/	[ˈhajː.ˀsa] ~ [ˈhajː.sa̰]	‘crop’
(805)	CV**hˀ**	/ua.**luhˀ**.a/	[waˈluh.ʔa]	‘vulture’
(806)	CV**ˀl**	/a.ka.**neˀl**.a/	[ˌɐː.kaˈneː.ˀɾa][ˌɐː.kaˈneː.ɾa̰]	‘daughter’
(807)	CV**ˀn**	/**nĩˀn**-a/	[ˈnĩ.ˀna] [ˈnĩː.na̰]	‘skunk’

Table 54 shows the segmental distribution in the coda of /CVC/ syllables. It was built similarly to *Table 53*, and it classifies rhymes according to the nucleus types (monophthongs, diphthongs, and triphthongs) as well as vowel features, namely [±nasal] and [±constricted]. For the sake of comparison with *Table 53*, information on the onset segments was not included:

Table 54: Segmental distribution in the coda of /CVC/ syllables, according to vowel types.

Monosyllabic vowel Types			Rhyme in CVC syllables		
			Nucleus	Coda	
	Features			Permissible	Non-permissible
Monophthongs	[-nasal]	[-constricted]	V	/t, k, ʔ, s, h, l, n, ˀt, ˀk, hˀ, ˀl, ˀn/	*/sˀ/
Monophthongs	[-nasal]	[+constricted]	V̰	/t, s, h, l, n, ˀt, ˀl/	*/k/, */ʔ/,*/ˀk/, */sˀ/, */hˀ/, */ˀn/
Monophthongs	[+nasal]	[-constricted]	Ṽ	/k, s, h, l, n, ˀt, ˀn/	*/t/, */ʔ/, */ˀk/, */sˀ/, */hˀ/, */ˀl/
Monophthongs	[+nasal]	[+constricted]	Ṽ̰	/t, s, l, n, ˀk, ˀl/[93]	*/k/, */ʔ/, */h/, */ˀt/, */sˀ/, */hˀ/, */ˀn/
Diphthongs	[-nasal]	[-constricted]	VV	/t, s, h, l, n, ˀt, sˀ, ˀn/	*/k/, */ʔ/, /ˀk/, */hˀ/, */ˀl/
Diphthongs	[-nasal]	[+constricted]	V̰V̰	/l, n, ˀk/	*/t/, */k/, */ʔ/, */s/, */h/, */ˀt/, */sˀ/, */hˀ/, */ˀl/, */ˀn/
Diphthongs	[+nasal]	[-constricted]	ṼṼ	/t, k, ʔ, h, l, n/	*/s/, /ˀt/, */ˀk/, */sˀ/, */hˀ/, */ˀl/, */ˀn/
Diphthongs	[+nasal]	[+constricted]	Ṽ̰Ṽ̰	/l, ˀk/	*/t/, */k/, */ʔ/, */s/, */h/, */n/, */ˀt/, */sˀ/, */hˀ/, */ˀl/, */ˀn/
Triphthongs	[-nasal]	[-constricted]	VVV	/s/	*/t/, */k/, */ʔ/, */h/, */l/, */n/, */ˀt/, */ˀk/, */sˀ/, */hˀ/, */ˀl/, */ˀn/
Triphthongs	[-nasal]	[+constricted]	V̰V̰V̰	∅[94]	*/t/, */k/, */ʔ/, */s/, */h/, */l/, */n/, */ˀt/, */ˀk/, */sˀ/, */hˀ/, */ˀl/, */ˀn/
Triphthongs	[+nasal]	[-constricted]	ṼṼṼ	/l/[95]	*/t/, */k/, */ʔ/, */s/, */h/, */n/, */ˀt/, */ˀk/, */sˀ/, */hˀ/, */ˀl/, */ˀn/
Triphthongs	[+nasal]	[+constricted]	Ṽ̰Ṽ̰Ṽ̰	/ˀl/	*/t/, */k/, */ʔ/, */s/, */h/, */l/, */n/, */ˀt/, */ˀk/, */sˀ/, */hˀ/, */ˀn/

[93] /s/ is only attested in the word [aˌneːˈkḭ̃sa], ‘hair,’ if syllables are parsed as /a.ne.kḭ̃s.a/.
[94] There are no attestations of creaky voice triphthongs following onset syllables in the data.
[95] There is only one attestation of nasal triphthongs following onset syllables in the data.

As one can see in *Table 54*, all consonants licensed to occur in the coda are attested in this syllable type. Note that [-constricted] vowels are also followed by a large set of coda consonants, when compared to onsetless syllables. Furthermore, [-constricted] vowels can be followed by a larger set of [+constricted] consonants. This observation contrasts with what was observed for onsetless syllables /VC/. Another difference between these two syllable types is related to the frequency of occurrence of the coda segments. As one can notice from *Table 54*, the voiced alveolar lateral /l/ is the consonant that follows most vowel types. Nasal /n/ is the second most frequently attested coda segment in /CVC/ syllables. Figure *8* is built upon the information displayed in *Table 54*. It shows a continuum with the degree of likelihood for segmental occurrences attested in the coda of /CVC/ syllables:

Figure 8: Continuum showing the degree of likelihood for segmental occurrences attested in the coda of /CVC/ syllables.

more likely ↔ less likely

l > n > t > h > ˀl > s > k > ˀt ~ ˀk > ˀn > ʔ > sˀ ~ hˀ

As shown in Figure *8*, certain classes of consonants are more likely to occur in the coda of /CVC/ syllables. In general, sonorants are preferred over plosives. In contrast with /VC/ syllables, plosives are preferred over continuants. Continuants are more frequently attested than most glottalized consonants. Among the glottalized consonants, glottalized liquid /ˀl/ is the most frequent. As for the other glottalized consonants occurring in the coda, note that /sˀ/ is only attested in /CVC/ syllables, whose nucleus is an oral diphthong. /sˀ/ and /hˀ/ are the least frequent coda segments.
In Table *55*, I organized the frequency of occurrence of all syllable types at the lexical level, categorizing them according to the absence or presence of a coda. Syllables in bold denote the most frequent syllable type under each of the three categories. The last row shows the distribution of all syllable types. The further to the right within the continuum a syllable type is, the least frequent it is:

Table 55: Frequency of occurrence of Kithãulhu syllables at the lexical level.

Open Syllables	**CV** > V
Closed Syllables	**CVC** > VC
All Syllable Types	**CV** > CVC > V > VC

Based on Table *55*, I argue that CV syllables are the most frequent syllable not only among open syllabic structure, but among all syllable types. This is in accordance with what has been claimed about other Nambikwaran languages (Eberhard 2009).

4.5. Syllable Structure at the Surface Level

As discussed, surface and lexical forms of syllables are usually asymmetric. This claim is particularly true for stressed syllables in specific morpheme classes (such as the roots). At the surface level, the syllable structure can be expanded to (C)(C)V(C)(C)[96], admitting two slots for both the onset and coda.
Complex onsets mainly arise at morpheme boundaries, usually via resyllabification. Alternatively, complex onsets can also derive from phonological rules both within the same morpheme (such as sequences of a plosive + a diphthong/triphthong, as diphthong and triphthong edges are phonetically realized as glides) or across it (e.g. after vowel elision). In

[96] A complex coda with two consonantal slots is only allowed if the first consonant in the coda is a glide.

cases where complex onsets derive from the input of sequences of a plosive followed by a diphthong or triphthong, the initial gliding phase of these complex segments following the plosive must share the same place feature (feature harmony). Hence, [tj] and [kw] are permissible, since both segments in these sequences share the same place feature, namely [+coronal] and [+dorsal], respectively, whereas *[tw] and *[kj] do not. Feature harmony is not observed in Northern Nambikwaran languages such as Mamaindê (Eberhard 2009) and Negarotê (Braga 2017). Furthermore, in contrast with Latundê (Telles 2002: 112), consonant cluster [kw] is not formed exclusively at morpheme boundaries, as it is attested word-initially.
In the surface representation, complex codas are also derived from morphophonological rules. Overall, they are usually comprised of the last phase of a falling diphthong or a triphthong, which is phonetically realized as a glide, and followed by a glottal consonant or nasal – the latter may be pre-plodded. Table *56* shows the maximal syllable expansion at the surface level, after morphophonological rules have taken place:

Table 56: Internal syllabic structures after morphophonological rules.

[σ]				
		Rhyme		
Onset		**Nucleus**	**Coda**	
(C_1)	**(C_2)**	**V**	**(C_1)**	**(C_2)**
[p, t, k, ʔ]	[s]	[i, e, a, o, u]	[p, t, k, ʔ]	[ʔ]
[b, d, g]	[ɾ]	[iː, eː, aː, oː, uː]	[d]	[h]
[pʰ, tʰ, kʰ]	[w, j]	[i̯, e̯, a̯, o̯, u̯]	[ˀt, ˀk]	[n, m, ŋ, ᵇm, ᵈn, ᵍŋ]
[ˀp, ˀt, ˀk]	[w̃, j̃]	[i̯ː, e̯ː, a̯ː, o̯ː, u̯ː]	[h]	
[ɓ, ɗ, ɠ]	[w̯, j̯]	[ĩ, ẽ, ã, ũ]	[n, m, ŋ, ᵇm, ᵈn, ᵍŋ]	
[ɸ, s, ʃ, h]	[w̯̃, j̯̃]	[ĩː, ẽː, ãː, ũː]	[w, j]	
[ʋ]		[ĩ̯, ẽ̯, ã̯, ũ̯]	[w̯, j̯]	
[z, ʒ]		[ĩ̯ː, ẽ̯ː, ã̯ː, ũ̯ː]	[w̃, j̃]	
[tʃ]		[ɐ, ɪ, ɪː, ʊ]	[w̯̃, j̯̃]	
[dʒ]		[ɐː]		
[ˀs, ˀh]		[ɐ̃]		
[n, m, ɲ]		[ɐ̃ː]		
[ʰn, ʰn̥]		[n̩ː]		
[ˀn]				
[l, ɾ, ʎ, ʎʲ]				
[ʰl, ʰl̥]				
[ˀl, ˀɾ]				

As illustrated in Table *52* for the lexical syllables, all consonants may occur in the onset. Implosives [ɓ, ɗ] are very often favored over the voiceless glottalized stops [ˀp, ˀt]. As for the coda, note that the language imposes some constraints in relation to the realization of [+continuant], [+lateral], and [+constricted] consonants such as [s], [sˀ], [hˀ], [l], and [ˀl]. Evidence for the occurrences of these consonants in the coda are based on the syllable structure of the following morpheme. Phonotactics of complex onsets and codas are given below.

Complex Onset Phonotactics

1. If **C_2** is [w], [w̃], [w̯], or [w̯̃], **C_1** is [k], [kʰ], [ˀk], or [h] – the latter only across morphemes.
2. If **C_2** is [j], [j̃], [j̯], or [j̯̃], **C_1** is [t], [h] or [l] – complex onsets with the latter two segments only occurring across morphemes.
3. If **C_2** is [ɾ], **C_1** is [t] ~ [d] – [tɾ] ~ [dɾ] only occurs across morphemes, after elision of the nucleus.
4. If **C_2** is [s], **C_1** is [t], [k], [ˀt], or [ˀk]

Complex onsets [CG] are phonetically derived from a simple onset followed by a diphthong or a triphthong and may occur in initial and medial positions within a word. [ts], [ks], [ˀts], and [ˀks] only occur at morpheme boundaries. [tɾ] ~ [dɾ] is phonologically derived from elided vowels within the verbal string of polar questions.

Complex Coda Phonotactics

1. If **C_2** is [d], [ʔ], [h], [n], [m], [ŋ], [ᵇm], [ᵈn], or [ᵍŋ], **C_1** is a glide, derived from a diphthong or triphthong.

Maximal syllable structure [CCVCC] is derived from the syllable type /CVC/ and it is only permissible if the nucleus in the input is a triphthong, the onset is a stop, and the coda is a [+continuant] consonant. In this scenario, [CCVCC] syllables are phonetically realized in accordance with the following constraints:

[$C_1C_2VC_1C_2$] Phonotactics:

1. Complex onset: **C_1** is a voiceless dorsal plosive [k]. **C_2** is a dorsal glide [w].
2. Nucleus: **V** is a low central vowel.
3. Complex coda: **C1** is a palatal glide [j]. **C_2** is a voiceless glottal obstruent [ʔ].

The full expansion of the syllable pattern [CCVCC] is only attested in roots. Table *57* shows the systematization of the phonological input (lexical level syllables) and all its derived forms at the surface level. Segments in brackets indicate that they are not obligatory: they are either derived from phonological rules such as resyllabification or from specific nucleus types, such as falling and rising diphthongs or triphthongs. Vowel lengthening is indicated in parentheses (ː) because it is only attested in stressed syllables without a coda, as discussed in Chapter 3:

Table 57: Surface level realizations of lexical level syllables.

Lexical Level	**Surface Level**
V	(C)V(ː), (C)(G)V(G)ː
CV	(C)CV(ː)(C), CGV(ː),
VC	(C)V(ː)(C), (G)V(G)(C)
CVC	CV(ː)(C), C_kG_wV(ː)(G_j)(C)

From the information displayed in Table *57* it is possible to predict all syllable types attested in the surface level. As one can see in the table above, onsetless syllables at the lexical level, namely /V/ and /VC/, can become onset syllables at the surface level. This phenomenon only occurs in two scenarios: 1) coda resyllabification of the morpheme it follows; and 2) the syllable nucleus is a diphthong or a triphthong at the lexical level. In the latter case, the initial high vowel is realized as a glide, which in turn fills in the onset position in the surface representation. Complex onsets attested in the phonetic realizations of /CV/ syllables are also due to resyllabification of codas.
Table *58* shows the phonetic realizations of syllables presented in Table *57* classifying them according to the presence or absence of codas:

Table 58: Surface syllables according to the presence or absence of codas.

open syllables:	[V(ː)]
	[GV(ː)]
	[CV(ː)]

	[CCV(:)], [CGV(:)]
closed syllables:	[VC], [VG:]
	[CVC], [CVG:], [CGVG:], [GVG:]
	[GVGC]
	[$C_kG_wVG_jC$]

As shown in Table *58*, there is slightly more variety in the closed syllable type if we consider glides to be an especial type of coda. Note that, whereas [GV(:)] are attested in stressed and in unstressed positions, [VG:] and [GVG:] are only permitted in the stressed ones.

4.5.1. Examples of Surface Level Syllables

a) Open Syllables

Surface level open syllables include the following types: onsetless syllable [V(:)], and onset syllables [GV(:)], [CV(:)], [CGV(:)], [CCV(:)], and [CCV(:)]. Lengthening (:) is optional and is attested in stressed positions within words.

[V(:)]

(808) [ˈ**ṵ̃**ː.su]
/ṵ̃.su/
'bee, sp.'

(809) [**a̰**ˈla̰ː.**a**ˌta̰ʰ.su]
/a̰.la̰.a.ta̰.su/
'guan, sp.'

[GV(:)]

(810) [**w̃ẽ**ː.su]
/ũẽ.su/
'dove, sp.'

(811) [**wa**ˈ**ji**ː.su]
/ua.ii.su/
'palm tree, sp.'

[CV(:)]

(812) [ˈ**sˀu**ː.**ʰl̥u**]
/sˀul.su/
'mouse, sp.'

(813) [ˌ**hˀi**ːˈ**tʰa**ːˌ**na**ː.**ɾa**]
/hˀi.tʰa.na.ɾa/
'he's tired'

[CGV(:)]

(814) [ˈ**kwi**ː.ɾʰu]
/kuil.su/
'fish, sp.'

(815) [**kwa**ˈlajː.su]
/kua.lai.su/
'spider' (general)

[CCV(:)]

(816) [ɲãˈteː.taˌ**dɾ**ãː] ~
[ɲãˈteː.taˌteː.ɾa.ʔã]
/ĩã.te.ta.te.la.ʔã/
'What is this?'

(817) [ˈtawː.**tsu**]
/taut.su/
'hawk' (general)

b) Closed Syllables

The following closed syllables are attested at surface level: [VC], [VG(ː)] have no onsets, whereas [CVC], [CVG(ː)], [CGVGː], [GVG(ː)], [GVC], [GVGC], [CGVGC] are onset syllables. Despite the maximal surface syllable structure being (C)(C)(V)(C)(C), the following syllable types are not attested: *[CVCC], *[CCVCC], *[CCVCC], and *[CCVGC]. [CGVGː] and [CGVGC] are the rarest syllable types, with only one attestation each.

[VC]

(818) [ˈ**ah**.su]
/ah.su/
'spider, sp.'

(819) [ˈ**id**ˌnaː.ɾa]
/in.na.ɾa/
'it's flying'

[VGː]

(820) [ˈ**ã̰w̰̃**ː.sa.ʰnaː.wa]
/ã̰ṵ̃.sa.ʰna.ua/
'I'm hungry for meat'

(821) [ˈ**aj**ːˌɾaː.wa]
/ail.a.ua/
'I'm hunting'

[CVC]

(822) [ˈ**ɗeh**.su] ~ [ˈɗeː.ʰsu]
/ˀteh-su/
'bee, sp.'

(823) [waˌtu.waˈ**tud**ˌnaː.ɾa]
/ua.tu.ua.tun.na.ɾa/
'it's flickering'

[CVG(ː)]

(824) [ˈ**tãw̃**ːˌtãː.ɾa]
/tãũt.na.ɾa/
'he's whistling'

(825) [**paw**ˈpawᵇmˌnaː.ɾa]
/pau.paun.na.ɾa/
'it's flat'

[GVGː]

(826) [ˈ**jaj**ːˌniː.ɾa]
/iain.i.ɾa/
'you're eating'

(827) [ˈ**w̃ãj̃**ː.su]
/ũãĩ.su/
'anteater, sp.'

[GVC]

(828) [ˈ**wed**ˌnaː.ɾa]
/uen.na.ɾa/
'he's dizzy'

(829) [ˈ**wad**ˌnaː.ɾa]
/uan.na.ɾa/
'it's swollen'

[GVGC]

(830) [ˈ**w̰a̰j̰h**.su]
/ṵa̰ḭh̰.su/
'straw'

(831) [ˈ**w̰a̰w̰ᵇm**.ᵗsu]
/ṵa̰ṵn.su/
'scorpion, sp.'

[CGVGː]

(832) [ˈkw̰̃ã̰j̰̃ː.ɾʰṵ]
/kṵ̃ã̰ḭ̃ˀl-su/
'alga, water plant'

[CGVGC]

(833) [ˈ**kʰwajʔ**.ᵗsu]
/kʰuais.su/
'humming bird, sp.'

As discussed in Chapter 3, the initial or final (or both in case of triphthongs) high vowel of diphthongs are phonetically realized as glides. Both glide-vowel and vowel-glide sequences are analyzed as phonetic realizations of underlying diphthongs. All glide-vowel and vowel-glide sequences may be lengthened. Lengthening occurs in stressed positions only, usually in the rightmost segment of the sequence, as shown in Chapter 3. Table *59* shows all glide-vowel sequences attested in phonetic syllables:

Table 59: Glide-vowel sequences (phonetic).

	[-nasal] vowels										**[+nasal] vowels**								
	[-constricted]					[+constricted]					[-constricted]				[+constricted]				
G₁↓	i	e	a	o	u	ḭ	ḛ	a̰	o̰	ṵ	ĩ	ẽ	ã	ũ	ḭ̃	ḛ̃	ã̰	ṵ̃	**←V₂**
j	ji	je	ja	jo	ju														
j̰						j̰ḭ	j̰ḛ	j̰a̰	j̰o̰	j̰ṵ									
j̃												j̃ẽ	j̃ã	j̃ũ					
j̰̃																j̰̃ḛ̃			
w	wi	we	wa	wo	wu														
w̰						w̰ḭ	w̰ḛ	w̰a̰											
w̃											w̃ĩ	w̃ẽ	w̃ã						
w̰̃															w̰̃ḭ̃	w̰̃ḛ̃	w̰̃ã̰		

As displayed in Table *59*, glide-vowel sequences are attested in 29 constellations, including sequences comprised of only [+coronal] segments, such as [ji, j̰ḭ], as well as only [+dorsal] segments, as in [wu]. The scenario involving vowel-glide sequences has a more concise configuration since the first segment within the sequence is necessarily a low vowel, as shown in Table *60*:

Table 60: Vowel-glide sequences (phonetic).

	[-nasal] vowels										**[+nasal] vowels**								
	[-constricted]					[+constricted]					[-constricted]				[+constricted]				
V₁→	i	e	a	o	u	ḭ	ḛ	a̰	o̰	ṵ	ĩ	ẽ	ã	ũ	ḭ̃	ḛ̃	ã̰	ṵ̃	**G₂↓**
			aj																j
								a̰j											j
													ãj̃						j̃
																	ã̰j̃		j̃
			aw																w
										aw̰									w̰
													ãw̃						w̃
																	ã̰w̰̃		w̰̃

According to Table *60*, only eight vowel-glide sequences are permissible at the phonetic level. In such sequences, the glides in the coda can be lengthened in the surface representation. As discussed in Chapter 3, Kithãulhu segmental phonology also includes triphthongs, which are phonetically realized as glide-vowel-glide sequences. The phonetic realizations of triphthongs are presented in Table *61* and Table *62*:

Table 61: [-nasal] glide-vowel-glide sequences (phonetic).

		[-nasal] glide-vowel-glide				
	G1↓	aj	aw	a̰j̰	a̰w̰	**←V1G2**
[-constricted]	j	jaj	jaw			
	w	waj	waw			
[+constricted]	j̰			j̰a̰j̰	j̰a̰w̰	
	w̰			w̰a̰j̰	w̰a̰w̰	

As shown in Table *61*, there are eight [-nasal] glide-vowel-glide sequences attested in the language, and the sequences comprised of [-constricted] segments are the most frequent. In contrast with the [-nasal] glide-vowel-glide sequences, the [+nasal] glide-vowel-sequences comprise a smaller set, as shown in Table *62*:

Table 62: [+nasal] glide-vowel-glide sequences (phonetic).

		[+nasal] glide-vowel-glide				
	G1↓	ãj̃	ãw̃	ã̰j̰̃	ã̰w̰̃	**←V1G2**
[-constricted]	j̃	j̃ãj̃	j̃ãw̃			
	w̃	w̃ãj̃	w̃ãw̃			
[+constricted]	j̰̃	j̰̃				
	w̰̃	w̰̃		w̰̃ã̰j̰̃		

As seen in Table *62*, there are 5 [+nasal] glide-vowel-sequences, one of which is comprised of [+constricted] segments. In glide-vowel-glide sequences, lengthening may occur in the off-glide, if it is not followed by a coda. Note that the phonetic realizations of diphthongs and triphthongs always include sequences of segments, which share the same value for the features [nasal] and [constricted], by what was described in Chapter 3.

4.6. Principles of Syllabification

Syllabification is a process that associates a linear string of segments with a syllable structure (Goldsmith 1990). Since every language follows a set of principles to arrange segments and syllabify them, syllabification is (partly) language specific (Hayes 1989: 251). It is through syllabification that all permissible syllable types of the language should be derived. In cases where segments in a word or utterance can be associated with both margins of a syllable, a set of principles may be followed to describe and differentiate them in relation to the syllable units and constituency. The most commonly used principles to determine syllable structure across languages are The Maximal Onset Principle (MOP), Directionality of Syllabification, The Total Syllabification Approach, and The Principle of Sonority. All these proposals share one commonality: the obligatoriness of the nucleus as the peak of sonority of the syllable, from which the other syllable constituents can be determined.
The MOP is a heuristic principle (Hayes 1989) that predicts the syllabification of intervocalic consonants as onsets, instead of codas, "as if it were more important to the syllable to have an onset than to have a coda" (Goldsmith 1990: 137). Moreover, the MOP is commonly used to reduce the licensing structures, which allow syllabification and consequently establish the smallest possible number of licensers (Goldsmith 1990). From this view, two consequences of the MOP are:

> (i) construct the fewest possible syllables consistent with the phonological string, a well-established result.

(ii) syllabify an intervocalic segment in an onset rather than a coda since the latter would require establishing one more licensing unit. (Goldsmith 1990: 137).

Another application of the MOP is the possibility of defining coda structures in the languages that allow codas, based on the remaining consonants that were not syllabified as an onset of another syllable. The MOP has been used to describe the syllable structure in Nambikwaran languages (Eberhard 2009; Costa 2020). In the case of Kithãulhu, the MOP is also very active in predicting syllable structures, but it can fail[97] to predict onsets of the syllable structure of some compound words. In cases where the MOP fails, other evidence, e.g. morphological structure, will be used, as discussed in 4.7.

A second common procedure to analyze syllable structures is directionality of syllabification (Goldsmith 1990: 119). According to this principle, every language constructs syllables in a linear way, following a specific direction – either from left to right or the other way around, depending on the language. As a result, segments are assigned to larger syllabic structures to build up the smallest number of syllables in a consistent way, without violating the permissibility related to the syllable formation.

The total syllabification approach determines that extra syllabic elements cannot occur. In other words, every segment under the skeleton tier must be associated with a syllable, as:

> Syllable structure is imposed equally on consonants and on vowels, and if no segmental material is available to fill an obligatory position (typically the vocalic nucleus of the syllable), then the structure is built anyway, with the nuclear position dominating no skeletal position. (Goldsmith 1990: 119)

Both directionality of syllabification and the total syllabification approach are used to determine syllable structures in Kithãulhu. As for the principle of sonority, it is based on the fact that sounds in world languages differ in terms of quality and sonority. Syllabification also acts to arrange the internal structure of syllables in terms of the sonority of sounds:

> The sonority of a sound is determined primarily by the size of the resonance chamber through which the air stream flows. Thus, a low vowel is more plainly audible than a higher vowel uttered with the same force, and any vowel is more audible than a higher vowel uttered with the same force, and any vowel is more sonorous than any consonant. A sequence of sounds in a normal utterance is therefore characterized by successive peaks and valleys of sonority. (Bloch and Trager 1942: 22, as cited in Goldsmith 1990: 110)

The idea of establishing means to measure the degree of sonority[98] of segments is not new. As Pawelec (2012) points out, it dates back to the late nineteenth century. The sonority of segments is usually given in articulatory (see Carr 1993 for a detailed discussion) or acoustic terms (Blevins 1996), although the latter is frequently disputable. Under this theoretical assumption, segments are measured by means of a scale (Saussure 1916; Selkirk 1984; Tropf 1986; Clements 1990; Goldsmith 1990; Broselow & Finer 1991; Zec 1995; Blevins 1996, to name a few), which revolves around the idea that certain classes of segments (e.g. sonorants) are less or more sonorous than others. To exemplify a commonly cited sonority scale, let us turn to

[97] One example of how the MOP may produce incorrect results is given by Hayes (1989: 251), with regard to certain onsets in English.

[98] More recently, it has been claimed that sonority is also shaped by environmental conditions, following the assumptions from the Acoustic Adaptation Hypothesis (see Maddieson 2018; Maddieson & Coupé 2015; Everett 2013).

Goldsmith (1990). Table *63* shows Goldsmith's Sonority Hierarchy, in a decrescent sonority scale:

Table 63: Sonority Hierarchy (Goldsmith 1990: 111).

vowels
low vowels
mid vowels
high vowels
glides
liquids
nasals
obstruents
fricatives
affricates
stops

According to Table *63*, vowels are the most sonorous segments. Note that, even in the case of certain classes of segments such as vowels, there are segments which are more sonorous than others. Following the sonority scale, it is possible to posit that sonority is assumed to play a role in defining segments which can serve as syllable nuclei, and consequently, is actively used to determine syllabicity:

> The sounds which constitute the peaks of sonority are called SYLLABIC; and an utterance has as many SYLLABLES as it contains syllabic sounds. When a vowel is uttered alone or contiguous to one or more consonants, it is always syllabic. (Bloch and Trager 1942: 22, as cited in Goldsmith 1990: 110)

Every language has a particular way of determining which sounds are available to make up syllables. However, it is assumed that certain classes and, most importantly, sequences of sounds are cross linguistically favored to occur within every syllable constituent – which then is determined by a particular set of constraints, such as the Sonority Sequencing Principle (SSP).

The SSP, also known as the Sonority Sequencing Generalization (SSG) or Sonority Sequencing Constraint (SSC), is a principle which establishes constraints relating to the way segments are distributed in syllable structures within the Sonority Hierarchy. This principle is commonly employed to describe the permissible order of segments or classes of segments to appear in the syllable.

According to the SSP, segments in a syllable must follow a sonority-related scale to become eligible to occur in a specific order depending on specific classes of sounds. The SSP suggests that there is a set of rules that determine, in a linear order, which segments may occur within a syllabic structure, from its beginning to its end, according to a sonority scale (Goldsmith 1990: 110-111). As a sequencing structure based on sonority, the syllable holds the nucleus as its core and peak of sonority, and the segments at its margins must progressively increase (onset) and decrease in sonority (coda) for syllables to be considered well formed (Selkirk 1984). However, languages such as Polish (Pawelec 2012) and, to a lesser degree, English, display permissible syllables, which violate the SSG[99]. As such, the SSG is a "a necessary condition for basic syllabification, not a universal statement of syllables possible in any language" (Goldsmith 1990: 111)[100]. As I illustrate in the following sections, the SSG is used to determine Kithãulhu syllable structures. My analyses do not point to any violation of the SSG during

[99] Alternatives to explain the violation of the Sonority Hierarchy are found in Ohala (1992).
[100] Sonority constraints are also reflected in prosodic structure (see Zeg 2018).

syllabification. To determine the Kithãulhu syllable structure, I used the following procedural guidelines:

(a) Finding the nucleus.
(b) Assigning every nucleus to a syllable.
(c) Applying the MOP, assigning every intervocalic consonant to the onset, instead of codas.
(d) Determining the directionality of syllabification.
(e) Associating segments altogether to construct the smallest number of syllables.
(f) Using the total syllabification approach to prevent extra syllabic elements.
(g) Contrasting consonants at the syllable margins to check if there is any violation of the sonority principle.
(h) Finding out the licensers (primary and secondary).
(i) Determining the phonotactic constraints and syllabification rules.
(j) Checking if there is no violation of the syllable construction.
(k) Establishing the phonological rules to determine the output (surface forms) of lexical level syllables.
(l) Contrasting and relating syllable structure to morphological structures.

After following the guidelines in (a) – (l), it is possible to argue that syllabification in Kithãulhu operates by stringing segments together from left to right, forming the fewest syllables possible in accordance with the directionality principle. This operation allows the phonological input to produce larger syllable structures to occur at the surface level due to phonotactic constraints that occur especially at the syllable margins at morpheme boundaries. As I show, the internal structure of the same syllables varies considerably in its lexical and surface forms. Overall, syllabification follows both the SSP and MOP.

4.6.1. Morphological Structure and the CV Tier

As outlined by Goldsmith (1990), the CV tier also plays a role in the representation of morphemes. In Kithãulhu, syllable structure is dependent on word morphology, as it is frequently observed in the interface between the morphological and phonological structures, including within the CV tier. Let us now address the issue of morphological and phonological structure. To begin, it is crucial to provide a definition for the (morphosyntactic) word. In this dissertation, we understand the morphosyntactic word as "a fundamental and universal category of language structure, which functions as a single unit in the syntax" (Haspelmath 2011: 01).

Nambikwaran morphosyntactic words are polysyllabic and consist of at least two syllables, that is, minimal lexical words are disyllabic. Disyllabic words are very frequently polymorphemic, but words like {hali} may be an exception[101]. It is very often observed across the morphosyntactic word that the segmental information at morpheme boundaries is fuzzy. Due to the opaqueness of segmental structure across morphemes, it is very difficult to determine the CV representation of morphemes without proper testing – for instance mapping the segmental realization of the same morphological structure by attaching to them morphemes with distinct CV structures. Overall, syllable edges, i.e. the onset and coda, pose a set of constraints that keep specific classes of sounds (such as continuants and stops) from being phonetically realized at morpheme boundaries. Some of these constraints were observed by Kroeker (2001: 83), who posed a set of complex rules to explain the morphophological phenomena occurring in (Southern) Nambikwara.

Most of the phonotactic constraints relating the morphological structure to the CV tier are highly predictable and the rules operating in this domain are not as complex as previously outlined. However, they are essential to understand how the language structure works. In order

[101] Numerals display a word final /i/. It is not clear whether /i/ is a morphological marker or just a coincidence.

to make a contribution to Nambikwaran studies, in the following tables I map all permissible consonant sequences on syllable edges (codas and onsets) at morpheme boundaries. Table *64* shows all permissible consonants that occur at syllable edges across morphemes. Note that there are 34 possible combinations of consonants cooccurring at morpheme boundaries in the lexical representation.

Table 64: Consonants on syllable edges at morpheme boundaries (lexical level).

C₁→ **Coda** *Morpheme final*	**/t/**	**/k/**	**/ʔ/**	**/ˀt/**	**/ˀk/**	**/s/**	**/h/**	**/sˀ/**	**/hˀ/**	**/n/**	**/ˀn/**	**/l/**	**/ˀl/**	**C₂↓** **Onset** *Morpheme Initial*
	-	-	-	-	-	-	-	-	-	-	-	-		/p/
	/t.t/	**/k.t/**	-	-	-	-	**/h.t/**	-	-	**/n.t/**	**/ˀn.t/**	-		/t/
	/t.k/	**/k.k/**	-	-	-	**/k.s./**	**/h.k/**	-	-	**/n.k/**	-	-		/k/
	-	-	-	-	-	-	-	-	-	-	-	-		/ʔ/
	-	-	-	-	-	-	-	-	-	-	-	-		/pʰ/
	-	-	-	-	-	-	-	-	-	-	-	-		/tʰ/
	-	-	-	-	-	-	-	-	-	-	-	-		/kʰ/
	-	-	-	-	-	-	-	-	-	-	-	-		/ˀp/
	-	-	-	-	-	-	-	-	-	**/n.ˀt/**	-	-		/ˀt/
	-	-	-	-	-	-	-	-	-	-	-	-		/ˀk/
	/t.s/	**/k.s/**	-	**/ˀt.s/**	**/ˀk.s/**	**/s.s/**	**/h.s/**	**/sˀ.s/**	**/hˀ.s/**	**/n.s/**	**/ˀn.s/**	**/l.s/**	**/ˀl.s/**	/s/
	/t.h/	-	-	-	-	-	-	-	-	**/n.h/**		**/l.h/**		/h/
	-	-	-	-	-	-	-	-	-	-	-	-		/sˀ/
	-	-	-	-	-	-	-	-	-	-	-	-		/ˀh/
	/t.n/	-	-	**/ˀt.n/**	-	-	**/h.n/**	-	-	**/n.n/**	**/n.ˀn/**	**/l.n/**		/n/
	-	-	-	-	-	-	-	-	-	-	-	-		/ʰn/
	/t.ˀn/	-	-	-	-	-	**/h.ˀn/**	-	-	**/n.ˀn/**	**/ˀn.ˀn/**	-		/ˀn/
	-	-	-	-	-	-	**/h.l/**	-	-	**/n.l/**	-	-		/l/
	-	-	-	-	-	-	-	-	-	-	-	-		/ɾ/
	-	-	-	-	-	-	**/h.ˀl/**	-	-	-	-	-		/ˀl/

As seen in Table *64*, sequences of consonants belonging to the same class, e.g., [+continuant], are allowed to occur at morpheme boundaries in the lexical representation. The scenario observed in the surface representation is very different from the one presented in Table *64* for the lexical representation, as presented in Table *65*:

Table 65: Consonants on syllable edges at morpheme boundaries (surface level).

C_1→ **Coda** *Morpheme final*	**[t]**	**[k]**	**[ʔ]**	**[ˀt]**	**[ˀk]**	**[s]**	**[h]**	**[sˀ]**	**[hˀ]**	**[l]**	**[ˀl]**	**[n]**	**[m]**	**[ŋ]**	**[ᵇm]**	**[ᵈn]**	**[ᶢŋ]**	**[ˀn]**	**[d]**	**C_2↓** **Onset** *Morpheme Initial*
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**[p]**
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**[b]**
	-	-	**[ʔ.t]**	-	-	-	**[h.t]**	-	-	-	-	**[n.t]**	**[m.t]**	-	**[ᵇm.t]**	**[ᵈn.t]**	-	-	-	**[t]**
	-	-	-	-	-	-	-	-	-	-	-	**[n.d]**	-	-	**[ᵇm.d]**	**[ᵈn.d]**	**[ᶢŋ.d]**	-	-	**[d]**
	-	-	**[ʔ.k]**	-	-	-	**[h.k]**	-	-	-	-	-	-	**[ŋ.k]**	-	-	**[ᶢŋ.k]**	-	-	**[k]**
	-	-	-	-	-	-	-	-	-	-	-	-	-	**[ŋ.g]**	-	-	**[ᶢŋ.g]**	-	-	**[g]**
	-	-	-	-	-	-	**[h.ʔ]**	-	-	-	-	**[n.ʔ]**	**[m.ʔ]**	-	**[ᵇm.ʔ]**	**[ᵈn.ʔ]**	**[ᶢŋ.ʔ]**	-	-	**[ʔ]**[102]
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**[pʰ]**
	-	-	**[ʔ.tʰ]**	-	-	-	-	-	-	-	-	**[n.tʰ]**	-	-	-	-	-	-	-	**[tʰ]**
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**[kʰ]**
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**[ˀp]**
	-	-	-	-	-	-	-	-	-	-	-	**[n.ˀt]**	-	-	-	**[ᵈn.ˀt]**	-	-	-	**[ˀt]**
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**[ˀk]**
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**[ɓ]**
	-	-	-	-	-	-	-	-	-	-	-	**[n.ɗ]**	-	-	-	**[ᵈn.ɗ]**	**[ᶢŋ.ɗ]**	-	-	**[ɗ]**
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**[ᶢŋ.ɠ]**	-	-	**[ɠ]**
	-	-	**[ʔ.tʃ]**	-	-	-	-	-	-	-	-	**[n.tʃ]**	-	-	-	**[ᵈn.tʃ]**	**[ᶢŋ.tʃ]**	-	-	**[tʃ]**
	-	-	**[ʔ.dʒ]**	-	-	-	-	-	-	-	-	**[n.dʒ]**	-	-	-	**[ᵈn.dʒ]**	**[ᶢŋ.dʒ]**	-	-	**[dʒ]**
	[t.s]	**[k.s]**	**[ʔ.s]**	-	-	-	**[h.s]**	-	-	-	-	-	-	-	-	-	-	-	-	**[s]**
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**[z]**
	-	-	**[ʔ.ᵗs]**	-	-	-	-	-	-	-	-	**[n.ᵗs]**	**[m.ᵗs]**	-	**[ᵇm.ᵗs]**	-	**[ᶢŋ.ᵗs]**	-	-	**[ᵗs]**
	-	-		-	-	-	-	-	-	-	-	**[n.ᵈz]**	**[m.ᵈz]**	-	**[ᵇm.ᵈz]**	-	**[ᶢŋ.ᵈz]**	-	-	**[ᵈz]**
	[t.h]	-	-	-	-	-	-	-	-	-	-	**[n.h]**	-	-	-	-	-	-	-	**[h]**
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**[sˀ]**
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**[hˀ]**
	-	-	**[ʔ.l]**	-	-	-	**[h.l]**	-	-	-	-	-	-	-	-	-	-	-	-	**[l]**

[102] Sequences of coda consonants followed by the glottal stop [ʔ] across morphemes are only attested in negative constructions via suffixation of negative morpheme {-ʔ}. In most cases, the glottal plosive suffix is attached to suffix {-na}, which is phonetically realized as [ˀn].

-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	[ɾ]
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	[ʰl̥]
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	[ɾʰ]
-	-	-	-	-	-	[h.ˀl][103]	-	[hˀ.l]	-	-	-	-	-	-	-	-	-	-	[ˀl]
-	-	-	-	-	-	[h.ˀɾ]	-	-	-	-	-	-	-	-	-	-	-	-	[ˀɾ]
-	-	[ʔ.n]	-	-	-	[h.n]	-	-	-	-	-	-	-	-	-	-	-	[d.n]	[n]
-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	[ᵍŋ.ʰn]	-	-	[ʰn]
-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	[ʰn̥]
-	-		-	-	-	[h.ˀn]	-	-	-	-	-	-	-	-	-	-	-	-	[ˀn]

103 The glottal plosive phase in sequences such as [h.ˀl] and [hˀ.l] is ambisyllabic. Ambisyllabicity is discussed in 4.7.2.

Note that, in contrast with Table *64*, Table *65* shows that there are a series of constraints operating at morpheme boundaries at the surface level. Such constraints set out a series of rules at the syllable edges within the CV tier. As a result, classes of segments such as [+continuant] are not allowed to co-occur with an adjacent [+continuant] segment. The most frequently attested rules are described in Chapter 5.

Phonotactic Constraints (Surface Level)

Based on Table *65*, it is possible to posit the permissible segmental sequences within Kithãulhu words at the surface level:

Table 66: Permissible segmental sequences in Kithãulhu.

Permissible segmental sequences	Non-permissible segmental sequences
Vowel-vowel (if heterorganic)	Vowel-vowel (if homorganic)[104]
Plosive-glide, if plosive is [-labial]	Plosive-plosive
Fricative-plosive, if fricative is [-coronal]	Plosive-nasal, if plosive is [-voice]
Fricative-fricative, if heterorganic and first fricative is [-coronal]	Nasal-nasal, if nasal is homorganic
Fricative-nasal, if fricative is [-coronal]	Fricative-fricative, if fricative is homorganic or if first fricative is [+coronal]
Fricative-liquid, if fricative is [-coronal]	Fricative-nasal, if fricative is [+coronal]
Fricative-glide, if fricative is [-coronal]	Fricative-liquid, if fricative is [+coronal]
Nasal-plosive	Fricative-glide, if fricative is [+ coronal]
Glide-plosive	Liquid-plosive
Glide-fricative	Liquid-nasal
Glide-nasal	Liquid-fricative
Glide-liquid	Liquid-glide
Glide-glide, if heterorganic	Nasal-liquid
	Nasal-glide
	Glide-glide, if homorganic[105]

As shown in Table *66*, Kithãulhu internal word structure is determined by a series of phonotactic constraints. For most of the non-permissible sequences, in case segmental sequences are permissible in the lexical representation, it is possible to observe a set of morphophonological rules that ensure that such constraints are not violated. Such phenomena must be considered in order to analyze how syllabification assigns segments to specific syllables in the language.

4.7. Syllabification in Kithãulhu

Syllabification in Kithãulhu operates from left to right, stringing all segments derived from the lexical level into well-formed syllables in the surface representation. In the output, syllables tend to be larger in shape, in accordance with the maximal template (C)(C)V(C)(C) described in the scheme presented in Table *57*, following the directionality of syllabification. Overall, codas are resyllabified, mostly regardless of whether the following morpheme is vowel or consonant initial. Furthermore, there is also a set of morphophonological rules that are applied to avoid onset maximization and violation of the SSG.

[104] Sequences of low central vowels [a.a] or coronal vowels [i.i] may occur at morpheme boundaries, in slow-paced/hyperarticulated speech, or if the first vowel of such sequences is lengthened.
[105] Homorganic glides such as [j.j] and [w.w.] are allowed to occur at the surface representation in slow-paced/hyperarticulated speech. Such occurrences are attested in reduplicated roots, such as in [ˌwa**w**ːˈ**w**aw^{b}mˌnaːɾa] ~ [ˌwaːˈwaw^{b}mˌnaːɾa], 'it's flat.'

The MOP ensures that intervocalic consonants are syllabified as onsets, instead of codas[106]. See examples of application of the MOP in nominal and verbal stems below:

(834)	/alã-su/	[a.**lã**ː.su]	'macaw (general)'

If the final coda within a morpheme is followed by a vowel-initial morpheme, it is then resyllabified:

Application of the MOP across morphemes: (C)VC]V > (C)Vː]CV (obligatory)

(835)	/nṵ̃s-a/	[ˈnṵ̃ː.**s**a]	'pestle'
(836)	/k^{h}ũn-a/	[ˈk^{h}ũː.**n**a]	'wolf apple'
(837)	/huˀk(i)-a/	[ˈhuːˀ**k**a]	'bow'
(838)	/uil-i-ɾa/	[ˈwiːˌ**ɾ**iː.ɾa]	'you're good'
(839)	/hoh-a-ua/	[ˈhoːˌ**h**aː.wa]	'I'm wandering'
(840)	/et-a-ua/	[ˈeːˌ**t**aː.wa]	'I'm grating'

In the context showed in (835) - (840), the codas of stressed syllables are resyllabified, whenever the following morpheme is vowel initial. Once coda material is lost, the following syllable becomes an onset syllable at the surface level due to the MOP. Moreover, the nucleus of the stressed syllable receives compensatory lengthening. In such cases, it is important to note that the MOP operates partially dependent on syllable stress.
To illustrate that resyllabification of codas is dependent on the following syllable structure, I provide examples of nominal roots followed by final nominal suffixes {-su} and {-a}. Whenever a stop occurs in the coda and the following morpheme is {-su}, complex onsets with voiceless continuant [s] are generated. If the coda is /l/ the onset of the following syllables is realized as an aspirated consonant, as shown in (847). Aspiration of onset is optional if the coda consonant it follows is /h/, as in (845):

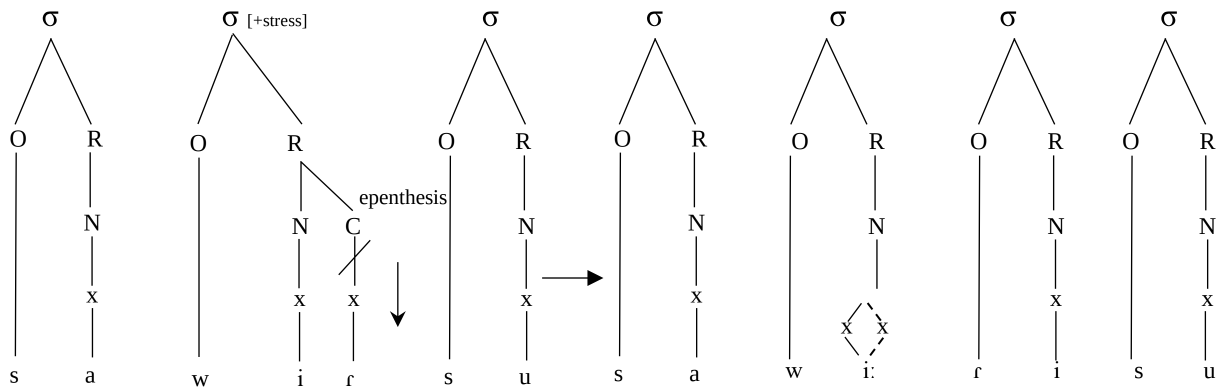
Table 67: Syllabification of codas at morpheme boundaries.

Lexical Form		Surface form		
root		Final suffix {-su}	Final suffix {-a}	Meaning
(841)	/pat-/	[ˈpaː.tsu]	[ˈpaː.ta]	'duck'
(842)	/tak-/	[ˈtaː.ki.su] ~ [ˈtaː.ksu]	[ˈtaː.ka]	'grasshopper, sp.'
(843)	/k^{h}aiʔ/	[ˈk^{h}ajː.su]	[ˈk^{h}ajː.ʔa]	'coati'
(844)	/hos-/	[ˈhoʔ.^{t}su]	[ˈhoː.sa]	'monkey' (general)
(845)	/soh-/	[ˈsoh.su] ~ [ˈsoː.^{h}su]	[ˈsoː.ha]	'banana'
(846)	/ṵa̰ṵn-/	[ˈw̰a̰w̰^{b}m.^{t}su]	[ˈw̰a̰w̰ː.na]	'scorpion, sp.'
(847)	/sauil-/	[saˈwiː.ɾ^{h}u] ~ [saˈwiːɾi.su]	[saˈwiː.ɾa]	'parakeet' (general)

One strategy to avoid sequences of consonants belonging to different morphemes being phonetically realized is epenthesis, as shown in (842) and (847). When epenthesis takes place, complex onsets are prevented from occurring at the surface level and another CV syllable is formed:

[106] According to Kroeker (2001:85): "Any single intervocalic consonant is the initial consonant of the second syllable."

Syllabification Rule (epenthesis): (C)VC_1]su > (C)Vː.C_1i, C_1 = plosives, glottalized plosives, liquids, glottalized liquids. (optional)



Note that epenthetic vowel [i] is usually inserted between the root and the final suffix {-su}. This strategy is usually employed to avoid glottalized consonants from being followed by a plain consonant at morpheme boundaries.

Syllabification Rule of Coda /l/: (C)V**l**]sV > (C)Vː].C[+spread]V (obligatory)

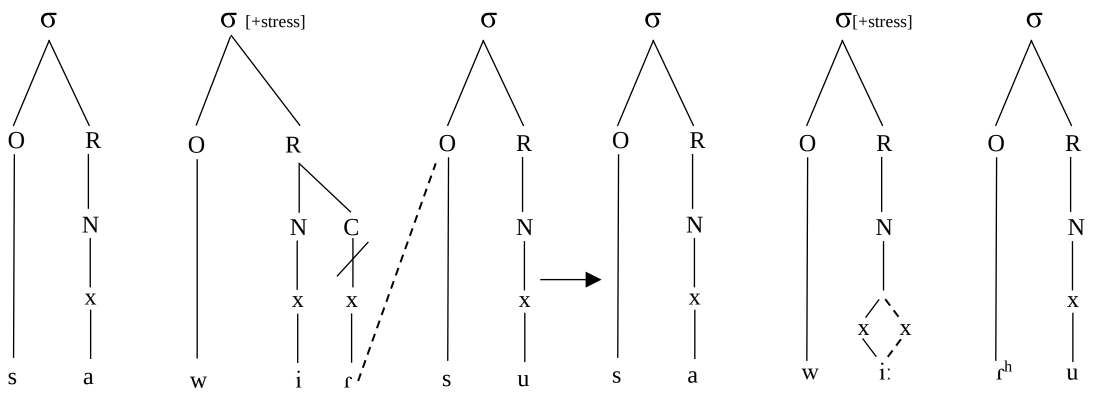
Resyllabification of codas is also attested across morphemes when some classes of consonants at final morpheme position are followed by another morpheme initial consonant class. In the surface representation, coronal consonant sequences such as [ls], [ɾs], and [tn] are not permitted at morpheme boundaries to avoid onset maximization and violation of the SSP, in the case of *[lsV] and *[ɾsV] sequences.
One of the strategies used to avoid the violation of the SSP after resyllabification is coalescence and elision. Coalescence of /l/ occurs across the stem or within it, the latter in serial verb constructions. Compare:

(848) /uil-sã/ [ˈwiː.**ɾʰã**] *[ˈwiː.**ɾsã**]
uil -sã
to be good-SS
'to be good'

(849) /ol-sa-ʰna-ua/ [ˈoː.**ʰl̥**aˌʰnaː.wa] *[ˈoː.**ls**aˌʰnaː.wa]
ol -sa -ʰna -ua
to be scared-1O-NV.EV-NPFV.M
'I'm scared'

(850) /sul-sa-na-ɾa/ [ˈsuː.**ʰl̥**aˌnaː.ɾa] *[ˈsuː.**ls**aˌnaː.ɾa]
sul -sa -∅ -na -ɾa
to beat-1O-3S-PRS-PFV.M
'he's beating me'

A representation of the syllabification of coda /l/ after coalescence in (847) is given below:



Syllabification Rule (elision of /l/): (C)Vl]nV > (C)Vː].nV (obligatory)

To avoid onset maximization in sequences such as [ln], coda /l/ is elided:

(851) /sul-na-ɾa/ [ˈsuːˌnaː.ɾa] *[ˈsuːˌ**ln**aː.ɾa]
sul -∅ -na -ɾa
to beat-3S-PRES-PFV.M
'he's beating'

When glottalized segments occur at morpheme boundaries, the glottal phase of these complex segments can undergo resyllabification if the following morpheme is {-a}, as in (852); complex segments can also undergo epenthesis (855), or resyllabification and simplification (853) if the following morpheme is {-su}:

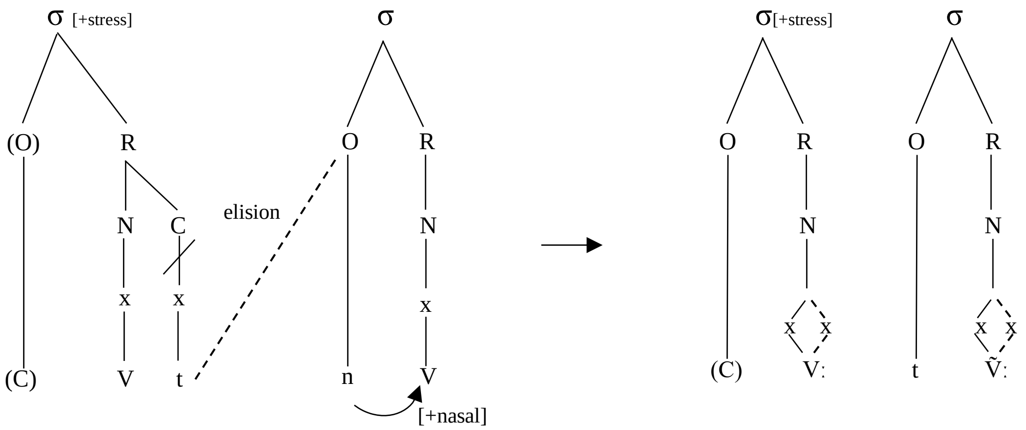
Lexical Form		**Surface Form**		
root		**Final suffix {-su}**	**Final suffix {-a}**	**Meaning**
(852)	/hauˀt(i)/	[ˈhawʔ.tsu] ~ [ˈhawʔ.ti.su]	[ˈhawː.ɗa] ~ [ˈhawːda̰]	'arrow'
(853)	/huˀk(i)/	[ˈhuʔ.ksu] ~ [ˈhuʔ.ki.su]	[ˈhuː.ˀka] [ˈhuːka̰]	'bow'
(854)	/haisˀ-/	[ˈhajʔ.tsu]	[ˈhajːˀsa] ~ [ˈhajːsa̰]	'crop'
(855)	/-ĩˀl-/	[ˌaːˈĩː.ɾʰu] ~ [ˌaːˈĩː.ɾḭ.su]	[ˌaːˈĩːˀɾa] ~ [ˌaːˈĩːɾa̰]	'name'
(856)	/ua.liˀn-/	[waˈliᵈn.ᵗsu]	[waˈliː.ˀna] ~ [waˈliː.na̰]	'manioc'
(857)	/ˀtuhˀ-/	[ˈɗuːʰsu]	[ˈɗuh.ʔa]	'*urucum*'

Kroeker (2001: 83) suggests that glottal plosives undergo metathesis, whenever a glottalized consonant is followed by a morpheme-initial /s/. I was not able to find any evidence that the glottal phase of the glottalized consonant undergoes metathesis and is resyllabified into the onset of the following morpheme {-su}, rendering the surface realization *[sˀu]. However, fricative [s] in {-su} usually has a higher duration value and the nucleus /u/ becomes creaky when it follows glottalized consonants, in contrast with the cases where there is no glottalized consonant preceding it. The difference in duration may account for the rule described by Kroeker, but the metathesis rule described by the author may also be derived from the orthography used by him and other members of the SIL who worked in the Nambikwaran communities.

Syllabification Rule (t final stems): (C)Vt]nV > (C)Vː]**tã** (obligatory)

When verbal stems display a final voiceless alveolar plosive /t/ in the coda and it is followed by a nasal initial morpheme, /t/ is resyllabified after the nasal /n/ is elided. Note that, the [+nasal] feature of /n/ is preserved, and it spreads to the following vowel /a/, which becomes nasalized:

(858)	/et.na.ɾa/	[ˈeː.ˌ**t**ãː.ɾa]	‘I’m grating’
(859)	/uet.na.ɾa/	[ˈweː.ˌ**t**ãː.ɾa]	‘he’s doing (it)’
(860)	/sakãũt.na.ɾa/	[saˈkãw̃ː.ˌ**t**ãː.ɾa]	‘it’s dripping’
(861)	/sakokot.na.ɾa/	[sa.koˈkoː.ˌ**t**ãː.ɾa]	‘it’s glowing’

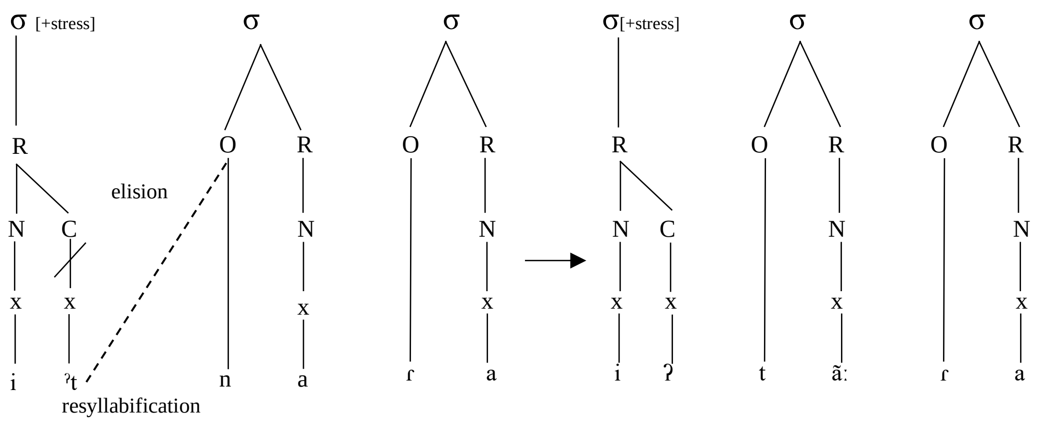


If the following morpheme is vowel initial, the resyllabification rule determined by the MOP is applied, as seen in (862):

(862)	/uet.a.ua/	[ˈweː.ˌ**t**aː.wa]	‘I’m doing’

Elision of morpheme initial /n/ is also attested when verbal stems end with the voiceless alveolar glottalized plosive /ˀt/. In this case, /ˀt/ undergoes resyllabification, keeping the glottal phase [ʔ] in the coda, probably to preserve the syllable weight. Then, the alveolar phase in /ˀt/ is resyllabified, resulting in the elision of /n/. Once again, the feature [+nasal] spreads to the following vowel:

(863)	/iˀt.na.ɾa/	[ˈi**ʔ**.ˌ**t**ãː.ɾa]	‘it’s windy’[107]



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[107] The verb {iˀt-}means ‘*ventar*’ or ‘*soprar*’ in Portuguese, which can be translated as ‘the wind is blowing’ or ‘to blow,’ respectively.

Syllabification Rule: (C)Vn]sV(C)/ > (C)VC$_{\text{m, n, ᵇm, ᵈn, ᵍŋ}}$]ᵗ**s**V(C)
(C)Vn]V$_{\text{with initial coronal vowel}}$(C) > (C)VC$_{\text{m, n, bm, dn, gŋ}}$]ᵗ**j**V(C) (obligatory)

Coda /n/ can also affect the syllable structure of morphemes beginning with the voiceless fricative /s/ or diphthongs and triphthongs with an initial coronal vowel. In this environment, epenthetic [t] is added to the syllable structure of the segments following /n/.

Examples with coda /n/ followed by morpheme-initial /s/:

(864) /ten.sa.ʰna.ɾa/	[ˈteᵈn.ᵗ**s**aˌʰnaː.ɾa]	'I want'
(865) /hain.sa/	[ˈhajᵍŋˌᵗ**s**a]	'to sing'
(866) /ia.lan.su/	[jaˈlaᵈn.ᵗ**s**u]	'toucan' (general)
(867) /ua.ˀnĩn.sã/	[waˈˀnĩːˌᵗ**s**a]	'to do magic'

Examples with coda /n/ followed by diphthongs with an initial coronal vowel /iV/:

(868) /ialan-a-hain-iahlo-su/ [jaˈlaː.naˌhajᵍŋˈᵗ**j**ah.lo.su] ~
[jaˈlaːnaˌhajᵍŋˈ**tʃ**ah.lo.su] 'toucan, sp.'

A more detailed description of epenthesis is provided in Chapter 5.

4.7.1. Diphthongs and Triphthongs

As described in Chapter 3, diphthongs and triphthongs are phonetically realized displaying a glide at one of the syllable edges, in the case of diphthongs, or at both syllable edges, in the case of triphthongs. Even when they are followed by other vowels or vowel sequences, the on- and off-gliding phase is never resyllabified. This observation is also used to justify why vowel sequences such as /uai.a.ˀli.a/ are not phonetically realized as *[wa.ji.a.ˀla], or *[wa.i.ja.ˀla], when all of these phonetic syllable types [wa], [ji], [i], [ja], [ˀla] are permissible. Moreover, it suggests that diphthongs and triphthongs are always syllabified as one single syllabic unit, whose surface realization is determined by the phonological input, instead of being comprised of multiple syllabic units as in */u.a.i.i.a-/[108]. Consequently, syllabification of diphthongs and triphthongs is also predictable in the surface representation. If diphthongs and triphthongs were analyzed as sequences of multiple heterosyllabic vowels, it would be difficult to predict how the vowels in /uai.a.ˀli.a/ would be syllabified in the output, e.g.: [waj.a.ˀla] instead of [wa.ja.ˀla] or [u.aj.a.ˀla].

Syllabification Rule: (C)V$_{\text{vowel/vowel sequence1}}$]V$_{\text{vowel/ vowel sequence2}}$(C) > (C)(G)V(G)](G)V(G)(C) (obligatory)

High vowels belonging to monosyllabic vowel sequences will be phonetically realized as on- and off-glides to establish syllabic boundaries between heterosyllabic vowels within the same morpheme:

(869) /ka.iai.su/	[k**a**ˈ**jaj**ː.su]	'hawk, sp.'
(870) /uai.a.ˀli.a/	[ˈ**waj**ː.a.la̰] ~ [ˈ**waj**ː.**ja**.ˀla]	'dog'

[108] For an alternative analysis of the vowel sequences in Southern Nambikwara, see Costa (2020), who considers all vowels to be heterosyllabic at the lexical level.

(871) /ua.iai.iain.na.ɾa/ [**wa**ˌ**jaj**ːˈ**jaj**^{g}ŋˌnaː.ɾa] ‘it’s roomy’
(872) /ua.io.ion.na.ɾa/ [**wa**.**jo**ˈ**jo**dˌnaː.ɾa] ‘it’s loose’

Syllabification Rule: (C)$V_\alpha V_\alpha$(C)# > (C)[$G_\alpha V_\alpha$(ː)](C) (obligatory)

Two identical high vowels $V_\alpha V_\alpha$ will always be syllabified as [$G_\alpha V_\alpha$(ː)] in the surface representation, if they belong to the same syllable within the same morpheme. In the lexical representation, both vowels are tautosyllabic and analyzed as diphthongs:

(873) /ua.iil.a/ [waˈ**ji**ː.ɾa] ‘hawk, sp.’
(874) /ua.ii.a/ [waˈ**ji**ː.a] ‘palm tree, sp.’
(875) /uu.uun.na.ɾa/ [**wu**ˈ**wu**dˌnaː.ɾa] ‘he’s clumsy’

When two identical high vowels, one of each belonging to a different morpheme, follow each other, they are not syllabified as a diphthong, as shown in (876):

(876) /a.li.i.ɾa/ [aˈ**li**ːˌ**i**ː.ɾa] *[aˈl**ji**ː.ɾa] *[aˈ**lij**ː.ɾa] ‘you’re leaving’

Syllabification Rule: CV_α]#V_α > (C)$Vː_\alpha$]#[$G_\alpha V$] sequences:

Across morphemes, two homorganic vowels will never be syllabified together:

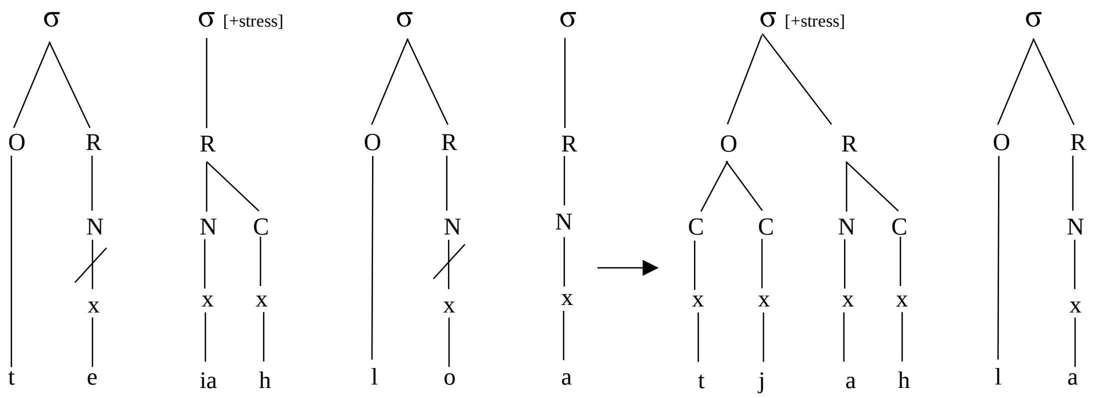
(877) /e-a-tu-ua/ [ˈeːˌaːˈ**tu**ː.**w**a] *[ˈeːˌaːˈt**wu**ː.a] ‘I’ll speak’

Syllabification Rule: $CV^{-stress}$]V(C) > CV(C) (obligatory)

Unstressed vowels are resyllabified at morpheme boundaries. See the example of the third person masculine singular pronoun /te-iahlo-a/:

(878) te. iah. lo. a > tjah.la > tʃah.la ~ tah.la[109]
CV.VC.CV.V > CGVC.CV > CVC.CV

The following illustration shows how /te-iahlo-a/ is resyllabified:



[109] Only attested with young speakers, which also use [taˈtahla].

4.7.2. Ambisyllabicity

As shown in section *4.3,* Kithãulhu allows both syllable codas and onsets to occur at the lexical and surface levels. When languages allow consonants to appear at both syllable edges, syllabification can create ambiguities with relation to the assignment of consonants to any syllable margin, especially in intervocalic environments. When a segment may be assigned to both the coda and the onset in a segment string, it is considered ambisyllabic.
In the case of Kithãulhu, the most salient example of ambisyllabicity arises with the voiceless glottal plosive /ʔ/, which is attested at syllables edges within the same morpheme in either a) an intervocalic environment or b) preceding a consonant. The latter is particularly relevant to the description of the syllable structure, as we have seen in Chapter 3 that Kithãulhu allows glottalized consonants in the segmental phonology. I will now present the strategies used to assign glottal plosives to the syllable onset or coda in the cases related to a), an intervocalic environment, and to the glottal phase of a glottalized consonants, in the case of b).

a) Intervocalic glottal plosive /VʔV/

In Chapter 3, I showed that glottal plosives are allowed to occur in either the onset or coda of a syllable, but never simultaneously within the same syllable. In other words, */ʔVʔ/ syllables are not permitted. In general, glottal plosives are often attested following the nucleus, i.e. they belong to the coda. In intervocalic positions, VʔV, glottal plosives may be associated with the coda or the onset, depending on the segment which follows them and the morphological structure. Some examples of intervocalic glottal plosives are provided in (879) – (883):

(879)	/sa**ʔ.**uen.su/	[sa**ʔ**ˈwe^{d}n.^{t}su]	‘jungle’
(880)	/ua**ʔ.**ial.a.ka.lo.su/	[wa**ʔ**ˈjaːlakaˌloː.su]	‘cockroach’
(881)	/ha**ʔ.**iel.su/	[ha**ʔ**ˈjeː.ɾ^{h}u]	‘stinking bug’
(882)	/ãũ.**ʔ**i.sã/	[ãw̃ˈ**ʔ**iː.sã]	‘to sleep’
(883)	/ho.**ʔ**i.sã /	[hoˈ**ʔ**iː.sã]	‘to bathe’

In this section I show the criteria I used to determine with which syllable edge a glottal plosive is associated.

- *Assigning glottal plosives to the coda*

Glottal plosives /ʔ/ are assigned to the coda under two conditions:

i) They are found intervocalically in the same morpheme.
ii) The nucleus following the glottal plosive is a diphthong followed by a coda.

As discussed in Chapter 3, glottal plosives can only occur in the onset if followed by a monophthong. Whenever a glottal plosive is found intervocalically, more precisely between a monophthong and a diphthong, it is assigned to the coda of the first syllable. Therefore, in examples (884) – (886) glottal plosive [ʔ] is assigned to the coda of the first syllable, instead of the onset of the second syllable:

(884)	/saʔ.uen.su/	[sa**ʔ**ˈwe^{d}n.^{t}su]	‘jungle’
(885)	/uaʔ.ial.a.ka.lo.su/	[wa**ʔ**ˈjaː.la.kaˌloː.su]	‘cockroach’
(886)	/haʔ.iel.su/	[ha**ʔ**ˈjeː.ɾ^{h}u]	‘stinking bug’

The syllabification shown in (884) – (886) renders disyllabic morphemes with both closed (heavy) syllables. This analysis also accounts for how stress is assigned, as discussed in section 4.9.4.

- *Assigning glottal plosives to the onset*

Glottal plosives /ʔ/ are assigned to the onset under the following conditions:

i) They belong to a polymorphemic construction.
ii) They are followed by a monophthong.

In examples (882) and (883), we see verbal constructions with intervocalic /ʔ/. Although one may argue that the glottal plosive is epenthetic in (882) to establish boundaries between two consecutive vowels with different values for nasality, example (883) shows that the glottal plosive is not related to epenthesis. By contrasting these two examples, we notice that {-ʔi} can be interpreted as a morpheme attached to a specific group of verbs. The meaning of morpheme {-ʔi} is not clear, but it is apparently related to the position of the body while asleep and bathing: horizontal in relation to the ground while the body is lying down or hovering/floating. In this context, the MOP is applied, turning an intervocalic consonant to an onset, rather than a coda. Hence:

(887)	/ãũ.ʔi.sã/	[ãw̃ˈ**ʔ**iː.sã]	'to sleep'
(888)	/ho.ʔi.sã/	[hoˈ**ʔ**iː.sã]	'to bathe'

Another argument to justify attributing the glottal plosive to the onset rather than the coda in examples above is also based on stress, as discussed in section 4.9.1. Assigning /ʔ/ to the first syllable would violate the generalization that stress is always assigned to a heavy syllable, if available. Note that in both examples, the rightmost syllable /ʔi/ is stressed, although it is underlyingly light.

b) Glottal plosive preceding a consonant /VʔC/.

When a glottal plosive precedes a consonant, it is interpreted as the glottal phase of a glottalized consonant under the following conditions:

i) it occurs within a polysyllabic morpheme.
ii) the syllable has either no coda or a resyllabified coda.

Example (889) shows the scenario in which a glottal plosive precedes a consonant:

(889)	[a**ʔ**ˈluː.a]	'mantis'

As illustrated in (889), the nucleus of the following vowel is lengthened, indicating that it is stressed. Stress is partly weight sensitive, so if the lexical representation of the syllables in (889) were */a**ʔ**.lu.a/, it would be assigned to the first syllable, rather than the second one. In this case, the phonetic realization of /a**ʔ**lua/ would be *[ˈa**ʔ**.lu.a] or *[ˈaː.lu.a], as glottal codas are usually assimilated in stressed syllables. However, such realizations never happen. Then, the example in (889) is syllabified as following, according to the MOP:

(890)	/a.ˀlu.a/	[aˈˀluː.a]	'mantis'

Other examples of ambisyllabic glottal plosives preceding a consonant and assigned as the glottal phase of the following glottalized consonant:

(891)	/tah.ˀli.a/	[ˈtah.l**a̰**] ~ [ˈtah.**ˀ**la]	‘stone’
(892)	/ha.ˀnũl.su/	[haˈ**ˀn**ũ.ʰl̥u]	‘pineapple, sp.’

4.8. The Stress System

This section provides an overview of the stress system, covering the rules that determine it. First, I address the acoustic correlates of stress to determine how syllable stress is assigned, followed by a discussion on prominence at word level and the structural properties used to determine how a syllable becomes more prominent than others. As I show, stress is not fixed, but it is mostly predictable in certain types of morphemes (e.g. roots), mainly because Kithãulhu distinguishes heavy and light syllables.
The mora is regarded as an important unit to determine syllable weight and stress assignment because stress is usually assigned to heavy syllables if they are available. This claim corroborates with the hypothesis that the stress system is partly quantity sensitive. Although independent from the stress system, contrastive tones are usually attested in stressed syllables, as later discussed in Chapter 6.

4.8.1. A Theoretical Overview of Stress

The word “stress” is generally used in linguistic theory to refer to the “force or intensity with which a syllable is uttered” (Hayes 2009: 271) and to a unit or metrical structure which provides the rhythmic patterns perceived in the syllables, words, and utterances in many languages (Goldsmith 1976). Stress may be treated as a property of [+syllabic] segments, as in the linear theory (Gussenhoven & Jacobs 2011), and it is commonly defined in relation to less prominent (in this case, unstressed) syllables (Hayes 2009). Since every theoretical framework has a different approach to providing a definition for stress, it has been the central point of debate among linguists. Much of the controversy related to the definition of stress and cross-linguistic comparison is compiled in Himmelmann (2022).
In most languages under the influence of a stress system, every word has one main (or primary) stress because stress is regarded as culminative. One common exception for this property is that of grammatical words because they are often stressless and concurrently uttered with a stressed content word (Hayes 2009). Apart from the culminative nature of stress, other properties have been associated with it. Hyman (2006:231) defines stress in languages which operate following this metrical structure based on the following two central claims:

> a. obligatoriness: every lexical word has AT LEAST one syllable marked for the highest degree of metrical prominence (primary stress).
> b. culminativity: every lexical word has AT MOST one syllable marked for the highest degree of metrical prominence. (Hyman 2006:231)

Stress can also display specific characteristics in specific language families. In Germanic languages such as English, German, and Dutch, stress may involve the following dimensions:

1. acoustic and auditory prominence.
2. phonotactic structure, phonological alternations.
3. metrical structure (foot structure).
4. lexical structure.
5. function in text-tune alignment (intonational anchoring).

> 6. function in conveying information-structural distinctions.
> (Himmelmann 2022: 06)

Stress is also regarded as a structured position (Liberman & Prince1977; Gussenhoven & Jacobs 2011), typically associated with the foot, an intermediate level above the syllable and below the prosodic word in the prosodic hierarchy – originally proposed by Selkirk (1978, 1981) and further developed by Nespor & Vogel (1982). We will see that the foot level is not all that relevant to determine how stress is assigned in Kithãulhu because it favors the mora as the basic unit for stress assignment. Acoustically, stress is associated with several parameters, such as intensity, pitch, vowel quality, and duration (Gussenhoven & Jacobs 2011). Some of these parameters are important to determine the acoustic cues of stressed syllables. As in many languages, phonological rules in Kithãulhu can be determined in relation to stress, as shown in Chapter 5.

4.8.2. The Metrical Theory and the Metrical Grid

The metrical theory was originally introduced by Liberman & Prince (Liberman & Prince 1977), who posited that specific features of prosodic systems are the reflection of a hierarchical rhythmic structure, with which syllables, words, and phrases are associated. This hierarchical structure organizes every constituent under its domain, influencing and defining the relative prominence of these constituents and providing the rhythmic patterns of every linguistic material aligned within it, represented in a metrical grid (Liberman & Prince 1977).
In metrical phonology, the metrical grid is one of the two formalisms[110] used to determine the prominence level of linguistic material within an utterance (Goldsmith 1976). It provides a horizontal representation of the basic rhythmic patterns of utterances, assigning the strength related to every beat in a word or phrase in a vertical axis.
In the metrical grid, the vertical level of representation is associated with a specific strength level. When a given beat associates with one level, it is then marked with an x. Based on the number of marked elements represented by an x, with which the same linguistic element associates, it is possible to measure its prosodic prominence level and consequently determine the relational prominence level of all elements which lie at the horizontal line. In other words, the more “x’s” lie over a beat, the more prominent it is. With this theoretical framework, what we perceive as stress can be regarded as the outcome of the confluence of linguistic structure sorted into different levels within the hierarchy, which in turn are associated with distinctive degrees of prominence within the grid.

4.8.3. Acoustic Correlates of Stress

Current discussion about the acoustic correlates of stress aims to provide an overview of the acoustic cues that are associated with lexical stress, namely duration, intensity, vowel quality, and pitch. In this section, I will not make a thorough distinction between prominence as the property of lexical stress and prominence resulting from pitch accent, which has a significant

[110] The other formalism is the metrical tree. I will not use this type of representation because it does not seem to be helpful to determine stress in Kithãulhú. In the phonological analysis of stress in Mamaindê, Eberhard (2009) also avoided the arboreal representation because:

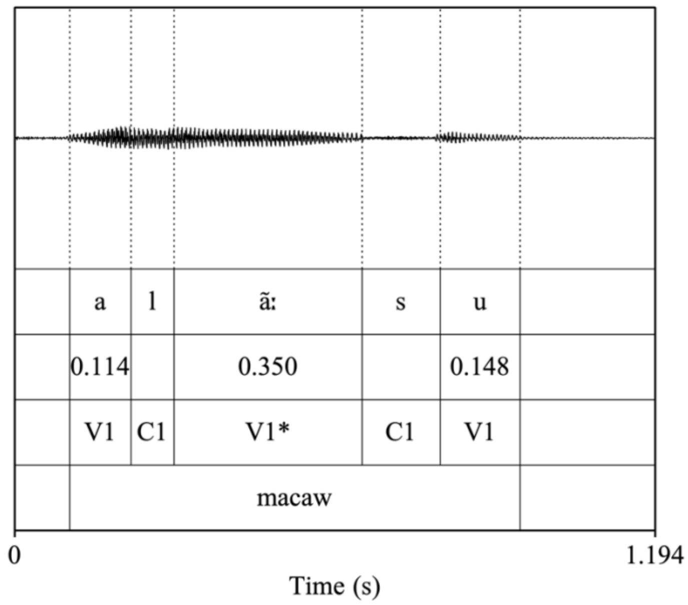
> it (the arboreal representation) often makes the wrong predictions in languages of this type (Mamaindê). These predictions have to do with the boundaries of metrical feet, which are crucial building blocks for the construction of metrical trees. But as we will soon see, foot boundaries are impossible to determine in many Mamaindê words. (Eberhard 2009: 142)

role in intonational phonology (Gussenhoven 2004). I can state, however, that tonal targets are commonly associated with stressed syllables and unstressed word-final syllables.
In the literature on Nambikwaran languages (Telles 2002; Eberhard 2009; Costa 2020; among others) lexical stress is associated with duration, intensity, and vowel quality. As I show, Kithãulhu stress is also acoustically associated with duration, and, to a lesser degree, with intensity and vowel quality.

a) Duration

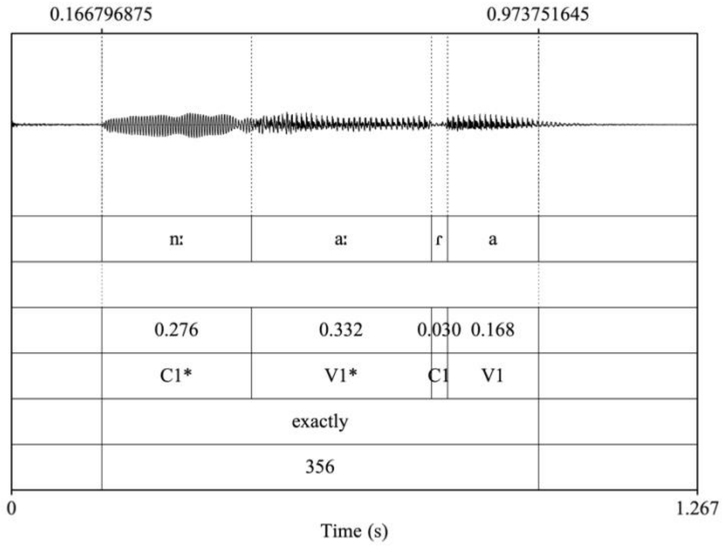
Duration is used as an acoustic correlate to determine syllable stress and prominence. Stressed syllables are longer in duration in comparison with unstressed syllables. Figure *9* shows a plotted image of the word for ‘macaw,’ /alã-su/. The segment with superscript (*) indicates the nucleus of the stressed syllable:

Figure 9: Spectrogram for the word /alãsu/, ‘macaw.’



As shown in Figure *9*, vowel duration in the stressed syllable [lãː] is 0.350s, a much higher value than that for the vowel duration in unstressed syllables [a], which is 0.114s, and [su], which displays 0.148s for the vowel duration. Figure *10* illustrates the duration of syllabic nasal in the word /n-na-ɾa/, which is used to agree with a previous statement. Note that the duration of the nasal segment [nː] is higher than the duration of the final unstressed vowel [a]:

Figure 10: Spectrogram for the word /nnaɾa/, 'exactly, I agree.'

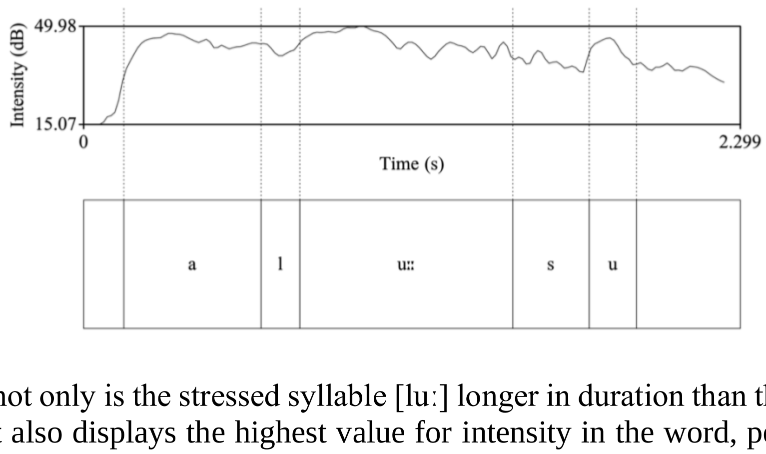


As illustrated in Figure *10*, the vowel following the syllabic nasal is lengthened and becomes stressed due to the position within the verbal string (I will address how certain morphemes occurring in the penultimate syllable in the verbal string become stressed later in this chapter). Vowel [aː] displays a higher value for duration (0.332s) in relation to [nː] (0.276s), probably because vowels are the most sonorous segment type in the sonority scale.

b) Intensity

Intensity also plays a significant role in syllable stress. When analyzing the spectrograms, spectral prominence caused by syllable intensity is a plausible acoustic correlate to determine whether a syllable is stressed. In Figure *11*, we see the intensity values in the trisyllabic word for 'mouse,' /alu-su/:

Figure 11: Intensity values in the word for 'mouse.'



As illustrated, not only is the stressed syllable [luː] longer in duration than the other unstressed syllables, but it also displays the highest value for intensity in the word, peaking at 49.98dB. The intensity in the last unstressed syllable decreases and reaches 36.28dB

Apart from duration and intensity, we should also address two other marginal topics that are commonly cited in the Nambikwaran literature and that may be related to stress: vowel quality and pitch. As discussed in Chapter 3, Kithãulhu does not contrast full and reduced vowels, but the near-close front and back vowels [ɪ, ʊ] as well as the near-open central vowel [ɐ] may occur phonetically. I also showed that there are four types of phonemic vowels, depending on the value of nasality [± nasal] and phonation type [±constricted]: oral, nasal, creaky voice, and nasal creaky voice. Vowel quality plays a secondary role in stress assignment, as some morphemes may become stressed because the nucleus displays a [+nasal] or [+constricted] vowel. Compare examples with classifiers {-ko̰} and {-te}:

(893) [ka̰ˈja̰ʔˌ**ko̰**ː.su]
/ka̰.ḭ̃a̰ˀt.ko̰.su/
ka̰ḭa̰ˀt -ko̰ -su
corn-CL.land-REF
'cornfield'

(894) [haˈloː.**te**.su]
/ha.lo.te.su/
halo -te -su
field-CL.generic-REF
'the Halotesu'

As seen in (893), suffixes displaying a creaky voice can become stressed, even if they are underlying light. Note that in (894), there is no stress assigned to classifier {-te}, as the nucleus is not creaky voice. Examples (893) and (894) suggest that vowel quality also plays a role in stress assignment of certain morphemes. Another argument for associating vowel quality with stress lies in the fact that [+nasal] vowels are very often contrastive in stressed syllables (as discussed in Chapter 3, there is just one attestation of non-stressed phonemic nasal vowels). Since Kithãulhu allows different values for both nasality and phonation type to occur within the same morpheme, [+nasal] vowels usually indicate the stressed syllables of polysyllabic morphemes:

(895)	/alũ.su/	[aˈ**lũ**ː.su]	'tapir'
(896)	/kalṵ̃.na.ɾa/	[kaˈl**ṵ̃**ːˌnaː.ɾa]	'it's sprouting'

Figure *12* shows the vowel quality continuum in Kithãulhu, according to the degree of likelihood of becoming stressed:

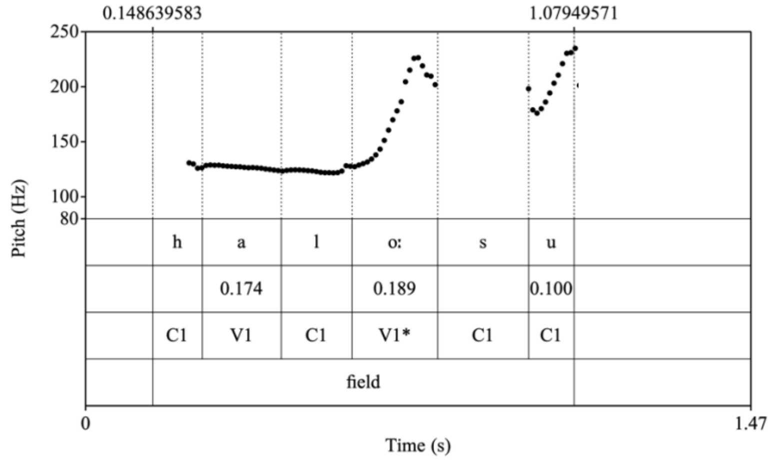
Figure 12: Vowel quality continuum.

creaky and nasal > nasal > creaky > oral

Another claim related to vowel quality and stress lies in the observation that there are very few attestations of stressed monosyllabic morphemes whose syllable structure is a monophthong /V/. Oral vowels occurring in stressed syllables within stems usually belong to polysyllabic morphemes.

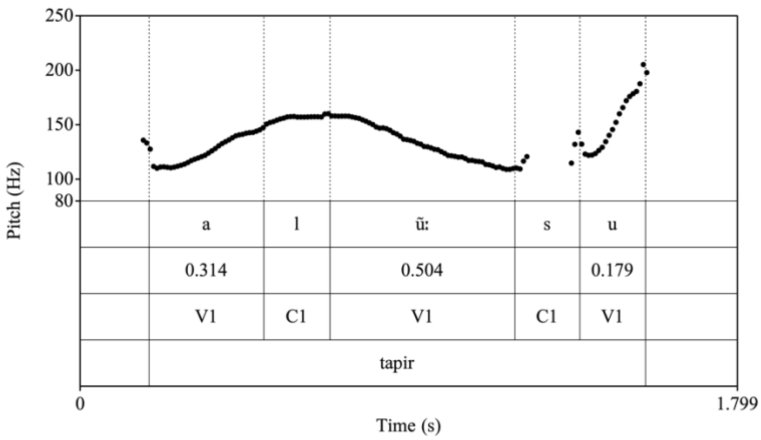
In contrast with what has been claimed for Sabanê (Araújo 2004), pitch cannot be regarded as an acoustic correlate of stress because stress is not marked by a specific pitch contour. However, stressed syllables are usually associated with different pitch contours, which is determined by tone, as discussed in Chapter 6. Figure *13*, Figure *14*, and Figure *15* below illustrate that stressed syllables may display different pitch contours. Stressed syllables are indicated by a superscript (*):

Figure 13: Rising pitch contour in stressed syllable [loː].



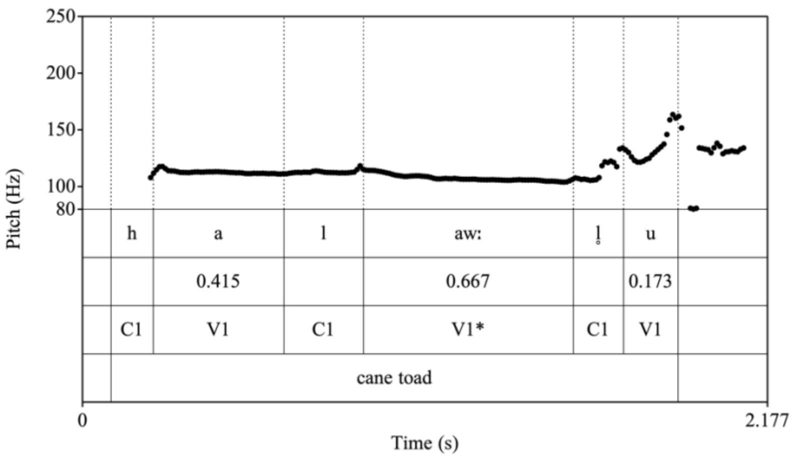
(897) /ha.lo.su/ [haˈloː.su] ‘field’

Figure 14: Falling pitch contour in stressed syllable [lũː].



(898) /a.lũ.su/ [aˈlũː.su] ‘tapir’

Figure 15: Low level pitch in stressed syllable [lawː]



(899) /ha.laul.su/ [haˈlawː.ʰl̥u] ‘cane toad’

4.9. Defining the Stress System

We have seen so far that duration, intensity, and, to a lesser degree, vowel quality, are the main acoustic correlates of stress, as they provide phonetic cues to distinguish stressed from unstressed syllables. In contrast, pitch cannot be used to distinguish stressed from unstressed syllables, although stressed syllables display more diverse pitch values in contrast with unstressed syllables. In the following sections, I discuss topics that must be addressed to understand the Kithãulhu stress system: syllable structure (weight) and morphological structure.

4.9.1. Stress and Syllable Weight

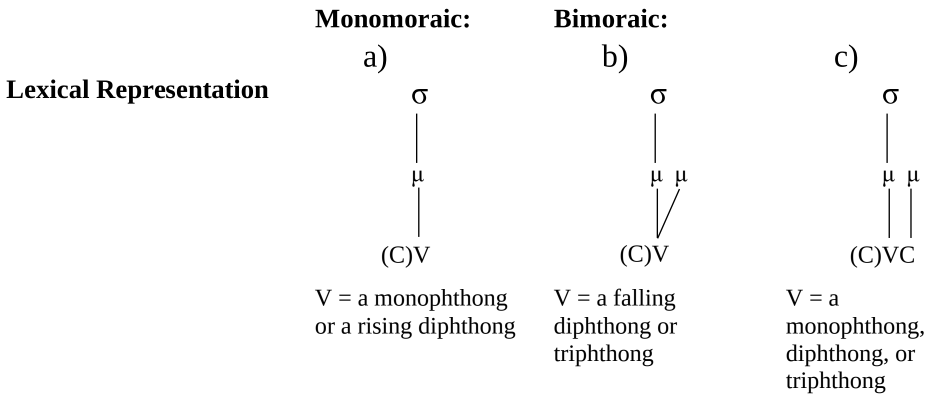
Syllable weight distinctions in Kithãulhu are binary. In other words, syllables are only classified into light or heavy, depending on their internal structure, specifically how many positions within the rhyme are occupied. Languages which make distinctions regarding syllable weight typically also distinguish vowel length (Hyman 1985), but this correlation is not absolute (Hayes 1989). We have seen so far that Kithãulhu does not distinguish short and long vowels in the underlying representation, but both short and long vowels can occur in the surface representation. As will be seen in section 4.9.3, vowel lengthening may seem complicated, but it is predictable. Furthermore, it can also be employed for the conservation of syllable weight caused by the loss of moraic elements of the syllable.

4.9.1.1. Light Syllables vs. Heavy Syllables

In moraic phonology, “languages differ in their rules for assigning moraic structure” (Hayes 1989: 255). In Kithãulhu, heavy syllables are easily distinguished from light syllables with regard to how many positions within the rhyme are required. Overall, light syllables only require one position within the rhyme, namely the nucleus, which is the only mandatory syllable constituent, as seen in section *4.3*. The nucleus of a light syllable can be filled in by a monophthong or a rising diphthong. This type of syllable is regarded as monomoraic, counting just one place in the rhyme. In the CV skeleton tier, light syllables are allowed to take up to two positions, namely the onset and the nucleus. As previously discussed, onsets are not obligatory. Furthermore, they do not count as moraic.

In contrast to light syllables, heavy syllables may require up to two places in the rhyme. Therefore, there are two subtypes of heavy syllables in the phonological system. The first subtype of heavy syllables only requires one filled position in the rhyme. In this subtype, the nucleus can be comprised of a falling diphthong or a triphthong. These complex vocalic segments are categorized as heavy because they are phonetically realized with a final glide, which provides additional weight to the syllable. In the second subtype of heavy syllables, two positions within the rhyme are required: the nucleus and the coda. Figure *16* illustrates the moraic structure of light and heavy syllables:

Figure 16: Lexical representation of monomoraic (light) and bimoraic (heavy) syllables.



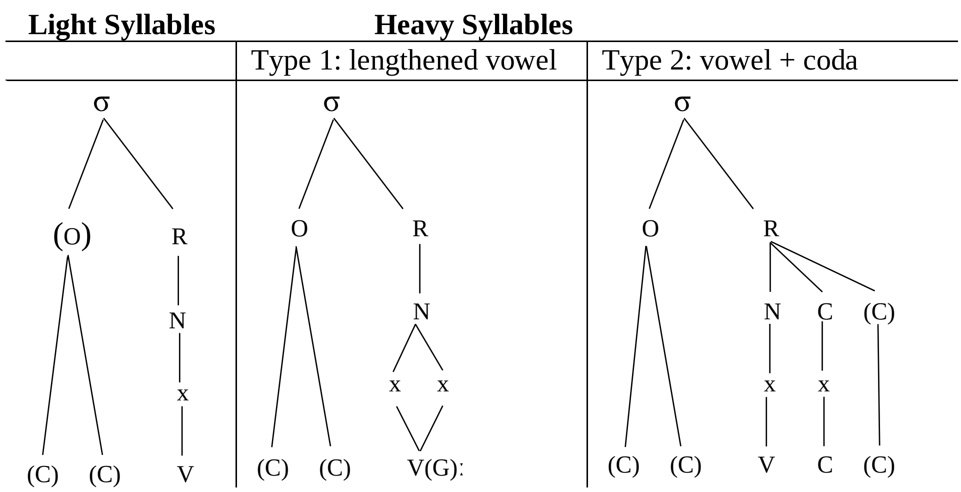
As seen in Figure *16*, Kithãulhu distinguishes between two types of heavy syllables, depending on the segments occurring in the nucleus and whether there is a coda in the rhyme. Since codas are also accounted to determine syllable weight, they are regarded as moraic.

One of the pieces of evidence which shows that codas are moraic is the vowel lengthening that occurs in stressed syllables. Whenever a /CVC/ syllable is followed by a vowel-initial syllable at morpheme boundaries, the coda is resyllabified and the vowel in the original syllable is lengthened. This strategy, known as compensatory lengthening or moraic conservation (Hayes 1989), is used to maintain the syllable weight regardless of the loss of coda material. Moraic conservation of codas has also been observed in Nambikwaran languages (Eberhard 2009; Costa 2020). As I show in section 4.9.1, both heavy and light syllables can occur in stressed and unstressed positions within a word. However, stress is assigned to heavy syllables when they are available.

In the surface representation, I assume that heavy syllables derive from heavy syllables in the lexical representation. Hence, I distinguish two types of lengthened vowels attested in stressed syllables. In the first type, vowel lengthening occurs to preserve the syllable weight of a heavy syllable after coda resyllabification (compensatory lengthening), as previously mentioned. In the second type, vowel lengthening is analyzed as a consequence of stress. In both types, lengthened vowels are analyzed as bimoraic in the surface representation and are conditioned by rules.

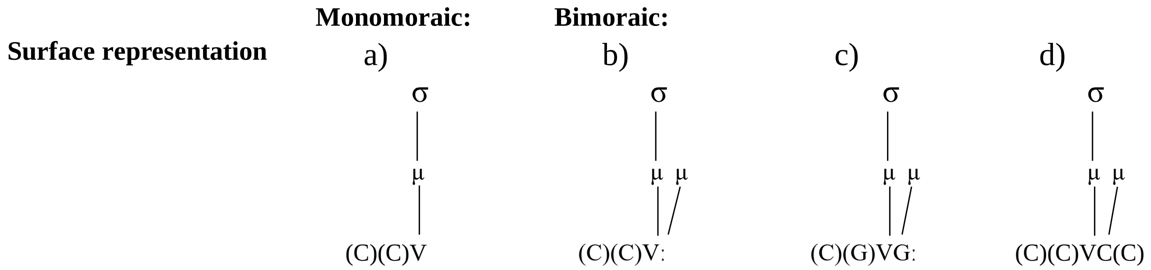
Since maximal syllable structure is CCVCC in the surface representation, I show in Figure *17* the skeletal representation of light and heavy syllables (phonetic):

Figure 17: Skeletal representation of light and heavy syllables in the surface representation.



Using the representation provided in Figure *17*, we can distinguish two subtypes of heavy syllables in the phonetic representation. Subtype 1 has a lengthened vowel, which requires that two positions within the nucleus be occupied. Type 2 differs from type 1 in the way the rhyme can be expended with up to three positions in case a falling diphthong or a triphthong is followed by a coda. In this type, however, only two positions in the rhyme are mandatory: the nucleus and the coda. In this analysis, diphthongs behave differently with regard to syllable weight, as discussed. Diphthongs with an initial high vowel /i, i̯, ĩ, ĩ̯, u, u̯, ũ, ũ̯/, rising diphthongs, are grouped under the light syllable type, as they are realized as [GV] in unstressed positions, and onsets are not moraic. On the other hand, diphthongs with a final high vowel are considered heavy, as they are realized as [VG], with a glide occupying the second position of the rhyme. Triphthongs are always heavy. See Table *56* to review the distribution of the segments in phonetic syllables. A schematic representation of moraic structure for syllables at the surface level is shown in Figure *18*:

Figure 18: Moraic structure in the surface representation.



As the maximal phonetic syllable structure is (C)(C)V(C)(C) and stress is based on syllable weight, we can distinguish light from heavy syllables according to Table *68*, which shows all attested syllables types and relates them to syllable weight:

Table 68: Classification of syllable weight according to syllable types (surface forms).

light syllables:	[V]
	[GV]
	[CV]
	[CGV]
heavy syllables:	[Vː]
	[GVː]
	[CVː]
	[VC], [VGː]
	[CVC], [GVGː]
	[CCVː], [CGVː]
	[GVGC]
	[$C_kG_wVG_jC$]

As I show in the following sections, all syllables with phonetic long vowels are stressed, but not all syllables with a coda are stressed.

4.9.2. Stress and Morphological Structure

It is nearly impossible to predict stress patterns of Kithãulhu words without analyzing their morphological structure, as stress is predominantly conditioned by morphology. The role of morphological structure in stress assignment is twofold. First, roots are chosen over affixes. Second, if a morpheme is polysyllabic, position in the morpheme (final vs. non-final) is also relevant. Overall, morphemes with high semantic information, such as roots, tend to attract stress, while other more peripherical morphemes such as suffixes do not. The association of stress with word morphology seems to be a phylogenetic feature of Nambikwaran languages, as it is often mentioned in the literature (Telles 2002; Eberhard 2009; Braga 2012, 2017; Costa 2020). As I demonstrate below, stress is easily predictable in roots and in most polysyllabic morphemes.

4.9.2.1. Stress Patterns of Polymorphemic Words

Before discussing how stress is assigned at the morpheme level, let us analyze five examples of Kithãulhu's (morphosyntactic) words, starting with the simplest word unit and moving further to more complex words. Primarily – and secondarily, if available – stressed syllables are indicated in bold:

(900)	[ˈ**ũ**ː.su]	'capybara'
(901)	[aˈ**lũ**ː.su]	'tapir'
(902)	[aˈ**lũ**ːˌ**nṵ̃**ː.su]	'clay'
(903)	[aˈ**lã**ː.te.su]	'the Alãtesu'
(904)	[aˈ**luh**ˌ**na**ː.ɾa]	'he's puking'
(905)	[aˈ**luh**.naˌ**he**ː.ɾa]	'he puked'

If we analyze the whole words as in (900) – (905), it is difficult to establish the stress patterns and predict how stress is assigned, as stress is not fixed. There is no clear scenario to determine whether stress is dependent on word position – compare (900), in which stress is assigned to the penultimate syllable and (903), where stress is placed on the antepenultimate one. It is possible, however, to posit some generalizations, such as: a) the final syllables (suffixes) of all words in (900) – (905) are always unstressed; b) there seems to be a correlation between stress and syllable weight, more specifically, between stress and morae: all stressed syllables in the examples above are bimoraic, be it via a lengthened vowel as in (900) and (902) or by means of a coda, as in (904).

4.9.2.2. Stress Patterns of Isolated Morphemes (Roots): The Role of Syllable Structure

Kithãulhu has a myriad of monosyllabic morphemes. Since monosyllables do not provide the best scenario to discuss the stress rules of a language, let us turn to a polysyllabic morpheme type with no added morphology[111], namely the roots, and observe the stress patterns within them:

(906) [taˈ**ki**ː]	'monkey, sp.'	(912) [kaˈ**nãh**]	'woodpecker'
(907) [ˈ**ta**ː**.**ki]	'grasshopper, sp.'	(913) [ˈ**jah**.lo]	'old man'
(908) [aˈl**ũ**ː]	'tapir'	(914) [ˈ**tah**.ˀli]	'rock'
(909) [waˈ**ji**ː]	'palm tree, sp.'	(915) [ˈ**waj**ː.a.ˀli]	'dog'
(910) [aˈ**laj**ː]	'sloth'	(916) [ˈ**jah**.ˀki]	'peccary'
(911) [jaˈ**la^{d}n**]	'toucan' (general)	(917) [saʔˈ**we^{d}n**]	'jungle'

We can see that in examples (906) – (917) all syllables must be heavy in the surface representation (i.e., displaying a long vowel or a coda) to become eligible to bear stress – a claim which was already pointed out in the polymorphemic words in (900) – (905). It is also

[111] As previously mentioned, no root occurs independently. Roots are presented in this way just to provide the reader with an overview of the stress patterns within a single morpheme type.

possible to assume that stress is determined in terms of morphological structure, as it is attracted to a certain morpheme type (roots, in this case). This assumption enables us to provide a more precise rule to determine how stress is assigned. Therefore, I argue that stress is related not only to phonological structure, but also to morphological structure. However, syllable weight and word morphology do not suffice to fully describe the stress system – see example (917), comprised of two heavy syllables. To account for such an example, we will turn to another crucial component to understand the stress system: syllable position within the morpheme.

4.9.2.3. Stress and Syllable Position Within the Morpheme

Another remark related to stress assignment is the syllable position within the morpheme. If a polysyllabic morpheme is comprised of syllables with the same (underlying) weight, stress is assigned to its rightmost syllable, as shown in (917) for two consecutive heavy syllables and (906) for two consecutive light syllables at the lexical level. An exception to the rule on syllable position within the morpheme is observed for light-syllabled polysyllabic morphemes with the rightmost syllable ending in [i] – an issue that is discussed in section 4.10.2.1.2. In cases where the syllable of polysyllabic morphemes differs with regard to weight, the stress rule is hegemonic: it is always assigned to the heavy syllable, regardless of its position within the morpheme, as shown in (913) and (912), where the heavy syllable is morpheme-initial and final, respectively. Syllable position within the morpheme is also challenged by some examples, such as (906) and (907), whose surface forms would supposedly be derived from the segmentally identical underlying form {taki-}. If we consider {taki-} as the lexical representation of both lexemes, stress is phonemic. However, that does not seem to be the case. Compare the examples below:

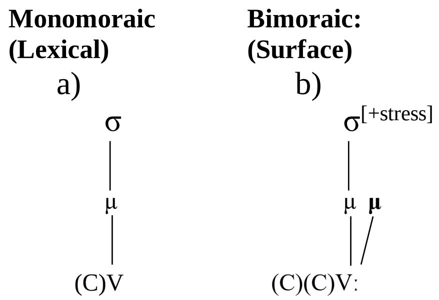
(918) [taˈ**ki**ː^{LH}.su]	‘monkey, sp.’
(919) [ˈ**ta**ː**.**ki^{L}.su] ~ [ˈ**ta**ː**.**ksu]	‘grasshopper, sp.’

As shown in (918) and (919), examples differ not only with regard to the stress position, but also in relation to tone. Whereas in (918), syllable [ki] is realized with a rising-contour tone (LH), it is realized with a low-level tone (L) in (919). In addition, note that (919) may be phonetically realized as a disyllabic, instead of a trisyllabic word, which leads to the conclusion that vowel [i] is phonetically derived. Hence, we have two different morphemes, one for each of these lexemes: {taˈki-}, a monkey species, and {ˈtak-}, a grasshopper species. Due to the tendency of organizing segments in CV syllables, surface realization of /tak-su/ as [ˈtaː.ki.su] is regarded as resulting from epenthesis, used to avoid consonant clusters such as [ks] occurring in the surface representation. As stress is lexically derived, the epenthetic vowel [i] is disregarded and the “original” syllable weight is preserved through compensatory lengthening to maintain the stress eligibility of its syllable. Consequently, we can use the following stress rule: if a monosyllabic consonant final morpheme undergoes epenthesis, stress is preserved on the underlying heavy syllable.

4.9.3. The Mora [μ] and the Stress Lengthening Rule

As discussed in section *4.3.2*, Kithãulhu’s rhyme may require up to two positions in the lexical representation, as it is divided into the nucleus and the coda. We have seen so far that stress is associated with heavy syllables of certain types of morphemes. When a morpheme is comprised of light syllables in the underlying representation, the quantity-sensitive nature of the stress system must provide the syllable eligible to bear stress with additional weight, so that it becomes more prominent than others. I call this operation the Stress Lengthening Rule, a basic principle that takes place in the surface realization of some stressed morphemes. According to this rule, every stressed syllable must be heavy, i.e. bimoraic. Hence, if the nucleus of the stressed syllable has no coda at surface level, it must be associated with an additional mora to become eligible to bear stress. Thus, the nucleus will become lengthened in the surface representation by addition of another mora, as illustrated in Figure *19*. Note that, whenever the additional mora is associated with the nucleus, it is then expanded with an additional slot to represent that two positions of the rhyme are filled in:

Figure 19: Representation of the Stress Lengthening Rule.



The rule illustrated in Figure *19* affects the nucleus of:

a) all light syllables[112] of monosyllabic morphemes with high semantic load, such as roots and possessive pronouns.
b) the rightmost syllable of *almost* all polysyllabic morphemes[113] if all syllables are underlyingly light.
c) all morphemes occurring at the penultimate position within the verbal string.

The following examples illustrate all cases where the Stress Lengthening Rules is applied.

- *Examples of monosyllabic morphemes with high semantic load*:

(920) /ũ.su/	[ˈ**ũ**ːsu]	capybara-REF	‘capybara’
(921) /ˀta.ha.ti.a/	[ˌ**ɗa**ː.haˈ**ti**ː.a]	1.POS-basket-REF	‘my basket’
(922) /a.ḭo̰.a/	[ˌ**a**ːˈ**j̰o̰**ː.a]	3.POS-mouth-REF	‘his mouth’

- *Examples of lengthened syllables of morphemes at the penultimate position within the verbal string*:

(923) /ail.a.ua/	[ˈajːˌ**ɾa**ː.wa]	‘I’m walking’
(924) /ul.he.i.ɾa/	[ˌuːˈɬeːˌ**i**ː.ɾa]	‘you’re far’
(925) /ĩãĩ.ʔa.ua/	[ˈj̃ãj̃ːˌ**ʔa**ː.wa]	‘she’s not sewing’
(926) /ũh.ha.lil.a.ua/	[ˌũːhaˈliː**ɾa**ː.wa]	‘I’m writing’
(927) /tau.na.ʰlo.ɾa/	[ˈtawːnaːˌ**ʰl̥o**ː.ɾa]	‘I’m won’t go lumbering”

Compensatory lengthening is described in Chapter 5.

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112 The off-gliding phase of falling diphthongs and triphthongs also becomes lengthened if not followed by a coda, as described in Chapter 3.
113 An example of a polysyllabic morpheme comprised exclusively of underlying light syllables, which does not have its rightmost syllable lengthened in the surface representation, is {hali}, ‘two’: [ˈ**ha**ːli], *[haˈ**li**ː]. There is currently no evidence for epenthesis in these morphemes, but it is possible that final [i] marks numerals, since it is also attested in {kanaki}, ‘one.’

4.9.4. The Parameters and Levels of Representation in the Metrical Grid

The following levels of analysis are used to determine stress assignment in Kithãulhu when using the metrical grid representation:

Level 1: Morpheme type: roots > affixes
Level 2: Syllable weight: heavy syllables > light syllables
Level 3: Syllable position within the morpheme: rightmost > leftmost

Levels 1 and 2 are the fundamental properties for predicting stress assignment in most morphemes. Level 3 is just used in the case where a morpheme is polysyllabic, and all syllables share the same weight. In accordance with Costa (2020), stress in Southern Nambikwara is partly predictable in affixes and always predictable in roots. I add to her findings that stress is predictable not only within roots, but also in all heavy monosyllabic as well as in all polysyllabic morphemes. The claim surrounding the unpredictable nature of stress assignment for monosyllabic affixes still stands, but stress in such morpheme types is also dependent on position within the phrase (in the case of the penultimate syllable of verbal morphology) and the way they encode meaning. Monosyllabic morphemes with a high semantic load (such as possessive pronouns in the case of nominal morphology, and first- and second-person singular marking morphemes in the case of verbal morphology) are always stressed.

4.9.5. Primary vs. Secondary Stress

This section addresses the distinction between primary and secondary stress in complex words, which are words with at least 3 morphemes. As discussed, stress is a property of the syllables of certain groups of morphemes. Using the general properties of stress summarized by Hyman (2006), we can state that every lexeme[114] has at least one and at most one syllable marked for the highest degree in the metrical grid (primary stress). Whenever a single lexical word displays different degrees of metrical prominence, the most prominent syllable bears the primary stress in compliance with the culminativity principle, and the other less prominent syllables may bear secondary stress or simply be regarded as stressless.

Heavy syllables may bear primary stress, secondary stress, or be stressless. Overall, roots bear primary stress, as illustrated below. The first level indicates the morpheme type. Roots get a beat, indicated by an (x). Then, level two (syllable weight) is indicated. Level three is not necessary for the following two examples because the root is monosyllabic, but it is indicated as an extra beat over the root:

	x	level 3		x	level 3
	x	level 2		x	level 2
	x x	level 1		x x	level 1
(928)	[ˈ**tu**ː.ha]		(929)	[ˈ**kãj̃**ː.sã]	
	/tuh.a/			/kãĩ.sã/	
	tuh -a			kãĩ -sã	
	bee-REF			to steal-SS	
	‘bee’ (general)			‘to steal’	

When further morphology is added to the words in (928) and (929), we see that additional metrical prominence is perceived at level two:

[114] I employ lexeme as a syntactic-semantic structure, as defined by Fischer & Nemo (2000).

x level 3
x x level 2
x x x x level 1
(930) [ˈ**tu**ː.haˌnũ̯ː.su]
/tuh.a.nũ̯.su/
tuh -a -nũ̯ -su
bee-REF-CL.granules-REF
‘sugar’

x level 3
x x level 2
x x x level 1
(931) [ˈ**kãĩ̯**ːˌnaː.ɾa]
/kãĩ.na.ɾa/
kãĩ -∅ -na -ɾa
to steal-3S-PRS.V.EV-PFV.M
‘he’s stealing’

From examples (930) and (931), we can visually perceive the main distinction between primary and secondary stress: whereas primary stress is marked on the syllable at level 3, secondary stress is assigned to any syllable at level 2, as long as there are also syllables marked at level 1 of metrical prominence. Kithãulhu usually parses syllables into trochees, a metrical foot unit comprised of a strong syllable followed by a weak one. However, foot structure is not all that relevant in determining primary stress.
In complex words comprised of two roots, for instance, both roots are stressed, but due to stress culminativity, one of them must be more metrically prominent than the other. In such cases, the syllable in the rightmost position is usually more prominent than the syllable it follows. Observe the following examples with two roots:

x level 3
x x level 2
x x x level 1
(932) [ˌohˈ**ˀsĩ**ː.na]
/ohˀ.sĩn.a/
ohˀ-sĩn -a
sky-meat-REF
‘cloud’

x level 3
x x x level 2
x x x x level 1
(933) [ˌwiːˈ**ɾũ**ː.ˀnaː.wa]
/uil.ũn.ˀna.ua/
uil -ũn -ʔ -∅ -na -ua
to be good-to smell-NEG-3S-PRS-NPFV.M
‘it does not smell good’

In (932) and (933), we see a nominal compound made up of two nominal roots and a serial verb, with two consecutive verbal roots, respectively. Both cases illustrate that roots with similar internal syllable structures are marked for stress, but the most prominent syllable is the one on the right. In nominal compounds comprised of a nominal root followed by another root other than nominal, primary stress is marked on the first root. The root on the rightmost position within the word receives secondary stress:

x level 3
x x level 2
x x x x level 1
(934) [ˈ**u**ː.ta̰ˌw̰a̰ː.ʰl̥u]
/uˀt.a.ṵa̰l.su/
uˀt -a -ṵa̰l -su
potoo-to scream-REF
‘potoo, sp.’

x level 3
x x level 2
x x x x level 1
(935) [haˈ**lo**ːˌja̰w̰ː.su]
/ha.lo.i̯a̰ṵ.su/
halo -i̯a̰ṵ -su
field-to be located-REF
‘savannah’

Secondary stress is also placed on syllables of affixes, directly or indirectly connected to the root, as in (936) and (937):

x level 3

x level 3

x x level 2
x x x level 1
(936) [ˌɗaːˈ**lo**ː.na]
/ˀta.lon.a/
ˀta- lon -a
1POS-brother-REF
‘my brother’

x x level 2
x x x x level 1
(937) [ˈ**iᵍŋ**.kaˌloː.su]
/in.ka.lo.su/
in -kalo -su
to fly-CL.flat-REF
‘airplane’’

In nominal incorporation, heavy instrumental suffixes become unstressed. The incorporated noun bears secondary stress, as in (938). When there is no noun incorporation, secondary stress is placed on the heavy syllable of the instrumental prefix, as in (939), in accordance with the rule described for (936) and (937):

x level 3
x x x level 2
x x x x x x level 1
(938) [ũˌhˀiːˈ**jo**ː.liˌnaː.ɾa]
/ũh.hˀi.io.li.na.ɾa/
ũh- ˀhi ioli -∅ -na^{LH}- ɾa
INST-NI.hand-to cut-3S-REC.PST.V.EV-PFV.M
‘he cut his hand’

x level 3
x x x level 2
x x x x level 1
(939) [ũːˈ**tãw̃**ːˌnaː.ɾa]
/ũh.tãũ.na.ɾa/
ũh -tãũ -∅ -na -ɾa
INST-to mow-3S-V.EV.PRS-PFV.M
‘he’s mowing’

We can parse the beating units of small utterances using the metrical grid for a visual representation of the rhythm in them, as in (940):

x x level 3
x x x x level 2
x x x x x x level 1
(940) [ˈ**kʰwaj**ː.saˌw̰ḭ̯ːˈɾuːˌnaː.ɾa]
/kʰuais.a (a) ṵ̯ḭ̯.(a).lu.na.ɾa/
kʰuais -a (-a) ṵ̯ḭ̯- alu -∅ -na -ɾa
humming bird-REF-3POS CL.sharp-to be long-3S-V.EV-PFV.M
‘the hummingbird’s beak is long’

Note that in short utterances as in (940), there is apparently no stress clash among consecutive syllables with different levels of metrical prominence (primary and secondary stress) within the grid.

4.10. Stress Patterns

Now that we have seen some basic distinctions between primary and secondary stress, as well as the influence of morphological and phonological structures in the levels of representation in the metrical grid, I will present the stress patterns of some words. Starting with words that have the most basic morphology, I will gradually move to more complex words such as compounds to illustrate how the stress system operates.

4.10.1. Monosyllabic Roots

Monosyllabic roots are the most frequently attested root type. According to what has been discussed so far, words with a monosyllabic root are minimally disyllabic. Stress is always marked on the root, with words predominantly carrying word-initial stress. Word-medial stress is also possible with an added prefix – possessive and inalienable pronouns in the case of nouns (944) and instrumentals in the case of verbs 0:

x level 3
x level 2
x x level 1
(941) [ˈ**a̰**ː.ʰlu]
/a̰l.su/
a̰l -su
armadillo-REF
‘armadillo, sp’

x level 3
x level 2
x x level 1
(942) [ˈeː.ɾʰã]
/el.sã/
el -sã
to make honey-SS
‘to make honey’

x level 3
x x level 2
x x x x level 1
(943) [ˈ**o**ːˌʰl̥aˌʰnaː.wa]
/ol.sa.ʰna.ua/
ol -sa -ʰna -ua
to be startled-1O.PRS-NV.EV-NPFV.M
‘I got startled’

Examples with a prefix:

x level 3
x x level 2
x x x level 1
(944) [ˌaːˈ**ta**ː.su]
/a.ta.su/
a- ta -su
INAL-evil spirit-REF
‘evil spirit’

x level 3
x x level 2
x x x x x level 1
(945) [ĩˈ**tod**.naˌtʃiː.wa]
/ĩton.na.tii.ua/
ĩton -na -tii -ua
to be sick-2S-INT.PRS-NPFV.M
‘Are you sick?’

4.10.1.1. Monosyllabic Roots with Epenthetic Vowel [i]

Epenthesis is a frequently observed phonological rule in monosyllabic and disyllabic roots. As discussed, it is usually applied to avoid sequences of consonants making up complex onsets at morpheme boundaries, even when certain consonantal sequences are permissible (for the permissibility of consonants across syllables and morphemes, see Table *65*.) Whenever an epenthetic vowel is attached to the root, the stress pattern is not affected. Compare examples with and without epenthesis and note that stress is conservated in word-initial position:

a) *Without* epenthesis:

- {a̰ḭˀk(i)-} ‘fish’

```
        x         level 3
        x         level 2
        x    x    level 1
(946)   [ˈ**a̰j**ː.ˀksu] ~ [ˈa̰j̰ː.ksu]
        /a̰ḭˀk(i).su/
        a̰ḭˀk(i) -su
        fish-REF
        ‘fish’ (general)
```

- {uˀt-} ‘potoo’

```
        x         level 3
        x         level 2
        x   x     level 1
(948)   [ˈ**u**ː.tsu]
        /uˀt.su/
        uˀt -su
        potoo-REF
        ‘potoo, sp.’
```

b) *With* epenthesis:

```
        x             level 3
        x             level 2
        x   x   x     level 1
(947)   [ˈ**a̰j**ːˀki.su] ~ [ˈa̰j̰ː.ki.su]
        /a̰ḭˀk(i).su/
        a̰ḭˀk(i) -su
        fish-REF
        ‘fish’ (general)
```

```
        x             level 3
        x             level 2
        x   x  x      level 1
(949)   [ˈ**u**ː.ti.su] ~ [ˈuː.tsu]
        /uˀt.su/
        uˀt -su
        potoo-REF
        ‘potoo, sp.’
```

Stress placement in -i final stems can provide evidence to distinguish monosyllabic roots with epenthetic vowel [i] (950) from disyllabic roots ending in [i] (951).

```
        x             level 3
        x             level 2
        x   x   x     level 1
(950)   [ˈ**ta**ː.ki.su] ~ [ˈtaː.ksu]
        /tak(i).su/
        tak(i) -su
        grasshopper-REF
        ‘grasshopper, sp’
```

```
            x         level 3
            x         level 2
        x   x   x     level 1
(951)   [taˈ**ki**ː.su]
        /ta.ki.su/
        taki -su
        monkey-REF
        ‘monkey, sp.’
```

```
        x             level 3
        x             level 2
        x   x   x     level 1
(952)   [ˈ**ha**ː.**ti**.su] ~ [ˈhaʔ.tsu]
        /haˀt(i).su/
        haˀt(i) -su
        bridge-REF
        ‘bridge’
```

```
           x          level 3
           x          level 2
        x  x   x      level 1
(953)   [haˈ**ti**ː.su]
        /ha.ti.su/
        hati -su
        basket-REF
        ‘basket’
```

Another feature which sometimes distinguishes monosyllabic from disyllabic roots with similar segmental structure in the surface representation is tone. The tone pattern of stressed syllables of this type of root with a morpheme final underlying /i/ is usually rising [LH], further discussed in Chapter 6.

4.10.2. Polysyllabic Roots

In this dissertation, polysyllabic roots encompass disyllabic and trisyllabic[115] only. Tetrasyllabic roots are possible if derived from full reduplication of disyllabic roots. Roots which are seemingly trisyllabic, such as {uaiaˀli-} and {uahkaˀli-} are likely compounds, although the meaning of their shared structure [a.ˀli], mostly attested in words for animals, cannot be determined by native speakers.

4.10.2.1. Disyllabic Roots

Words including dissyllabic roots may display two different stress patterns depending on the internal structure of their syllables: word-initial or medial stress. Words with word-initial stress are the least frequent. Examples below are organized according to underlying syllable structure. In the sections below, L stands for light, whereas H means heavy.

4.10.2.1.1. Stress Patterns

4.10.2.1.1.1. Word-medial Stress

a) Both underlying open syllables /σL.σL/

Both underlying open syllables will mostly render word-medial stress. Note that the stressed syllable is usually the rightmost syllable within the root:

	x	level 3		x	level 3
	x	level 2		x	level 2
	x x x	level 1		x x x	level 1
(954)	[haˈ**lo**ː.su]		(955)	[ta̰ˈ**lḭ**ː.su]	
	/ha.lo.su/			/ta̰.lḭ.su/	
	halo -su			ta̰lḭ -su	
	field-REF			parakeet-REF	
	‘field’			‘parakeet, sp.’	

b) Second syllable with a coda /σL.σH/

In roots, whose first syllable is light and second is heavy, stress is always marked in the second syllable:

	x	level 3		x	level 3
	x	level 2		x	level 2
	x x x	level 1		x x x	level 1
(956)	[taˈ**leh**.su] ~ [taˈleː.ʰsu]		(957)	[saˈ**wi**ː.ɾʰu]	
	/ta.leh.su/			/sa.uil.su/	
	taleh -su			sauil -su	
	taleh-REF			parakeet-REF	
	‘parakeet, sp.’			‘parakeet’ (general)	

115 Trisyllabic roots are usually derived from reduplication.

c) Both syllables with a coda /$\sigma_H.\sigma_H$/

If both syllables have a coda in the underlying representation, stress is assigned to the rightmost syllable of the morpheme:

		x		level 3
	x	x		level 2
	x	x	x	level 1

(958) [haʔˈ**je**ː.ɾʰu]
/haʔ.iel.su/
haʔiel -su
stink bug-REF
‘stink bug’

		x		level 3
	x	x		level 2
	x	x	x	level 1

(959) [kaʔˈ**ju̯̰**ː.ʰsu]
/kaʔ.ĩ̯ṵ̯hˀ.su/
kaʔḭ̯ṵ̯ˀh -su
meat-REF
‘meat, game’

4.10.2.1.1.2. Word-initial stress

a) First syllable with a coda /$\sigma_H.\sigma_L$/

If the first syllable has a coda and the second does not, stress falls on the first syllable:

	x			level 3
	x			level 2
	x	x	x	level 1

(960) [ˈ**jah**.lo.su]
/iah.lo.su/
iahlo -su
old man-REF
‘old man’

	x			level 3
	x			level 2
	x	x	x	level 1

(961) [ˈ**jeh**.ˀni.sã]
/ieh.ˀni.sã/
iehˀni -sã
to nest-SS
‘to nest’

4.10.2.1.2. Exceptions

Disyllabic roots with both underlying light syllables, whose second syllable ends with coronal vowel /i/ are an exception to the rule of stress based on syllable position. This observation has been made by Costa (2020), who argues that examples with a final high vowel /i/ can be accounted for with extrametricality. A similar interpretation has been made to account for the stress system of Mamaindê (Eberhard 2009).
In our analysis, some of the examples provided by Costa (2020) as extrametrical assignment of stress of roots with a final unstressed high vowel fit under a monosyllabic root followed by epenthetic [i] described above. However, some others do not and deviate from the stress rule regarding syllable position within the morpheme: instead of assigning stress to the rightmost syllable, the syllable on the left is preferred. These cases where epenthesis is not applied, as it would break the sonority scale of the syllable, are analyzed as extrametrical examples:

x level 3
x level 2
x x level 1
(962) [ˈ**ha**ː.li] *[haˈliː]
/ha.li /
‘two’

x level 3
x x level 2
x x x x level 1
(963) [ˈ**he**ː.ɾiˌnaː.ɾa]*[heˈ**ɾi**ːˌnaː.ɾa]
/he.li.na.ɾa/
heli -∅ -na -ɾa
to fight-3S-V.EV.PRS-PFV.M
‘he’s fighting’

You may recall that the stress syllable must be phonetically implemented with an additional mora, regardless of the position within the morpheme. In examples above, note that it is the first syllable of the morpheme that becomes lengthened, instead of the rightmost one. Synchronically, it is not possible to determine why stress is placed on the first syllable. One could argue that vowel [i] was attached through epenthesis in (962), as liquids are not phonetically realized in the coda, but the example in (963) would be difficult to explain through the following very frequent phonological rule: all syllables belonging to a /l/ final verbal root are phonetically realized as [(C)Vː] before any consonant initial syllable. As such, both cases are treated as exceptions to the general stress rule.

4.10.2.2. Disyllabic Roots with Epenthetic Vowel [i]

The stress position within a disyllabic root is not affected if an epenthetic vowel is attached to it. Compare examples with and without epenthesis, where stress is always kept on the same syllable, but a different word rhythm is rendered:

a) *Without* epenthesis:

- {taˈkoˀk(i)-} ‘forest’

x level 3
x level 2
x x x level 1
(964) [taˈ**ko**ː.ˀksu]
/takoˀk(i).su/
takoˀk(i) -su
forest-REF
‘forest’

b) *With* epenthesis:

x level 3
x level 2
x x x x level 1
(965) [taˈ**ko**ː.ˀki.su] ~ [taˈ**ko**ː.kisu]
/ta.koˀk(i).su/
takoˀk(i) -su
fish-REF
‘forest’

4.10.2.3. Trisyllabic Roots

Trisyllabic roots are very rare, and they probably originate from lexicalization of suffixes into roots or through reduplication. All examples below show stress being assigned to the first heavy syllable. As discussed, it is likely that following examples of trisyllabic are complex words comprised of a monosyllabic root followed by [a.ˀli]:

x level 3
x level 2
x x x level 1
(966) [ˈ**waj**ː.a.la̰]
/uai.a.ˀli.a/
uaiaˀli- a
dog-REF
‘dog’

x level 3
x level 2
x x x level 1
(967) [ˈ**wah**.ka.la̰]
/uah.ki.a.ˀli.a/
uahk(i)aˀli-a
caiman-REF
‘caiman’

Note that both examples in (966) and (967) have the same ending /-aˀli/. This shared ending can be an indication that trisyllabic roots are compounds. If that is the case, trisyllabic roots are underlyingly monosyllabic or disyllabic.

4.10.2.4. Reduplication

Reduplication is a common morphophonological process in Kithãulhu and has been attested in Southern Nambikwara by Kroeker (2001) and Costa (2020). Phonologically, reduplication involves copying prosodic units, namely the syllable and, to a certain degree, the mora, as codas are never copied. At the morphological level, reduplication operates by copying the root fully or partially.
In accordance with Costa (2020), we see that the base is on the right, while the reduplicant is on the left. Reduplicated syllables generate roots with two, three or four syllables – the latter in case the reduplicant copies two syllables from the base. What we can add as new information on reduplication is that the number of copied syllables in the reduplicant can also be used to distinguish lexical items, as shown in (968), where the reduplicant copies two syllables of the base, and (969) where just one syllable is copied. In both examples, underlying coda /n/ is not copied:

x level 3
x x x level 2
x x x x x x level 1
(968) [waˌsiː.waˈ**sid**ˌnaː.ɾa]
/ua.si.ua.sin.na.ɾa/
uasiuasin -∅ -na -ɾa
RED.to be brown-3S-V.EV-PFV.M
‘it’s brown’

x level 3
x x level 2
x x x x x level 1
(969) [wa.siˈ**sid**ˌnaː.ɾa]
/ua.si.sin.na.ɾa/
uasisin -∅ -na -ɾa
RED.to be dry-3S-V.EV-PFV.M
‘it’s dry’

The same stress rules described for non-reduplicated roots are applied to the reduplicated ones.

4.10.2.4.1. One Syllable Is Copied

a) Partial copy

Base: CVC
Reduplicant: CV

In partial copies, one CV syllable is copied from a CVC base. Stress is placed on the base because it is underlyingly heavy. If the reduplicant includes a falling diphthong, it bears secondary stress, as in (971). Reduplicants are transcribed in bold:

```
        x          level 3
        x          level 2
    x   x   x      level 1
(970) [hĩˈhĩː.ɾʰu]
      /hĩ.hĩl.su/
      hĩhĩl -su
      RED.tinamou -REF
      ‘tinamou, sp.’
```

```
          x        level 3
      x   x        level 2
      x   x   x    level 1
(971) [ˌpʰaj:ˈpʰajː.ɾa]
      /pʰai.pʰail.su/
      pʰaipʰail -su
      RED.frog-REF
      ‘frog, sp.’
```

b) Full copy: **CV**.CV

Base: CV
Reduplicant: CV

Full copies of the base are only attested if the base has no coda. When the CV syllable is copied, stress is kept in the base, following the stress rule which predicts that morphemes comprised of light syllables have stress marked on the rightmost syllable. Nasality is not copied for this type of reduplication, but nasalization of the reduplicant may occur due to an optional phonological rule, as shown in (972). Creaky voice vowels are always copied, as in (973):

```
        x          level 3
        x          level 2
    x   x  x       level 1
(972) [nĩˈnĩː.su] ~ [niˈnĩː.su]
      /ni.nĩ.su/
      ninĩ -su
      RED.mosquito-REF
      ‘mosquito, sp.’
```

```
        x          level 3
        x          level 2
    x   x   x      level 1
(973) [ko̰ˈko̰ː.su]
      /ko̰.ko̰.su/
      ko̰ko̰ -su
      RED.enemy-REF
      ‘enemy’
```

4.10.2.4.2. Two Syllables Are Copied

a) Partial copy:

Partial copies of disyllabic bases occur when two syllables of the base are copied without the coda of the stressed syllable. When two syllables are partially copied, secondary stress is assigned to the second syllable of the reduplicant if the nucleus is creaky. Primary stress always falls on the rightmost syllable of the base, as it is heavy:

Base: GV.CVC
Reduplicant: GV**.**CV

Base: CV.CVC
Reduplicant: CV**.**CV

```
                x      level 3
        x       x      level 2
    x   x   x   x   x  level 1
(974) [waˌlṵːwaˈlṵᵈnᵗsã]
      /ua.lṵ.ua.lṵn.sã/
      ualṵualṵn -sã
      RED.to be loose-SS
      ‘to be loose’
```

```
                  x          level 3
                  x   x      level 2
      x   x   x   x   x   x  level 1
(975) [ka.na.kaˈnaːˌtãː.ɾa]
      /ka.na.ka.nat.na.ɾa/
      kanakanat -∅ -na -ɾa
    RED.to be one-3S-V.EV-PFV.M
      ‘it’s one’
```

b) Full copy

When two syllables are fully copied, secondary stress is assigned to the second syllable of the reduplicant if the nucleus is creaky[116]. Primary stress always falls on the rightmost syllable of the base:

Base: CV.CV
Reduplicant: CV.CV

CV.**CV**.CV.CV

	x	level 3
	x	level 2
	x x x x x	level 1
(976)	[**ka.la**.kaˈlaː.su]	
	/ka.la.ka.la.su/	
	kalakala -su	
	RED.chicken -REF	
	‘chicken.’	

	x	level 3
	x x	level 2
	x x x x x	level 1
(977)	[**ta̰ˌˀkã̰**ː.ta̰ˈˀkã̰ː.su]	
	/ta̰.ˀkã̰.ta̰.ˀkã̰.su/	
	ta̰ˀkã̰ta̰ˀkã̰ -su	
	RED.hawk-REF	
	‘hawk, sp.’	

Simultaneous creaky and nasal features are very often not copied during reduplication, except in fully copied disyllabic roots, as in (977).

4.10.2.5. Stress on Grammatical Morphemes

Grammatical (derivational and inflectional) morphemes can be stressed or unstressed. Most stressed grammatical morphemes are comprised of heavy syllables, but some light-syllabled morphemes, such as possessive pronouns, are stressed. Stress in grammatical morphemes is also partially unpredictable in light-syllabled morphemes, but predictable in morphemes comprised of at least one heavy syllable. As I show, morphemes occurring in nominal and verbal words may follow the general stress rule, but stress also operates distinctively in the latter word class. For instance, the verbal word has a specific environment for the assignment of secondary stress: the penultimate position of the verbal string. Stress of grammatical morphemes is discussed below.

4.10.2.5.1. Stress in Nominal Affixes

As previously discussed, morphological structure is essential to understanding how stress is assigned. The minimal structure for a morphosyntactic word is disyllabic, as roots are not allowed to occur independently and require a final suffix. The stem is comprised of a mandatory root, but classifiers may also be part of the stem. Inalienable nouns also require the inalienable prefix {a-} to be attached to the stem. Table *69* shows the basic morphological structure for nouns:

[116] An exception to the rule is the number four, [ˈhaːliˈhaːli], comprised of fully reduplicated syllables, whose stress is preserved on the first syllable of the base and copied in the reduplicant.

Table 69: Basic morphological structure of nominal words.

<table>
<tr><td colspan="4">Nominal Word</td></tr>
<tr><td rowspan="2">Prefix</td><td>root$_1$</td><td>root$_2$/ classifier (optional)</td><td rowspan="2">Final Suffix {-a}, {-su}</td></tr>
<tr><td colspan="2">stem</td></tr>
</table>

As a rule, primary stress always occurs on the stem. All the monosyllabic suffixes occurring at the final edge of a morphological word are unstressed. Polysyllabic suffixes occurring at the penultimate position within a morphological word are stressed. In the cases where a polysyllabic morpheme has one heavy syllable, stress is placed upon it, as previously discussed.

4.10.2.5.1.1. Nominal Prefixes

Nominal prefixes are stressed because they contain relevant semantic information, despite being comprised of a light syllable. Since the intensity and vowel duration values observed in prefixes are lower in relation to the values for the vowel in the stressed syllable belonging to the root, prefixes are transcribed bearing secondary stress [ˌ] in the following examples:

Morpheme Type	Morpheme (lexical form)	Meaning	Surface Forms	Example
Possessive	{ˈˀta-}	my	[ˌˀtaː], [ˌdaː], [ˌda̰ː], [ˌɗaː]	[ˌ**ɗa**ːˈĩːɾa̰] /ˀta.ĩˀl.a/ ˀta- ĩˀl- a 1POS-name-REF ‘my name’
	{ˈṵa̰-}	your	[ˌw̰a̰ː], [ˌˀwa̰ː]	[ˌ**w̰a̰**ˈw̰ḭː.a] /ṵa̰.ṵḭ.a/ ṵa̰- ṵḭ- a 2POS-tooth-REF ‘your tooth’
	{ˈa-}[117]	his/her/its	[ˌaː], [ˌɐː], [ˌãː], [ˌɐ̃ː]	[ˌ**ɐ**ːˈw̃ẽː.sa] a- ũẽs- a 3POS-child-REF ‘his/her child’

4.10.2.5.1.2. Nominal Suffixes

- *Classifiers*

Classifiers can be stressed or unstressed. Stressed classifiers fall into two categories: 1) monosyllabic and 2) polysyllabic. Stressed monosyllabic classifiers have a coda, are comprised of a diphthong/triphthong, or display a creaky voice vowel. The stress syllable of polysyllabic classifiers is mostly predictable: if all syllables are light, it usually falls on the rightmost syllable. If at least one syllable is heavy, stress is marked in it. Most classifiers, if not all, can be employed as a root.

[117]Masculine and feminine personal pronouns {ˈtiahla} and {ta̰ˈkaˀla}, respectively, can also be used in possessive constructions.

- *Unstressed monosyllabic classifiers:*

a) **{te-}**: *generic*
Surface form: [te]

(978) [aˈliː.**te**.su]
/a.li.te.su/
ali -te -su
to clean-CL.generic-REF
‘broom’

(979) [ˈhãj̃ː.**de**.su]
/hãĩˀn.te.su/
hãĩˀn -te -su
to let be-CL.generic-REF
‘he is like that, it’s his way’

b) **{-ki}**: *small and round, seed*
Surface form: [ki]

(980) [ˈsiː.sa.**ki**.su]
/sis.a.ki.su/
sis -a -ki -su
grass-REF-CL.seed-REF
‘rice’

(981) [ˈḛː.ɾa.**ki**.a.waˈnãː.**ki**.su]
/ḛl.a.ki.a.ua.nã.ki.su/
ḛl -a -ki -a uanã -ki -su
cashew-REF-CL.seed-nut-CL.seed.REF
‘cashew nut’

c) {**-nũ**}: people, kinship

(982) [ˌaːˈw̃ĩː.**nũ**.su]
/a.ũĩn.nũ.su/
a- ũĩn -nũ -su
INAL-father-CL.people-REF
‘father’

- *Stressed monosyllabic classifiers*:

a) **{-ˈien}**: *circular*
Surface forms: [ˈjeᵈn] ~ [ˈtʃeᵈn] ~ [ˈdʒeᵈn] ~ [ˈjeː] ~ [ˈtʃeː] ~ [ˈdʒeː]

(983) [ˈsˀiːˌ**ʰjeᵈn**.ᵗsu]
/sˀih.ien.su/
sˀih -ien -su
house-CL-circular-REF
‘village’

b) **{-ˈḭ̃ã̰ṵ̃}**: *liquid, fluid*
Surface forms: [ˈjã̰w̰̃ː] ~ [ˈtʃã̰w̰̃ː] ~ [ˈdʒã̰w̰̃ː]

(984) [ˈw̰̃ḭ̃ːˀtaˌwiːˌ**j̃ã̰w̰̃**ː.su]
/ṵ̃ḭ̃ˀt.a.ṵ̃ḭ̃.ḭ̃ã̰ṵ̃.su/
ṵ̃ḭ̃ˀt -a ṵ̃ḭ̃ -ḭ̃ã̰ṵ̃ -su
venom-REF-tooth-CL.liquid-REF
‘snake venom’

c) **{-ˈẽn}**: *hole, hollow cavity*
Surface forms: [ˈ(C)ẽː] ~ [ˈ(C)ẽn]

(985) [ˈnṵ̃ːˌ**sẽ**ː.ᵗsu]
/nṵ̃s.ẽn.su/
nṵ̃s -ẽn -su
pestle- CL.hole-REF
‘pestle’

d) **{-ˈẽh}**: *string, vine*
Surface forms: [ˈ(C)ẽː] ~ [ˈ(C)ẽh]

(986) [ˈhoː.saˌ**ˀkẽ**ː.ʰsu]
/hos.a.ˀki.ẽh.su/
hos -a -ˀki -ẽh -su
monkey-REF-bone-CL.string-REF
‘monkey teeth necklace’

e) **{-ˈkaˀt}**: *long, solid, cylindrical, disease*
Surface forms: [ˈkaˀt] ~ [ˈkaʔ] ~ [ˈka̰ː]

(987) [ˈɓa̰ː.laˈĩː.ta̰ˌ**kaʔ**.tsu]
/ˀpa̰l.a.ĩt.a.kaˀt.su/
ˀpa̰l -a ĩt -a -kaˀt -su
leishmaniasis-REF- to be sick-LV-CL.disease-REF
'leishmaniasis'

(988) [waˈtuʔˌ**ka̰**ː.ta̰]
/ua.tuk.kaˀt.a/
uatuk -kaˀt -a
lightning-CL.cylindric-REF
'lightning'

f) **{ko̰-}**: *land, region*
Surface form: [ko̰ː]

(989) [kaˈja̰ː.ta̰ˌ**ko̰**ː.su]
/kua.ḭa̰ˀt.a.ko̰.su/
kuaḭa̰ˀt- a- ko̰ -su
corn-REF-CL.region-REF
'corn field'

g) **{-ˈtʰoʔ}**: *ash-like, big fire*
Surface forms: [ˈtʰoː]

(990) [saʔˈweːnaˌ**tʰo**ː.su]
/saʔ.uen.tʰoʔ.su/
saʔuen -a -tʰoʔ -su
jungle-REF-CL.big fire-REF
'big fire in the jungle'

h) **{-ˈtʰĩn}**: *village, houses*
Surface forms: [ˈtʰĩn] ~ [ˈtʰĩː]

(991) [saʔˈweːˌ**tʰĩ**ː.na]
/saʔ.uen.tʰĩn.a/
saʔuen -tʰĩn -a
jungle-CL.village-REF
'village in the jungle'

i) **{-ˈˀnãn}**: *leaf-shaped*
Surface forms: [ˈˀnãː] ~ [ˈnãː] ~ [ˈˀnãn] [ˈnãn]

(992) [haˈdḛːˌ**ˀnã**ː.ᵈzu]
/ha.tḛh.ˀnãn.su/[118]
hatḛh -ˀnãn -su
?-CL.leaf like-REF
'money'

j) **{-ˈnãũʔ}**: *egg-shaped*
Surface forms: [ˈnãw̃ː]

(993) [ˈhḛːˌ**nãw̃**ː.su]
/hḛl.nãũʔ.su/
hḛl -nãũʔ -su
buriti- CL.egg.shaped-REF
'*buriti* maggot'

k) {-ˈ**na̰ˀk(i)**}: *closed receptacle, sphere, fruit*
Surface forms: [ˈna̰ːki] ~ [ˈna̰ˀki] ~ [na̰ʔ]

(994) [ˈboː.laːˌ**na̰**ː.**ki**.su]
/<bola>.a.na̰ˀk(i).su/
<bola>-a -na̰ˀk(i) -su
ball-REF-CL.sphere-REF
'ball'

l) **{nṵ̃-}**: *dough, powder, granules*
Surface form: [nṵ̃(ː)] ~ [ɗṵ̃(ː)]

(995) [kaˈja̰ˌ**ʔdṵ̃**ː.su]
/kua.ḭa̰ˀt.nṵ̃.su/
kuaḭa̰ˀt- nṵ̃ -su
corn-REF-CL.granules-REF
'corn flour'

[118] Alternatively, han-te-ˀnãn-su: to be clear-CL.generic-CL.leaf-like-REF, according to Silva (2021).

m) **{-u̯i̯}**: *tooth, twig, wood-like, sharp*
Surface form: [w̰ḭː]

(996) [ˈhiː.saˌ**w̰ḭ**ː.su]
/his.a.u̯i̯.su/
his -a -u̯i̯ -su
wood-REF-CL.sharp-REF
'firewood'

- *Stressed polysyllabic classifiers:*

There are two groups of polysyllabic classifiers. In the first group, all syllables are light and stress is mostly predictable following the general rule. In the second group, classifiers have at least one heavy syllable.

i) All light syllables

In this groups, stress falls on the ultimate syllable if the morpheme is disyllabic. If it is trisyllabic, stress is marked on the penultimate syllable, as an exception to the general stress assignment rule:

a) **{-kaˈlo}**: *cloth, flatten, hull, surface*
Surface form: [kaˈloː] ~ [gaˈloː]

(997) [waʔˈjaː.la.**ka**ˌ**lo**ː.su]
/uaʔ.ial.a.ka.lo.su/
uaʔial -a -kalo -su
cockroach-REF-CL.flatten-REF
'cockroach'

b) **{-a̰ˈkaˀlo}**: female
Surface form: [(C)a̰ˈka̰ːla̰]

(998) [ta̰ˈ**ka̰**ː.la̰]
/te.a̰.ka.ˀlo.a/
te -a̰kaˀlo -a
3S-CL.female-REF
'she'

iii) One heavy syllable and one light syllable

In this group, stress is assigned to the heavy syllable:

a) **{-ˈiahlo}**: *male*

Surface forms: [ˈjahlo] ~ [ˈtʃʲahlo] ~ [ˈtʃahlo] ~ [ˈdʒʲahlo]~ [ˈdʒahlo]

(999) [jaˈlaː.naˌhajgŋˈ**tʃʲah**.lo.su]
/ia.lan.a.hain.iahlo.su/
ialan -a hain -iahlo -su
toucan-REF-to sing-CL.male-REF
'toucan, sp.'

b) **{-ˈĩhnũ} ~ {ˈtĩhno}**: *trail, string*
Surface forms: [ˈ(C)ĩhnu] ~ [(C)ĩhno] ~ [ˈ(C)ĩhna]

(1000) [ˈjajːˌ**nĩh**.nũ.su]
/iain.ĩh.nũ.su/
iain -ĩhnũ -su
to eat-CL.string-REF
'leech'

Whenever a classifier is employed as a root, it follows the general stress rule for nouns. Note that unstressed classifiers become stressed when used as roots, as in (1004):

(1001) /a.ka.lo.su/
[ˌɐː.**ka**ˈ**lo**ː.su]
a- kalo -su
INAL-husk-REF
'husk'

(1002) /iah.lo.su/
[ˈ**jah.lo**.su]
iahlo -su
CL.male-REF
'old man'

(1003) /a̰.ka.ˀlo.a/
[a̰ˈ**ka̰**ː.**la̰**]
a̰kaˀlo -a
CL.female-REF
'old woman'

(1004) /a.ki.su/
[aˈ**ki**ː.su]
a- ki -su
INAL-seed-REF
'seed'

(1005) /a.nṵ̃.su/
[aˈ**nṵ̃**ː.su]
a- nṵ̃ -su
INAL-granules-REF
'flour' (general)

(1006) /a.nãũʔ.a/
[aˈ**nãw̃**ː.ʔa]
a- nãũʔ -a
INAL-egg-REF
'egg'

- *Other Nominal Suffixes*

Table *70* and Table *71* provide an overview of the nominal morphemes and how they relate to stress. As shown in Table *70*, all unstressed suffixes are monomoraic, i.e. comprised of a light syllable, whereas most stressed suffixes have more than one mora as illustrated in Table *71*. Most of the stressed suffixes and some of the unstressed suffixes at the stem boundary are also allowed to bear a contour tone as discussed later in Chapter 5.

List of Unstressed Suffixes in Nominal Morphology[119]

Table 70: Unstressed nominal suffixes.

Morpheme Type	Morpheme (Lexical Form)	Meaning	Surface Forms	Example
Linking Vowel	{-a}	-	[a]	[ˈhiː.s**a.**kaʔ.tsu] his- a- kaˀt -su wood-LV-CL.cylindrical-REF ‘wood’
Inclusive	{-i}	‘and’ in listing.	[(C)i]	[ˈhuː.ˀkaˈteː.n**i**ˈhawː.ɗaˈteː.n**i.**saˌʰnaː.wa] /huˀk.a.ten.i.hauˀt.a.ten.i.sa.ʰna.ua/ huˀk(i)-a ten -i hauˀt(i) -a ten -i -sa -ʰna -ua bow-REF-DES-INCL-arrow-REF-DES-INCL-1O-NV.EV-NPFV.M ‘I want a bow and an arrow’
Referential	{-a}	see Chapter 2.	[(C)a], ∅	[ˈw̃ãː.**sa**] /ũãs.a/ ũãs -a hat-REF ‘hat’ [aˈlãː] /a.lã.a/ alã -a macaw-REF ‘macaw’ (general)

[119] Focus morpheme {-sa} is not included in the list, but it is assumed to be unstressed due to its phonetic structure and position within the word/sentence.

	{-su}	see Chapter 2.	[su], [zu], [tsu], [dzu], [ksu], [ʰsu] [ʰl̥], [ɾʰu]	[aˈlajː.**su**] /a.lai.su/ alai -su sloth-REF ‘sloth’ [ˌaːˈnũ̯ː.**zu**] /a.nũ̯.su/ a- nũ̯ -su INAL-CL.dough-REF ‘dough’ [ˈw̰a̰w̰ᵇm.**ᵈzu**] /uaun.su/ ṵa̰ṵn -su scorpion-REF ‘scorpion, sp.’ [ˈhoʔ.**tsu**] /hos.su/ hos -su monkey-REF ‘monkey’ [ˌa̰j̰ˈda̰ː**ksu**] ~ [ˌa̰j̰ˈda̰ːkisu] /a̰ḭn.tak.su/ a̰ḭn -tak(i) -su fish-grasshopper-REF ‘crab’ [ˈaː.**ʰsu**] ~ [ˈah.su] /ah.su/ ah -su spider-REF ‘spider, sp.’ [saˈlaː.**ʰl̥u**] /sa.lal.su/ salal -su

				kingfisher-REF ‘kingfisher, sp.’ [saˈwiː.**rʰu**] /sauil.su/ sauil -su parakeet-REF ‘parakeet’ (general)

List of Stressed Suffixes in Nominal Morphology[120]

Table 71: Stressed nominal suffixes.

Morpheme Type	Morpheme	Meaning	Surface Form	Example
Augmentative	{-ˈta̰}[121]	super, extra, huge.	[ˈta̰ː] ~ [ˈta̰ʰ]	[ˈtuː.haˌ**ta̰**ː.su] /tuh.a.ta̰.su/ tuh -a -ta̰ -su bee-REF-AUG-REF ‘bee, sp.’
Group	{-ˈkaˀt(i)}	Group.	[ˈkaːɗi] ~ [ˈkaːdḭ] ~ [ˈka̰ː]	[ˌaːˈnũːˌ**kaː.ɗi**.su] /a.nũ.kaˀt(i).su/ a- nũ -kaˀt(i) -su 3S.POS-CL.people-GR-REF ‘his group’
Authenticity	{-ˈkʰaiʔ}	for real	[ˈkʰajː]	[aˈnũːˌ**kʰaj**ː.su] /a.nũ.kʰaiʔ.su/ a- nũ -kʰaiʔ -su INAL-people-AUTH-REF ‘people (for real)’
Emphatic	{-ˈkʰaiʔ}	very	[ˈkʰajː]	[ˌhãw̃ːˈʔiː ˈ**kʰaj**ː ˈˀnẽːˌnaː.ɾa] /ãũ.ʔi.kʰaiʔ.ˀne.na.ɾa/ ãũʔi -kʰaiʔ ˀne -∅ -na -ɾa to sleep-EMP.AFF-COP-3S-PRS-V.EV-PFV.M ‘he sleeps a lot’
	{-tiˈheʔ}	not very	[tiˈheː]	[ˌhãw̃ːˈʔiː.**ti**ˈ**he**ː.ˀnẽːˌna̰ː.wa] /ãũ.ʔi.tiheʔ.ˀne.ˀna.ua/ ãũʔi -tiheʔ ˀne -ʔ -∅ -na -ua

[120] This list does not include suffixes {-ãũˀt(i)} (GR), {-aitali} (TEMP.P), {-ĩnti} (INCL) because they do not occur in the corpus. Based on the stress patterns of other suffixes with similar structure, I assume that they are stressed on their first syllables.

[121] Silva (2020: 66) regards{-ta̰} as an augmentative root.

				to sleep-?-EMP.NEG-COP-NEG-3S-NV.EV-NPFV.M 'he does not sleep a lot'
Nominal Temporal Future	{-ˈnũ}	future	[ˈnũː]	[ˌw̰a̰ːˈhuːˀkiˌ**nũ**ː.su] /ṵa̰.huˀk(i).nũ.su/ ṵa̰- huˀk(i) -nũ -su 2S.POS-bow-TMP.FUT-REF 'your future bow'
Locative	{-ˈnau}	to, towards, in, on, at	[ˈnawː]	[ˈhajː.sa̰ ˈkǫːˌ**naw**ː.a] /haisˀ.a.kǫ.nau.a/ haisˀ -a -kǫ -nau -a crop-REF-CL.region-LOC-REF 'to the crop'
Plural	{-ˈnãũʔ} ~ {-ˈnãʔ}	group	[ˈnãː] ~ [ˈnaː] ~ [ˈnãw̃ː]	[ˈtʃah.loˌ**nã**ː.ʔa] /te.iah.lo.nãũʔ.a/ te -iahlo -nãũʔ -a 3S-CL.male-PL-REF 'they'
Quantifier	{-ˈhala}	(a) few, more than one	[ˈhaː.la]	[ˈw̃ẽːˌ**haː.la**] /ũẽs.a.ha.la/ ũẽs -a -hala child-REF-QT 'a few children'
	{-ˈhali}	two, a couple	[ˈhaː.li]	[ˈw̃ẽːsaˌ**haː.li**ˈɲũːˌnaː.ɾa] /ũẽs.a.ha.li.ĩũn.na.ɾa/ ũẽs -a -hali # ĩũn -∅ -na -ɾa child-REF-two to have-3S-V.EV-PFV.M 'he has two children'
Nominal Temporal Past	{-ˈnũta}	(from the) past, a long time ago, of yore	[ˈnũː.ta]	[ˈhawː.ɗaˌ**nũː.ta** ˈajː.na ˈkʰoᵈn.daˌheː.ɾa] /hauˀt(i).a.nũt.a.ai.na.kʰon.ta.he.ɾa/ hauˀt(i) -a -nũta -aina #kʰon -tahe -ɾa

				bow-REF-TMP.PST-DEM.NR.VS-to be broken-3S-PST-NV.EV-PFVF.M ‘the arrow broke up a long time ago’
	{-ũˈtetã} / {-uˈtaina}	(from the) past, a long time ago, of yore	[uˈtajːna] [ũˈteːta]	[ˈkãj̃ːˈhĩː.na **uˌtajː.na**] /kãĩn.hĩn.a.u.tai.na/ kãĩn -hĩn -a -utaina to be long-time-REF-TMP.P ‘a long time ago’ [ˈhawː.ɗa **ũˌteː.tã**] /hauˀt(i).a.ũ.te.tã/ hauˀt(i) -a -ũtetã arrow-REF-TEMP.P ‘an arrow (from the past)’
Demonstrative	{-ˈaili}	This (visible an very near)	[ˈ(C)ajːɾi]	[ˈhawːˌ**ɗajː.ɾi**ˈkʰodˌnaː.ɾa] /hauˀt(i).ai.li.kʰon.na.ɾa/ hauˀt(i)- -aili kʰon -∅ -na -ɾa arrow-DEM- to be broken-3S-V.EV-NPFV.M ‘this arrow is broken’
	{-ˈaina}	This (visible and near)	[ˈ(C)ajːna]	[ˌɗaːˈnũːˌkaːˈ**ɗajː.na**] /ˀta.nũ.kaˀt(i).ai.na/ ˀta- nũ -kaˀt(i) -aina 1S.POS-CT.people-GR-DEM.NR.VIS ‘my group’
	{-ˈaitã}	That (distal demonstrative)	[ˈ(C)ajːtã]	[ˈsũː.diˈhĩːˌ**najː.tã**] /sũn.ti.hĩn.ai.tã/ sũnti -hĩn -aitã yesterday-TEMP-DEM.DIST ‘yesterday’
Exclusive	{ˈsoˀli}	only, always	[ˈsoː.ˀli] ~ [ˈsoː.li]	[ˈa̰jː.naˌ**soː.ˀli**ˈadˌnaː.ɾa] /a̰ḭn.a.so.ˀli.an.na.ɾa/

				a̰ḭn- a -soˀli an -∅ -na -ɾa fish -REF -only- to kill-3S-V.EV-NPFV.M ‘he only kills fish’

4.10.3. Adverbs

Adverbs follow the general stress rule, with the exceptions of {ˈã̰la} and {ˈsoˀli}, which are comprised of light syllables only, but stress is assigned to the leftmost syllable. It is possible to assume that adverb{ˈã̰la} is comprised of two morphemes, but as we have seen in section *4.8.3*, vowel quality is also an acoustic correlate of stress. Vowels with simultaneous creaky phonation and nasal features are more energetic, and therefore it is reasonable that stress is placed on the first syllable rather than the rightmost one.

Table 72: Stress patterns in adverbs.

Adverb Type	Morpheme	Meaning	Lexical Form	Surface Form
Mode	{ãʔ}	still	{ˈãʔ}	[ˈ(C)ãː] ~ [(C)ãʔ]
	{ã̰la}	already, yet	{ˈã̰la}	[ˈã̰ːla]
	{soˀli}	only	{ˈsoˀli}	[ˈsoːˀli] ~ [ˈsoːli]
	{nũhli} / {nũʔ}	alone, by oneself	{ˈnũhli}	[ˈnũhli]
Locative	{ḭṵhẽna}	under, below	{ˈḭṵhˌẽn-a}	[ˌjṵːˈhẽː.na]
	{nekahana}	on, above	{ˈnekaˈhana}	[ˌneːkaˌˈhaː.na]
	{nekata}	in front of	{neˈkata}	[ˌneːˈkaː.ta]
	{netaũã}	there	{neˈtaũã}	[neˈtaː.w̃ã]
	{taloa}	behind	{taˈloa}	[taˈloː.a]
	{tanã}	beside, next to	{ˈtanã}	[ˈtaː.nã]
	{uli}	far	{ˈuli}	[ˈuː.li]

4.10.4. Numbers

Numbers usually do not require stressed syllables to be underlying heavy. However, note that stress never falls on the final and rightmost syllable if it ends with [i]. We cannot explain this phenomenon from a synchronic perspective.

Table 73: Stress patterns in numbers.

Number Lexical Form	Meaning	Surface Form	Example
{kaˈnaki}	one	[kaˈnaː.ki]	[kaˈ**na**ː.ki] /ka.na.ki/ kanaki ‘one’
{ˈhali}	two	[ˈhaː.li]	[ˈ**ha**ː.li] /há.li/ hali ‘two’
{ˈhali kaˈnaki}	three	[ˈhaː.li kaˈnaː.ki]	[ˈ**ha**ː.li kaˈ**na**ː.ki] /ha.li.ka.na.ki/ hali-kanaki two-one ‘three’
{ˈhali ˈhali}	four	[ˈhaː.liˈhaː.li]	[ˈ**ha**ː.liˈ**ha**ː.li] /ha.li.hali/ hali-hali two-two ‘four’
{ˈhˀiˀk(i)-a ˈhat(i)}	five	[ˈˀhiː.ka̰ˈhaː.ti]	[ˈ**hˀi**ː.ka̰ˈ**ha**ː.ti] /hˀik(i).a.ha.ti/ hˀik-a hati hand-REF-? ‘five’ (lit. one hand)
{ˈhˀiˀk(i)-a ˈhali}	ten	[ˈhˀiː.ka̰ˈhaː.li]	[ˈ**hˀi**ː.ka̰ˈ**ha**ː**.**li] /hˀik(i).a.ha.li/ hˀik(i) -a hali hand-REF-two ‘ten’ (lit. two hands)

{kaˈla}	many, much, a lot	[kaˈlaː]	[kaˈ**la**ːˌnaː.ɾa] kala -∅ -na -ɾa to be many-3S-PRS.V.EV-PFV.M ‘they’re many, it’s a lot’

4.10.5. Particles

Particles follow the same general stress rule: whenever all syllables of a polysyllabic morpheme are light, stress is placed on the rightmost syllables after phonetic implementation of the nucleus:

Table 74: Stress patterns in particles.

Type	Particle	Meaning	Surface Form	Example
Emotion	{haˈio}	agreement, thank you, hi, hello	[haˈjoː]	[haˈjoː] ‘exactly’
	{haˈã}	agreement	[haˈãː]	[haˈãː] ‘yes’

4.10.6. Verbal Affixes and Stress

Most verbal affixes are unstressed, as they are usually comprised of light syllables. Affixes comprised of heavy syllables are stressed, but they are less prominent than roots and analyzed bearing secondary stress. Certain light suffixes indicating evidentiality, tense, aspect, mood, among others, are phonetically realized with lengthened vowels and bear secondary stress because they occur in the penultimate position of the verbal string. Other light suffixes denoting reflectiveness or subject markers may bear secondary stress if occurring in the penultimate position of the verbal string. Otherwise, they are unstressed. Some examples of stressed and unstressed affixes are given in the following section.

4.10.6.1. Verbal Prefixes

4.10.6.1.1. Unstressed Verbal Prefixes

Morpheme Type	Morpheme (lexical form)	Meaning	Surface Forms	Example
Instrumental	{ĩ-}	Unspecified agent acting in continuum (Kroeker 2001: 53).	[ĩ]	[**ĩ**ˈsuːˌnaː.ɾa] /ĩ.sul.na.ɾa/ ĩ- sul -∅ -na -ɾa INST-to beat-3S-PRS.V.EV-PFV.M ‘he’s beating’ (continuously)
	{sa-}	Unspecified agent acting on the goal (Kroeker 2001: 53). *Used in both human and non-human agents, as long as it is unspecified.*	[sa]	[**sa**ˌniːˈɾʰoːˌnaː.wa / /sa.nil.so.na.ua/ sa- nil -so -na -ua INST-to break-to pull-1S.PRS-NPFV.M ‘I’m plucking’

4.10.6.1.2. Stressed Verbal Prefixes

Morpheme Type	Morpheme (lexical form)	Meaning	Surface Forms	Example
Instrumental	{ˈṵ̯a̰-}	Action performed with the hands, paws, claws, etc.	[ˌw̰a̰ː], [ˌˀw̰a̰ː]	[ˌ**w̰a̰**ːˈhohˌnaː.ɾa] /ṵ̯a̰.hoh.na.ɾa/ ṵ̯a̰- hoh -∅ -na -ɾa INST-to swim-3S-PRS.V.EV-PFV.M ‘he’s swimming’
	{ˈũh-}	Action performed with a tool	[ˌũh], [ˌũː]	[ˌ**ũ**ːˈhohˌnaː.ɾa] /ũh.hoh.na.ɾa/ ũh- hoh -∅ -na -ɾa

				INST-to swim-3S-PRS.V.EV-PFV.M ‘he’s rowing’
Stative	{ˈan} ~ {ˈã}		[ˌaː] ~ [ˌan] ~ [ˌãː]	[ˌ**a**ːˈnjiːˌtuː.wa] /an.ii.tu.ua/ an- ii -tu -ua STAT-to stop-IMP-NPFV.M ‘stop!’

4.10.6.2. Verbal Suffixes

4.10.6.2.1. Stressed Verbal Suffixes

As previously discussed, stressed suffixes belong to one of the two groups: 1) they display a heavy syllable, or 2) they occur in the penultimate position of the verbal string. Some examples are given below:

Morpheme Type	Morpheme (lexical form)	Meaning	Surface Forms	Example
Emphatic	{-ˈkʰaiʔ}	a lot	[ˈkʰajː]	[ˌhãw̃ːˈʔiːˌ**kʰaj**ːˈˀnẽːˌnaː.ɾa] /ãũ.ʔi.kʰaiʔ.ˀne.na.ɾa/ ãũʔi -kʰaiʔ ˀne -∅ -na -ɾa to sleep-EMP.AFF-COP-3S-PRS-V.EV-PFV.M ‘he sleeps a lot’
	{-tiˈheʔ}	not a lot	[tiˈheː]	[ˌhãw̃ːˈʔiː.**ti**ˈ**he**ː.ˀnẽːˌna̰ː.wa] /ãũ.ʔi.tiheʔ.ˀne.ˀna.ua/ ãũʔi- tiheʔ- ˀne -ʔ -∅ -na-ua to sleep-EMP.NEG-COP-NEG-3S-NV.EV-NPFV.M ‘he does not sleep a lot’
Person (Subject)	{-ˈ(n)a}	1S	[ˌ(C)aː], [ˌnaː]	[ˈĩˌ**a**ː.wa] /ĩ.a.ua/ ĩ -a -ua to see-1S.PRS-NPFV.M ‘I’m seeing it’ (lit.)
	{-ˈ(n)i}	2S	[ˌ(C)iː], [ˌniː]	[ˈkãj̃ːˌ**ni**ː.ɾa] /kãĩn.i.ɾa/ kãĩn -i -ɾa to be big-2S.PRS-PFV.M ‘you´re big’
	{-ˈkit}[122],	1S+2S	[ˌkiː] [ˌkiʔ]	[waˈkoᵍŋˌ**ki**ːˈtãː.ɾa] /ua.kon.kit.na.ɾa/

[122] For Silva (2021), the subject marker for 1S + 2S is {ki ~ kita}. For Kithãulhu, I assume that the underlying form of this morpheme is {-kit} because of the nasalization in the following vowel. As discussed in Chapter 4 and 5, morpheme final /t/ becomes resyllabified, and if the following morpheme is /n/ initial, the nucleus becomes nasalized. This is exactly what seems to happen in the example above. Other evidence for {-kit} comes from the future form. In the sentence ‘we will go hunting,’ [ˈa̰j̰ːˌkiʔˈtuːwa], we see that morpheme {-kit} is realized as [kiʔ], with a final debuccalized consonant, before future suffix {-tu}. Debuccalization of morpheme final plosives

				uakon -kit -na -ɾa to work-1S+2S-PRS.V.EV-PFV.M ‘we are working’
Person (Object)	{-nĩn}[123]	1O+2O	[ˌnĩn] ~ [ˌnĩː]	[kaˈlihˌ**nĩn**ˈʰnaː.wa] /ka.lih.nĩn.ʰna.ua/ kalih -nĩn -ʰna -ua to be happy-1O+2O-PRS.NV.EV-NPFV.M ‘we are happy’
	{-naˈli}	2O.DUAL	[naˈli]	[ˈĩː.naˈ**li**ːˌnaː.ɾa] /ĩ.na.li.na.ɾa/ ĩ -nali -∅ -na -ɾa to bite-2O.DUAL-3S-PRS.V.EV-PFV.M ‘it’s biting you two’
Tense/ Evidentiality	{-ˈna}	Action was seen by the utterer	[ˌnaː] ~ [ˌtãː]	[ˈhohˌ**na**ː.ɾa] /hoh.na.ɾa/ hoh -∅ -na -ɾa to wander-3S-PRS.V.EV-PFV.M ‘he’s wandering’ (I saw him)
	{-ˈʰna}	Non-visual verification.	[ˌʰnaː] ~ [ˌʰn̥a]	[ˌhˀiːˈtʰaː.saˌ**ʰna**ː.wa] /hˀi.tʰa.sa.ʰna.ua/ hˀi -tʰa -sa -ʰna -ua NI.hand-to be tired-1O-PRS.NV.EV-NPFV.M ‘I’m tired’
Tense (future)	{-ˈtel}	Imminent future	[ˌteː]	[ˈa̰jːˌteːˈ**ɾa**ː.wa] /ail̃.tel.a.ua/ ail -tel -a -ua to go hunting-IMM.FUT-1S-NPFV.M ‘I’m going to hunt’

4.10.7. Compounds

Compounding is a very productive word-formation process in Kithãulhu. Stress in compounds follows the basic rules described in *4.10*, with roots bearing primary stress – which is also dependent on syllable structure. Note that some exceptions to the assignment of primary stress are also attested, as in (1012).

is frequently attested if the following morpheme is another plosive, as described in Chapter 5. This hypothesis should be tested with a native speaker.

[123] According to Silva (2021), object marker for 1O + 2O is {nĩ ~ ni}. In the Kithãulhu data, I only found evidence for [ˌnĩn] ~ [ˌnĩː].

4.10.7.1. Nouns

Nominal compounds are usually made of a root followed by other lexical morphemes, such as classifiers, and a mandatory final suffix.

a) Root + Root

- Monosyllabic roots

i. Heavy Monosyllabic Root + Light Monosyllabic Root

```
                 x                      Level 3
                 x     x                Level 2
                 x  x  x  x             Level 1
(1007)      [ˈhoː.saˌta̰ʰ.su][124]
            /hos.a.ta̰.su/
            hos -a -ta̰ -su
            monkey-REF-AUG-REF
            ‘spider monkey’

                 x                      Level 3
                 x     x                Level 2
                 x  x  x  x             Level 1
(1008)      [ˈsˀiː.ha ˌjo̰ː.su]
            /sˀih.a.i̯o̰.su/
            sˀih -a -i̯o̰ -su
            house-REF-mouth-REF
            ‘door’
```

- Disyllabic Roots

In compounds including disyllabic roots, primary stress is assigned to the root which contains the most meaningful element. Examples (1009) and (1010) show words for different species of animals. Notice that primary stress is assigned to the root for the animal type and not the species itself:

Disyllabic Root + Monosyllabic Root

```
                  x                     Level 3
                  x     x               Level 2
               x  x  x  x    x          Level 1
(1009)      [jaˈnaː.laˌkãw̃.ʰl̥u]
            /ia.nal.a.kãũl.su/
            ianal -a kãũl -su
            jaguar-REF-?-REF
            ‘ocelot’ (considered a small kind of jaguar by the Nambikwara)
```

[124] I follow Silva’s (2021) analysis for augmentative morpheme [ta̰], which is regarded as a root.

i. Disyllabic Root + Reduplicated Monosyllabic Root

```
     x                   Level 3
     x         x         Level 2
  x  x  x   x  x   x     Level 1
```

(1010) [jaˈ**la**ː.na.tũˈ**tũ**ː.ta̰]
/ialan.a.tũ.tũˀt.a/
ialan -a tũtũˀt- a
toucan-REF-RED.?-REF
‘*araçari*’

b) Root + Classifier

As previously discussed, classifiers are suffixes that can be employed as roots. Consequently, they are usually used in compounds. In this type of compound, primary stress is mostly assigned to the root and not to the classifier, but there are exceptions. Example (1012) shows primary stress being assigned to the classifier instead of the root after resyllabification:

i. Light Monosyllabic Root + Light Monosyllabic Classifier

```
   x                     Level 3
   x                     Level 2
   x  x  x               Level 1
```

(1011) [ˈ**hi**ː.ki.su]
/hi.ki.su/
hi -ki -su
fruit-CL.round-REF
‘fruit’

ii. Heavy Monosyllabic Root + Heavy Monosyllabic Classifier

```
       x                 Level 3
   x   x                 Level 2
   x   x    x            Level 1
```

(1012) [ˌ**hu**ːˈ**ˀkẽ**ː.ha]
/huˀk(i).ẽh.a/
huˀk(i) -ẽh -a
bow-CL.vine.REF
‘vine’

iii. Heavy Monosyllabic Root + Heavy Monosyllabic Classifier

```
   x                     Level 3
   x        x            Level 2
   x    x   x    x       Level 1
```

(1013) [ˈ**w̃ẽ**ː.haˌ**ja̰w̰**ː.su]
/ũẽh.a.ḭa̰ṵ.su/
ũẽh -a -ḭa̰ṵ -su
rain-REF-CL.liquid-REF
‘rain’

c) Root + Other Suffixes

In nominal compounds with a higher combination of morphemes, all heavy roots bear primary stress when there is a monosyllabic morpheme between them. Morphemes indicating number and classifiers receive secondary stress. Monosyllabic morphemes without a coda are unstressed, as previously discussed.

i. Heavy Monosyllabic Root + Heavy Monosyllabic Root + Disyllabic Suffix

Note that in the example below all roots receive primary stress, since they are separated by the referential suffix {-a}:

	x x	Level 3
	x x x x	Level 2
	x x x x x x x	Level 1
(1014)	[ˌaːˈ**hˀiː**.ˀkaˈ**w̃ẽː**.ˌ**haː**.li.su]	
	/a.hˀiˀk(i).a.ũẽs.ha.li.su/	
	a- hˀik(i) -a -ũẽs -hali -su	
	INAL-hand-child-PL-REF	
	‘fingers’	

ii. Heavy Monosyllabic Root + Linking Vowel[125] + Heavy Monosyllabic Classifier

If a monosyllabic morpheme is heavy, it receives secondary stress, even if there is an unstressed monosyllabic morpheme between it and the root:

	x	Level 3
	x x	Level 2
	x x x x	Level 1
(1015)	[ˈ**hiː**.saˌ**kaʔ**.tsu]	
	/his.a.kaˀt.su/	
	his-a -kaˀt -su	
	wood-LV-CL.cylindrical-REF	
	‘wood’	

[125] Linking vowel {-a} is attached between a root and another morpheme to avoid sequences of non-permissible phones to occur at syllable edges in the surface representation - *[sk] in the case shown in (1015). Note that, if vowel [a] was part of the root, the stress syllable would be *[ˈsaː] instead of [ˈhiː]. Linking vowels can be easily distinguished from referential suffix {-a}, as they are usually inserted to avoid non-permissible sequences shown in Table *65* to occur phonetically. Moreover, linking vowel and referential suffix {-a} have a different tonal pattern. Whereas {-a} referential suffix has a rising contour tone [a^{LH}], linking vowels display a low-level tone [a^{L}].

iii. Light Disyllabic Root + Nominalizer

Heavy monosyllabic morphemes receive secondary stress, even when following a primary stressed syllable:

```
                 x                  Level 3
                 x    x             Level 2
            x    x    x    x        Level 1
(1016)     [haˈ**lo**ː.ˌ**ja̰w̰**ː.su]
           /ha.lo.ḭa̰ṵ.su/
           halo -ḭa̰ṵ -su
           field-NZ-REF
           'savannah'
```

d) Root + Root + Classifier

i. Heavy Monosyllabic Root + Heavy Monosyllabic Root + Light Monosyllabic Classifier

Whenever there is no unstressed monosyllabic morpheme between two heavy roots, the first root receives secondary stress, and the second bears primary stress:

```
                 x                  Level 3
            x    x                  Level 2
            x    x    x    x        Level 1
(1017)     [ˌ**tuh**ˈ**nẽ**ː.de.su]
           /tuh.nẽn.te.su/[126]
           tuh -nẽn -te -su
           bee-?-CL.generic-REF
           'bee, sp.'
```

ii. Heavy Monosyllabic Root + Heavy Monosyllabic Root + Nominalizer

The rule described for (1017) is also observed in the nominalization of verbs, as in (1018):

```
                 x                  Level 3
            x    x                  Level 2
            x    x    x  x   x      Level 1
(1018)     [ˌ**wi**ːˈ**ri**ː.na̰.te.su]
           /uil.in.ʔa.te.su/
           uil -in -ʔ -a -te -su
           to be good-?-NEG-REF-NOMZ-REF
           'something not good'
```

[126]Alternatively /tuh-ni-ẽn-te-su/: bee-?-CL.hole-CF.generic-REF. Since the tone pattern of /-ẽn/ is not the standard [HL] in this word, I preferred glossing this word as shown in example (1017), as no evidence of tonal sandhi in suffix {-ẽn}is attested in the data.

iii. Heavy Monosyllabic Root + Heavy Monosyllabic Root + Heavy Monosyllabic Classifier

In this type of compound, every root receives primary stress if followed by a monosyllabic unstressed morpheme. The heavy monosyllabic classifier bears secondary stress, as described:

```
x       x                     Level 3
x       x      x              Level 2
x   x   x x    x   x          Level 1
```

(1019) [ˈ**ɓa̰**ː.la ˈ**ĩ**ː.ta ˌ**ka**ː.ɗa]
ˀpa̰l -a ĩt -a -kaˀt -a
leishmaniosis-REF to be sick-LV-CL.disease-REF
‘leishmaniosis’

iv. Disyllabic Root + Monosyllabic Root + Disyllabic Classifier

When a root is placed between an unstressed suffix and a stressed suffix, it receives secondary stress. The stressed suffix is marked with primary stress:

```
   x              x            Level 3
   x       x      x            Level 2
 x x  x    x      x   x  x     Level 1
```

(1020) [jaˈlaː.naˌ**hajᵍŋ**ˈtʃʲah.lo.su]
/ia.lan.a.hain.iah.lo.su/
ialan -a hain -iahlo -su
toucan-REF-to sing-CL.male-REF
‘toucan, sp.’

v. Disyllabic Root + Reduplicated Monosyllabic Root + Monosyllabic Classifier

If there is an unstressed syllable between roots, both roots will receive primary stress:

```
   x      x                    Level 3
   x      x                    Level 2
 x x  x   x    x  x            Level 1
```

(1021) [aˈ**lã**.ːheˈ**heᵈn**.de.su]
/a.lã.(a).he.hen.te.su/
alã -(a) -hehen -te -su
macaw-REF-RED.to be red-CL.generic-REF
‘red-and-green macaw’

4.10.7.2. Serial Verbs

In serial verbs, primary stress is assigned to the heavy root (1022). If all root parts of the serial construction have the same weight, stress falls on the rightmost root, as shown in (1023) and (1024):

i. Heavy Monosyllabic Root + Light Monosyllabic Root

```
x                Level 3
x   x  x         Level 2
x   x  x   x     Level 1
```

(1022) [ˈ**u**ːˌɬeːˌiː.ɾa]
/ul.he.i.ɾa/
ul -he -i -ɾa
to be far-to be-2S-PFV.M
‘you’re far’

ii. Heavy Monosyllabic Root + Heavy Monosyllabic Root

```
    x            Level 3
x   x    x       Level 2
x   x    x   x   Level 1
```

(1023) [ˌiːˈ**na̰j**ːˌnaː.ɾa]
/in.ail.nã.ɾa/
in -ail -∅ -na -ɾa
to fly-to walk-3S-V.EV-PFV.M
‘it’s flying’

```
     x               Level 3
x   x      x         Level 2
x   x      x   x     Level 1
```

(1024) [ˌeːˈ**taj^{g}ŋ**ˌnaː.ɾa]
/et.ain.na.ɾa/
et -ain -∅ -na -ɾa
to grate-?-3S-V.EV-PFV.M
‘he’s grating’

4.11. Stress in Loanwords

Many words of Brazilian Portuguese origin are found in the Nambikwaran lexicon, such as /pat-su/, <pato> meaning ‘duck,’ [seluˈlaː(te)su], <celular> ‘cellphone,’ [ˈbɔːlaˌna̰ːkisu], <bola> ‘ball,’ among others. In all cases, the stressed syllable of the borrowed word in the input language (Brazilian Portuguese) is preserved, but phonological and morphological accommodation are commonly observed. Except for some specific words such as discursive markers, all other borrowed words display morphological and phonological information from both Portuguese and Nambikwara.

In more recently adopted words, such as the word for cellphone ‘<celular>tesu,’ we can see that much of the phonetic segmental structure from Brazilian Portuguese is used, probably because of the increasing contact between the indigenous and non-indigenous populations. However, the scenario in borrowed words incorporated in the indigenous lexicon for a longer span of time is different. Overall, in words borrowed over a longer period, it is possible to see that there has been accommodation of some phonological features of the new contacted language to be in accordance with the segmental inventory of the indigenous language. Furthermore, Nambikwaran speakers opt to maintain the stress patterns of the Brazilian Portuguese words, adapting its morphophonological structure to the stress rules of Nambikwara, via elision, coalescence, among others.

As I have shown in section *4.10.2*, if a disyllabic root is comprised of two syllables of the same length, stress is placed on the rightmost syllable, i.e. the ultimate syllable of the root. In Brazilian Portuguese, many disyllabic words are stressed on the penultimate syllable, such as the word for duck, ‘*pato*’ [ˈpaː.tʊ]. Following the lexical stress rules described in section *4.10,* the word [ˈpaː.tʊ], if it follows the stress rules, must have stress placed on its ultimate syllable, but *[paˈtuː] is not allowed. Instead, to preserve the stress from the input [ˈpaː.tʊ], the last vowel is elided, rendering a [CVC] syllable. Some of the accommodation rules are described in the following sections.

a) Elision of vowel of final unstressed syllable to preserve stress

Input: [ˈpaː.tʊ]
Output: [ˈpaː.tsu]

(1025) <pat(o)>- su
pat-REF
‘duck’

Input: [saˈpaː.tʊ] ~ [saˈpaː.to]
Output: [saˈpaː.ta.kaˌloː.su]

(1026) <sapat(o)>-a-kalo-su
shoe-REF-CL.flat.REF
‘shoe’

b) Devoicing + Fortition

As shown in Chapter 3, there are no phonemic voiced plosives, but voiceless plosives can become voiced under specific conditions (such as an intervocalic environment). We have also seen that only low central vowels can be followed by a high vowel within the same syllable. Moreover, I have also shown that no nominal root is comprised of a consonant followed by an oral diphthong. To account for the phonotactics of Nambikwara, the Brazilian Portuguese word for cattle, ‘<boi>’ must undergo a series of sound changes. The voiced labiodental plosive becomes devoiced, and the off-gliding phase of falling diphthong [oj] undergoes fortition and is realized as coronal pre-plodded nasal [^{d}n], as shown below. Stress is once again preserved:

Input: [ˈboːj]
Output: [ˈpo^{d}n.^{t}su]

(1027) pon -su
cattle-REF
‘cattle’

c) Glottalization + Diphthongization + Elision + Coalescence

In the example for ‘horse,’ ‘<cavalo>,’ the final unstressed vowel is also elided, as in (1025) and (1026). Voiced labiodental fricative is glottalized and the nucleus [a] undergoes diphthongization, to produce cluster [hw]. As discussed, cluster [hw] is not allowed to occur within the same morpheme, but it is attested across morphemes due to resyllabification. After vowel elision in [lʊ] ~ [lo], liquid [l] coalesces into [^{h}l̥] before fricative [s] to avoid cluster [ls], a typical rule observed in the language. Once again, the stressed syllable of the input language is preserved:

Input: [kaˈvaːlʊ] ~ [kaˈvaːlo]
Output: [kaˈhwaːʰl̥u]

(1028) kah.ual-su
horse-REF
'horse'

As shown, borrowed words follow the same stress rules describe in section *4.10*. They not only provide more solid evidence for the stress rules described in section *4.10*, but also show that the output in the indigenous language is easily predicted from Brazilian Portuguese.

Chapter Summary

In this chapter, I described the syllable structure in Kithãulhu and related its internal structures to the stress system. Following the autosegmental phonology framework, I showed that the syllable node is the primary licenser, and the coda is regarded as the secondary licenser, as Kithãulhu syllables admit codas. The nucleus is the only essential part of a syllable, i.e. not every syllable has an onset, and not every rhyme has a coda. Maximal syllable structure in the lexical representation is (C)V(C), which can be regarded as moderately complex (Maddieson 2013). All possible syllable types predicted from the (C)V(C) template, namely /V/, /CV/, /VC/, and /CVC/ are attested. /CV/ syllables are the most frequent syllable type, while occurrences of /VC/ syllables are relatively rare. Moreover, there is a set of tautosyllabic restrictions for segments found at the nucleus edges, which should be accounted to describe the syllabic structure.

Overall, phonetic complex codas and onsets differ considerably with regard to the distribution of consonantal fillers for every available slot. The distribution and phonotactic constraints for every slot at the syllable edges indicate that underlying and surface representation of syllables are asymmetric. In the surface representation, Kithãulhu admits a slight more complex syllable structure with an additional consonantal slot in the onset and coda, with maximal structure (C)(C)V(C)(C). Complex onsets are predicted from resyllabification as well as phonological rules that affect rising diphthongs and triphthongs occurring in the nucleus. Complex codas can also be derived from phonetic implementation, and they only occur when falling diphthongs and triphthongs follow a coda, usually /s, h, n/. Kithãulhu syllables also display a series of phonotactic constraints regarding permissible consonantal sequences on syllable edges at morpheme boundaries. Syllabification occurs from left to right and follows principles such as The Maximal Onset Principle (MOP), Directionality of Syllabification, The Total Syllabification Approach, and The Principle of Sonority. Most of these principles were also used to describe syllabification of languages in the Nambikwaran family (Eberhard 2009, Costa 2020, etc.). There is an ambisyllabic consonant, voiceless glottal plosive /ʔ/, which can be assigned to the coda and the onset in a segment string, depending on the segment following it and morphological structure. Glottal plosive is assigned to the coda, if the following segment is a diphthong, and to the onset if it belongs to a polysyllabic construction, whose syllable following the glottal stop is consonant initial. As shown, understanding the internal syllable structure of words is essential to describe the stress system. There is a clear distinction between light and heavy syllables, and stressed syllables are heavy in the surface representation (either because they are underlyingly heavy or via phonetic implementation, because of stress). Codas are accounted as moraic: if a coda consonant is elided or resyllabified, the nucleus should be phonetically implemented by compensatory lengthening. These observations suggest that the mora is a crucial phonological unit to the language, and that the stress system is partly weight sensitive. I have also shown that Kithãulhu distinguishes diphthongs with regard to syllable weight. Falling diphthongs are accounted as bimoraic, since the high vowel within this complex segment is phonetically realized as a glide in the coda. On the other hand, rising diphthongs are only regarded as heavy in the stressed positions, as the high vowel is phonetically realized as a glide in the onset, which is not counted as moraic. I have also shown that the acoustic correlates of stress are duration and intensity and that vowel quality also plays a secondary, but significant role in stress assignment. Pitch is not regarded as an acoustic correlate of stress, although we have seen that stressed syllables are the best environment for all pitch movements (level and contours) to occur. In words borrowed from Brazilian Portuguese, the stressed syllable is always marked by high pitch. Using the metrical grid, I showed that stress assignment is dependent on both morphological and phonological structures. Furthermore, stress assignment is predictable in lexical morphemes, and mostly predictable in grammatical morphemes. There are three levels of analysis used to determine stress assignment in Kithãulhu: syllable weight: (heavy syllables > light syllables), syllable position within the morpheme (rightmost > leftmost), and morphological structure (roots > affixes). The position within the morpheme parameter is only employed in polysyllabic morphemes whose syllables share the same weight, i.e. they are all heavy or all light. CV syllables are the most frequent syllable in the unstressed position, whereas CVC syllables are usually preferred in the stressed positions.

Chapter 5: Morphophonological Rules

Introduction

This chapter presents the most frequently attested morphophonological rules in Nambikwaran words. As I show, morphemes can undergo optional or mandatory rules, which are frequently predicted by the phonetic or phonological environment in which they occur. Since most rules are attested in stressed syllables of morphemes, stress is frequently used to determine the environment in which specific rules occur. In general, one single morpheme can undergo multiple rules. Consequently, it can assume multiple phonetic shapes depending on the segmental structure of the surrounding morphemes as well as the stress and morphological structure.

5.1. An Overview of the Morphophonological Rules

Recall from Chapter 2 that Nambikwaran words are predominantly polymorphemic, roots being bound morphemes. In Chapter 4, I showed that maximal syllable structure is (C)V(C) in the lexical representation and that syllable structure can be extended to (C)(C)(V)(C)(C) in the surface representation due to phonological rules.

Most of these rules are frequently attested at morpheme boundaries and associated with phonotactic constraints related to the segmental structures of syllables as well as to syllabification. As discussed in the previous chapter, morpheme codas tend to be resyllabified. Coda resyllabification of stressed syllables affects the phonetic realization of the syllable structure of the morpheme following it, regardless of whether it is stressed. Since most of the rules refer not only to the segmental structure of syllables but also to stress and morphological structure, we refer to them as morphophonological.

To illustrate how fundamental coda resyllabification is for the description of the morphophonological rules, observe examples (1029) – (1035), in which the root {kuaḭa̰ˀt}, ‘corn,’ is followed by other morphemes with distinct segmental structures:

.

a) {kuaḭa̰ˀt} + {-su}

(1029) [kaˈja̰ʔˌ**ts**u]
/kua.ḭa̰ˀt.su/
kuaḭa̰ˀt -su
corn -REF
‘corn’

b) {kuaḭa̰ˀt} + {sahˀ}

(1030) [kaˈja̰ʔˌ**ts**aːʰsu]
/kua.ḭa̰ˀt.sahˀ.su/
kuaḭa̰ˀt -sahˀ -su
corn-penis-REF
‘corn cob’

c) {kuaḭa̰ˀt} + {-ḭa̰ṵ}

(1031) [kaˈja̰ʔˌ**tʃ**a̰w̰ːsu]
/kua.ḭa̰ˀt.ḭa̰ṵ.su/
kuaḭa̰ˀt -ḭa̰ṵ -su
corn-CL.liquid-REF
‘*chicha*, the Pleiades’

d) {kuaḭa̰ˀt} + {-ˀnãn}

(1032) [kaˈja̰ʔˌ**ɗ**ãːᵗsu]
/kua.ḭa̰ˀt.ˀnãn.su/
kuaḭa̰ˀt -ˀnãn -su
corn-CL.leaf-REF
‘corn husk’

e) {kuai̯a̰ˀt} + {-a} + {ko̰}

(1033) [kaˈja̰ʔˌta̰ˌko̰ː.su]
/kua.i̯a̰ˀt.a.ko̰.su/
kuai̯a̰ˀt -a -ko̰ -su
corn-REF-CL.land-REF
'corn field'

f) {kuai̯a̰ˀt} + {-nṵ̃}

(1034) [kaˈja̰ʔˌɗṵ̃ː.su]
/kua.i̯a̰ˀt.nṵ̃.su/
kuai̯a̰ˀt -nṵ̃ -su
corn-CL.granules-REF
'corn flour'

g) {kuai̯a̰ˀt} + {-ki}

(1035) [kaˈja̰ʔˌˀ**k**i.su]
/kua.i̯a̰ˀt.ki.su/
kuai̯a̰ˀt -ki -su
corn-CL.seed-REF
'corn kernel'

As seen in (1029) – (1035), the coda /ˀt/ in {kuai̯a̰ˀt} affects the structure of the following syllable. As an illustration, let us observe another example, this time with the disyllabic word /u̯a̰u̯n-su/, 'scorpion, sp.,' comprised of the root/stem {u̯a̰u̯n} and mandatory final suffix {-su}. Note that all components of the underlying syllable structure of {u̯a̰u̯n} undergo phonetic changes. Moreover, the phonetic realization of the following morpheme is also affected:

(1036) [ˈw̰a̰w̰ᵇm.ᵗsu] ~ [ˈw̰a̰w̰ᵇm.ᵈzu]
/u̯a̰u̯n.su/
u̯a̰u̯n -su
scorpion-REF
'scorpion, sp.'

In the example (1036), one can see that the nucleus /u̯a̰u̯/ becomes [w̰a̰w̰] because high vowels at the edges of diphthongs and triphthongs are realized as glides, as discussed in Chapter 3. Besides the rules affecting the nucleus, the coda /n/ is also affected via assimilation of the [+labial] feature of the labial off-glide [w̰]. Hence, it is realized as the pre-plodded labial nasal [ᵇm]. Moreover, epenthetic voiceless alveolar plosive [t] is added to the following morpheme. Epenthetic [t] can also be realized as voiced alveolar plosive [d], as illustrated in (1036). In the latter case, the onset of {-su} becomes voiced and is realized as voiced alveolar fricative [z] via assimilation, as illustrated. Now observe what happens when final suffix {-su} is replaced by final suffix {-a}:

(1037) [ˈw̰a̰**w̰**ː.**na**] *[ˈw̰a̰w̰**ᵇm.**a] *[ˈw̰a̰w̰ː**ᵇm.ᵗ**a] *[ˈw̰a̰w̰ː**ᵇm**.**ᵈ**a]
/u̯a̰u̯n.a/
u̯a̰u̯n -a
scorpion-REF
'scorpion, sp.'

Example (1037) shows that some of the rules described for (1036), such as pre-plosion of the nasal /n/ in the coda and consonantal epenthesis affecting the syllable structure of the following morpheme, do not occur. In turn, other rule is observed: compensatory lengthening of the nucleus followed by coda resyllabification. These observations can be used as evidence for the claim that phonological derivations are also dependent on the syllable structure of the following morpheme. All these multiple rules occurring even in the smallest nominal grammatical words

(henceforth, GW) are also attested in more complex GWs in view of the polysynthetic nature of Nambikwara.
The rules described above were identified following the same principle mentioned in Chapter 1: testing the phonetic realizations of morphemes by attaching to them morphemes with different syllable structures, e.g. vowel initial, fricative initial, plosive initial, and so on. As seen in examples (1036) and (1037), multiple rules occurring in the same morpheme seem to follow one directionality principle of syllabification. As such, the rules start taking place on the leftmost edge of the syllable and move rightwards to the other edge.
Overall, the coda is the part of the syllable which is more prone to undergoing phonological changes. This is mainly because of the phonotactic constraints related to the syllable structure and the sequences of segments that are allowed to occur in the surface representation at morpheme boundaries, as shown in Table 64 and Table 65 in Chapter 4. Onsets are the second most affected part of syllables, and, consequently, the nucleus is the most stable component.
In the following sections I show that most rules described by Kroeker (2001: 83 – 85), Netto (2018), and Costa (2020) are confirmed in this work on Kithãulhu. Furthermore, in some cases where all three publications agree on the observation of a rule, one can notice that current work provides a new analysis for the phenomena observed.

5.2. The Morphophonological Rules

5.2.1. Vowel Alternation

Vowel alternation is an optional process attested in the realization of mid-vowels and high back vowels. It can occur both in stressed and unstressed syllables and is more frequently observed with surrounding low central vowels.

5.2.1.1. Vowel Raising

a) /e/ > [iː]

The vowel /e/ can become [iː] when stressed and occurring between two syllables whose nucleus is a low vowel:

Rule: /e/ > [iː] (optional)
Environment: a] _ [a

(1038)	[ˈa̰j̰ː.na]	[ˌãːˈ**ti**ːˌɾaː.wa] ~
	[ˈa̰j̰̃ː.na]	[ˌãːˈ**te**ːˌɾaː.wa]
	/a̰ḭn.a/	/ã.tel.a.ua/
	a̰ḭn -a	ã -tel -a -ua
	fish-REF	to fish-DES-1S.PRS-NPF.M
	‘I want to fish’	

b) /e/ > [ɛː]

The vowel /e/ can also become [ɛː] when stressed and occurring between two syllables whose nucleus is a low vowel:

Rule: /e/ > [ɛː] (optional)
Environment: a] _ [a

(1039) [ˌw̰a̰ˈhoh.naˌ**hɛ**ː.ɾa] ~ [ˌw̰a̰ˈhoh.naˌh**e**ː.ɾa]
/ṵa̰.hoh.na.he.ɾa/
ṵa̰- hoh -∅ -nahe -ɾa
INST-to swim-3S-REC.PST.V.EV-PFV.M
'he had swum'

c) /e/ > [ɪː]

The vowel /e/ becomes [ɪː] in stressed positions when followed by a syllable whose nucleus is a low vowel:

Rule: /e/ > [ɪː] (optional)
Environment: _ [a

(1040) [ˈ**ɪ**ːˌnaː.ɾa] ~ [ˈ**e**ːˌnaː.ɾa]
/e.na.ɾa/
e -∅ -na -ɾa
to speak-3S-PRS.V.EV-PF.M
'he's speaking'

d) /ḛ/ > [ɪ̰]

The creaky voice vowel /ḛ/ in monophthongs or diphthongs becomes [ɪ̰] in stressed positions when followed by the coda [ʔ]. This phonetic realization of /ḛ/ is more frequent when the following morpheme displays the high back vowel /u/.

Rule: /ḛ/ > [ɪ̰] (optional)
Environment: _ʔ]+ stress

(1041) [ˈ**ɪ̰**ʔ.ᵗsu] ~ [ˈ**ḛ**ʔ.tsu]
/ḛs.su/
ḛs -su
tobacco-REF
'tobacco'

(1042) [ˌaːˈjo̰ːˈw̰**ɪ̰**ʔ.tsu] ~ [ˌaːˈjo̰ːˈw̰**ḛ**ʔ.tsu]
/a.i̯̰o̰.ṵḛt.su/
a -i̯̰o̰ -ṵḛt -su
INAL-mouth-hair-REF
'beard'

e) /o/ > [uː]

The back mid-vowel /o/ can be phonetically realized as [uː] in stressed positions. The phone [uː] is frequently attested following an unstressed syllable, whose nucleus is a low vowel, and being followed by an unstressed syllable with a high back vowel:

Rule: /o/ > [uː] (optional)

(1043) [ˌaːˈjo̰ː.kaˌl**u**ː.su] ~ [ˌaːˈjo̰ː.kaˌl**o**ː.su]
/a.i̯̰o̰.ka.lo.su/
a- i̯̰o̰ -kalo -su
INAL-mouth-CL.flat-REF
'chin'

5.2.1.2. Vowel Lowering

Vowel lowering affects back vowels. It is also an optional alternation.

f) /o/ > [aː]

Vowel lowering can affect the mid back vowel /o/ in stressed positions within a word.

Rule: /o/ > [aː] (optional)
Environment: _]$^{+\text{ stress}}$

(1044) [kuˈjɛː.kaˌl**a**ː.su] ~ [kuˈjeː.kaˌl**o**ː.su]
/<colher>ka.lo.su/
<colher> -kalo -su
spoon-CL.flat-REF
'spoon'

g) /u/ > [o]

Vowel lowering can also affect the high back vowel /u/ in unstressed positions within a word.

Rule: /u/ > [o] (optional)
Environment: _]$^{-\text{ stress}}$

(1045) [kaˈnah.s**u**] ~ [kaˈnah.s**o**]
/ka.nah.su/
kanah -su
woodpecker-REF
'woodpecker'

In some cases, lowering of /u/ can occur due to vowel harmony:

Rule: /u/ > [o] (optional)
Environment: _e$^{+\text{ stress}}$

(1046) [**o**ˈtʃeː.na.ki.su] ~ [**u**ˈtʃeː.na.ki.su]
/uien.a.ki.su/
uien -a -ki -su
sun-REF-CL.round-REF
'sun'

5.2.2. Vowel Lengthening

Vowels become lengthened in stressed positions within a word under two conditions: 1) the stressed syllable belongs to a morpheme comprised of light syllables only or 2) compensatory lengthening after the syllable coda is lost through resyllabification or elision. Examples of vowel lengthening in the stressed syllables of morphemes comprised of light syllables are illustrated below:

Rule: /(C)V/ > [(C)Vː] (mandatory)
Environment: _]$^{+\text{ stress}}$

(1047) [haˈ**t**iː.a]
/ha.ti.a/
hati -su
basket-REF
'basket'

(1048) [ˈ**ũ**ː.a]
/ũ.a/
ũ -a
capybara-REF
'capybara'

As discussed, vowels can also become lengthened via compensatory lengthening. Compensatory lengthening occurs when the syllable coda /C_{α}/ is resyllabified or elided, as a strategy to preserve the syllable weight:

Rule: /(C)V(C)/ > [(C)Vː] (mandatory)
Environment: _]$^{+\text{ stress}}$

(1049) [ˈ**w̰a̰j**ː.ha.ˀli.su]
/ṵa̰ḭh.a.ˀli.su/
ṵa̰ḭh -aˀli -su
straw-?-REF
'bamboo, sp.'

(1050) [ˈɗ**u**ː.su] ~ [ˈɗ**u**ː.ʰsu]
~ [ˈɗuh.su]
/ˀtuh.su/
ˀtuh -su
woman-REF
'woman'

Vowel lengthening is also attested in the nucleus of unstressed syllables within polysyllabic morphemes, as an optional rule. For the unstressed nucleus to become lengthened, the following syllable must be stressed, have a voiced onset, and an [HL] tone:

(1051) [**a**ːˈlajː.su] ~
[**a**ˈlajː.su]
/a.lai.su/
alai -su
sloth-REF
'sloth'

(1052) [**a**ːˌluːˈtʃeᵍŋ.gi.su][127]
~ [**a**ˌluːˈtʃeᵍŋ.gi.su]
/a.lu.ien.ki.su/
alu -ienki -su
? -? -REF
'partridge'

More details on the relation between lengthening and tone are provided in Chapter 6.

5.2.3. Nasalization

Oral vowels can become nasalized. Nasalization of vowels is usually attested in unstressed syllables. Although most nasalized vowels follow the nasal consonant /n/, nasalization is not necessarily triggered by the [+nasal] feature of surrounding segments. All unstressed morphemes and some stressed morphemes displaying a rising tonal contour [LH] can become nasalized.

Rule: /V/ > [Ṽ] (optional)

Environment 1: _n

[127] Palatalization is covered in section 1.5.2.8.

(1053) [**nĩ**ˈnĩː.su] ~ [niˈnĩːsu]
/ni.nĩ.su/
ninĩ -su
RED.mosquito.REF
'mosquito, sp.'

In some cases, nasalization is not necessarily derived from a surrounding [+nasal] consonant, as in (1054). It seems that there is a correlation between nasalization and the phonetic realization of the rising contour tone [LH]. All following syllables marked in bold display a rising contour tone. In this context, nasalization may also occur in stressed syllables, as in (1055):

Environment 2: V]^{LH}

(1054) [ˌ**ã**ːˈjeː.ɾʰu] ~ [ˌaːˈjeːɾʰu]
/a.iel.su/
a- iel -su
INAL-bladder-REF
'bladder'

(1055) [ˈ**w̃ãj̃**ː.n**ã**] ~ [ˈw̰a̰j̰ː.n**ã**] ~ [ˈw̰a̰j̰ːna]
/ṵa̰ḭ.(ai)̃.na/
ṵa̰ḭ -aina
2S-P.DEM
'you'

(1056) [ˈa̰j̰ː.**nã**] ~ [ˈa̰j̰ː.na]
/a̰ḭn.a/
a̰ḭn -a
fish-REF
'fish' (general)

Nasalization of oral stressed vowels is rare, but it may occur, as shown in (1055). It is also attested when a vowel initial morpheme follows an /n/-final stressed morpheme and is followed by a nasal consonant.

Environment 3: Vn]$^{+stress}$ _ [n

(1057)

[ˈw̃ãj̃ː.na]	[ˈhajː.n**ĩ**ː.gajˈnãː.dṵ]
[ˈw̃ãj̃ː.na]	[ˈhajː.niʔ.gajˈnãː.dṵ]
/ṵa̰ḭ.na/	/hai**n**.**in**.ˀkai.nãn.tṵ/
ṵa̰ḭna	hain -in -ˀkainãntṵ
2S	to sing-2S-COND
[ˈtʰaː.la]	[ˈajː.giˌtuː.a]
[ˈtʰaː.la]	[ˈajː.giˌtuː.a]
te.iah.lo.a	[ain.ki.tu.ua]
tiahla	ainki -∅ -tu -ua
3S	to-hear-3S-FUT-NPFV.M

'if you sing, he will hear'

5.2.4. Aspiration

Aspiration may precede (pre-aspiration) or follow segments (post-aspiration).

5.2.4.1. Pre-Aspiration

Pre-aspiration of consonants can occur when a heavy morpheme whose coda is the voiceless glottal fricative /h/ is followed by an /s/ initial morpheme.

Rule: /s/ > [ʰs] (optional)
Environment: _h]$^{+stress}$ _[

(1058) [ˈhoː.**ʰs**u] ~ [hoh.su]
/hoh.su/
hoh -su
tinamou-REF
'tinamou'

(1059) [ˈtuː.**ʰs**u] ~ [tuh.su]
/tuh.su/
tuh -su
bee-REF
'bee' (general)

5.2.4.2. Post-Aspiration

Morpheme-final creaky-voice vowels can be realized with final aspiration at morpheme boundaries.

Rule: /V̰/ > [V̰ʰ] (optional)
Environment: _V̰]

(1060) [ˈwajᵍŋ.d**ḭʰ**#ˈeːˌnaː.ɾa]
/uain.ˀti.e.na.ɾa/
uain-ˀti e -∅ -na-ɾa
to be straight-ADVZ-to speak-3S-PRS.V.EV-PFV.M
'he's speaking correctly'

(1061) [aˈluː.aˌt**a̰**ʰ.su]
/a.lu.a.ta̰.su/
alu -a -ta̰ -su
mouse-AUG-REF
'Brazilian guinea pig'

5.2.5. Rhotacism

Rhotacism can be obligatory or optional. Obligatory rhotacism is usually attested across morphemes, when coda /l, ˀl/ of a stressed syllable following a [+coronal] vowel is resyllabified. Moreover, rhotacism is also obligatory in polysyllabic morphemes[128], whose final syllable is comprised of a liquid followed by the coronal unstressed vowel [i], as in (1066):

Rule: /l> [ɾ], [ˀl] >[ɾ, ˀɾ]
Environment: [+coronal]_l, ˀl] $^{+stress}$ _ [V

(1062) [ˈsiː.**ɾ**a]
/sil.a/
sil -a
mouse-REF
'mouse, sp'

(1063) [aːˈhḭː.**ɾ**a]
/a.hḭˀl.a/
a- hḭˀl -a
INAL-liver-REF
'liver'

[128] Current analysis points to morpheme {heli} as polysyllabic. However, a monosyllabic analysis is also possible since final syllable {-li} is frequently attested in other Nambikwaran verbs.

(1064) [hĩˈhĩː.**ɾ**a]
/hi.hĩl.a/
hihĩl -a
RED.tinamou-REF
'tinamou, sp.'

(1065) [ˌaːˈĩː.**ˀɾ**a] ~ [ˌaːˈĩː.**ɾ**a̰]
/a.ĩˀl.a/
a- ĩˀl -a
INAL-name-REF
'name'

(1066) [ˈheː**ɾ**i.naːɾa]
/he.li.na.ɾa/
heli -∅ -na -ɾa
to fight-3S-PRS.V.EV-PFV.M
'he's fighting'

(1067) [haˈˀneh.ˀ**ɾ**iˌnaː.ɾa]
/ha.ˀneh.ˀli.na.ɾa/
haˀnehˀli -∅ -na -ɾa
to be dangerous-3S-PRS.V.EV-PFV.M
'it's dangerous'

(1068) [ˈˀkḛː.**ɾ**a]
/ˀkḛl-a/
ˀkḛl -a
urine-REF
'urine'

(1069) [ˌaː.siˈw̰̃ḛ̃ː.**ɾ**a]
/a.si.ṵ̃ḛ̃l.a/
a- siṵ̃ḛ̃l -a
INAL-tail-REF
'tail'

(1070) [ˌpʰajːˈpʰajː.**ɾ**a]
/pʰai.pʰail.a/
pʰaipʰail -a
RED.frog-REF
'frog, sp.'

Optional rhotacism can occur when liquids /l, ˀl/ are followed by the vowel /i/ in stressed positions within a word:

(1071) [ˈw̃ãːˌtʃahˈˀ**ɾ**iː.ɾa] ~ [ˈw̃ãːˌtʃahˈˀliːɾa]
/ũãn.iahˀli.ɾa/
ũãn.iahˀli.ɾa
to burn-2S.PL.PRS-PFV.M
'you're burning'

(1072) [kaliˈ**ɾ**iː.tsu] ~ [kaliˈliː.tsu]
/ka.li.lit.su/
kalilit -su
RED.cricket.REF
'cricket'

5.2.6. Coalescence of Coda /l, ˀl/

Coalescence occurs when a liquid final morpheme /l, ˀl/ is followed by a morpheme with initial voiceless alveolar fricative /s/[129]. Coalescence takes place after rhotacism, hence segmental sequences /l.s/, /ˀl.s/ can be phonetically realized as [l̥, ʰl̥] if /l, ˀl/ follows [-coronal] vowels /a, a̰, a̰, ã̰, o, o̰, u, ṵ, ũ, ṵ̃/ or [ɾ, ɾʰ] if it follows [+coronal] vowels /i, ḭ, ĩ, ḭ̃, e, ḛ, ẽ, ḛ̃/.

Rule: /l, ˀl/ > [l̥, ʰl̥] (obligatory)
Environment: [-coronal]_l, ˀl] $^{+stress}$ _ [s

In the examples below, I transcribed all realizations as [ʰl̥], but [l̥] can also occur:

[129] This rule is very similar to the one proposed by Kroeker (2001). Costa (2020) suggests a more complex rule involving suffix {-li}.

(1073) [saˈlaː.ʰl̥u]
/sa.lal.su/
salal -su
kingfisher-REF
'kingfisher'

(1074) [ˈoː.ʰl̥aˌʰnaː.wa]
/ol.sa.ʰna.ua/
ol -sa -ʰna -ua
to get scared-1O-NV.EV-NPFV.M
'I got scared'

(1075) [aˈhũːˈʰl̥uːˌnaː.ɾa]
/a.hũl.su.na.ɾa/
ahũl -su -∅ -na -ɾa
water-REF-3S-PRS.V.EV-PFV.M
'it's water'

(1076) [jaˈnaː.la ˈkãw̃ː.ʰl̥u]
/ianal-a-kãũl-su/
ianal-a-kãũl-su
jaguar-REF-tree sp-REF
'ocelot'

(1077) [ˈa̰ː.ʰl̥u]
/a̰l.su/
a̰l -su
armadillo-REF
'armadillo, sp.'

(1078) [taˈlãː.ʰl̥u]
/ta.lãl.su/
talãl -su
trap-REF
'trap'

(1079) [kaˈw̰̃ã̰ː.ʰl̥u]
/ka.ṵ̃ã̰ˀl.su/
kaṵ̃ã̰ˀl -su
river-REF
'river'

(1080) [ˈã̰w̰̃ː.ʰl̥ṵ]
/ã̰ṵ̃ˀl.su/
ã̰ṵ̃ˀl -su
parrot-REF
'parrot' (general)

Rule: /l, ˀl/ > [ɾ, ɾʰ]
Environment: [+coronal]_l, ˀl] $^{+stress}$ _ [s

In the examples below, I transcribed all phonetic realizations of /l, ˀl/ as [ɾʰ], but [ɾ] can also occur:

(1081) [ˈiː.**ɾʰ**u]
/il.su/
il -su
howler monkey-REF
'howler monkey'

(1082) [ˌaːˈĩː.**ɾʰ**u]
/a.ĩˀl.su/
a- ĩˀl -su
INAL-name-REF
'name.'

(1083) [ˌpʰajːˈpʰajː.**ɾʰ**u]
/pʰai.pʰail.su/
pʰaipʰail -su
RED.frog-REF
'frog, sp.'

(1084) [ˌaː.siˈw̰̃ḛ̃ː.**ɾʰ**u]
/a.si.ṵ̃ḛ̃ˀl.su/
a- siṵ̃ḛ̃ˀl -su
INAL-tail-REF
'tail'

Evidence for the glottalized liquid in the coda of examples (1079), (1080), (1082) and (1084) is more often observed if the following morpheme is vowel initial, as discussed in Chapter 3.

5.2.7. Gemination

Consonant gemination is attested at morpheme boundaries. It frequently occurs in sequences of fricatives /hˀ.s/ and nasal consonants /n̩.n/.

(1085) [ˈɗuh.**s**ːu]
/ˀtuhˀ.su/
ˀtuhˀ -su
urucum-REF
‘*urucum*’

(1086) [ˌ**n**ːˈaː.ɾa]
/n̩.na.ɾa/[130]
n -∅ -na -ɾa
to agree- 3S-PRS.V.EV-PFV.M
‘exactly’ (lit. it agrees)

Gemination can also occur due to hyperarticulation, usually to make stressed syllables more prominent. In this case, the segment affected is the nasal coda /n/ or voiceless glottal plosive /ʔ/. Lengthening of morpheme final /ʔ/ is usually perceived as a pause before the following syllable is articulated. A similar rule has been described as “extra lengthening for emphasis” (Kroeker 2001: 82):

(1087) [ˈw̃ã**n**ːˌnaː.ɾa]
/ũãn.na.ɾa/
ũãn -∅ -na -ɾa
to burn-3S-PRS.V.EV-PFV.M
‘he’s burning’

(1088) [ˈuːˈkʰaj**ʔ**ːˌnaːɾa]
/ul.kʰaiʔ.na.ɾa/
ul - kʰaiʔ -∅ -na -ɾa
to be far-EMP-3S-PRS.V.EV-PFV.M
‘it’s *really* far’

5.2.8. Palatalization

Diphthongs and triphthongs with initial coronal vowels are usually palatalized. Palatalization occurs after the initial coronal vowels become palatal glides [j, j̃, j̰, j̰̃]. In most cases, palatalization of phonetic glides occurs following high vowels[131].

Rule: /iV/ > [tʃV] ~ [tʃʲV] (mandatory)
Environment: high vowel] _

(1089) [aːˌ**l**uːˈ**tʃ**ʲeᵍŋ.gi.su]
/a.lu.ien.ki.su/
alu -ienki -su
?-thing-REF
‘partridge’

(1090) [**u**ˈ**tʃ**eː.na.ki.su]
/u.ien.a.ki.su/
uien -a -ki -su
sun-REF-CL.round-REF
‘sun’

(1091) [ˈw̃ãː.ɗaˈtoh.ˀ**l**iˌ**tʃ**a̰w̰.ʔa]
/ũãn.ˀti.a.toh.ˀli.ḭa̰ṵ.a/
ũãnˀti-a -tohˀli -ḭa̰ṵ -a
word-REF-?-CL.fluid-REF
‘gossip’

If the initial high vowel of a diphthong or triphthong is [+nasal], it may become palatal nasal [ɲ]. In this case, palatalization is not necessarily triggered by a preceding high vowel, as in:

Rule: /ĩṼ/ > [ɲṼ] (optional)
Environment: high vowel] _

[130] /n̩/ seems to be a reduced form of the copula /ˀne/ and it is only used as an answer. The Kithãulhu represents the syllabic nasal as <nx>, which indicates a pre-glottalized nasal /ˀn/.
[131] Although palatalization is mostly predictable, it can sometimes occur spontaneously, as described by Costa (2020).

(1092) [ĩˈ**ɲ**ãːˌtãː.ɾa] ~ [ĩˈj̃ãːˌtãː.ɾa]
/ĩ-ĩãt-na-ɾa/
ĩ- ĩãt -∅ -na -ɾa
INST-3S-PRS.V.EV-PFV.M
‘he’s breathing’

(1093) [ˌhiːˈ**ɲãw̃**ː.sa] ~ [ˌhiːˈj̃ãw̃ː.sa]
/hi(s)-ĩãũs-a/
hi(s) -ĩãũs -a
stem-flower-REF
‘flower’

Palatalization of initial coronal high vowels of [+nasal] diphthongs and triphthongs is not necessarily triggered by a preceding high vowel, as illustrated in (1094) and (1095):

(1094) [ˈ**ɲũ**ː.zu] ~ [ˈj̃ũː.su]
/ĩũ-su/
ĩũ -su
tick-REF
‘tick’ (general)

(1095) [ˈ**ɲ**ãw̃ːˌkaː.ɗa] ~ [ˈj̃ãw̃ːˌkaː.ɗa] ~ [ˈ**ɲ**ãw̃ːˌkaː.ta̰] ~ [ˈj̃ãw̃ːˌkaː.ta̰]
/ĩãũ.kaˀt.a/
ĩãũ -kaˀt -a
spirit-CL.long-REF
‘spirit’

Palatalization can also occur when alveolar plosive /ˀt/ in the coda of a stressed syllables is followed by a diphthong beginning with /i, ḭ/. Note that, in this context, the palatalized segment can also become voiced:

Rule: /iV/ > [tʃV] ~ [dʒV] (mandatory)
Environment: ˀt] _ /ᵢV/

(1096) [kaˈja̰ʔˌ**tʃ**a̰w̰ː.su] ~ [kaˈja̰ʔˌ**dʒ**a̰w̰ː.su]
/ka.ḭa̰ˀt.ḭa̰ṵ.su/
kaḭa̰ˀt -ḭa̰ṵ -su
corn-CL.liquid-REF
‘*chicha*’

Palatalization is also triggered by epenthesis of [t] between a morpheme final /n/ and a diphthong beginning with /i, ḭ/. In this context, the voiceless alveolopalatal affricate [tʃ] can also become voiced and be realized as [dʒ]:

Rule: /iV/ > [tʃV] ~ [dʒV] (optional)
Environment: n]+stress _ [ᵢV, after epenthesis

(1097) [aˈlo^{d}nˌ**tʃ**ah.la] ~ [aˈlo^{d}nˌ**dʒ**ah.la] ~ [aˈloːˌ**dʒ**ah.la] ~ [aˈlo^{d}nˌjah.la]
/a.lon.iah.lo.a/
a- lon -iahlo -a
INAL-brother-CL.male-REF
'brother'

Palatalization can also affect the phonetic realization of coda /l/ of stressed syllables if followed by a triphthong with initial /ḭ/:

Rule /l/ > [ʎ], [ʎʲ] (optional)
Environment: l]$^{+stress}$ /$_{\text{i}}$V/

(1098) [aˈhũːˌ**ʎ**a̰w̰ː.su] ~ [aˈhũːˌ**ʎʲ**a̰w̰ː.su] ~ [aˈhũːˌlj̰a̰w̰ː.su]
/a.hũl.ḭa̰ṵ.su/
ahũl -ḭa̰ṵ -su
water-CL.liquid-REF
'water'

5.2.9. Assimilation

Assimilation can affect the realization of the onset, nucleus, and the coda.

5.2.9.1. Voicing

Voiceless consonants can become voiced. Voiceless plosives, except /p/, can become voiced if they follow /n/-final stressed syllables:

Rule: /t, k, ˀt, ˀk/ > [d, g, ɗ, ɠ] (optional)
Environment: n]$^{+ stress}$ [_

(1099) [ɲũˈɲũː.kiˈka^{d}n.**d**e.su]
/ĩũĩũ-ki-kan-te-su/
ĩũĩũ -ki -kan -te -su
worm-CL.round-to be hard-CL.generic-REF
'*embuá*'

(1100) [tʃahla# ^{h}ã.**g**a.lu.tãː.ɾa]
/te.iah.lo.a/ /an.kalut.na.ɾa/
tiahla an- kalut -∅ -na -ɾa
3S STAT-to be wet-3S-PRS.V.EV-PFV.M
'he's wet'

(1101) [ˌw̰a̰ˈhoː.haka̰j̰] [kaˈjaː.**g**iˌnaː.ɾa]
/ṵa̰.hoh.haˀkaĩ/ /kaian.ki.na.ɾa/
ṵa̰ -hoh -∅ -haˀkai kaian -ki -∅ -na -ɾa
INST-to swim-CAUS to be wet-APP-3S-PRS.V.EV-PFV.M
'he' swimming, that's why he's wet'

(1102) [ˈw̃ãː.**ɗ**a]
/ũãn.ˀti.a/
ũãnˀti -a
word-REF
'word'

Voiceless alveolar plosive /t/ can also become voiced if followed by a creaky voice vowel /V̰/:

Rule: /t/ > [d] (optional)
Environment: _V̰

(1103) [**d**ḭˈ**d**ḭdˌnaː.ɾa] ~ [tḭˈtḭdˌnaː.ɾa]
/tḭ.tḭn.na.ɾa/
tḭtḭn -∅ -na -ɾa
RED.to be black-3S.PRS.V.EV-PFV.M
'it's black'

(1104) [ˌaːˈ**d**ḭː#ˈkãj̃ːˌnaːɾa] ~ [ˌaːˈtḭː#ˈkãj̃ːˌnaːɾa]
/a.tḭ/ /kãĩn.na.ɾa/
a- tḭ kãĩn -∅ -na -ɾa
3.POS-belly to be big-3S-PRS.V.EV-PFV.M
'his belly's big'

In contrast with /t/, the voiceless alveolar plosive /k/ does not become voiced when followed by creaky voice vowels:

(1105) [kḭˈkḭː.tsu]. *[**g**ḭˈ**g**ḭː.tsu]
/kḭ.kḭt.su/
kḭkḭt -su
RED.cicada-REF
'cicada' (general)

As mentioned, /p/ never becomes voiced:

(1106) [pawˈpawᵇmˌnaː.ɾa] *[**b**awˈ**b**awᵇmˌnaː.ɾa]
/pau.paun.na.ɾa/
paupaun -∅ -na -ɾa
RED.to be flat-3S-PRS.V.EV-PFV.M
'it's flat'

Voiceless consonants can also become voiced if they follow nasal creaky vowels or nasal or creaky voice triphthongs:

Rule: C$^{[-\text{voiced}]}$ > C$^{[+\text{voiced}]}$ (optional)
Environment 2: Ṽ, Ṽ̰, V̰]$^{+\text{stress}}$ _ [

(1107) [ʊiˈɾiˈja̰w̰ː.ˌ**dʒ**iː.ʔa] ~ [ʊiˈɾiːˈja̰w̰ː.ˌtʲiː.ʔa]
/uil.in.i̯a̰ṵ.tii.ʔa/
uil -in -i̯a̰ṵ -tii[132] -ʔa
to be good-2S-to stay-PQ.PRS-NPFV.F
'are you okay?'

(1108) [jaˈnṵ̃ː.**g**i.su]
/ia-nṵ̃-ki-su/
ia -nṵ̃ -ki-su
ash-CL.granule-CL.round-REF
'charcoal'

(1109) [ˈw̃ãj̃ː.**z**u] ~ [ˈw̃ãj̃ː.su]
/ũãĩ.su/
ũãĩ -su
anteater-REF
'anteater, sp.'

5.2.9.2. Assimilation of the [+glottal] Feature of Codas

When resyllabified, coda glottalized consonants /ˀC/ other than /hˀ/ usually trigger the assimilation of the [+glottal] feature into the following vowel initial morpheme. In this context, the following vowel is realized as creaky voice [V̰]:

Rule: /V/ > [V̰] (optional)
Environment: _ˀC]$^{+stress}$ _ [V, after resyllabification of /ˀC/

(1110) [ˈhawː.d**a̰**] ~ [ˈhawː.ˀta] ~ [ˈhawː.ɗa] ~ [ˈhawː.t**a̰**]
/hauˀt(i).a/
hauˀt(i) -a
arrow-REF
'arrow'

(1111) [ˈhuː.k**a̰**] ~ [ˈhuː.ˀka] ~ [ˈhuː.ˀk**a̰**]
/huˀk(i).a/
huˀk(i) -a
bow-REF
'bow'

(1112) [ˈhajː.s**a̰**] ~ [ˈhajː.sˀa]
/haisˀ.a/
haisˀ -a
crop-REF
'crop'

(1113) [kaˈw̰̃ã̰ː.l**a̰**] ~ [kaˈw̰̃ã̰ː.ˀla]
/kaṵ̃ã̰ˀl.a/
kaṵ̃ã̰ˀl -a
river-REF
'river'

(1114) [ˌaːˈĩː.ɾ**a̰**] ~ [ˌɐːˈĩː.ˀɾa]
/a.ĩˀl.a/
a- ĩˀl -a
INAL-name-REF
'name'

(1115) [waˈliː.n**a̰**] ~ [waˈliː.ˀna]
/ua.liˀn.a/
ualiˀn -a
'manioc'

[132] Alternatively: {-tiu}, as in Silva (2021: 172).

Unstressed oral vowels can also become creaky voice via assimilation when they follow a stressed creaky voice vowel:

(1116) [ˈhajː.sa̰ˌko̰ː.**ṵ**] ~ [ˈhajː.sa̰ˌko̰ː.su]
/haisˀ.a.ko̰.su/
haisˀ -a -ko̰ -su
crop-REF-CL.land-REF
‘farm’

In negative constructions, vowels following negative suffix /-ʔ/ can become creaky via assimilation:

(1117)	[aˈlajː.a]	[uːˈɬeːˌ**ʔa**ː.wa] ~
	[aˈlajː.a]	[ˌuːˈɬeːˌ**a̰**ː.wa]
	/a.lai.a/	/ul.he.ʔa.ua/
	alai -a	ul -he -ʔ -∅ -a -ua
	sloth-REF-to	be far-to be-NEG-3S-PRS.V.EV-NPFV.M
	‘the sloth is near’ (lit. it’s not far)[133]	

5.2.9.3. Assimilation of the [+nasal] Feature

Oral vowels can also assimilate the [+nasal] feature of nasal stop /n/. This assimilation rule is observed in the verbal morphology when morpheme final /t, ˀt/ is resyllabified. Resyllabification of /t, ˀt/ triggers elision of /n/, whose [+nasal] feature is preserved and assimilated by the following vowel. This rule is in accordance with what has been described by Kroeker (2001: 83).

Rule:: /nV/ > [tṼ] (obligatory)
Environment: _ t, ˀt]$^{+stress}$ _ [n_, after resyllabification of /t, ˀt/ and elision of /n/

(1118) [saˈkãw̃ːˌ**tã**ː.ɾa]
/sakãũt.na.ɾa/
sakãũt -∅ -na -ɾa
to drip-3S-PRS.V.EV-PFV.M
‘it’s dripping’

(1119) [ˈiʔˌ**tã**ː.ɾa]
/iˀt.na.ɾa/
iˀt -∅ -na -ɾa
to blow-3S-PRS.V.EV-PFV.M
‘the wind is blowing’

Examples (1118) and (1119) illustrate that multiple rules can be observed in the same sequence of morphemes. Since the morphophonological rules described above follow the directionality of syllabification, we can predict that they occur in the following order:

Table 75: List of phonological rules affecting the same morpheme.

_**t**]$^{+stress}$ _ [n_	_**ˀt**]$^{+stress}$ _ [n_
1) Coda /t/ is resyllabified. 2) Onset /n/ is elided. 3) [+nasal] feature of /n/ is preserved in the syllable after elision.	1) Coda /ˀt/ is simplified, and the glottal phase /ʔ/ is preserved following the nucleus. 2) /t/ is resyllabified. 3) Onset /n/ is elided.

[133] Antonyms are frequently indicated by negative verbal constructions. Hence, near ~ not far, small ~ not big, bad ~ not good, ugly ~ not beautiful, and so on.

_**t**]$^{+stress}$ _ [n_	_**ʔt**]$^{+stress}$ _ [n_
4) [+nasal] feature of [n] is assimilated by the nucleus of the following vowel.	4) [+nasal] feature of /n/ is preserved in the syllable after elision. 5) [+nasal] feature of [n] is assimilated by the nucleus of the following vowel.

Coda /s/ can also become assimilated if the nucleus is a nasal vowel /Ṽ/ and the following morpheme is /s/ initial. In this context, /s/ assimilates the [+nasal] feature of the nucleus. When /s/ is assimilated, it becomes [m] or [n], depending on the place feature of the vowel it follows. If coda /s/ follows [-dorsal] nasal vowels, it becomes [n]. If /s/ follows [+dorsal] nasal vowels, as in the triphthong /ĩãũ/, it becomes [m]. When /s/ is realized as nasal consonants [m, n], epenthetic consonants [t, d] are added to the onset of the following morpheme. In some cases, the nasal consonants can also be elided. In this case, epenthesis of [t, d] in the onset of the following morpheme still occurs, as illustrated in the following examples.

Rule: /(C)Ṽs/ > [CṼn], [CṼm] (optional)
Environment: (C)Ṽs] $^{+stress}$ _ [s

(1120) [ˈw̃ẽ**n**^{t}su] ~ [ˈw̃ẽ**n**^{d}zu] ~ [ˈw̃ẽː.^{d}zu] ~ [ˈw̃ẽː.^{t}su]
/ũẽs.su/
ũẽs -su
child-REF
'child'

(1121) [ˈw̃ã**n**^{t}su] ~ [ˈw̃ã**n**^{d}zu] ~ [ˈw̃ãː.^{d}zu] ~ [ˈw̃ãː.^{t}su]
/ũãs.su/
ũãs -su
hat-REF
'hat'

(1122) [ˌhiːˈȷ̃ãw̃**m**^{t}su] ~ [ˌhiːˈȷ̃ãw̃**m**^{d}zu]
/hi(s).ĩãũs.su/
hi(s) -ĩãũs -su
stem-flower-REF
'flower'

Evidence for lexical coda /s/ in the examples above is found when s-final morphemes are followed by a vowel initial morpheme, such as the referential suffix {-a}. In this context, coda /s/ is realized as [s] once it becomes resyllabified. After resyllabification of /s/, the nucleus undergoes compensatory lengthening to preserve its moraic weight:

(1123) [ˈw̃ẽː.**sa**]
/ũẽs.a/
ũẽs -a
child-REF
'child'

(1124) [ˈw̃ãː.**sa**]
/ũãs.a/
ũãs -a
hat-REF
'hat'

(1125) [ˌhiːˈj̃ãw̃ː.**sa**]
/hi(s).ĩãũs.a/
hi(s) -ĩãũs -a
wood-flower-REF
‘flower’

Note that, when coda /s/ is resyllabified, the alternations described in (1120), (1121), and (1122) do not happen.

5.2.9.4. Assimilation of the [+labial] Feature

Morpheme-final /t, ˀt/ can undergo assimilation at morpheme boundaries and become realized as [p] or [m]. Occurrences of [p] are attested when the coda /t, ˀt/ of a stressed syllable follows falling diphthongs /au, a̰ṵ/. In this environment, /t, ˀt/ assimilates the place feature of the final vowel and becomes the voiceless labial plosive [p]. After assimilation, epenthetic [t] is added.

Rule: /t/ > [p] (optional)
Environment: au, a̰ṵ _]+ stress

(1126) [ˈtaw^{p}.tsu] ~ [ˈtawː.tsu]
/taut.su/
taut -su
hawk -REF
‘hawk’ (general)

(1127) [ˌaːˈj̰o̰ːˌka̰ˈka̰w̰^{p}.tsu] ~
[ˌaːˈjo̰ːˌka̰ˈka̰w̰ː.tsu]
/a.ḭo̰.ka̰ṵ.ka̰ṵt.su/
a- ḭo̰ -ka̰ṵka̰ṵt -su
INAL-mouth-?-REF
‘guariroba’

(1128) [ˈhaw^{p}.ta̰]
/hauˀt(i).a/
hauˀt(i) -a
arrow-REF
‘arrow’

Assimilation of coda /t/ was first described by Costa (2020) for Nambikwara do Campo. According to the author, coda /t/ assimilates the place of articulation of labial glide [w]. Morpheme final /t/ can also be phonetically realized as [m], when following nasal diphthong /ãũ/ in a stressed syllable is followed by an /n/ initial morpheme. Note that, whenever assimilation happens, coda /t/ is still resyllabified in the following morpheme, as shown in the example below:

Rule: /t/ > [m] (optional)
Environment: ãũ_][134]+ stress_ [n

(1129) [ˈtãw̃**m**ˌtãː.ɾa] ~ [ˈtãw̃ːˌtãː.ɾa]
tãũt -na -ɾa
tãũt -∅ -na -ɾa
to whistle-3S-PRS.V.EV-PFV.M
‘he’s whistling’

[134] Although only attested with the nasal diphthong /ãũ/, it is possible that this rule may occur with the nasal creaky diphthong /ã̰ṵ̃/.

5.2.9.5. Nasal Codas

As described in Chapter 3, nasal coda /n/ has the largest allophonic realization. Overall, nasal coda assimilates the features of surrounding segments. Observe the following examples with roots {tun}, 'violet, dark color,' and {ialan}, 'toucan':

(1130) [ˈtu^{d}**n**.de.su] ~ [ˈtu^{d}**n**.te.su]
/tun.te.su/
tun -te -su
to be violet-CL.generic-REF
'dark, violet' (color)

(1131) [ˈtu^{g}**ŋ**.gi.su] ~ [ˈtu^{g}**ŋ**.ki.su]
/tun-ki-su/
tun -ki -su
to be violet-CL.seed-REF
'dark seed'

(1132) [jaˈla^{d}**n**.^{d}zu] ~ [jaˈla^{d}**n**.^{t}su]
/ia.lan.su/
ialan -su
toucan-REF
'toucan' (general)

(1133) [jaˈla^{g}**ŋ**.gaˌloː.su] ~ [jaˈla^{g}**ŋ**.kaˌloː.su]
/ia.lan.ka.lo.su/
ialan -kalo -su
toucan-CL.flat-REF
'*cocar*' (traditional headdress)

As seen in examples (1130) – (1134), the nasal coda of the same morpheme can be phonetically realized differently, depending on the place of articulation of the following consonant. Note that, if coda /n/ is followed by a vowel-initial morpheme, assimilation does not occur when it becomes resyllabified:

(1134) [jaˈlaː.na] *[jaˈlaː.^{d}**n**a]
/ia.lan.a/
ialan -su
toucan-REF
'toucan' (general)

(1135) [waˈkoˌnaː.wa] *[waˈkoːˌ^{d}**n**aː.wa]
/uakon-a-ua/
uakon -a -ua
to work-1S-PFV.M
'I'm working'

Pre-plosion of /n/ is also attested when negative suffix {-n}[135] is attached to the stressed syllable of a root. Compare the examples below:

(1136) [^{h}nãˈdĩːˌnaː.wa]
/^{h}nã.^{ʔ}ti.na.ua/
^{h}nã^{ʔ}ti -na -ua
to be dirty-1S-PRS-NPFV.M
'I'm dirty'

(1137) [^{h}nãˈdĩ^{d}**n**ˌ^{ʔ}naː.wa]
/^{h}nã.^{ʔ}tin.^{ʔ}na.ua/
^{h}nã^{ʔ}ti -n -ʔ -na -ua
to be dirty-NEG-NEG-1S.PRS-NPFV.M
'I'm not dirty'

135 Negation can be expressed in Nambikwara through a series of strategies within verbal morphology, which can also be encoded more than once in the same morphosyntactic construction. Strategies are usually morphophonological in nature and include attaching negative morpheme {-ʔ} to the verbal string and/or negative morpheme {n} to the stressed syllable of the stem of one class of verbs, changing the final aspectual/gender indexation morpheme {-ɾa/ -na} to {-ua/ - ʔa}, nasalization of morpheme {-na} in stative constructions, and other morphological changes. More on negation is described in Chapter 6 when addressing grammatical tone.

5.2.9.5.1. Assimilation of Nasal Codas

Nasal coda /n/ can be realized as labial nasal [m] and velar nasal [ŋ] via assimilation.

a) [m]

Coda /n/ can also become labial nasal [m], if it follows nasal diphthongs /ãũ, ãṵ̃/ or nasal triphthong /ĩãũ/:

Rule: /n/ > [m]
Environment: ãũ, ĩãũ_]+^{stress} _ [C

(1138) [waˌtãw̃ː.waˈtãw̃**m**.ᵗsã] ~ [waˌtãw̃ː.waˈtãw̃**m**.ᵈzã]
/ua.tãũ.ua.tãũn.sã/
uatãũuatãũn -sã
RED.to be round-SS
'to be round'

(1139) [ˈɲãw̃**m**.ʰnaːˌnaː.ɾa]
/ĩãũn.ʰna.na.ɾa/
ĩãũn -∅ -ʰna -na -ɾa
to refuse-3S-RFL-PRS.V.EV-PFV.M
'he's refusing'

(1140) [ˈnãw̰̃**m**ˌnaː.ɾa]
/nãṵ̃n.na.ɾa/
nãṵ̃n -∅ -na -ɾa
to be sweet-3S-PRS.V.EV-PFV.M
'it's sweet'

b) [ŋ]

When the nasal /n/ follows a [+nasal] vowel and the following syllable begins with the voiceless velar plosive /k/, it becomes velar nasal [ŋ]:

Rule: /n/ > [ŋ]
Environment: Ṽ_]+^{stress} _ [k

(1141) [ˈkwẽ**ŋ**.ka]
/kũẽn.ki.a/
kũẽnki -a
year-REF
'year'

5.2.9.5.2. Pre-Plosion of Nasal Codas

c) [ᵈn]

Coda /n/ or /ˀn/ becomes [ᵈn], when it follows a [-nasal] vowel and is followed by a [-nasal], [+coronal] consonant:

Rule: /n, ˀn/ > [ᵈn]
Environment: V_]$^{+stress}$ [C
[-nasal] [-nasal]
[+coronal]

(1142) [waˈliᵈ**n**.ᵗsu]
/ua.liˀn.su/
ualiˀn -su
manioc-REF
'manioc'

(1143) [heˈheᵈ**n**.de.su]
/he.hen.te.su/
hehen -te -su
RED.to be red-CL.generic-REF
'red' (color)

(1144) [kwaˈlaᵈ**n**.ᵗsu]
/kualan.su/
kualan -su
armlet-REF
'armlet'

(1145) [ˌaːˈloᵈ**n**.ᵗsu]
/a.lon.su/
a- lon -su
INAL-brother-REF
'brother'

(1146) [ˈtuᵈ**n**.ᵗsã]
/tun.sã/
tun -sã
to be dark-SS
'to be purple, dark'

d) [ᵇm]

The coda /n/ becomes [ᵇm] when it follows oral falling diphthong /au/:

Rule: /n/ > [ᵇm]
Environment: au_]$^{+stress}$ _ [C

(1147) [haˈlawᵇ**m**ˌnaː.ɾa]
/ha.laun.na.ɾa/
halaun -∅ -na -ɾa
to be shelly-3S-PRS.V.EV-NPFV.M
'it's shelly'

(1148) [ˌpʰawːˈpʰawᵇ**m**ˌnaː.ɾa]
/pʰau.pʰaun.na.ɾa/
pʰaupʰaun -∅ -na -ɾa
RED.to be grey-3S-PRS.V.EV-NPFV.M
'it's gray'

e) [ᵍŋ]

If /n/ follows the diphthong /ai/ or triphthongs /uai, iai/ and the follow morpheme begins with the nasal consonants /n, ʰn/, it becomes the pre-plodded velar nasal [ᵍŋ]:

Rule: /n/ > [ᵍŋ]
Environment 1: ai, iai, uai_]$^{+stress}$ _ [n, ʰn

(1149) [ˈhaj^{g}**ŋ**ˌnaː.ɾa]
/hain.na.ɾa/
hain -∅ -na -ɾa
to sing-3S-PRS.V.EV-PFV.M
‘he’s singing’

(1150) [ˈjaj^{g}**ŋ**ˌnaː.ɾa]
/iain-na-ɾa/
iain -∅ -na -ɾa
to eat-3S-PRS.V.EV-PFV.M
‘he eats’

(1151) [ˌw̰a̰ːˈwaj^{g}**ŋ**.^{h}niːˌnaː.ɾa]
/ṵa̰.uain.^{h}ni.na.ɾa/
ṵa̰- uain -^{h}ni -∅ -na -ɾa
INST-to scratch-REFL-3S-PRS.V.EV-PFV.M
‘he’s scratching himself’

If /ai/, /iai/, /uai/ follow a coronal consonant other than a nasal, the coda /n/ becomes [^{d}n]:

(1152) [ˈhaj^{d}**n**.^{t}sã]
/hain.sã/
hain -sã
to sing-SS
‘to sing’

(1153) [ˈwaj^{d}**n**.^{t}sã]
/uain.sã/
uain -sã
to be straight-SS
‘to be straight’

(1154) [ˈjaj^{d}**n**.^{t}sã]
/iain.sã/
iain -sã
to eat-SS
‘to eat’

Coda /n/ can also become [^{g}ŋ], if it follows any oral vowel and the following morpheme is /k/ initial:

Environment 2: V_]$^{+ \text{stress}}$ _ [k
[-nasal]

(1155) [heˈhe^{g}**ŋ**.giːˌtãː.ɾa] ~ [heˈhe^{g}**ŋ**.kiːˌtãː.ɾa]
/he.hen.kit.na.ɾa/
hehen -kit -na -ɾa
RED.to be red-1P-PRS.V.EV-PFV.M
‘we’re red’

(1156) [waˈko^{g}**ŋ**.kiːˌtãː.ɾa] ~ [waˈko^{g}**ŋ**.giːˌtãː.ɾa]
/ua.kon.kit.na.ɾa/
uakon -kit -na -ɾa
to work-1P-PRS.V.EV-PFV.M
‘we’re working’

(1157) [ˈtuᵍ**ŋ**.ki.su] ~ [ˈtuᵍ**ŋ**.gi.su]
/tun.ki.su/
tun -ki -su
to be dark-CL.seed-REF
'dark seed'

If coda /n/ follows creaky voice diphthong /a̰ṵ/ or triphthong / ṵa̰ṵ /, it may be phonetically realized as labial [ᵇm] or velar [ᵍŋ] preploded nasals, in free variation. In this scenario, the nasal consonant may assimilate the [+dorsal] or [+labial] of the phonetic glide it follows:

Rule: /n/ > [ᵇm], [ᵍŋ]
Environment 1: ṵa̰, ṵa̰ṵ_]^{stress}

(1158) [ˈa̰w̰**ᵇm**.ᵈzã] ~ [ˈa̰w̰**ᵍŋ**.ᵈzã]
/a̰ṵn-sã/
a̰ṵn -sã
to fester-SS
'to fester'

(1159) [ˈw̰a̰w̰**ᵇm**.ᵈzu] ~ [ˈw̰a̰w̰**ᵍŋ**.ᵈzu]
/ṵa̰ṵn-su/
ṵa̰ṵn -su
scorpion-REF
'scorpion, sp.'

5.2.10. Dissimilation

Dissimilation[136] is attested in sequences of nasal consonants /n/ at morpheme boundaries. To avoid sequences of identical nasal consonants being phonetically realized, coda /n/ of the syllable bearing primary stress is realized as voiced alveolar plosive [d]. Dissimilation of nasal /n/ is motivated by the Obligatory Contour Principle (OCP):

Rule: /n/ > [d]
Environment: V, V̰, rising diphthongs _n]$^{+stress}$ _ [n

(1160) [waˈko**d**ˌnaː.ɾa]
/ua.kon.na.ɾa/
uakon -∅ -na -ɾa
to work-3S-PRS.V.EV-PFV.M
'he's working'

(1161) [ˈw̰a̰**d**ˌnaː.ɾa]
/ṵa̰n.na.ɾa/
ṵa̰n -∅ -na -ɾa
to scream-3S-PRS.V.EV-PFV.M
'he's screaming'

[136] For Kroeker (2001) and Costa (2020), nasal /n/ in this environment becomes pre-plodded alveolar nasal [ᵈn].

If the following morpheme is vowel initial or consonant initial, other than nasal /n/, /n/ is not dissimilated:

(1162) [waˈkoːˌniː.ɾa]
/ua.kon.i.ɾa/
uakon -i -ɾa
to work-2S-PFV.M
'you're working'

(1163) [ˈi^{d}n.da̰] ~ [ˈi^{d}n.ɗa]
/in.ˀti.a/
in -ˀti -a
man-?-REF
'man'

5.2.11. Monophthongization

Monophthongization/fusion is attested in both rising and falling diphthongs with the low back vowel /a/. Overall, rising diphthongs are monophthongized when they occur in unstressed positions within a word, whereas falling diphthongs undergo monophthongization in stressed positions.

- **[-nasal] diphthongs**

a) /ua/

Rising diphthong /ua/ can become [a, ɔ, o] in unstressed positions:

(1164) [k**a**ˈneː.ki.su] ~ [k**wa**ˈneː.ksu]
/kua.nek(i).su/
kuanek(i) -su
jandaya-REF
'jandaya parakeet'

(1165) [k**ɔ**ˈlajː.su] ~ [k**wa**ˈlajː.su]
/kua.lai.su/
kualai -su
spider-REF
'spider' (general)

(1166) [ˈajː.giˌtuː.**a**] ~ [ˈajː.giˌtuː.**wa**]
/ainki-tu-ua/
ainki -∅ -tu -ua
to hear-FUT.NPFV.M
'he will hear'

b) /au/

Falling diphthong /au/ can become [a, o] in unstressed positions:

(1167) [p**a**ˈpaw^{b}mˌnaː.ɾa] ~ [p**aw**ˈpaw^{b}mˌnaː.ɾa]
/pau.paun.na.ɾa/
paupaun -∅ -na -ɾa
to be flat-3S-PRS.V.EV-PFV.M
'it's flat'

(1168) [ˈj̰ṵːˌˀlajːˈɾaː.**o**] ~ [ˈj̰ṵːˌˈˀlajːˈɾaː.**wa**]
/ḭṵˀl-aila-ua/
ḭṵˀl-aila-ua
knife-AFF.COP-NPFV.M
'it's a knife'

c) /a̰ṵ/

Falling creaky diphthong /a̰ṵ/ can become monophthongized as [o̰ː] in stressed positions. The example below with a monophthong is the standard pronunciation of the Kithãulhu, whereas the full diphthong is used by the Halotesu. It would not be possible to determine the lexical form /ha̰ṵ-su/ if the Kithãulhu did not provide the Halotesu pronunciation:

(1169) [ˈh**o̰**ːsu] ~ [ˈh**a̰w̰**ːsu]
/ha̰ṵ-su/
ha̰ṵ -su
maned wolf-REF
'maned wolf'

- **[+ nasal] diphthongs**

[nasal] diphthongs /ãũ, ã̰ṵ̃, ũẽ/ can become nasal low central vowels or oral mid-back vowels. Nasalized mid-back vowels *[õ, õ̰] never occur. Monophthongization of [+nasal] diphthongs are frequently attested in stressed syllables, but it can also occur in unstressed positions if reduplicated.

a) /ãũ/ > [ãː] ~ [oː] *[õː]

(1170) [ˌaː.n**ã**ːˈkw̰a̰j̰ː.ɾʰu] ~ [ˌaː.n**o**ːˈkw̰a̰j̰ː.ɾʰu] ~ [ˌaː.n**ãw̃**ːˈkw̰a̰j̰ː.ɾʰu]
/a.nãũ.kṵa̰ḭl̰.su/
a- nãũkṵa̰ḭl -su
INAL-chest-REF
'chest'

(1171) [ˈwajː.a.la̰.k**ã**ˈkãw̃ː.ta.ˀli.su] ~ [ˈwajː.a.la̰ˌk**ãw̃**ːˈkãw̃ː.ta.ˀli.su]
/uai.a.ˀli.a.kãũ.kãũt.a.ˀli.su/
uai -aˀli -a -kãũkãũt -aˀli -su
dog-?-REF-RED.?-?-REF
'fox'

b) /ã̰ṵ̃/ > [ã̰ː] *[õ̰ː]

(1172) [aˈl**ã̰**ːsu] ~ [aˈl**ã̰w̰̃**ːsu]
/a.lã̰ṵ̃.su/
alã̰ṵ̃ -su
tree-REF
'tree, sp.'

c) /ũẽ/ > [o] *[õ]

(1173) [kʰ**o**ˈkʰw̃ẽː.ki.su] ~ [kʰ**w̃ẽ**ˈkʰw̃ẽː.ki.su]
/kʰũẽ.kʰũẽk(i).su/
kʰũẽkʰũẽk(i) -su
RED.fan-REF
'fan'

5.2.12. Epenthesis

Epenthesis can be vocalic and consonantal, the former occurring more frequently. Overall, epenthesis is attested after stressed syllables, where coronal vowel [i] is inserted to avoid consonant sequences from occurring in the surface representation. Consonantal epenthesis occurs in the beginning of a syllable (prothesis). Other than that, epenthesis is also employed to avoid violations of The Sonority Principle as well as the occurrence of more marked phones such as voiceless and/or aspirated liquids, [l̥, ʰl̥, ɾʰ], as discussed in Chapter 4. Epenthesis in Nambikwara follows the typical left-to-right directionality in syllabification.

5.2.12.1. Epenthesis of Vowels

The quality of epenthetic vowels is fixed by default: coronal vowel [i] ~ [ɪ], the latter being rarer. Acoustically, epenthetic [i] is also significantly shorter in duration than phonemic /i/ occurring in stressed positions within a word. Besides affecting syllabification of codas, epenthetic vowels do not seem to interact with other phonological processes – an observation opposed to the tendency observed cross linguistically for this type of vowel (Hall 2011: 1185). Furthermore, they do not count in the stress assignment. The intuition of Nambikwaran speakers on the nature of epenthetic vowels also varies considerably. The younger speakers are usually unaware of whether unstressed i-final syllables of roots are underlying CVC or CV.Ci, particularly when [i] follows a plosive. This observation suggests that there may be phonological variation across generations and that CVC syllables whose coda is a plosive may become two /CV/ syllables in the future.

i. Epenthetic vowel [i]

Epenthetic [i] is usually inserted to break consonant clusters at morpheme boundaries or to prevent more marked phones from being phonetically realized. In all attested cases, [i] is inserted between the stressed syllable and the suffix {-su}:

Rule: /C/ > [Ci]
Environment: _C]$^{+stress}$ _ [s

(1174) [jaˈnaː.ʰl̥u] ~ [jaˈnaː.**li**.su]
/ia.nal.su/
ianal -su
jaguar-REF
'jaguar'

(1175) [saˈwiː.ɾʰu] ~ [saˈwiː.ɾ**i**.su]
/sa.uil.su/
sauil -su
parakeet-REF
'parakeet' (general)

(1176) [ˈuʔ.tsu] ~ [ˈuː.t**i**.su]
/uˀt.su/
uˀt -su
potoo-REF
'potoo' (general)

(1177) [ˈhuʔ.k**i**.su] ~ [ˈhuʔ.ksu]
/huˀk(i).su/
huˀk(i) -su
bow-REF
'bow'

5.2.12.2. Epenthesis of Consonants

ii. Epenthetic consonant [t]

Epenthesis of coronal plosive [t, d] is attested across morphemes under three conditions. In the first one, [t, d] is added when the coda of the stressed syllable is coronal nasal /n/, and the following morpheme is /s/-initial. This type of epenthesis is probably motivated by the effects of co-articulation of two adjacent homorganic consonants, distinguished by the feature [±continuant]. An analogous effect of nasal + fricative sequences can be observed in English words such as /fens/ > [fen**t**s].

Rule: /s/ > [ᵗs] ~ [ᵈz] (obligatory)
Environment 1: n$^{+stress}$] _ [s

(1178) [ˈiᵈn.**ᵗs**ã] ~ [ˈiᵈn.**ᵈz**ã]
/in-sã/
in -sã
to fly-SS
'to fly'

(1179) [ˈweᵈn.**ᵗsu**] ~ [ˈweᵈn.**ᵈz**u]
/uen-su/
uen -su
bacaba-REF
'*bacava*'

(1180) [ˈw̃ãː.**ᵗs**aˌʰnaː.wa]
/ũãn.sa.ʰna.ua/
ũãn -sa -ʰna -ua
to be warm-1O-PRS.NV.EV-NPFV.M
'I'm getting hot'

Epenthesis of [t, d] occurs even when the coda /n/ is elided, as seen in (1180). When there is no underlying coda /n/ occurring in the stressed syllable, no epenthetic [t, d] is added to the following /s/-initial morpheme, as in (1181):

(1181) [ˈw̃ãȷ̃ː.su] ~ [ˈw̃ãȷ̃ː.zu], but *[ˈw̃ãȷ̃ː.ᵗsu] *[ˈw̃ãȷ̃ː.**ᵈ**zu]
/ũãĩ.su/
ũãĩ -su
anteater-REF
'anteater, sp.'

One of the consequences of epenthesis is the coalescence of /s.s/ sequences into voiceless aspirated alveolar plosive [tʰ]. Coalescence of /s.s/ is only attested at morpheme boundaries, after coda /s/ underwent other morphophonological rules, such as elision, glottalization and epenthesis:

(1182) [ˈw̃ẽː.**tʰ**u] ~ [ˈw̃ẽʔ.**tʰ**u] ~ [ˈw̃ẽn.ᵈzu] ~ [ˈw̃ẽʔ.ᵗsu] ~[ˈw̃ẽː.ᵗsu]
ũẽs.su
ũẽs -su
child-REF
'child'

The phonetic realization of /s.s/ sequences as [tʰ] are most frequent among young speakers.

In the second environment, [t, d] is added when coda /n/ in the stressed syllable is followed by a diphthong or triphthong with the initial coral vowel /i, i̯, ĩ, ĩ̯/, phonetically realized as a coronal approximant [j, j, j̰, j̃, j̰̃].

Rule: /iV/ > [tjV]

Environment 2: n]$^{+stress}$ _ [iV

(1183) [waˈˀnĩːˌ**t**ʲah.la] ~ [waˈˀnĩːˌ**t**ʃah.la] ~ [w̰a̰ˈˀnĩːˌ**d**ʒah.la]
/uaˀnĩn-iahlo-a/
uaˀnĩn-iahlo-a
to do magic-CL.man.REF
'*pajé*'

As seen in the section on palatalization, clusters comprised of an obstruent [t] and an approximant [j] undergo palatalization and are phonetically realized as [tʃ, dʒ]. This rule is in accordance with Kroeker (2001), who predicts epenthesis of [t] in sequences of nasal + palatal glide.

In the third environment, [t] is added between sequences of alveolar fricatives /s.s/, /sˀ.s/ at morpheme boundaries. [t] can become voiced if it follows a phonetic nasal consonant, as in (1184):

Rule: /s/ > [ᵗs] ~ [ᵈz]
Environment 2: s, ˀs]$^{+stress}$ _ [s

(1184) [ˌhiːˈj̃ãw̃m.**ᵗ**su] ~ [ˌhiːˈj̃ãw̃m.**ᵈ**zu]
/hi(s).ĩãũs.su/
hi(s) -ĩãũs -su
stem-flower-REF
'flower'

(1185) [ˈhajʔ.**ᵗ**su]
/haisˀ-su/
haisˀ -su
crop-REF
'crop'

As seen in (1184) and (1185), epenthetic [t] is added after the coda /s, sˀ/ of the stressed syllable undergoes assimilation or glottalization.

5.2.12.3. Epenthesis of Glides

Glides [w, j] can also be inserted intervocalically at morpheme boundaries. Both stressed and unstressed vowel-initial morphemes can undergo epenthesis, but epenthesis of glides are most frequently attested in the latter rather than the former. In all examples, epenthesis of glides [w, j] can be determined by the features of the vowel found at the left edge of the morpheme to which a glide is added. If the nucleus of the morpheme is [+coronal], coronal glide [j] is added. In contrast, [w] follows a stressed [-coronal] vowel and affects the realization of the unstressed vowel.

Rule: /V/ > [GV] (optional)

iii. Epenthetic glide [j]

Epenthesis of [j] affects the realization of the following vowel initial syllable. Epenthetic [j] is probably derived from an articulatory transition to the following syllable as a strategy to keep the [+nasal] feature of the preceding vowel from spreading.

Rule: /V/ > [jV] (optional)
Environment: V] _ + ^{stress} [V
[+coronal]

(1186) [ĩˈ**j**eːˌnaː.ɾa] ~ [ĩˈeːˌnaː.ɾa]
/ĩ.e.na.ɾa/
ĩ- e -∅ -na -ɾa
INST-to speak-3S-PRS.V.EV-PFV.M
'he's speaking'

iv. Epenthetic glide [w]

Epenthetic glide [w] is added between stressed morpheme final back vowels /o, u/ followed by a low-vowel initial morpheme:

Rule: /a/ > [wa] (optional)
Environment:_o, u$^{+stress}$] _a

(1187) [waˈhoː.**w**a]
/ua.ho.a/
uaho -a
bamboo-REF
'bamboo'

(1188) [ˌɐːˈsuː.ʷa] [saˈɗeːˌnaː.ɾa]
/a.su.a/ /sa.ˀte.na.ɾa/
a -su -a saˀte -∅ -na -ɾa
INAL-bone-REF to be heavy-3S-PRS.V.EV-PFV.M
'the bone is heavy'

v. Prothesis

Prothesis is attested in two different environments. In the first one, epenthetic [h] is added to a word-initial morpheme. In (1189), [h] is attached to inalienable prefix {a-}, while in (1190), it is attached to a root:

Rule: /V(C)/ > [hV(C)]
Environment 1: $^{word\text{-}initial}$ [V$^{+stress}$

(1189) [ˌ**h**aːˈnũː.su] ~ [ˌaːˈnũː.su]
/a-nũ-su/
a- nũ -su
INAL-people-REF
'people'

(1190) [ˈʰadˌnaː.ɾa] ~ [ˈadˌnaː.ɾa]
/an-na-ɾa/
an -∅ -na -ɾa
shoot-3S-PRS.V.EV-PFV.M
'he is killing[137]'

The example in (1190) tends to be avoided as it raises ambiguity since the root {han-} means 'to be clear,' so initial [h] usually occurs as a pre-aspiration of the following vowel, instead of a plain consonant. In the second environment, epenthetic [h] is inserted between two adjacent

[137] The verb {an-} means to shoot and is frequently employed to denote 'to shoot with a bow or a shotgun, with the intention to kill.'

low central vowels across word boundaries to keep them from occurring simultaneously next to each other:

Environment **2**: a] # [a$^{+stress}$

(1191) [ˈtʃah.la ˌ**h**aːˈw̃ĩː.na]
/te-iahlo-a a-ũĩn-a/
tiahla a- ũĩn -a
3S.M POS.3S-father-REF
'his father'

(1192) [ˈtʃah.la] [ãˈlũ.a] [ˈʰadˌnaː.ɾa]
/te-iahlo-a/ /alũ-a/ /an-na-ɾa/
tiahla alũ -a an -∅ -na -ɾa
3S.M tapir-REF to beat-3S-PRS.V.EV-PFV.M
'he killed the tapir'

(1193) [ˈtʃah.la] [ˌʰãː.gaˈluː.tãː.ɾa]
/te-iahlo-a/ /an-kalut-na-ɾa/
tiahla an- kalut -∅ -na -ɾa
3S.M STAT-to be wet-3S-PRS.V.EV-PFV.M
'he's wet'

5.2.13. Elision

Elision can affect both vocalic and consonantal segments. It can be optional or mandatory.

5.2.13.1. Vowel Elision

Rule: /V/ > ∅

Overall, unstressed vowels are elided to avoid heterosyllabic vowels from occurring next to each other:

(1194) [ˈjah.l**a**]
/iahlo.a/
iahlo -a
CL.male-REF
'old man'

(1195) [ta̰ˈka̰ː.l**a̰**]
/te.a̰kaˀlo.a/
te-a̰kaˀlo-a
3S.CL.female-REF
'she'

(1196) [ˈwajː.a.ˀl**a**] ~ [ˈwajː.a.l**a̰**]
/uai.a.ˀli.a/
uai -aˀli -a
dog-?-REF
'dog'

The low back vowel /a/ can be elided when it occurs between two stressed morphemes or after a low vowel final morpheme, as in (1199):

Rule: /a/ > ∅ (optional)
Environment: σ^{+stress}]_a(_[σ^{+stress})

(1197) [ˌaˈˀke̤ːˌ**rja̤**w̤ː.su] ~ [ˌaˈˀke̤ː.ɾ**a**ˌja̤w̤ː.su]
/a.ˀkel.a.i̯a̤u̯.su/
a- ˀkel -a -i̯a̤u̯ -su
POS.3S-urine-REF-CL.liquid-REF
'his urine'

(1198) [ˈhoːˌ**hẽ**ː.ᵈzu] ~ [ˈhoːh**a**ˌẽː.ᵈzu]
/hoh.a.ẽn.su/
hoh -a -ẽn -su
tinammou-REF-CL.hole-REF
'tinammou nest'

(1199) [aˈl**ã**ː] ~ [aˈlãː.**a**]
/a.lã.a./
alã -su
macaw-REF
'macaw' (general)

Vowel elision is also attested in syllables marked with secondary stress. In examples (1200) and (1201), the morpheme final [+coronal] vowel is followed by the stressed portmanteau morpheme {-i}. In this environment, the coronal vowel /i/ is elided.

Rule: /V/ > ∅ (obligatory)
Environment: coronal vowel]^{+stress} _ ^{+stress}[coronal vowel

(1200) [ʰnãˈɗ**i**ː.ɾa]
/ʰnã.ˀti.i.ɾa/
ʰnãˀti -i -ɾa
to be dirty-2S-PFV.M
'you're dirty'

(1201) [haˈnṳ̃ːˈˀ**ne**ː..ɾa]
/ha.nṳ̃.ˀne.i.ɾa/
hanṳ̃ -ˀne -i -ɾa
to threaten-COP-2S-PFV.M
'you're threatening'

As discussed in Chapter 6, the tone of {-i} is preserved, while the tone from the stressed syllabled of the stem is deleted.

5.2.13.2. Consonant Elision

Coda of /l/ final morphemes becomes elided if followed by [-continuant] consonant initial morphemes. When elision takes place, the nucleus undergoes compensatory lengthening:

Rule: /_l/ > ∅ (obligatory)
Environment: _l] ^{+stress} _ [C [+obstruent]
[-continuant]

(1202) [ˈw̃ãȷ̃ːˌka̤ʔ.ᵗsu]
/ũãĩ**l**.ka̤ˀt.su/
ũãĩl -ka̤ˀt -su
flute-CL.cylindrical-REF
'big flute'

(1203) [ˈw̃ãȷ̃ː.te.su]
/ũãĩ**l**-te-su/
ũãĩl-te-su
flute-CL.generic-REF
'flute people'

(1204) [ˈsuː.naˌhɛː.ɾa]
/su**l**.na.he.ɾa/
sul -∅ -nahe -ɾa
to beat-3S-PST.V.EV-NPFV.M
‘he had killed’

Elision of codas is also observed with nasals /n, ˀn/. Whenever coda /n/ follows a nasal vowel /Ṽ/, it can be elided:

Rule: /(C)Ṽn/, /(C)Ṽˀn/ > [Ṽː] (optional)
Environment: (C)Ṽn, (C)Ṽˀn]$^{+stress}$ _ [C

(1205) [ˈkʰ**ũ**ː.ᵈzu] ~ [ˈkʰ**ũ**ː.ᵗsu] ~ [ˈkʰũn.ᵈzu] ~ [ˈkʰũn.ᵗsu]
/kʰũn.su/
kʰũn -su
wolf apple-REF
‘wolf apple’

(1206) [saˈ**w̰̃ã̰**ː.ᵈzu] ~ [saˈ**w̰̃ã̰**ː.ᵗsu] ~ [saˈw̰̃ã̰n.ᵈzu] ~ [saˈw̰̃ã̰n.ᵗsu]
/sa.ṵ̃ã̰ˀn.su/
saṵ̃ã̰ˀn -su
‘ant, sp.’

In examples (1205) and (1206), evidence of the underlying coda /n/ is only perceived by the presence of epenthetic consonants [t] ~ [d], attached to the following morpheme {-su}. See section 5.2.12 for a detailed description of epenthesis. Note that, whenever there is no underlying nasal coda, no consonant is added to {-su}:

(1207) [ˈũː.su] *[ˈũː.ᵗsu]
/ũ.su/
ũ -su
capybara-REF
‘capybara’

(1208) [aˈlãː.su] *[aˈlãː.ᵗsu]
/a.lã.su/
alã -su
macaw-REF
‘macaw’ (general)

Glottal consonants /ʔ/ and /h/ occurring in the coda can also become elided. Elision of coda /h/ is optional, and is attested when coda /h/ of a stressed syllable is followed by a consonant initial morpheme:

Rule: /(C)Vh/ > [(C)Vː] (optional)
Environment: _h]$^{+stress}$ _ [C

(1209) [ˈɗ**u**ː.su] ~ [ˈɗu**h**.su] ~ [ˈɗuː.ʰsu]
/ˀtuh.su/
ˀtuh -su
woman-REF
‘woman’

(1210) [ka̰ˈl**ḭ**ːˌnaː.ɾa] ~ [ka̰ˈlḭ**h**ˌnaː.ɾa]
/kalih-na-ɾa/
kalih -∅ -na -ɾa
to be happy-3S-PRS.V.EV-PFV.M
‘he’s happy’

Elision of coda /ʔ/ occurs before final suffix {-su}.

Rule: /(C)Vʔ/ > [Vː] (mandatory)
Environment: _ʔ]+stress _ [su

(1211) [ˈkʰajː.su]
/kʰai**ʔ**.su/
kʰaiʔ -su
coati-REF
‘coati’

(1212) [ˌaːˈnãw̃ː.su]
/a.nãũ**ʔ**.su/
a- nãũʔ -su
INAL-maggot-REF
‘maggot’

Coda /ʔ/ is revealed when the following morpheme is vowel initial, as in (1070). Compare with (1071), which shows no coda /ʔ/ in the lexical representation.

(1213) [ˈkʰajː.**ʔ**a] *[ˈkʰajː.a]
/kʰaiʔ.a/
kʰaiʔ -a
coati-REF
‘coati’

(1214) [ˌaːˈlajː.a] *[ˌaːˈlajː.**ʔ**a]
/a.lai.a/
alai -a
sloth-REF
‘sloth’

5.2.14. Compensatory Lengthening

Compensatory lengthening is normally triggered by resyllabification or elision of coda consonants, occurring in stressed positions, as shown in the examples below.

Rule: /(C)VC/ > [(C)Vː] (mandatory)

a) Examples of compensatory lengthening after resyllabification of codas:

(1215) [ˈp**i**ː.ta]
/pit.a/
pit -a
gourd-REF
‘gourd’

(1216) [ˈkwaˈn**e**ː.ka]
/kua.nek(i).a/
kuanek(i) -a
jandaya-REF
‘jadaya parakeet’

(1217) [ˌaːˈn**ãw̃**ː.ʔa]
/a.nãũʔ.a/
a- nãũʔ -su
INAL-maggot-REF
‘maggot’

(1218) [ˈn**ṵ̃**ːˌs**ẽ**ː.na]
/nṵ̃s.ẽn.a/
nṵ̃s -ẽn -a
pestle-REF
‘pestle’

(1219) [ˈw**i**ː.ˌɾiː.ɾa]
/uil.i.ɾa/
uil -i -ɾa
to be pretty-2S.PRS-PFV.M
'you're pretty'

(1220) [ˈh**aw**ː.ɗa] ~ [ˈh**aw**ː.ta̰]
/hauˀt.a/
hauˀt -a
arrow-REF
'arrow'

(1221) [ˌh**u**ːˈˀk**ẽ**ː.ha]
/huˀk(i).ẽh.a/
huˀk(i) -ẽh -a
bow-CF.string-REF
'vine'

(1222) [ˈh**aj**ː.sa̰ˌko̰ː.su]
/haisˀ.a.ko̰.su/
haisˀ -a -ko̰ -su
crop-REF-CF.land-REF
'farm'

(1223) [ˌɗaːˈ**ja̰**ː.ɾa̰]
/ˀta.ḭa̰ˀl.a/
ˀta- ḭa̰ˀl -a
1.POS-friend-REF
'my friend'

(1224) [ˈn**ĩ**ː.ˀna] [ˈn**ĩ**ː.na̰]
/nĩˀn.a/
nĩˀn -a
skunk-REF
'skunk'

Note that compensatory lengthening does not take place with resyllabified coda /hˀ/.

b) Examples of compensatory lengthening after elision of codas:

(1225) [ˈkʰ**aj**ː.su]
/kʰai**ʔ**.su/
kʰaiʔ -su
coati-REF
'coati'

(1226) [ˈh**o**ː.ˌnaː.ɾa] ~ [ˈhohˌnaː.ɾa]
/ho**h**.na.ɾa/
hoh -∅ -na -ɾa
to swim-3S-PRS.V.EV-PFV.M
'he's swimming'

(1227) [ˈh**ũ**ː.ˌnaː.ɾa]
/hũ**n**.na.ɾa/
hũn -∅ -na -ɾa
to be pink-3S-PRS.V.EV-PFV.M
'it's pink'

(1228) [waˈl**u**ː.ʰsu]
/ualu**hˀ**.su/
ualuhˀ -su
vulture-REF
'vulture'

5.2.15. Simplification of Complex Consonants

Simplification of complex consonants is attested with aspirated and glottalized consonants /Cʰ, ˀC/ in stressed positions within a word. Although simplification of glottalized consonants usually occurs at morpheme boundaries, it is also attested within the same polysyllabic morpheme. Overall, simplification of complex consonants usually involves a glottalized consonant in the coda of a stressed morpheme. In most cases, it takes place when the following morpheme is consonant initial, but attestations of simplification with a following vowel-initial morpheme are also observed.

- *Simplification of coda glottalized consonants*

a) Simplification of glottalized plosives [ˀt, ˀk]

Glottalized plosives /ˀt, ˀk/ undergo simplification if the following morpheme is consonant initial:

Rule: /_ˀt, ˀk/]$^{+stress}$ > _ʔ] _ [C_ (mandatory)
Environment: /_ˀC/]$^{+stress}$ _ [C_

(1229) [ˈhiː.saˌka̰**ʔ.t**su]
/his.a.kaˀt.su/
his -a kaˀt -su
stem-REF-CL.cylindrical-REF
'tree' (general)

(1230) [ˈi**ʔ**ˌ**t**ãːɾa]
/iˀt.na.ɾa/
iˀt -∅ -na -ɾa
to blow-3S-PRS.V.EV-PFV.M
'the wind is blowing'

(1231) [ˈhu**ʔ.k**su] ~ [ˈhu**ʔ.k**isu]
/huˀk(i).su/
huˀk(i) -su
bow-REF
'bow'

Note that in (1231) simplification still takes place when epenthetic [i] is added between morphemes. If glottalized plosives /ˀt, ˀk/ occurring in the coda of stressed syllables are followed by a vowel-initial morpheme, simplification does not occur. In this context, glottalized voiceless alveolar plosive /ˀt/ can be imploded or become voiced alveolar stop [d], while /ˀk/ undergoes neither implosivization nor voicing:

(1232) [ˈhiː.saˌkaː.t**a̰**] ~ [ˈhiː.saˌkaː.d**a̰**] ~ [ˈhiː.saˌkaː.ɗa] ~ [ˈhiː.saˌkaː.ɗ**a̰**]
/his.a.kaˀt.a/
his -a kaˀt -a
tree-REF-CL.cylindrical-REF
'tree' (general)

(1233) [ˈhuː.k**a̰**] ~ [ˈhuː.ˀka] ~ [ˈhuː.ˀk**a̰**]
/huˀk(i).a/
huˀk(i) -su
bow-REF
'bow'

As discussed in the section on assimilation, resyllabification of coda glottalized stops can also trigger glottalization of the following vowel, which is realized as creaky voice via assimilation, as indicated in bold.

b) Simplification of glottalized fricative /hˀ/

In contrast with what has been discussed on glottalized plosives, simplification of glottalized fricatives is attested if the following morpheme is vowel or consonant initial, via resyllabification. According to Kroeker (2001:83), “when a morpheme-final /Cx/ precedes a morpheme-initial /s/, the /x/[138] metathesizes to follow the /s/.” In my analyzes of Kithãulhu, simplification of glottalized fricative /hˀ/ does not trigger the resyllabification of the glottal phase to final morpheme {-su}. However, a longer value for the duration of the onset of final suffix {-su} is attested, which may signal the loss of the glottal phase through gemination of the following consonant.

The glottalized fricative /hˀ/ in the coda of a stressed syllable undergoes simplification if followed by a vowel initial morpheme. The glottal phase is resyllabified:

Rule: /hˀ/ > _h$_{\alpha}$] _ [ʔ$_{\alpha}$V$_{\beta}$ (obligatory)
Environment: _hˀ]$^{+stress}$ _ [V

(1234) [ɐːˈsa**h.ʔ**a]
/a.sahˀ.a/
a- sahˀ -a
INAL-penis-REF
‘penis’

(1235) [ˈɗu**h.ʔ**a]
/ˀtuhˀ.a/
ˀtuhˀ -a
urucum-REF
‘*urucum*’

(1236) [kaʔˈjṵ**h.ʔ**aˌnṵ̃ː.su]
/kaʔ.ḭ̃ṵhˀ.nṵ̃.su/
kaʔḭṵhˀ -a -nṵ̃ -su
meat-REF-CL.dough-REF
‘*paçoca*’

(1237) [ˈo**h.ʔ**a]
/ohˀ.a/
ohˀ -a
sky-REF
‘sky’

The /hˀ/ also undergoes simplification and resyllabification of the glottal phase if followed by a consonant initial morpheme other than {-su}:

Rule: /hˀ/ > _h$_{\alpha}$] _ [C$_{\beta}$V$_{\beta}$]
Environment: /_ˀC/]$^{+stress}$ _ [C

(1238) [ˌohˈ**ˀs**ĩː.ᵈzu] ~ [ˌohˈ**ˀs**ḭ̃n.ᵈzu]
/ohˀ.sĩn.su/
ohˀ -sĩn -su
sky-meat-REF
‘cloud’

Note that, once the glottal phase is resyllabified in (1238), it can also affect the realization of the following vowel.

- *Simplification of onset glottalized consonants*

Simplification of the glottal phase of glottalized consonants is also attested within the same morpheme. For simplification of glottalized onsets to occur, the morpheme must be polysyllabic and the glottalized consonant must occur intervocalically. In all examples, the nucleus of the first syllable must be the low central vowel /a/. This phonological environment may render four surface realizations for the morpheme: 1) [(C)aʔˈCVː], 2) [(C)aˈˀCVː], 3) [(C)a̰ˈˀCVː], and 4) [(C) a̰ʔˈCVː]

[138] Letter <x> represents a glottal stop in most publications on Southern Nambikwara.

Rule: /(C)aˀC(V)(C)/ > [(C)aʔˈCVː] (optional)
Environment: (C)a_ˀC

(1239) [a**ʔˈl**uː.su] ~ [**a**ˈ**ˀl**uː.su]~ [a̰ˈ**ˀl**uː.su] ~ [a̰ʔˈluː.su]
/a.ˀlu.su/
aˀlu -su
mantis-REF
‘mantis’

(1240) [k**aʔˈd**iː.su] ~ [k**a**ˈ**ɗ**iː.su] ~ [k**a̰**ˈ**ɗ**iː.su] [k**a̰ʔˈd**iː.su]
/ka.ˀti.su/
kaˀti -su
lizard-REF
‘lizard, sp.’

(1241) [k**aʔ**ˈlaːˌnaː.ɾa] ~ [kaˈ**ˀl**aːˌnaː.ɾa] ~ [**ka̰**ˈˀlaːˌnaː.ɾa] ~ [**ka̰ʔ**ˈlaːˌnaː.ɾa]
/ka.ˀla.na.ɾa/
kaˀla -∅ -na -ɾa
to be many-3S-PRS.V.EV-PFV.M
‘they’re many’

As discussed in Chapter 4, examples (1239) – (1241) can raise ambiguities in relation to the underlying syllable structure of the roots. However, note that, if glottal stop /ʔ/ was assigned to the first syllable in the lexical representation, stress would be placed in the penultimate syllable of the morpheme, instead of the ultimate one. As seen in (1239) – (1241), that is not the case. Consequently, stressed forms such as *[ˈaʔ.lu.su] and *[ˈkaʔlaˌnaːɾa] are not permitted.

- *Simplification of aspirated consonants*

The aspirated voiceless velar plosive /kʰ/ can also be simplified. When simplification occurs, it loses the velar phase and is realized as voiceless glottal fricative [h]. It is an optional rule:

Rule: /kʰ/ > [h] (optional)
Environment: [_$^{+\text{ stress}}$

(1242) [ˈ**kʰ**w̰a̰ː.ʰl̥u] ~ [ˈ**h**w̰a̰ː.ʰl̥u]
/kʰṵa̰l.su/
kʰṵa̰l -su
pineaple-REF
‘pineapple, sp.’

(1243) [ˈ**kʰ**ajː.ʔa] ~ [ˈ**h**ajː.ʔa]
/kʰaiʔ.a/
kʰaiʔ -a
coati-REF
‘coati’

5.2.16. Devoicing

Aspirated alveolar nasal /ʰn/ can become devoiced and phonetically realized as voiceless alveolar nasal [n̥]. Devoicing of /ʰn/ is an optional rule, and it is attested at morpheme boundaries.

Rule: /ʰn/ > [n̥] ~ [ʰn̥] (optional)
Environment: _ [ʰn

(1244) [ˈteᵈn.ᵗsaˌ**ʰn̥**aː.wa] ~ [ˈteᵈn.ᵗsaˌ**n̥**aː.wa] ~ [ˈteᵈn.ᵗsaˌʰnaː.wa]
/ten.sa.ʰna.ua/
ten -sa -ʰna -ua
to want-1O-NV.EV-NPFV.M
'I want'

The alveolar lateral /l/ can become devoiced, hardened and be realized as voiceless alveolar lateral fricative [ɬ] at morpheme boundaries. Devoicing of /l/ is attested when it occurs in the coda and is followed by a stressed morpheme, whose onset is the voiceless glottal fricative /h/.

Rule: /l/ > [ɬ] (obligatory)
Environment: _l] _ [h+stress

(1245) [ˈdajː.na] [ˌuːˈ**ɬe**ːˌaː.wa]
/ˀtai.na/ /ul.he.a.ua/
ˀtaina ul -he -a -ua
1S to be far-to be-1S.PRS-NPFV.M
'I'm far'

5.2.17. Glottalization

Glottalization can affect segments on both edges of stressed syllables. It is attested in word-initial positions, affecting the onset, and medial position within a word in which the coda is affected.

- *Word-initial positions*

Glottalized plosives /ˀp, ˀt, ˀk/ can be phonetically realized as implosives [ɓ, ɗ, ɠ]. Implosivization is only attested with glottalized plosives occurring in the onset and it is not necessarily triggered by a following creaky voice vowel, as in (1247). Implosive [ɠ] only occurs if /ˀk/ follows nasal creaky vowels or a nasal creaky vowel:

a) **Rule**: ˀt_ > [ɗ] (optional)

(1246) [ˈ**ɗ**odˌnaː.ɾa] ~ [ˈdodˌnaː.ɾa] ~ [ˈˀtodˌnaː.ɾa]
/ˀton.na.ɾa/
ˀton -∅ -na -ɾa
to buil-3S-PRS.V.EV-PFV.M
'he's building'

(1247) [ˈ**ɗ**ṵ̃ːˌnaː.ɾa] ~ [ˈdṵ̃ːˌnaː.ɾa]
/ˀtṵ̃.na.ɾa/
ˀtṵ̃ -∅-na-ɾa
to suck-3S-PRS.V.EV-PFV.M
'he's sucking'

b) **Rule**: ˀp_ > [ɓ] (optional)

(1248) [jaˈ**ɓ**ãn.ᵈzu] ~ [jaʔˈbãn.ᵈzu] ~ [jaʔˈpãn.ᵈzu]
/ia.ˀpãn.su/
iaˀpãn -su
taioba-REF
'*taioba*'

(1249) [**ɓ**ḭˈ**ɓ**ḭː.taˌˀli.su] ~ [bḭˈbḭː.taˌˀli.su]
/ˀpḭ.ˀpḭt.a.ˀli.su/
ˀpḭˀpḭt -aˀli -su
RED.finch-?-REF
'finch, sp.'

c) **Rule**: /ˀk/ > [ɠ] (optional)
Environment: Ṽ̰_ / n _

(1250) [ˈkw̰̃ã̰ː.ɠi.su] ~ [ˈkw̰̃ã̰ː.ˀki.su]
/kṵ̃ã̰ˀk(i)-su/
kṵ̃ã̰ˀk(i)-su
grave-REF
'grave'

(1251) [w̰a̰ˈtʰiᵍŋ.ɠiˌnaː.ɾa] ~ [w̰a̰ˈtʰiᵍŋ.giˌnaː.ɾa]
/ṵa̰.tʰin.ˀki.na.ɾa/
ṵa̰- tʰinˀki -∅ -na -ɾa/
INST-to shoot-3S-PRS.V.EV-PFV.M
'he's shooting'

- *Word-medial position*

When glottalization occurs at morpheme boundaries, it involves sequences of heterosyllabic consonants, which share the same manner of articulations, such as plosive-plosive and fricative-fricative. The segment which undergoes glottalization is the one in the coda of the stressed syllable, which is realized as voiceless glottal plosive [ʔ]. Although plosive-plosive and fricative-fricative sequences generate a glottal stop in the coda, the onset of the following morpheme is affected in different ways. It is a mandatory rule.

a) Plosive-plosive sequences

Plosive-plosive sequences always involve any sequence of voiceless plosives such as /t.k/, /t.t./ /k.t/, /k.k/ at morpheme boundaries. In these sequences, the coda is phonetically realized as voiceless glottal plosive [ʔ] and it is resyllabified to the onset of the following morpheme, which becomes a phonetic glottalized consonant. If the coda is a glottalized consonant, the following rules occur:

- Complex consonant simplification: /ˀC/ > [ʔ.C].
- The glottal phase [ʔ] is kept in the coda, followed by resyllabification of [C].
- The resyllabified [C] is glottalized and realized as [ʔ].
- Following initial stop /C/ becomes phonetically glottalized [ˀC] after resyllabification.

If the onset of the following syllable is voiceless alveolar plosive /t/, it becomes glottalized voiceless alveolar consonant [ˀt]. On the other hand, if the onset is voiceless alveolar plosive, it is realized as glottalized velar consonant [ˀk].

Rule: /t, k, ˀt, ˀk/ > [ʔ] (mandatory)
Environment: _t, k, ˀt, ˀk]$^{+\text{ stress}}$ # [t, k_

(1252) [ˈwajː.**ʔ**ki.su]
/uaik.ki.su/
uaik -ki -su
peanut-CL.seed-REF
'peanut'

(1253) [kaˈja̰**ʔ**ˌˀki.su]
/kua.ḭa̰ˀt.ki.su/
kuaḭa̰ˀt -ki -su
corn-CL.seed-REF
'corn kernel'

(1254) [ˌɗaːˈjṵ**ʔ**ˌkaː.ɗa]
/ˀta.ḭṵˀk(i).kaˀt(i).a/
ˀta- ḭṵˀk -kaˀt(i) -a
POS.1S-foot-GR-REF
'my feet'

b) Fricative-fricative sequences

Fricative-fricative sequences always involve the plain voiceless alveolar fricative /s/ or its glottal counterpart /ˀs/ in the coda of a morpheme followed by a morpheme initial voiceless alveolar fricative /s/. In these sequences, the coda is glottalized and phonetically realized as voiceless glottal plosive [ʔ]. As a result, an epenthetic voiceless alveolar plosive [t] is added to the onset of the following morpheme, rendering complex onset [ts].

Rule: /s, ˀs/ > [ʔ] (mandatory)
Environment: _s, ˀs]$^{+\text{ stress}}$ _ [s_

(1255) [ˈhajʔ.tsu]
/haisˀ-su/
haisˀ -su
crop-REF
'crop'

(1256) [ˈsi**ʔ**.tsu]
/sis-su/
sis -su
grass-REF
'grass' (general)

The nasal /n/ can also become debuccalized and realized as [ʔ]:

Rule: /n/ > [ʔ] (optional)
Environment: _n]$^{+\text{ stress}}$ _ [C

(1257) [ˈta**ʔ**ˌnaː.ɾa] ~ [ˈta̰dˌnaː.ɾa]
/ta̰n.na.ɾa/
ta̰n -∅ -na -ɾa
to be bitter-3S-PRS.V.EV-PFV.M
'it's bitter'

5.2.18. Loss of Secondary Articulation

Glottalized plosives /ˀp, ˀt/ can be lenited and lose the glottal phase of their secondary articulation. When glottalized plosives lose their secondary articulation, they can be realized as voiced stops [d, b] or implosives [ɓ, ɗ], as described.

Rule: /ˀp, ˀt/ > [b, ɓ, d, ɗ]
Environment: _V̰

(1258) [**b**ḭˈ**b**ḭː.taˌlḭ.su] ~ [**ɓ**ḭˈ**ɓ**ḭː.taˌˀli.su]
/ˀpḭ.ˀpḭt.a.ˀli.su/
ˀpḭˀpḭt-aˀli-su
RED.finch-?-REF
'finch, sp.'

(1259) [saˌ**d**ḛː.saˈ**d**ḛᵈn.ᵗsa] ~ [saˌ**ɗ**ḛː.saˈ**ɗ**ḛᵈn.ᵗsã]
/sa.ˀtḛ.sa.ˀtḛn.sã/
saˀtḛsaˀtḛn -sã
RED.to be green-SS
'to be green'

Chapter Summary
Chapter 5 presented the main morphophonological rules observed in Kithãulhu, namely: vowel alternation, vowel lengthening, nasalization, assimilation, dissimilation, voicing, devoicing, pre- and post-aspiration, epenthesis, coalescence, elision, palatalization, compensatory lengthening, gemination, complex consonant simplification, and glottalization. Most of the rules are optional, but there are also mandatory rules frequently observed at morpheme

boundaries. As discussed, segments occurring in the syllable coda are the most prone to undergoing morphophonological rules, followed by the ones occurring in the onset and the nucleus, respectively. The segmental structure of morphemes as well as stress are two relevant criteria for determining the environments in which most of the rules take place. As seen, one single morpheme can undergo multiple morphophonological rules. When multiple rules are observed in one single morpheme, it seems that the rules follow the principle of directionality of syllabification described in Chapter 4, starting from the leftmost edge of the syllable and moving to the right.

Chapter 6: The Tone System

Introduction

This chapter provides a description of the tone system. According to Hyman (2006: 229), a tone language is a language "(...) in which an indication of pitch enters into the lexical realization of at least some morphemes." (Hyman 2006: 229). In Kithãulhu, tone can be perceived by the indication of pitch into the lexical realization of all morphemes. The first part of this chapter deals with the phonetic realizations of tone. I show that tone is used to distinguish lexical items as well as to mark grammatical functions such as tense and aspect and to indicate certain aspects of morphosyntax. Following the description of the phonetic realization of tone, I discuss the phonology of tones, defining the tone-bearing units (TBUs) and tonal rules.

6.1. Initial Description

Tone is realized in three different patterns, depending on whether there is a high target as well as where the high target is placed in the syllable. Depending on whether the high target is realized at the beginning or at the end of a syllable, tonal patterns with a high target are auditorily perceived as rises or falls. In the absence of a high target, pitch is realized and perceived as low level. Although syllables with a high target are frequently attested in the lexicon, syllables without a high target are the most frequent.

Tones are attested in the entire Nambikwaran lexicon and all syllables are marked with one of the three tonal patterns. Furthermore, all borrowed words from Brazilian Portuguese can also display tones (with or without a high target). As I discuss later, every stressed syllable of words of Portuguese origin displays a high target – either a fall or a rise.

Tones in nominal and verbal morphology also behave differently. In word-formation processes, the tonal melody of nominal stems does not vary, but change in the tonal melody of verbal stems is observed when flexional morphology is added to the stem. The variation in the melody of verbal stems is predictable in certain verbal classes and can be explained by the interaction with the lexical as well as with grammatical tones occurring in the verbal morphology. The change of the stem melody in verbs seems to occur to ensure that semantic differences of segmentally identical small utterances are perceived through an additional acoustic cue (pitch). Since the tone system displays specific rules in nouns and verbs, I will start by describing the nouns and then move to the description of verbs. Grammatical tone is covered in the verb section.

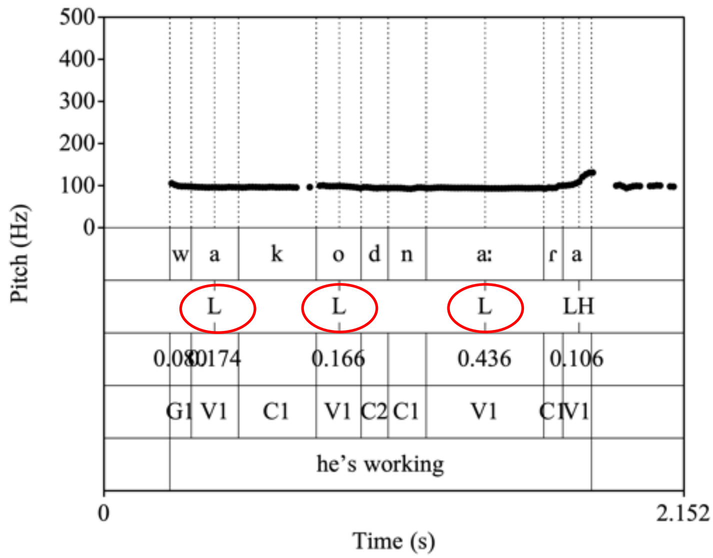
6.2. High x Low Pitch

As most Kithãulhu words are polymorphemic, words can display tonal melodies due to the variation in pitch that may involve a Low (L) or High (H) target. Example of H and L targets are shown below.

- **Examples of L targets**:

In Figure *20*, note that almost all syllables in the word /wakon-na-ɾa/ display L targets. The final syllable displays a rising contour:

Figure 20: L targets in the word /wakon-na-ɾa/, ‘he’s working.’

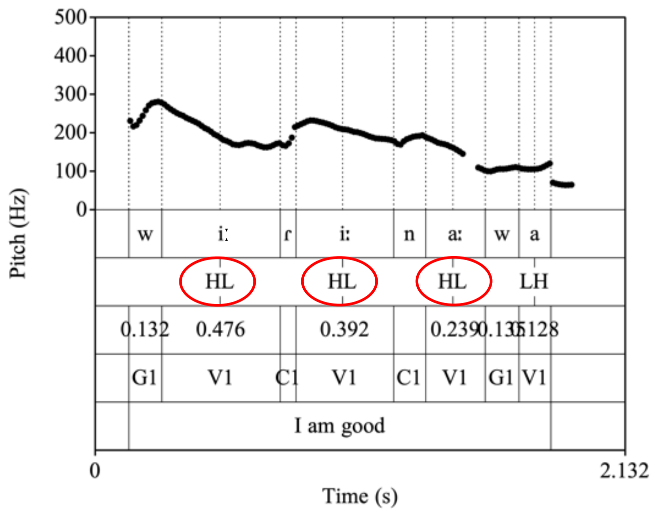


- **Examples of H targets**:

As previously discussed, H targets can be syllable initial or final, generating falling (HL) and rising (LH) contours. Note that the H targets are higher on the leftmost edge of the word and tend to decrease in height on the rightmost edges.

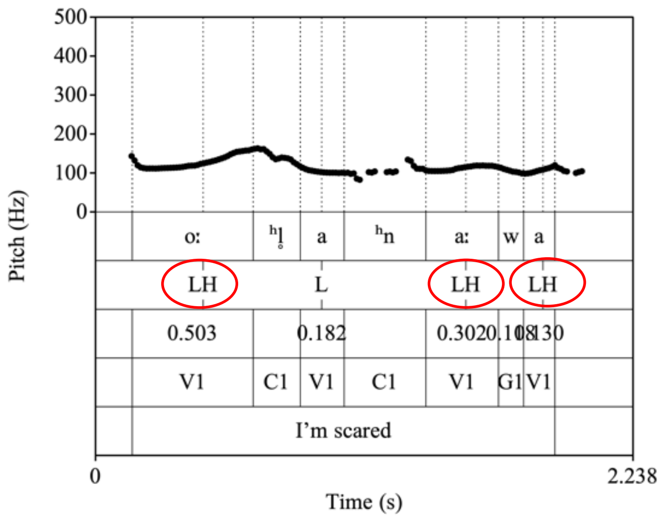
a) Syllable initial H target (HL):

Figure 21: Syllable initial H targets in the word /uin-in-a-ua/, ‘I’m good.’



b) Syllable final H target (LH):

Figure 22: Syllable final H targets in the word /ol-sa-ʰna-ua/, 'I'm scared.'



c) As illustrated in Figure *20* – Syllable final H target (LH):

Figure *22*, polysyllabic words can display combinations of L and H targets. Alternation between L and H targets gives Nambikwaran words particular melodies, which can be predicted based on the tonal structure of morphemes.

Part 1: Phonetic realizations of tone [T]

6.3. Tonal Melodies

In this initial description, I present the phonetic realizations of tone [T]. Tonal melodies are allowed within words. This is probably because all syllables are marked with tone and all morphemes have a particular tone pattern – or melody, in the case of polysyllabic morphemes. Most grammatical words (henceforth, GWs) are comprised of a fixed tone melody, which is lexically assigned to them. However, changes in the tone melody of morphemes, which affect the general melody of GWs, are also attested, as described in section 6.15.2. Overall, Nambikwaran GWs have a fixed tone pattern in their final syllables. The tone pattern of GW-final syllables can be classified according to the word class, as described below:

Nouns:	display a fixed final [LH]-toned syllable.
Numerals:	display a fixed final [HL]-toned syllable[139].
Adverbs:	display a fixed [L]-toned syllable[140].
Verbs:	display a [L]- [LH]- or [HL]-toned syllable, depending on the tone pattern of the final suffix.

[139] An exception to this generalization is the number five, /hˀiˀk(i)-a-hati/, which was recently included in the lexicon for teaching purposes and displays a final LH-toned syllable.

[140] I describe adverbial words in terms of form instead of function. Adverbial words derived from nouns, such as /hĩn-a/, 'now,' and /tin-a/, 'here,' display an LH-toned syllable because of final suffix {-a}, which is typical of nominal morphology. These words function as adverbs, but they are treated here as nouns.

Some examples of tone patterns according to word classes are given below:

a. Nouns:

	Transcription	Melody	Meaning
(1260)	[ˈw̃ẽː.**sa**]	[L.**LH**]	‘child’
(1261)	[ˈk^{h}ajː.**ʔa**]	[L.**LH**]	‘coati’
(1262)	[ˈhoh.**su**]	[LH.**LH**]	‘tinammou’ (general)
(1263)	[taˈkiː.**su**]	[L.LH.**LH**]	‘monkey, sp.’
(1264)	[kaʔˈdoː.**su**]	[L.HL.**LH**]	‘monkey, sp.’
(1265)	[waˈliː.**ta̰**]	[LH.HL.**LH**]	‘rubber’

b. Numerals

(1266)	[kaˈnaː.**ki**]	[L.L.**HL**]	‘one’
(1267)	[ˈhaː.**li**]	[HL.**HL**]	‘two’

c. Adverbs

(1268)	[ˈsoː.**ˀli**]	[HL.**L**]	‘only’
(1269)	[waˈsuː.**tḭ**]	[L.HL.**L**]	‘fast’
(1270)	[ˈuː.**li**]	[LH.**L**]	‘far’

d. Verbs

(1271)	[ˌw̰a̰ːˈhi^{d}n.diːˌnaː.**nã**]	[LH.L.LH.L.**HL**]	‘he’s washing’ (pensive)
(1272)	[ˌw̰a̰ːˈhi^{d}n.diːˌnaː.**na**]	[LH.L.LH.L.**LH**]	‘he’s washing’ (told to a woman)
(1273)	[kaˈlaːˌnaː.**wa**]	[L.L.HL.**LH**]	‘I’m climbing’
(1274)	[kaˈla^{d}nˌˀna̰ː.**wa**]	[L.LH.L.**LH**]	‘I’m not climbing’
(1275)	[kaˈlaː.**sã**]	[L.LH.**L**]	‘to climb’

As seen in a. – d., all tone patterns can occur within GWs, except for numerals, which are not attested with [LH] tones. Furthermore, most attested stressed syllables of adverbial words, whether they are derived from a verb as in (1269) or they have apparently no added morphology as in (1268), display an [HL] contour, as illustrated. As observed, numerals can also be distinguished from the other word classes, such as nouns and verbs, by the lack of an [LH] contour – which is only attested in the recently adopted numerals for ‘five’ and ‘ten,’ both of which are derived from nominal constructions, hence the [LH]. This observation suggests that there are phonological constraints associated with the distribution of tones according to word class.

Therefore, the examples in a. – d. suggest that tone in Nambikwara is morphologically relevant, since “a whole word class or a derivational category is marked by tone” (Gussenhoven 2004: 46). Furthermore, I argue that tone is also used in a syntactically relevant manner because particular tones are used to characterize phrases (such as the noun phrase, which is marked by a syllable-final [LH] tone) and types of clauses (for instance, main clauses), as discussed in section 6.14.2.

The examples in a. – d. also show that GWs can host all three contours within their structure simultaneously, as seen in (1264). In addition, sequences of the same tone pattern can occur freely within a GW without necessarily affecting the tonal patterns of the morphemes in it, as

seen in (1262), (1266), and (1267). However, some tone sequences can affect the melody of verbal morphemes, such as in the stem {kaˈla} seen in (1273) and (1274). Changes of the tone patterns/melody of roots and suffixes are covered in section 6.15.
In contrast with the GW, which allows all three contours to occur within it, roots and affixes are not allowed to display all of them simultaneously. The non-permissibility of three contours simultaneously in roots and affixes can be explained based on constraints related to the morphological and phonological structure. As discussed in Chapter 4, most Nambikwaran roots and suffixes are comprised of a maximum of two syllables. Three- and four-syllabled roots can occur, but predominantly because of partial or full reduplication of disyllabic roots. Monosyllabic roots and affixes can display one of the three contours.
Polysyllabic roots and suffixes can be monotonal, i.e. displaying the same tone pattern across their structure, or bitonal, displaying two different tone patterns. Sequences of [L] tones only allow monotonal sequences to occur within the same root or suffix[141]. Examples of monotonal and bitonal roots/stems and suffixes are given below. Examples with prefixes are not given because they are always monosyllabic, and, therefore, monotonal:[142]

a. Monotonal morphemes:

- *stems*:

{a.lã}[L.L] ‘macaw’ (general)

(1276) [aˈlãː.su] [**L.L**.LH]
/a.lã.su/
alã -su
macaw-REF
‘macaw’ (general)

{ka.ian}[L.L] ‘to be wet’

(1277) [kaˈjadˌnaː.ɾa] [**L.L**.L.LH]
/ka.ian.na.ɾa/
kaian -∅ -na -ɾa
to be wet-3S-PRS.V.EV-PFV.M
‘he’s wet’

- *suffixes*:

{ka.lo}[L.L]

(1278) [ˈw̃ãː.la.**ka**ˌ**lo**ː.su] [LH.LH.**L.L**.LH]
/ũãl.a.ka.lo.su/
ũãl -a -kalo -su
skin-REF-CL.flat-REF
‘cloth’

[141] In reduplication, H targets can be reduplicated. Reduplication of H targets are not covered in this dissertation. For two different overviews of reduplicated morphemes, see Kroeker (2001) and Costa (2020).
[142] I do not consider prefixal constructions such as {ˀta} 1.POS + {ṵa̰} 2.POS in this analysis.

b. Bitonal morphemes:

- *stems*:

{ha.lo}[L.LH] 'field, land'

(1279) [**ha**ˈ**lo**ː.ʷa] [**L**.**LH**.LH]
/ha.lo.a/
halo -a
field-REF
'field, land'

{haˀnũl}[L.HL] 'pineaple, sp.'

(1280) [**haʔ**ˈ**nũ**ː.ʰl̥u] [**L**.**HL**.LH]
/ha.ˀnũl.su/
haˀnũl -su
pineapple-REF
'pineaple, sp.'

- *suffixes*:

{(i)ah.ˀli} '2S.PL'

(1281) [ˈa̰jː.ˌ**ɾah**ˈ**ˀli**ː.ɾa] [L.**L**.**HL**.LH]
/a̰ḭl̃.(i)ah.ˀli.ɾa/
a̰ḭl -(i)ahˀli -ɾa
to go hunting-2S.PL-PFV.M
'you're going hunting'

Note that in all the examples above, only the stressed syllable gets an H target. In addition, not all stressed syllables are marked with an H target, as seen in (1276) and (1281).

6.4. Tonal Contrasts

Tone is contrastive in stressed syllables within roots/stems, and in certain verbal suffixes. Overall, tonal minimal pairs mostly apply to monosyllabic morphemes, but there are few examples of tonal contrasts in disyllabic morphemes.[143]
Tonal contrasts are usually observed in morphemes whose stressed syllables have an L versus an H target, i.e. either [L] x [HL] or [L] x [LH], and seldom contrasting two high targets, namely [HL] x [LH]. Although occurrences of minimal pairs are relatively frequent in both nominal and verbal roots, examples of morphemes contrasting all three tone patterns, [L] x [HL] x [LH] are only attested in verbal words.

[143] One example of a tonal contrast in disyllabic morphemes is [L] x [HL]:

/ia.na̰l.a/	[jaˈ**na̰**ː.la]	[L.**L**.LH]	/iana̰l-a/	lizard-REF	'lizard, sp.'
/ia.nal.a/	[jaˈ**na**ː.la]	[LH.**HL**.LH]	/ianal-a/	jaguar-REF	'jaguar'

Note that in this pair, there is also a segmental opposition, namely /a̰/ : /a/.

6.4.1. Tonal Contrasts in Nominal Morphology:

Tonal minimal pairs in nominal morphology are frequently attested within roots with segmentally identical surface realizations. You may notice that some roots displaying a tonal contrast in the surface sometimes have contrastive segmental structures in the lexical representation – which usually pertains to the coda, as in (1285) and (1287). If segmental contrasts are lost in the surface representation due to morphophonological constraints, the phonemic contrast is usually indicated by tone. No minimal pairs for [HL] x [LH] are attested in nominal roots.

i. Roots/Stems

a) [L] x [HL]

Contrastive [L] x [HL] within stems are less frequently attested than contrastive [L] x [LH].

Stem: {ṵ̃ḭ̃} 'potato, frog, sp.'

	[**L**.LH]		[**HL**.LH]
(1282)	[ˈ**w̰̃ḭ̃**ː.su] 'potato'	(1283)	[ˈ**w̰̃ḭ̃**ː.su] 'frog, sp'

Figure *23* and Figure *24* illustrate the tonal contrast in the words for 'potato' and 'frog.' Difference in pitch is indicated in red:

Figure 23: Spectrogram for the word /ṵ̃ḭ̃-su/, 'potato.'

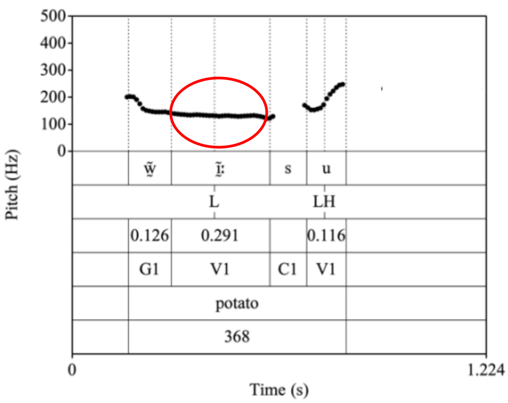
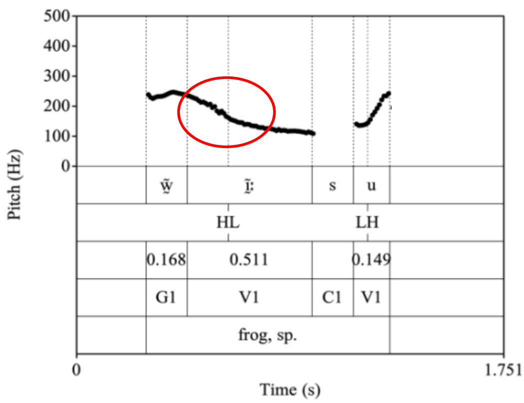


Figure 24: Spectrogram for the word /ṵ̃ḭ̃-su/, 'frog, sp.'



Other examples of contrastive [L] x [HL]-toned syllables:

Stem:{kṵ̃n} 'cotton, *timbó*'

	[**L**.LH]		[**HL**.LH]
(1284)	[ˈ**kṵ̃n**.ᵈzu] 'cotton'	(1286)	[ˈ**kṵ̃n**.ᵈzu] '*timbó*, sp'

Stem: {hais**ˀ**} 'crop' *Stem*: {hai**s**} 'warrior, war'

	[**L**.LH]		[**HL**.LH]
	| |		| |
(1285)	[ˈ**hajʔ**.ᵗsu]	(1287)	[ˈ**hajʔ**.ᵗsu]
	'crop'		'warrior, war'

Note that examples in (1288) and (1289) also have contrastive segmental structure in the coda, namely /sˀ/ : /s/. In this case, tone is the only contrastive feature in the surface representation, as mentioned.

b) [L] x [LH]

Contrastive [L] x [LH] stems are frequently attested. They also usually involve segmentally identical stems in the surface representation.

Stem: {us} 'tayra' *Stem*: {uˀt} 'potoo'

	[**L.**LH]		[**LH.**LH]
	| |		| |
(1288)	[ˈ**uʔ**.ᵗsu]	(1289)	[ˈ**uʔ**.tsu]
	'tayra'		'potoo'

Note that in (1288) and (1289), stems do not share the same segmental structure in the underlying representation. However, both stems are phonetically realized identically before final suffix {-su} due to the morphophonological rules applying at morpheme boundaries, and tone disambiguates them. Figure *25* and Figure *26* illustrate the tonal contrast in the words for 'tayra' and 'potoo,' shown in (1288) and (1289). Difference in pitch is indicated in red:

Figure 25: Spectrogram for the word /us-su/, 'tayra.'

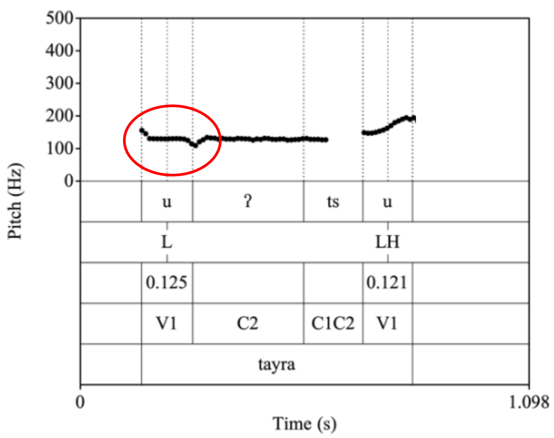
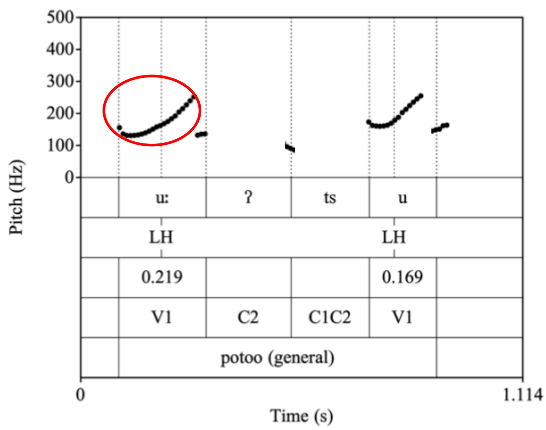


Figure 26: Spectrogram for the word /uˀt-su/, 'potoo.'



Other examples of contrastive [L] x [LH]-toned syllables, some of them with identical segmental structures, are given below:

Stem:{ah} ‘ant, sp., spider, sp.’

[**L.**LH]
| |
(1290) [ˈ**ah**.su]
‘ant, sp.’

[**LH**.LH]
| |
(1291) [ˈ**ah**.su]
‘spider, sp.’

Stem: {ũãĩˀl}: ‘baby, doll’

[**L**.LH]
| |
(1292) [ˈ**w̃ãj̃**ː.ɾʰṵ̃]
‘baby, doll’

Stem: {ũãĩl}: ‘flute’

[**LH**.LH]
| |
(1293) [ˈ**w̃ãj̃**ː.ɾʰu]
‘flute’

6.4.2. Tonal Contrasts in Verbal Morphology

Tone is also contrastive within stems and suffixes in verbal morphology. Verbal roots can display any of the three available tone patterns, but minimal pairs usually involve contrasting [L]- and [LH]-toned stressed syllables. There are few attestations of [L]- vs. [HL]-toned stressed syllables within verbal roots, and one of the attested examples belongs to the minimal triplet shown in (1300) – (1302). In contrast with what is attested in the nominal morphology, contrastive tone in verbal roots tends to have identical segmental structure in the lexical representation. However, segmentally identical morphemes can sometimes have different phonetic realizations due to the syllable structure of adjacent morphemes, as seen in Chapter 5.

i. Stems

- *Minimal pairs*

a) [L] x [LH]

[L] x [LH] tones are the most frequently attested contrast in verbal stems. This is in accordance with what has been observed for nominal stems.

Stem: {ĩ} ‘to bite, to see’

[**L.**L.LH]
| | |
(1294) [ˈ**ĩ**ːˌnaː.ɾa]
‘he’s biting’

[**LH.**L.LH]
| | |
(1295) [ˈ**ĩ**ːˌnaː.ɾa]
‘he’s seeing’ (lit.)

Figure *27* and Figure *28* illustrate contrastive [L] and [LH] tones in the words for ‘he’s biting’ and ‘he’s seeing.’ Tonal contrasts are indicated in red:

Figure 27: Spectrogram for the word /ĩ-na-ɾa/, ‘he’s biting.’

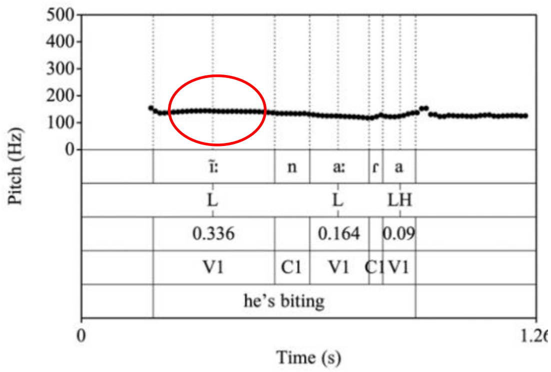
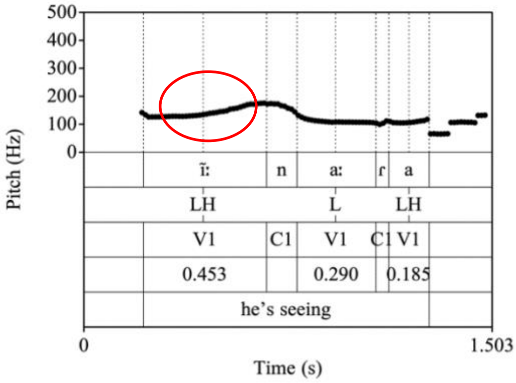


Figure 28: Spectrogram for the word /ĩ-na-ɾa/, ‘he’s seeing.’



Other examples of contrastive [L]- and [LH]-toned syllables:

Stem: {hoh} ‘to wander, to swim’

[**L**.L.LH]
| | |
(1296) [ˈ**hoh**ˌna:.ɾa]
‘she’s wandering’

[**LH**.L.LH]
| | |
(1297) [ˈ**hoh**ˌna:.ɾa]
‘she’s swimming’

Stem: {on} ‘to remain’

[**L**.L.LH]
| | |
(1298) [ˈodˌna:.ɾa]
‘it remains’

Stem: {o̞n} ‘to burn’

[**LH**.L.LH]
| | |
(1299) [ˈo̞dˌna:.ɾa]
‘it’s burning’

b) [L] x [HL]

Stem: {il} ‘to be breastfed, to breastfeed’

[L.HL.HL**]**
| | |
[ˈ**i**:ˌɾa:.wa]
‘I’m being breastfed’

[HL.HL.LH**]**
| | |
[ˈ**i**:ˌɾa:.wa]
‘I’m breastfeeding‘ (lit.)

- *Minimal triplets:*

Stems contrasting [L], [LH], and [HL] are also possible. Only one minimal triplet is attested in the data:

[**L**.L.LH]
| | |
(1300) [ˈkadˌna:.ɾa]
‘he’s getting off’

[**LH**.L.LH]
| | |
(1301) [ˈkadˌna:.ɾa]
‘it’s hard’

[**HL**.L.LH]
| | |
(1302) [ˈkadˌna:.ɾa]
‘it’s ripe’

ii. Verbal Suffixes

Tone can also be contrastive in verbal suffixes, especially the ones occurring in the penultimate position within the GW. This is mainly due to grammatical tone. Examples of minimal pairs are given in the following examples.

a) [L]- x [HL]-toned syllables:

	[**L**]		[**HL**]
	|		|
(1303)	[ˈnãː.ˌ**na**ː.ɾa]	(1304)	[ˈnãː.ˌ**na**ː.ɾa]
	‘he’s drinking’		‘I drank’

b) [L]- x [LH]-toned syllables:

	[**L**]		[**LH**]
	|		|
(1305)	[ˈnãː.ˌ**na**ː.ɾa]	(1307)	[ˈnãː.ˌ**na**ː.ɾa]
	‘he’s drinking’		‘he drank (recently)‘
	[**L**]		[**LH**]
	|		|
(1306)	[ˈḭː.ˌ**na**ː.ɾa]	(1308)	[ˈḭː.ˌ**na**ː.ɾa]
	‘it’s lit’		‘it was lit’

c) [HL]- x [LH]-toned syllables:

Occurrences of contrastive three tones in the verbal string are due to grammatical tone, which will be addressed in section 6.16:

	[**L**]		[**HL**]		[**LH**]
	|		|		|
(1309)	[ˈnã̰ː.ˌ**na**ː.ɾa]	(1310)	[ˈnã̰ː.ˌ**na**ː.ɾa]	(1311)	[ˈnã̰ː.ˌ**na**ː.ɾa]
	‘he’s crying’		‘I cried’		‘he cried’

6.5. Tone, Nasality, and Phonation Type

Tone is independent of nasality and phonation type. Therefore, falls [HL], rises [LH], and low levels [L] are observed in syllables whose nucleus is a vowel of any type. [L] is most frequently attested, followed by [LH] and [HL]. Examples of tonal patterns attested with all four vowel types are given below.

- **Examples with [L] levels:**

[L] level tones occur with any type of vowel.

a) [-nasal] Vowels

- *Oral vowel:*

(1312)
[**L**.LH]
| |
[ˈ**i**ː.ɾʰu]
/il.su/
il -su
howler mokey-REF
'howler monkey'

- *Creaky voice vowel:*

(1313)
[**L.**LH]
| |
[ˈ**ḛ**ː.ɾʰu]
/ḛl.su/
ḛl -su
cashew-REF
'cashew'

b) [+nasal] Vowels

- *Nasal vowel:*

(1314)
[**L**.LH]
| |
[ˈkʰ**ũ**ː.ᵈzu]
/kʰũn.su/
kʰũn -su
wolf apple-REF
'wolf apple'

- *Nasal creaky voice vowel:*

(1315)
[LH.L.**L.**LH]
| | | |
[ˌaː.siˈw̰̃**ḛ̃**ː.ɾʰu]
/a.si.ṵ̃ḛ̃l.su/
a- siṵ̃ḛ̃l -su
INAL-tail-REF
'tail'

Examples with [HL] contours

a) [-nasal] Vowels

[HL] tones are more frequently attested with oral vowels. Attestations of [HL] contours associated with creaky voice vowels are very rare and usually involve reduplication, as in (1317):

- *Oral vowel*

(1316)
[**HL**.LH]
| |
[ˈkw**i**ː.ɾʰu]
/kuil.su/
kuil -su
kuil-REF
'catfish, sp.'

- *Creaky voice vowel*

(1317)
[**HL**.**HL**.L.LH]
| | | |
[kw̰**ḭ**ˈkw̰**ḭ**ː.ˀki.su]
/kṵḭ.kṵḭˀk(i).su/
kṵḭkṵḭˀk(i)-su
RED.hawk-REF
'hawk, sp.'

b) [+nasal] Vowels

[HL] contours are more frequently attested with nasal and creaky voice vowels (1319) than with nasal vowels without the creaky phonation (1318). In fact, attestations of [HL] tones with nasal vowels without the creaky phonation are relatively rare:

- *Nasal vowel*

(1318)
[LH.**HL**.LH]
| | |
[aˈ**lũ**ː.su]
/a.lũ.su/
alũ -su
tapir-REF
'tapir'

- *Nasal creaky voice vowel*

(1319)
[**HL**.LH]
| |
[ˈ**hã̰j̰̃**ː.ɾʰu]
/hã̰ḭ̃l.s̃u/
/hã̰ḭ̃l -su
ball-REF
'ball'

Examples with [LH] contours

a) [-nasal] Vowels

[LH] contours are frequently attested with both [-nasal] vowel types:

- *Oral vowels*

(1320)
[L.**LH**.LH]
| | |
[saˈ**wi**ː.ɾʰu]
/sa.uil.su/
sauil -su
parakeet-REF
'parakeet' (general)

- *Creaky voice vowels*

(1321)
[L.**LH**.LH]
| | |
[ta̰ˈ**lḭ**ː.su]
/ta̰.lḭ.su/
ta̰lḭ -su
parakeet-REF
'parakeet, sp.'

b) [+nasal] Vowels

[LH] contours are attested with both [+nasal] vowel types. However, attestations of [LH] contours in syllables whose nucleus is a nasal and creaky voice vowel are very rare and usually involve reduplication, as in (1323):

- *Nasal vowels*

(1322)
LH LH
| |
[ˈ**w̃ãj̃**ː.zu]
/ũãĩ.su/
ũãĩ -su
anteater-REF
'anteater, sp.'

- *Nasal and creaky voice vowels*

(1323)
LH **LH** LH
| | |
[ˌ**tã̰j̰̃**ːˈ**tã̰j̰̃**ː.ɾʰu]
/tã̰ḭ̃.tã̰ḭ̃l.s̃u/
tã̰ḭ̃tã̰ḭ̃l -su
RED.cricket-REF
'cricket, sp.'

Table 76 is based on the current description for the phonetic realizations of tone and vowel quality. It shows the frequency of occurrences of [L], [HL], and [LH] tones in relation to all vowel types. Note that [L] tones can be associated with syllables with vowels of all attested types with a very similar frequency. In contrast, contour tones are less frequently associated with creaky as well as nasal and creaky vowels.

Table 76: Frequency of occurrences of [L], [HL], and [LH] tones in relation to vowel type.

L	V ~ Ṽ ~ V̰ ~ Ṽ̰
HL	V > Ṽ̰ > Ṽ > V̰
LH	V ~ Ṽ > V̰ > Ṽ̰

As shown in Table 76, occurrences of rises and falls differ significantly in relation to both nasality and phonation type. [LH] contours are frequently associated with both oral and nasal vowels, followed by creaky voice vowels, and, very rarely, nasal creaky voice vowels. In turn, [HL] contours are most frequently attested with oral vowels and nasal creaky vowels, followed by nasal vowels and rarely by creaky voice vowels.

6.6. Tone and Syllable Structure

Let us now turn the discussion to the relation between tone and syllable structure. We have seen so far that [HL] and [LH] are predominantly attested in stressed syllables, while [L] tones can occur freely. We have also seen in Chapter 4 that Kithãulhu has a partly weight-sensitive stress system. If we assume that every stressed syllable is heavy, [HL] and [LH] tones would also be associated with syllable weight. However, the association of [LH] and [HL] tones with heavy syllables is partially incorrect if we do not consider word morphology.
As previously discussed, [HL] and [LH] frequently occurs in stressed syllables within stems. [LH] can occur with (phonetic) heavy syllables of prefixes, or with light or heavy in suffixes. In this section, I will only address tones occurring in word-initial and medial positions. Word-final tone is discussed in 6.8.3.

6.6.1. Underlying Light Syllables

All three patterns are attested in underlying light syllables. Furthermore, there seems to be no correlation between the [±voice] feature of consonants and tone in the stressed syllables.

- **Examples with [L] tones:**

[L] tones occur regardless of word position and morpheme types.

a) prefix

{ĩ} ‘INST’

(1324) [**L**.L.L.LH]
[ĩˈiʔˌtãː.ɾa]
/**ĩ**.iˀt.na.ɾa/
ĩ- iˀt -∅ -na -ɾa
INST-to blow-3S-PRS.V.EV-PFV.M
‘he’s blowing’

b) stem

{aˈlu} ‘mouse’

(1325) [**L**.**L**.LH]
[aˈluː.su]
/**a**.**lu**.su/
alu-su
mouse-REF
‘mouse’

c) suffix

{-ˈna} ‘PRS.V.EV’

(1326) [L.**L**.LH]
[ˈĩː.ˌnaː.ɾa]
/ĩ.**na**.ɾa/
ĩ -∅ -na -ɾa
to bite-3S-PRS.V.EV-PFV.M
‘he’s biting’

- **Examples with [HL] tones:**

[HL] tones occur with (1327) or without (1328) an onset. Onsets can be voiceless or voiced:

a) stems

{kaˀto} ‘monkey, sp.’

(1327) [L.**HL**.LH]
[kaˈ**ɗo**ː.su]
/ka.**ˀto**.su/
kaˀto -su
monkey-REF
‘monkey, sp.’

{nã̰} ‘otter’

(1329) [**HL**.LH]
[ˈ**nã̰**ː.su]
/**nã̰**.su/
nã̰ -su
otter-REF
‘otter’

b) suffix

{-a} ‘1S’

(1328) [HL.**HL**.LH]
[ˈweː.ˌ**ta**ː.wa]
/uet.**a**.ua/
uet -**a** -ua
to do-1S-NPFV.M
‘I’m doing’

- **Examples with [LH] tones**

[LH] tones can also occur in syllables with or without an onset. Onsets may be voiced or voiceless:

a) prefix

{a-} ‘INAL

(1330) [ˌaːˈĩːɾa̰]
[**LH**.L.LH]
/**a**.ĩˀl.a/
a- ĩˀl -a
INAL-name-REF
‘name’

b) stem

{halo} ‘field’

(1331) [haˈloːsu]
[L.**LH**.LH]
/ha.**lo**.su/
ha**lo** -su
field-REF
‘field’

c) suffix

{-te} 'CL.generic'

(1332)
[L.**LH**.LH]
[ˈtu^{d}n.**de**.su]
/tun.**te**.su/
tun -**te** -su
to be dark-CL.generic-REF
'purple, dark color'

6.6.2. Underlying Heavy Syllables

All three patterns are attested in underlying heavy syllables. However, [HL] and [LH] tones are once again attested in different environments. Generally, [HL] and [LH] tones do not occur in heavy prefixes. Consequently, all heavy prefixes are [L]-toned. Furthermore, there are no attestations of [LH]-toned heavy suffixes in the lexical representation. All lexically heavy suffixes with a H target are categorically [HL]-toned.

- **Examples with [L] tones:**

Lexically heavy syllables can occur with [L] tones in all morpheme types, in syllables with voiced or voiceless codas:

a) prefix

{ũh-} 'INST'

(1333)
[ˌ**ũ**ːˈhohˌnaː.ɾa]
[**L**.LH.L.LH]
/**ũh**.hoh.na.ɾa/
ũh- hoh -∅ -na -ɾa
INST-to swim-3S-PRS.V.EV-PFV.M
'he's rowing'

b) stem

{kṵ̃n} 'cotton'

(1334)
[ˈ**kṵ̃**ː.na]
[**L**.LH]
/**kṵ̃n**.a/
kṵ̃n -a
cotton-REF
'cotton'

c) suffix

{-kaˀt} 'CL.long'

(1335)
[ˈhḛː.ɾaˌ**ka̰ʔ**.tsu]
[L.L.**L**.LH]
/hḛl.a.**kaˀt**.su/
hḛl -a -**kaˀ**t -su
buriti-LV.CL.long-REF
'*burit*i tree'

- **Examples with [HL] tones**

Lexically heavy syllables can only occur with [HL] tones in stems and suffixes. They are attested with voiceless and voiced codas:

a) **Stem**:

{uan} ‘to be swollen’

(1336)
[**HL**.L.LH]
[ˈ**wad**ˌnaː.ɾa]
/**uan**.na.ɾa/
uan -∅ -na -ɾa
to be swollen-3S-PRS.V.EV-PFV.M
‘it’s swollen’

b) **Suffix**:

{-ẽh} ‘CL.vine’

(1337)
[L.**HL**.LH]
[ˈhuːˌˀ**kẽ**ː.ha]
/huˀk(i).**ẽh**.a/
huˀk(i) -ẽh -a
bow-CL.vine-REF
‘vine’

No [HL] was attested in prefixes.

- **Examples with [LH] tones**

Lexically heavy syllables only occur with [LH] tones of stems. Codas can be voiceless or voiced:

a) **Stems**:

{sauil} ‘parakeet’

(1338)
[L.**LH**.LH]
[saˈ**wi**ː.ɾʰu]
/sa.**uil**.su/
sauil -su
parakeet-REF
‘parakeet’ (general)

{kanãh} ‘woodpecker’

(1339)
[L.**LH**.LH]
[kaˈ**nãh**.su]
/ka.**nãh**.su/
kanãh -su
woodpecker-REF
‘woodpecker’

As can be seen, all tones are attested in lexically heavy and light syllables. Moreover, features of the consonants in the onset and coda do not seem to be relevant in determining what kind of contour will be assigned to the syllables. Table *77* is built based on the information in this section and it provides the distribution of tones in relation to the lexical syllable weight of morphemes and morpheme type:

Table 77: Distribution of tones in relation to the lexical syllable weight of morphemes and morpheme type.

		Morpheme type					
		prefixes		**stems**		**suffixes (non-final)**	
Tone pattern	**syllable weight (lexical)**	light	heavy	light	heavy	light	heavy
[L]		x	x	x	x	x	x
[HL]		-		x	x	x	x
[LH]		x	-	x	x	x	-

As seen in *Table 77*, the occurrences of [LH] and [HL] tones are independent from the syllable weight of the stems. In contrast, the distribution of [HL] and [LH] tones are dependent on the syllable weight of affixes. *Table 77* also shows that affixes with lexical heavy syllables can only be assigned an [HL] or [L] tone, while the ones with lexically light syllables can only be assigned an [LH] or [L] tone. This finding suggests that occurrences of [LH] and [HL] tones are not predictable within the stems but are partly predictable within affixes.

6.7. Tone and Stress

It is not possible to predict the tone patterns of all morphemes based on stress. However, you may remember that we can argue that syllables with an H target are usually attracted to stressed syllables, but not every stressed syllable gets a contour tone. As I show in the following section, polysyllabic bitonal morphemes may include sequences of an [LH] and an [HL] contour in the surface representation.

6.7.1. Stressed Syllables

Stressed syllables can display any of the three attested tone patterns: [L], [HL], and rising [LH]. Melodies within polysyllabic morphemes can frequently be predicted from the tone pattern in the stressed syllable, as well as based on their syllable structure. In the examples below, both the stressed syllable and the tone associated with it are signalized in **bold**.

a) [L]-toned stressed syllables

[L]-toned stressed syllables are the most frequently attested and they can occur in word-initial and medial positions. Sequences of [L] tones do not affect the realization of the tone pattern of following syllables, even across morphemes, as in (1341):

- *Examples of [L] in roots/stems:*

	Transcription	Melody	Morphemes	Meaning
(1340)	[ˈ**ho**ː.sa]	[**L**.LH]	hos-a	'monkey' (general)
(1341)	[aˈl**ã**ː.su]	[L.**L**.LH]	alã-su	'macaw' (general)
(1342)	[ˈ**waj**ː.a.la̰]	[**L**.L.LH]	uai-aˀli-a	'dog'

There is just one example of a word-initial stressed polysyllabic morpheme whose first syllables displays an [L] tone and the second an [LH] contour:

(1343)	[ˈ**tih**.**no**.su]	[**L**.**LH**.LH]	tihno-su	'road'

We treat this example as an exception. As this is the only example in the data, it may also suggest that 1) the tone in the unstressed syllable of the stem is assigned by a rule or 2) this morpheme is made of two morphemes. None of the hypotheses could be tested.

- *Examples of [L] in affixes:*

[L] tones can occur in stressed syllables of prefixes and suffixes, as seen in (1346) and (1344) and, respectively.

[L.**L**.LH]
(1344) [ˈeːˌ**ja̰w**ː.ʔa]
/e.**ḭa̰ṵ**.a/
e -**ḭa̰ṵ**-a
to speak-NZ.REF
'voice'

(1345) [L.LH.L.**L**.LH]
[ˈw̃ãː.la.kaˈ**lo**ː.su]
/ũãl.a.ka.**lo**.su/
ũãl-a-kalo-su
skin-REF-CL.flat-REF
'cloth'

(1346) [**L**.HL.L.HL.LH]
[ˌ**ũ**ːˈhũː.saˌtuː.wa]
/**ũh**-ũ-sa-tu-ua/
ũh- ũ -sa -∅ -tu -ua
INSt-to give-1O-3S-FUT-NPFV.M
'he'll give (it) to me'

b) [HL]-toned stressed syllables

[HL]-toned stressed syllables are the least frequent type. They are attested in word-initial (1348) and medial positions (1349). Note that no prefix is attested with an [HL] tone, as discussed:

- *Examples in stems:*

	Transcription	Melody	Morphemes	Meaning
(1347)	[haˈ**ˀnũ**ː.la]	[L.**HL**.LH]	haˀnũl-su	'pineaple, sp.'
(1348)	[ˈ**kʰwi**ː.dĩ.su]	[**HL**.(L).LH]	kʰuiˀt(i)-su	**'**deer, sp.'
(1349)	[aːˈ**laj**ː.su]	[LH.**HL**.LH]	alai-su	'sloth'

- *Examples in affixes:*

(1350) [L.LH.**HL**.LH]
[ˈhoː.saˌˀ**kẽ**ː.ʰsu]
/hos-a-ki-**ẽh**-su/
hos -a -ˀki **-ẽh** -su
monkey-REF-bone-CL.string-REF
'monkey teeth necklace'

(1351) [L.L.**HL**.LH]
[waˈkoːˌ**na**ː.wa]
/uakon.**a**.ua/
uakon **-a** -ua
to work-1S.PRS-NPFV.M
'I'm working'

(1352) [L.**HL**.LH]
[ˈjajᵍŋˌ**du**ː.wa]
/iain.**tu**.ua/
iain -∅ -tu -ua
to eat-3S-FUT-NPFV.M
'he'll eat'

c) [LH]-toned stressed syllables

[LH]-toned stressed syllables are the second most frequent type. They are also attested in word-initial and medial positions. The stressed syllable of polysyllabic roots displaying an [LH] tone is usually the rightmost one, as in (1354):

	Transcription	Melody	Morphemes	Meaning
(1353)	[ˈ**ho**ː.ha]	[**LH**.LH]	hoh-a	‘tinamou’
(1354)	[taˈ**ki**ː.su]	[L.**LH**.LH]	taki-su	‘monkey, sp.’

- *Examples in affixes:*

(1355)
[**LH**.LH.LH]
[ˌ**a**ːˈw̃ãː.ʰl̥u]
/**a**.ũãl.su/
a- ũãl -su
INAL-skin-REF
‘skin’

(1356)
[L.L.**LH**.LH]
[ˈteᵈn.ᵗsaˌ**ʰna**ː.wa]
/ten.sa.**ʰna**.ua/
ten -sa -**ʰna** -ua
DES-1O-NV.EV-NPFV.M
‘I want’

(1357)
[L.L.**LH**.LH]
[waˈkodˌ**na**ː.ɾa]
/ua.kon.**na**.ɾa/
uakon -∅ -na^{LH} -ɾa
to work-3S-V.EV.REC.PST-PFV.M
‘he worked’

[LH] tones can occur in the stressed syllables of prefixes (1355) and suffixes, as in (1356) and (1357).

6.7.2. Unstressed Syllables

Unstressed syllables can also display all three tonal patterns. However, occurrences of unstressed [HL] tones are restricted to the final syllable of certain word classes (such as numerals) or some monosyllabic final morphemes in the verbal morphology.
Overall, unstressed syllables display predominantly [L] tones. Attestations of [LH] tones in unstressed syllables are also relatively frequent and they fall into two specific groups. The first group is comprised of [LH] tones assigned to certain affixes in both nominal and verbal morphology. The second group encompasses [LH] tones occurring in unstressed syllables of polysyllabic roots. Although both types of [LH] are presented in this section, I will make a clear distinction between the two types of [LH] tones occurring in unstressed syllables of polysyllabic roots, which are addressed in section 6.11. Tone patterns in unstressed syllables are shown in **bold**.

a) [L]-toned unstressed syllables

As discussed, most unstressed syllables are [L]-toned by default. Based on this observation, we can predict that [L] tones are expected to occur in unstressed positions of polysyllabic morphemes, except when a tonal rule is attested.

- *Examples in roots/stems:*

	Transcription	Melody	Morphemes	Meaning
(1358)	[**a**ˈˀluː.su]	[**L**.L.LH]	aˀlu-su	‘mantis’
(1359)	[**ka**ˈˀluh.ʔa]	[**L**.HL.LH]	kaˀluhˀ-a	‘*pantanal*’
(1360)	[**a**ˈɗĩː.su]	[**L**.LH.LH]	aˀtĩ-su	‘bird, sp.’

- *Examples in affixes:*

Prefix:

(1361)
[**L**.HL.L.LH]
[**ĩ**ˈsuːˌnaː.ɾa]
/**ĩ**.sul.na.ɾa/
ĩ- sul -∅ -na -ɾa
INST-to beat-3S-PRS.V.EV-PFV.M
‘he’s beating (tirelessly)’

Suffixes:

(1362)
[L.L.**L**.L.LH]
[jaˈlaᵍŋ.**ga**ˈloː.su]
/ia.lan.**ka**.lo.su/
ialan -kalo -su
toucan-CL.flat-REF
‘*cocar*’

(1363)
[LH.LH.HL.**L**]
[ˈteː.aˌsoː.**ˀli**]
/te.a.so**.ˀli**/
te -a -soˀli
CL.generic-REF-EXCL
‘only this’

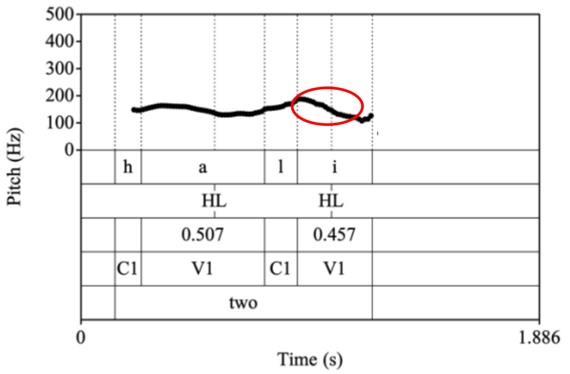
As seen in (1361), [L] tones are attested in both prefixes and suffixes.

b) [HL]-toned unstressed syllables

[HL] tones are not attested in unstressed syllables in nominal stems. In contrast with nominal morphology, [HL] tones can occur in unstressed syllables of some morphemes in other word classes. Examples of [HL]-toned unstressed syllables can be found in the ultimate syllables of numerals and the indefinite pronoun {aio̧ˈhaka}[144]. Furthermore, [HL] tones are also observed in the verification/pensive quote morpheme {-ʔã}. To illustrate the occurrences of final [HL]-toned unstressed syllables, the spectrograms of all examples are provided. Once again, the phonetic realization of tone is marked in red in the spectrograms:

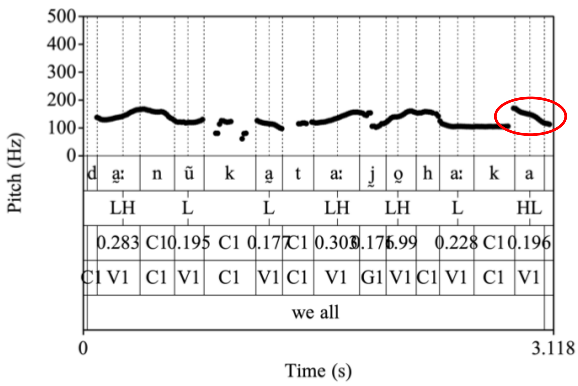
(1364) [HL.**HL**]
[ˈhaː.**li**]
/ha.**li**/
'two'

Figure 29: Spectrogram showing an unstressed [HL] tone in the word {ha.li}, 'two.'



(1365) [LH.L.L.LH.LH.L.**HL**]
[ˌdḁː.nũˌkḁ.taːˌjo̧ˈhaː.**ka**]
/ˀta.nũ.kaˀt(i).a.(a).io̧.ha.**ka**/
ˀta-nũ-kaˀt(i)-a-aio̧haka
1POS-CT.people-PL-REF-everyone
'we all' (lit. everyone in my group)

Figure 30: Spectrogram showing an unstressed [HL] tone in the word /a.io̧.ha.ka/, 'all.'



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[144] This pronoun seems to be a compound. Gloss was omitted since it was not checked with a native speaker. The two initial syllables of {a.io̧.ha.ka} have the same lexical structure and tonal patterns of inalienable prefix {a-}^{LH}, and root {io̧}^{LH}, 'mouth.'

(1366) [LH.L.L.L.**HL**]
[ˌda̰ːˈhuː.ˀkiˌsa̰ː.**ʔã**]
/ˀta-huˀk(i)-sˀa-**ʔã**/
ˀta -huˀk(i) -ʔ -sa -ʔã
1POS-bow-NEG-COP-PENS
‘it’s not my bow’

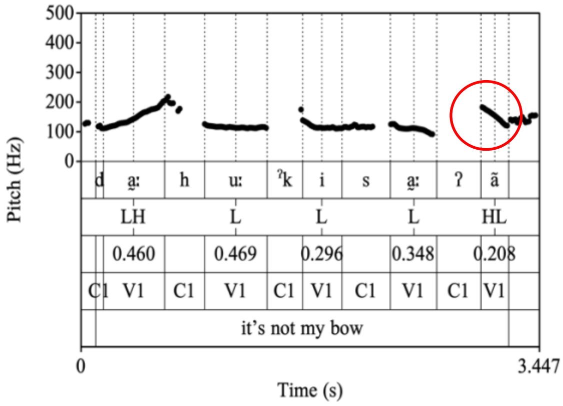


Figure 31: Spectrogram showing the [HL] tone in unstressed suffix {-ʔã}.

c) [LH]-toned unstressed syllables

In contrast with [HL] tones, [LH] tones occur more often in unstressed syllables.

- *Examples in roots/stems*:

	Transcription	Melody	Morphemes	Meaning
(1367)	[**ja**ːˈnaː.la]	[**LH**.HL.LH]	ianal-a	‘jaguar’
(1368)	[**a**ːˈlajː.su]	[**LH**.HL.LH]	alai-su	‘sloth’
(1369)	[**a**ːˈlũː.su]	[**LH**.HL.LH]	alũ-su	‘tapir’

Unstressed [LH] tones followed by a stressed syllable in polysyllabic stems can be predicted, as described in 6.11.

- *Examples in affixes*:

[LH] tones can only occur in unstressed syllables of monosyllabic suffixes:

(1370) [L.L.**LH**.LH]
[heˈheᵈn.**de**.su]
/he.hen.**te**.su/
hehen -te -su
RED.to be red-CL.generic-REF
‘red’

(1371) [LH.L.**LH**]
[ˈĩːˌnaː.**ɾa**]
/ĩ.na.**ɾa/**
ĩ -∅-na -ɾa
to see-3S.SG-PRS.V.EV-PFV.M
‘he’s seeing’

6.8. Tone and Syllable Position Within a GW

As discussed in the section correlating tone to stress, [L], [LH] and [HL] tones occur in both stressed and unstressed syllables. I also showed that [HL] and [LH] are most frequently attracted to stressed positions within morphemes. Table *78* presents a summary of what has been discussed so far and shows the distribution of tone patterns in relation to stress and morpheme types:

Table 78: Tone pattern distribution in relation to stress and morpheme type.

	[Tone pattern]		
Morpheme type	**[L]**	**[HL]**	**[LH]**
Prefixes	stressed and unstressed syllables.	-	stressed syllables
roots	stressed and unstressed syllables.	stressed syllables only.	stressed syllables and unstressed
Suffixes	stressed and unstressed syllables.	stressed syllables and unstressed final syllables.	stressed and unstressed syllables.

Based on table Table *78*, we can claim that [L] tones can occur in all morpheme types. Furthermore, occurrences of [L] tones do not depend on stress. In contrast, occurrences of [HL] and [LH] tones can vary according to stress and morpheme types. While [LH] tones can occur in all morpheme types, [HL] tones are not attested in prefixes. I also showed that [HL] tones occurring in unstressed syllables are only attested in the ultimate position within GWs. More information on the relation between tone position within a word is given in the following sections.

6.8.1. Word-Initial [HL] and [LH] Tones

Let us now see the distribution of tones in relation to word position. Since [L] tones can occur in stressed and unstressed positions in all morpheme types, I will initially focus on the distribution of [LH] and [HL] in word-initial and medial positions. Then I will move to word-final position. As I presented no evidence of word-final [L] tones so far, except for the brief presentation in the section on the relation between tone and word class, the section on word-final tones will cover all tone patterns.
As seen in section 6.7, which addresses the correlation between stress and tone, both [HL] and [LH] can occur word initially. Since [HL] tones are not attested in prefixes, word-initial [HL] tones can only occur if the stressed syllable of the stem is word-initial, as shown in examples (1372) – (1374).

a) **[HL]**

- *Word-initial [HL] tones in stressed syllable of stems:*

(1372)	[ˈ**weː**ˌtaː.wa]	**[HL**.HL.LH]	‘I’m doing’
(1373)	[ˈ**kʰw̰a̰ː**.ʰl̥u]	[**HL**.LH]	‘pineapple, sp.’
(1374)	[ˈ**ɗod**ˌnaː.ɾa]	[**HL**.L.LH]	‘it’s growing’

Word-initial [LH] tones can occur under three conditions: 1) prefixation, 2) word-initial stressed stems, 3) or phonetic implementation, which is discussed further in section 6.11. Examples are given below:

b) [LH]

- *Prefixation:*

(1375)	[ˌ**a**ːˈw̰ḭː.su]	[**LH**.LH.LH]	‘tooth’
(1376)	[ˌ**ɗa**ːˈa̰j̰ː.na]	[**LH**.L.LH]	‘my fish’
(1377)	[ˌ**w̰a̰**ːˈh̃oh.naˌheː.ɾa]	[**LH**.LH.L.HL.LH]	‘he had swum’

- *Word-initial stressed syllable of stems*:

(1378)	[ˈ**ah**.su]	[**LH**.LH]	‘spider, sp.’
(1379)	[ˈ**waj**ː.ka]	[**LH**.LH]	‘peanut’
(1380)	[ˈ**nĩ**ː.ka]	[**LH**.LH]	‘*breuzinho*’

- *Phonetic implementation*:

(1381)	[ˌ**a**ːˈluːˈw̃ãj̃ː.ɾʰu]	[**LH**.HL.LH.LH]	‘hawk, sp.’
(1382)	[**ja**ːˈnaː.laˈkãw̃ː.ʰl̥u]	[**LH**.HL.LH.LH.LH]	‘ocelot’

6.8.2. Word-Medial [HL] and [LH] Tones

Word-initial [HL] and [LH] tones can become word medial if they follow a prefix. Prefixation does not alter the tone pattern of the stems, as shown in (1383) – (1387):

a) [HL]

- Examples with a prefix followed by a stem initial [HL] tone:

(1383)	[ˌ**a**ːˈ**w̰̃ḭ̃**ː.ʔa]	[**LH**.**HL**.LH]	‘his frog’
(1384)	[ˌ**u**ːˈ**hũ**ː.saˈtuː.wa]	[**L**.**HL**.L.HL.LH]	‘he will give to me’

b) [LH]

- Examples with a prefix followed by a stem initial [LH] tone:

(1385)	[ˌ**a**ːˈ**sˀi**ː.ha]	[**LH**.**LH**.LH]	‘his house’
(1386)	[ˌ**sa**ːˈ**nãw̃**ːˈsoːˌnaː.wa]	[**LH**.**LH**.HL.HL.LH]	‘he’s plucking’
(1387)	[ˌw̰a̰ːˈhohˌnaː.ɾa]	[LH.**LH**.L.LH]	‘he’ swimming’

Apart from the occurrences due to prefixation, [HL] and [LH] are also attested in the word medial position due to suffixation if the suffixes display one of these tone patterns. Suffixation can alter the tone pattern of verbal stems, as described in section 6.15.2, but no alteration is observed in the verbal stems below.

a) **[HL]**

Examples with [HL]-toned suffixes:

(1388)	[ˈsˀajːˌ**na**ː.wa]	[HL.**HL**.LH] ‘	I’m taking’
(1389)	[ˈkãj̃ː.**ni**ː.ɾa]	[LH.**HL**.LH]	‘you’re big’
(1390)	[ˈajːgiˌ**tu**ː**.**wa]	[L.**HL**.LH]	‘he will hear’
(1391)	[ˈhuːˌˀk**ẽ**ː.na]	[L.**HL**.LH]	‘shotgun’

b) **[LH]**

Examples with [LH]-toned suffixes:

(1392)	[haˈloː.**te**.su]	[L.LH.**LH**.LH]	‘the Halotesu’
(1393)	[ˈheh.saˌ**ʰna**ː.wa]	[L.L.**LH**.LH]	‘I’m hungry’

6.8.3. Word-Final Tones

Syllables in word-final positions can also display all three attested phonetic realizations of tone, but [LH] tones are the most frequently attested word finally. In this study, word-final tones are interpreted as lexically assigned. You may recall from early sections that roots are usually bound and that the tone patterns of suffixes are typically assigned according to word class. A very typical example is the referential suffix {-su}, which is attested following nominal roots and bears an [LH] tone:

[LH.HL.**LH**]
(1394) [aˈlũː.**su**]
alũ -**su**
tapir-REF
‘tapir’

Although typically occurring in the word final position, {-su} can also be attested in an intermediate position within a word. In this type of construction, {-su} is integrated into the verbal morphology as a filler for the position typically occupied by a verbal stem:

[LH.HL.**LH**.L.LH]
(1395) [aˈlũːˌ**su**ːˌnaː.ɾa]
alũ -**su** -∅ -na -ɾa
tapir-REF-3S.PRS.V.EV-PFV.M
‘it’s tapir’ (lit.)

In this intermediate position, {-su} becomes stressed just like any other verb. Note that the tone pattern of {-su} is not altered. This suggests that the [LH] tone in {-su} is not only assigned by the word class, but it is also inherited from the lexical structure. This seems to be the case for other word final suffixes/ syllables.

As I show in the following section, current analysis suggests that word-final tones are also related to syntax. For instance, the noun phrase is typically marked by a word-final [LH]. Consequently, subjects and objects that are not encoded in the inflectional morphology of verbs are usually recognized by an [LH] final tone. Furthermore, I will also show that the word-final [L] tones commonly observed following connective words usually signalize coordination.

a) [L]

Word-final [L] tones are attested in some morphemes, such as the adverbializer {-ˀti} and connective {ˀkainãntu̯}, illustrated in Figure *32* and Figure *33*, respectively:

Figure 32: Spectrogram of word /uasu-ˀti/, ‘quickly,’ displaying a word-final L tone.

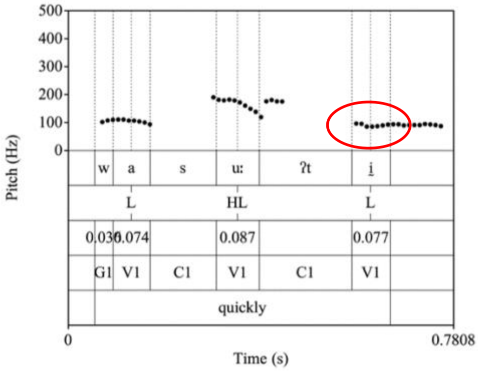
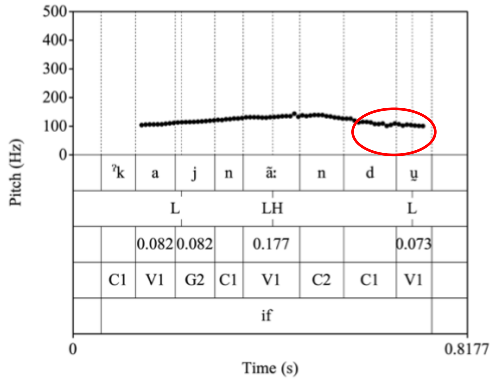


Figure 33: Spectrogram of word /ˀkainãntu̯/, ‘if,’ displaying a word-final L tone.



Note that in Figure *32*, the first syllable of the stem shows an [L] tone, when the following stressed syllable is marked with an [HL] tone. [L] final tones are also attested in the causal connective {-hakai}, which can be attached to copula verb {ˀne} and inserted between two main clauses, as shown in (1396). Note that the main clauses are marked with an [LH] tone due to aspectual suffixes:

(1396)

[HL.L.LH]		[LH.L.**L**]
[ˈwiː.ˌnaː.ɾa]		[ˈˀneːha**.ka̰j]**
/uil.na.ɾa/		/ˀne.ha.kai/̃
uil -∅ -na -ɾa		ˀne -ha.kai
to be good-3S-PRS.V.EV-PFV.M		COP-CAUS

[LH.LH]	[LH.L.L.L.LH.LH]
[ˈw̃ãː.la]	[ˈĩː.tiˈteᵈn.ᵗsa.ˌʰnaː.wa]
/ũãl.a/	/ĩ.ti.ten.sa.ʰna.ua/
ũãl-a	ĩ-ti-ten-sa-ʰna-ua
cloth-REF	to see-NZ-DES-1O-PRS.NV.EV-NPFV.M

‘it is good, so I want to see the cloth’

b) [HL]

As discussed, word-final [HL] tones are relatively rare. They occur in very few morphemes such as numerals, as illustrated in Figure *34* and Figure *35*:

Figure 34: Spectrogram of word /kanaki/, 'one,' displaying a word-final HL tone.

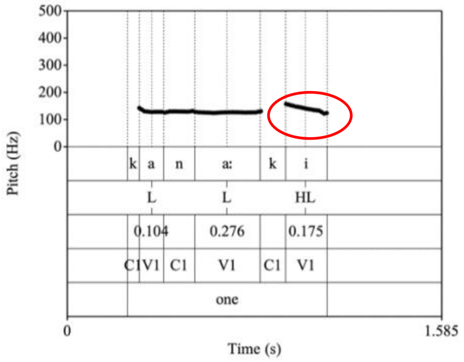
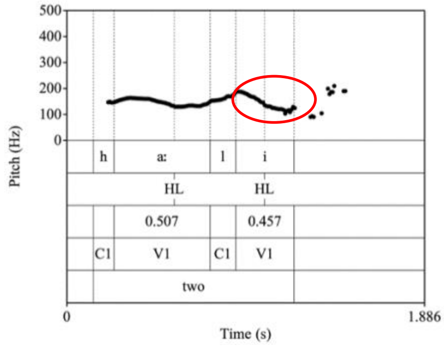


Figure 35: Spectrogram of word /hali/, 'two,' displaying a word-final HL tone.



[HL] tones are attested in the last syllable of the switch reference connective {nahate}:

(1397)	[L.L.LH]	[L.LH]	[HL.L.HL.**HL]**
	[ta̰ˈka̰ːla̰]	[ˈjajː.ɗa]	[ˈweː.taˌhaː.**te**]
	ta̰ka̰ˀla	iain-ˀti-a	uet -∅¹ -naha**te**
	3S.F	to eat-NZ-REF	to make-3S-SRb.CN
	'she's making food'		

[LH.L.L.LH]	[L.L.HL.L.LH]
[ˌhãː.kaˈnẽː.ˀɾa]	[wa̰ˌniːˈɾodˌnaːɾa]
a-kanẽˀl-a	u̯a̰nilon -∅² -na -ɾa
3S.POS-daughter-REF	to play-3S-PRS.V.EV-PFV.M
'her daughter is playing'	

'she is cooking, (while) her daughter is playing'

Another example of final [HL] tone is also observed on the direct speech marker{-ui}.[145]

	[L.HL.HL.**HL**]
(1398)	[ˈjajːˌnaːˈtuː.**wi**]
	iain -a -tu **-ui**
	to eat-1S-FUT-NPFV.DS
	'I will eat (as I said)'

c) [LH]

Final [LH] tones are the most frequently attested tone pattern in this word position. As discussed, noun referential suffixes{-su} and {-a} always display a rising contour tone. Word-final [LH] tones are also attested in final verbal suffixes. See the following examples:

[145] Direct marker {-ui} can also be interpreted as a complex morpheme, comprised of {-ua} + {-i}. This hypothesis was not tested in the fieldwork sessions.

- In nominal morphology:

(1399)
[L.**LH**]
[ˈtʰãw̃ː.**ʰl̥u**]
/tʰãũl.su/
tʰãũl -su
quince-REF
‘quince’

(1400)
[L.L.**LH**]
[saˈnajː.**a**]
/sa.nai.a/
sanai -a
armadillo-REF
‘armadillo, sp’

- In verbal morphology:

(1401)
[L.L.**LH**]
[ˈĩːˌnaː.**na**]
/ĩ.na.**na**/
ĩ -∅ -na -na
to bite-3S-PRS.V.EV-PFV.F
‘he’s biting’ (told to a woman)

(1402)
[LH.L.**LH**]
[ˈuːˌnaː**ɾa**]
/ul-na-**ɾa**/
ul -∅ -na -ɾa
to be far-3S-PRS.V.EV-PFV.M
‘it’s far’

(1403)
[LH.L.L.L.**LH**]
[ˌw̰a̰ːˈhiᵈndiˌnaː**.ʔa**]
/ṵ̯a̰.hin.ti.na.**ʔa**/
ṵ̯a̰- hinti -na -ʔa
INST-to wash-1S-NPFV.F
‘I’m doing the dishes’

(1404)
[L.L.HL.HL.**LH**]
[ũːˈtãw̃ːˈaːˌtuː.**wa**]
/ũh.tãũ.a.tu.**ua**/
ũh -tãũ -a -tu -ua
INST-to mow-1S-FUT-NPFV.M
‘I will mow’

6.9. Tone and Iconicity

Tone assignment in stressed syllables of stems can also be a reflection of ideophones. Overall, tone can be used to depict the sounds that animated beings (mostly birds and amphibians, but also possible for some insects) make. The tone patterns added to the stems provide the segmental structure with an iconic representation of the animal sounds. In the examples below, all three attested tone patterns can be observed. All the examples are comprised of monosyllabic stems, but polysyllabic ideophones are also attested, if reduplicated.

a) [**L] tone**

(1405)
[**L**.LH]
[ˈ**tãn**.ᵈzu]
/**tãn**.su/
tãn -su
frog-REF
‘frog, sp.’

Ideophone: [tãn.tãn.tãn]
[L.L.L]

b) [HL] tone

(1406)
[**HL**.LH]
[ˈ**w̰̃ḭ̃**ː.su]
/**ṵ̯̃ḭ̃**.su/
ṵ̯̃ḭ̃ -su
frog-REF
‘frog, sp.’

Ideophone: [w̰̃ḭ̃ː.w̰̃ḭ̃ː.w̰̃ḭ̃ː]
[HL.HL.HL]

c) [LH] tone

(1407)
[**LH**.LH]
[ˈ**ho**ː.ʰsu]
/**hoh**.su/
hoh -su
tinamou-REF
‘tinamou, sp.’

Ideophone: [hoː.hoː.hoː]
[LH.LH.LH]

6.10. Tone and Loanwords

As discussed in Chapter 2, words of Brazilian Portuguese origin have been incorporated into the Nambikwaran lexicon. I also showed that, apart from discursive markers, all new words with a Portuguese origin mandatorily display Nambikwaran morphology, mainly classifiers and referential suffixes. I argued so far that, at least in the surface representation, all syllables of Nambikwaran morphemes are marked by tone.
As known in the literature, Portuguese does not display lexical tone. Based on this claim, one can argue that Brazilian Portuguese loanwords in Nambikwara also lack lexical tone. I show in the examples below, however, that that is not the case. All syllables of Brazilian Portuguese words incorporated into the Nambikwaran lexicon are marked with tones. Furthermore, I also show that stressed syllables are indicated with tones with an H target ([HL] and [LH]), and no [L] tones were attested in stressed syllables.

- *Word-initial HL*:

(1408)
[**HL**.LH]
[ˈ**poᵈn**.ᵗsu]
/**pon**.su/
pon -su
‘cattle’

From Portuguese ‘*boi’*

- *Word-initial LH*:

(1409)
[**LH**.LH]
[ˈ**pa**ː.tsu]
/**pat**.su/
pat -su
‘duck’

From Portuguese ‘*pato*’

- *Word-medial HL:*

(1410)
[LH.**HL**.LH]
[kaːˈ**hwa**ː.ʰl̥u]
/kah.ual.su/
kahual -su
horse-REF
‘horse’

From Portuguese ‘*cavalo*’

- *Word-medial LH:*

(1411)
[L.L.**LH**.LH.LH]
[se.luˈ**la**ː.te.su]
/<celu**lar**>.te.su/
<celular> -te -su
cellphone-CL.generic-REF
‘cellphone’

(1412)
[L.**LH**.L.L.LH]
[maˈ**mãw̃**ː.ki.su]
/<ma**mão**>.ki.su/
<mamão> -ki -su
papaya-CL.seed.REF
'papaya'

(1413)
[**LH**.L.LH]
[ˈ**lej**ː.ˌtṵ̃ː.su]
/<**lei**te>.nṵ̃.su/
<leite> -nṵ̃ -su
milk-CL.dough.REF
'milk'

In examples (1408) – (1413), it is not clear why some stressed syllables get an [HL], while others are marked with an [LH]. However, the examples of loan-words suggest that H targets are more attracted to stressed syllables, in accordance with what has been discussed so far for the native Nambikwaran words.

Part 2: The Phonology of Tone /T/

6.11. The Tone-Bearing Unit

We have seen so far that [HL] and [LH] tones occur in certain groups of syllables, based on stress and syllable weight. Since both contour tones are attested with both light and heavy syllables in the lexical representation, we cannot claim that their occurrences are dependent on syllable weight. Furthermore, I also showed that [LH] tones are not associated with heavy syllables (with a coda or a falling diphthong) in suffixes. Therefore, we cannot state that the mora is the tone-bearing unit since occurrences of contour tones are not restricted to heavy syllables. This finding suggests that the tone system, although it interacts with the stress system, is not fully dependent on stress since stress is assigned to heavy syllables, if they are available. In the case of the tone system, it is the syllable that seems to be the best candidate for the tone-bearing unit (TBU). Just like what happens with stress, morphological structure also seems to play a relevant role in the assignment of tones, based on what has been shown in this study so far. Other arguments for analyzing the syllables as the TBU are:

a. Tone is not contrastive in unstressed syllables.
b. Phonetic realization of tone in unstressed syllables of polysyllabic morphemes can be predicted in relation to the syllable structure and tones of their stressed syllables.
c. Moraic analysis is not supported for contour tones since both contours occur in light syllables in the lexical representation.

In the surface representation, all TBUs are marked with phonetic tones [T]. However, not all syllables are specified for tone in the lexical representation. Figure *36* shows the two types of TBUs in Kithãulhu. Specified TBUs carry tones assigned in the lexical representation, while unspecified receive a [T] after phonetic implementation:

Figure 36: Specified and unspecified TBUs (lexical).

a. /σ/
|
/T/

b. /σ/
|
/∅/

We have seen that indication of pitch usually contrasts L and H targets, and that H targets can also be distinguished as to whether they occur syllable initially [HL] or finally [LH]. In the present study, it was not possible to find evidence for one single /H/ tone, from which [HL] and [LH] could be derived. We carried out tests with native speakers to check if we could switch [HL] to [LH] tones and vice-versa, and the results show that it is not possible. See examples:

***[LH]** ***[HL]**

(1414)	[**HL**] | [ˈ**w̃ḭ̃**ː.su] 'frog, sp.'	*[**LH**] | *[ˈ**w̃ḭ̃**ː.su]
(1415)	[**LH**] | [ˈ**hoh**.su] 'tinamou, sp.'	***[HL]** | *[ˈ**hoh**.su]
(1416)	[**HL**] | [kaˈ**ɗo**ː.su] 'monkey, sp.'	*[**LH**] | *[kaˈ**ɗo**ː.su]
(1417)	[**LH**] | [haˈ**lo**ː.su] 'field'	*[**HL**] | *[haˈ**lo**ː.su]

As discussed in section *6.16.1*, altering the tones of a morpheme could also affect the meaning of GWs. Examples in which [HL] and [LH] convey different meanings are given below:

(1418)	[L.LH.**LH**.LH] [hoˈʔiːˌ**na**ː.ɾa] 'he bathed'
(1419)	[L.LH.**HL**.LH] [hoˈʔiːˌ**na**ː.ɾa] 'I bathed'

As shown in (1418) and (1419), if the tone pattern on suffix {-na} changes from [LH] to [HL], the subject of the verb also changes. Hence, both tones are marked in the lexicon. Based on these examples, I assume that [HL] and [LH] represent different tones in the lexical representation, namely /HL/ and /LH/.

If a TBU is not specified for tone, it becomes an [L] tone by phonetic implementation, except in the environments later described in this section or by receiving a grammatical /LH/ tone. Overall, [L] tones are added to toneless syllables by default, and that is why it is zeroed out in the underlying representation. Since the TBUs of all stressed syllables in the examples (1414) – (1417) are specified for tone, it is also not grammatically accepted to replace them with an [L] tone. In this view, TBUs displaying an [L] tone are regarded as underlyingly toneless. In this view, Figure *37* shows specified TBUs (a, b):

Figure 37: Association of tones and TBUs (lexical).

a. /σ/
|
/HL/

b. /σ/
|
/LH/

As discussed so far, tone is only contrastive in stressed positions within GWs. You may remember that occurrences of [HL], [LH], and [L] are unpredictable within stressed syllables of stems. Consequently, stressed syllables can be specified by /HL/ and /LH/ tones, and, in the absence of an H target, they are marked by low pitch [L], if they are underlyingly toneless.

The scenario observed for unstressed syllables is different. Overall, unstressed syllables are marked with an [L] tone, with very few exceptions (such as some unstressed suffixes with an [HL], [LH] tone, most of which are related to word classes) because their TBUs are unspecified. Phonetic implementation of toneless units is described below.

6.11.1. Unspecified TBUs

Monosyllabic toneless stems and non-final affixes are realized with an [L] level pitch by default. All examples below are provided without mandatory final suffixes for illustrational purposes.

Stem: {ũ} ‘capybara’ *After phonetic implementation:*

	/∅/	[L]
	|	|
(1420)	/ũ/	[ˈũː]

Prefix: {ĩ-} INST

	/∅/	[L]
	|	|
(1421)	/ĩ/	[ĩ]

Suffix: {ki} CL.seed

	/∅/	[L]
	|	|
(1422)	/ki/	[ki]

Toneless syllables belonging to polysyllabic stems can be phonetically implemented with an [L] or an [LH] tone, depending on the syllable structure and the tone of the following stressed syllable. If a polysyllabic morpheme has a stressed syllable specified with an /HL/, and the stress is stem final, the previous syllables will be implemented with [LH] if the stressed syllable has a voiced onset. The unstressed syllable also becomes lengthened:

Stem: {ua.liˀt} ‘rubber’ *After phonetic implementation:*

	/∅//HL/	[**LH**] [HL]
	| |	| |
(1423)	/ua.liˀt/	[**wa**ːˈliʔ]

In all other cases, unspecified toneless units are phonetically realized with [L] pitch:

Stem: {ka.ˀto} ‘monkey, sp.’ *After phonetic implementation:*

	/∅/ /HL/	[**L**] [HL]
	| |	| |
(1424)	/ka.ˀto/	[**ka**ˈɗoː]

Stem: {ha.ˀnũl} 'pineapple, sp.'

	/∅//HL/	[**L**] [HL]
	| |	| |
(1425)	/ha.ˀnũl/	[**ha**ˈˀnũː]

Stem: {sa.uil}

	/∅/ /LH/	[**L**] [LH]
	| |	| |
(1426)	/sa.uil/	[**sa**ˈwiː]

If a stem undergoes epenthesis, the epenthetic vowel is also marked with [L] pitch:

Stem: {nik} '*breuzinho*' *After phonetic implementation:*

	/LH/	[LH] [**L**]
	|	| |
(1427)	/nik(i)/	[ˈniː.k**i**]

Table *79* is built upon the information in this section. It associates the surface realizations of tones [T] with specified and unspecified TBUs:

Table 79: Phonetic realizations of specified and unspecified TBUs.

TBU	Lexical Representation	Surface Representation
/T/	/HL/	[HL]
	/LH/	[LH][146]
/∅/	/∅/	[L], [LH]

The examples presented in this section show that /HL/ and /LH/ cannot occur within the same polysyllabic morpheme in the lexical representation. This suggests that, at least in the verbal and nominal stems, tones with an H target are culminative at the morphological level:

(a) polysyllabic nominal and verbal stems can be marked at most with an /HL/ or /LH/ tone.

Since contour tones are assumed to be culminative at least in stems, it is possible to predict the tonal melodies of stems based on the tone of the stressed syllable as a starting point. Stressed syllables of disyllabic[147] stems are indicated in **bold**:

[146] /LH/ occurring in the verbal stem can also become [L] due to sandhi, as discussed in 1.6.15.
[147] I did not include the melodies or trisyllabic and tetrasyllabic stems because they are mostly reduplicated. As discussed, tone can be reduplicated, but reduplication of tones is complicated, so it was not included in the analysis of the tone system at this time.

Table 80: Tonal melodies in disyllabic stems.

	Tone of the stressed syllable		
stem	/HL/	/LH/	/∅/
σˈ**σ**	[L.HL], if onset is voiceless [LH.HL], if onset is voiced	[L.LH]	[L.L]
ˈ**σ**.σ	[HL.L]	[LH.L]	[L.L]

Since stems can only display a maximum of one /HL/ or /LH/ tone in the lexical representation, they can be categorized according to the contour tone or the absence of one if the stem does not bear a lexical tone.

d. Examples of /HL/ stems:

a) σˈ**σ**

[L.**HL**.LH]
(1428) [kaˈ**ˀluh**.su]
kaˀ**luhˀ** -su
pantanal-REF
‘pantanal’

/∅.HL.LH/
/ka.ˀluhˀ.su/

b) ˈ**σ.**(σ)

[**HL**.L.LH]
(1429) [ˈ**kʰwi**ː.dî.su]
kʰuiˀt(i) -su
deer-REF
‘deer, sp.’

/HL.(∅).LH/
/kʰuiˀt(i).su/

[LH.**HL**.LH]
(1430) [jaˈ**na**ː.ʰl̥u]
ia**nal** -su
jaguar-REF
‘jaguar’

/∅.HL.LH/
/ia.nal.su/

e. Examples of /LH/ stems:

a) σˈ**σ**

[L.**LH**.LH]
(1431) [kãˈ**j̃ã**ː.ʰl̥u]
ka**ĩãl** -su
washed sand-REF
‘washed sand’

/∅.LH.LH/
/ka.ĩãl.su/

b) ˈ**σ.**(σ)

[**LH**.L.LH]
(1432) [ˈ**waj**ː.ˀki.su]
uaiˀk(i) -su
jararaca-REF
‘*jararaca*’

/LH.(∅).LH/
/uaiˀk(i).su/

f. Examples of /∅/ stems:

a) **σˈσ**

(1433)
[**L**.**L**.LH]
[jaˈ**la^{d}n**.^{t}su]
ialan -su
toucan-REF
'toucan'

/∅.∅.LH/
/ia.lan.su/

b) **σˈσ**

(1434)
[**L**.**L**.L]
[**sa**ˈ**kãw̃**ː.tsã]
sakãũt -sã
to drip-SS
'to drip'

/∅.∅.∅/
/sa.kãũt.sa/

Toneless syllables can also become toned by receiving a grammatical tone or by tone spreading. Grammatical tones are attested in the penultimate position of the verbal strings and serve as tonal morphemes. See section 6.16 for more details.

6.12. Tones in Nominal Morphology

We have seen so far that we can classify stems according to the tones occurring in the TBUs. Nominal affixes can also be associated with tones. The tone of the nominal affixes used in this study is provided in this section. Like stems, tones in affixes are unpredictable, i.e. assigned in the lexical representation. As shown, morphemes can bear a contour tone or be toneless.

6.12.1. Affixes

6.12.1.1. Prefixes

All nominal prefixes bear an /LH/ tone:

Morpheme Type	Morpheme	Gloss	Surface Forms
Possessive	{ˈˀta-}^{LH}	1.POS	[LH] [ˀtaː], [daː], [da̰ː], [ɗaː]
	{ˈṵa̰-}^{LH}	2.POS	[LH] [w̰a̰ː], [ˀwa̰ː]
	{ˈa-}^{LH}	3.POS, INAL	[LH] [aː], [ɐː], [ãː], [ɐ̃ː]

6.12.1.2. Suffixes

Suffixes can be specified or unspecified for tone. Note that, in consonance with what was observed in the stems, all syllables specified with an /HL/ are stressed. Moreover, syllables bearing an /HL/ tone must be heavy, except for the stressed syllables of exclusive suffix {ˈsoˀli} and quantifier {ˈhali}:

Morpheme Type	**Morpheme**	**Gloss**	**Surface Forms**
Linking Vowel	{-a}$^{\varnothing}$	LV	[L] [a]

Morpheme Type	Morpheme	Gloss	Surface Forms
Classifier	{-ˈna̰ˀk(i)}$^{\varnothing}$	CL.sphere	[L.(L)] [ˈna̰ː.ki] ~ [ˈnaʔ.ki] ~ [ˈna̰ː.ˀki] ~ [ˈnaʔ] ~ [ˈna̰ʔ]
	{-ˈnũ}^{LH}	CL.people	[LH] [ˈnũ], [ˈnũː]
	{-a̰ˈkaˀlo}$^{\varnothing}$	CL.female	[L.L.L] [(C)a̰ˈka̰ːlo]
	{-ˈẽh}^{HL}	CL.string, vine	[HL] [ˈ(C)ẽː] ~ [ˈ(C)ẽh]
	{-ˈẽn}^{HL}	CL.hole, hollow cavity	[HL] [ˈ(C)ẽː] ~ [ˈ(C)ẽn]
	{-ˈiah.lo}$^{\varnothing.LH}$	CL.male	[L.LH] [ˈjah.lo], [ˈtʃah.lo], [ˈtʲah.lo], [ˈdʒah.lo], [ˈdʒʲah.lo]
	{-ˈien}$^{\varnothing}$	CL.circular	[L] [ˈjeᵈn], [ˈtʃeᵈn], [ˈtʃeᶢŋ]
	{-ˈ(t)ĩh.no}$^{\varnothing.LH}$	CL.trail, string	[L.LH] [ˈ(C)ĩh.nu] ~ [(C)ĩh.nũ] ~ [(C)ĩh.no]
	{-ˈḭa̰ṵ}$^{\varnothing}$	CL.liquid, fluid	[L] [ˈja̰w̰ː], [ˈtʃa̰w̰ː], [ˈtʃʲa̰w̰ː], [ˈdʒʲa̰w̰ː], [ˈdʒa̰w̰ː]
	{-kaˈlo}$^{\varnothing}$	CL.cloth, flatten, hull, surface	[L.L] [kaˈloː], [gaˈloː]
	{-ˈkaˀt}$^{\varnothing}$	CL.long, solid, cylindrical, disease	[L] [ˈkaˀt] ~ [ˈkaʔ] ~ [ˈka̰ː] ~ [ˈka̰ʔ]
	{-ki}$^{\varnothing}$	CL.seed	[L] [ki], [gi], [ˀki]
	{-ˈko̰}$^{\varnothing}$	CL.land, region	[L] [ˈko̰ː]
	{-ˈnãũʔ}$^{\varnothing}$	CL.egg	[L] [ˈnãw̃ː]
	{ˈnũ}^{LH}	CL.people	[LH] [ˈnũː]
	{-ˈnṵ̃}$^{\varnothing}$	CL.granular, powder, dough	[L] [ˈnṵ̃ː], [ˈɗṵ̃ː], [ˈdṵ̃ː]
	{ˈˀnãn}$^{\varnothing}$	CL.leaf-shaped	[ˈˀnãː] ~ [ˈnãː] ~ [ˈˀnãn] ~ [ˈnãn] ~ [dãː] ~ [dãn] ~ [ˈɗãː] ~ [ˈɗãn]

Morpheme Type	Morpheme	Gloss	Surface Forms
	{-te}^{LH}	CL.generic	[LH] [te], [de]
	{-ˈtʰĩn}$^{\varnothing}$	CL.village, houses	[L] [ˈtʰĩn] ~ [ˈtʰĩː]
	{-ˈtʰoʔ}$^{\varnothing}$	CL.ash-like, big fire	[L] [ˈtʰoː]
	{-ˈṵḭ}^{LH}	CL.tooth, sharp	[LH] [ˈw̰ḭː]
Authenticity	{-ˈkʰaiʔ}^{HL}	AUTH	[HL] [ˈkʰajː]
Augmentative	{-ˈta̰}$^{\varnothing}$	AUG	[L] [ˈta̰ː]
Emphatic	{-ˈkʰaiʔ}^{HL}	EMP	[HL] [ˈkʰajː]
	{-tiˈheʔ}$^{\varnothing.HL}$	EMP	[L.HL] [tiˈheː]
Group	{-ˈkaˀt(i)}$^{\varnothing}$	GRP	[L.(L)] [ˈkaː.di] ~ [ˈkaː.di̥] ~ ~ [ˈkaː] ~ [ˈka̰ː] ~ [ˈkaʔ]
Nominal Temporal Past	{-ˈnũta}$^{\varnothing.LH}$	TMP.PST	[L.LH] [ˈnũː.ta]
	{-uˈtaina}$^{\varnothing.\varnothing.LH}$	TMP.PST	[L.L.LH] [uˈtajː.na]
	{-ũˈtetã}$^{\varnothing.\varnothing.LH}$	TMP.PST	[L.L.LH] [ũˈteː.tã]
Nominal Temporal Future	{ˈnũ}$^{\varnothing}$	TMP.FUT	[L] [ˈnũː]
Demonstrative	{-ˈaili}$^{\varnothing.LH}$	DEM	[L.LH] ~ [LH.LH] [ˈ(C)ajː.ri]
	{-ˈaina}$^{\varnothing.LH}$	DEM	[L.LH] ~ [L.LH] [ˈ(C)ajː.na]
	{-ˈaitã}$^{\varnothing.LH}$	DEM	[L.LH] [ˈ(C)ajː.tã]
Exclusive	{ˈsoˀli}$^{HL.\varnothing}$	EXC	[HL.L] [ˈsoːˀli]
Locative	{-ˈnau}$^{\varnothing}$	LOC	[L] [ˈnaː]
Plural	{-ˈnãũʔ} ~ {-ˈnãʔ}$^{\varnothing}$	PL	[L] [ˈnãː] ~ [ˈnaː] ~ [ˈnãw̃ː]
Quantifier	{-ˈhali}$^{HL.HL}$	QNT	[HL.HL] [ˈhaː.li]
Referential	{-a}^{LH}	REF	[LH]

Morpheme Type	Morpheme	Gloss	Surface Forms
			[(C)a], ∅[148]
	{-su}^{LH}	REF	[LH] [su], [zu], [ᵗsu], [ᵈzu], [ksu], [ʰsu] [ʰl̥], [ɾʰu]

6.12.2. Free Personal Pronouns

Free personal pronouns[149] also carry tone. Note that all personal pronouns have a final /LH/ tone, which originates from the final suffixes and their lexical form. Since pronouns are polymorphemic, they are allowed to display two /LH/ tones, or an /HL/ and an /LH/:

Morpheme Type	Morpheme	Gloss	Lexical Form	Surface Forms
Personal Pronoun	{ˈˀtai.na-}$^{LH-LH}$	1	/ˈˀta-ˈaina/	[LH.LH] [ˈˀtajː.na] [ˈta̰j̰ː.na], [ˈdajː.na], [ˈda̰jː.na], [ˈɗajː.na]
	{ˈṵa̰ḭ.na-}$^{LH-LH}$	2	/ˈṵa̰-ˈaina/	[LH.LH] [ˈw̰a̰jː.na], [ˈw̰̃ã̰j̃ː.na]
	{ˈtiah.la-}$^{HL-LH}$	3.M	/te-ˈiahlo-a/	[ˈtʃah.la], [ˈtah.la], [taˈtah.la], [ˈtʲah.la]
	{ta̰ˈka.ˀla}$^{∅.∅-LH}$	3.F	/te-a̰ˈkaˀlo-a/	[L.L.LH] [ta̰ˈka̰ː.la], [ta̰ˈka̰ː.la̰]

6.13. Tone in Nominal Words

In nominal words, the word melody is defined by the tones of the stem and added morphology. The tonal melodies in compound nouns are stable, i.e., there is no tone sandhi. Some examples are provided below.

i. **/HL/ stems**

a) /HL/ stem followed by an /HL/ suffix:

(1435)
[LH.**HL**.**HL**.LH]
[aˈ**lũ**ːˌ**ẽ**ː.ᵈzu]
alũ -ẽn -su
tapir-CL.hole-REF
‘tapir hole’

/∅.HL.HL.LH/
/a.lũ.ẽn.su/

[148] The non-realization of referential suffix {-a} is due to elision of /a/ when it follows a /(C)a, (C)ã/ stressed syllable. Whenever this rule takes place, the LH tone is preserved in the stem.
[149] Plural forms of personal pronouns are formed by adding group suffixes. For instance: /te-a̰kaˀlo-a-**nãũʔ**-a/, they (feminine). For a comprehensive list of free personal pronouns, see Silva (2021: 105).

b) /HL/ stem followed by an /LH/ suffix:

(1436)
[**HL**.**LH**.LH]
[ˈ**w̰̃ḭ̃**ː.**te**.su]
ṵ̃ḭ̃ -te -su
poison-CL.generic-REF
'poison'

/HL.LH.LH/
/ṵ̃ḭ̃.te.su/

c) /HL/ stem followed by a /∅/ suffix:

(1437)
[**HL**.**L**.L.L.LH]
[ˈ**hã̰j̰̃**ː.ɾ**a**ˌna̰ʔ.ki.su]
hã̰ḭ̃l -a -na̰ˀk(i) -su
ball-LV-CL.sphere-REF
'ball

/HL.∅.∅.LH/
/hã̰ḭ̃l.a.na̰ˀk(i).su/

ii. **/LH/ stems**

a) /LH/ stem followed by an /HL/ suffix:

(1438)
[**LH**.**HL**.LH]
[ˈ**w̃ãj̃**ːˌ**ɾẽ**.ːᵈzu]
ũãĩl -ẽn -su
flute-CL.hole-REF
'flute hole'

/LH.HL.LH/
/ũãĩl.ẽn.su/

b) /LH/ stem followed by an /LH/ suffix:

(1439)
[L.**LH**.**LH**.LH]
[haˈ**lo**ːˌ**te**.su]
halo -te -su
field-CL.generic-REF
'the Halotesu'

/∅.LH.LH.LH/
/ha.lo.te.su/

c) /LH/ stem followed by a /∅/ suffix:

[**LH**.**L**.LH]
[ˈ**waj**ː.**ˀki**.su]
(1440) uaik -ki -su
peanut-CL.seed-REF
'peanut'

/LH.∅.LH/
/uaik.ki.su/

iii. /∅/ **stems**

a) /∅/ stem followed by an /HL/ suffix

[**L**.**HL**.LH]
[ˌ**hu**ːˈˀ**kẽh**.su]
huˀk(i) -ẽh -su
bow-CL.vine-REF
'vine'

/∅.HL.LH/
/huˀk(i).ẽh.su/

b) /∅/ stem followed by an /LH/ suffix:

[**L**.**LH**.LH]
(1441) [ˈ**tu^{d}n**.**de**.su]
tun -te -su
to be violet-REF
'violet, black, dark color'

/∅.LH.LH/
/tun.te.su/

c) /∅/ stem followed by a /∅/ suffix:

[**L**.**L**.LH]
(1442) [ˈ**haj^{d}n**ˌ**dʒa̰w̰**ː.su]
hain -ḭa̰ṵ -su
to sing-NZ-REF
'chant'

/∅.∅.LH/
/hain.ḭa̰ṵ.su/

As shown in examples (1435) – (1442), no tonal alteration is observed in nominal words, regardless of the tone occurring in the suffixes following the stem.

6.14. Tone and Morphosyntax

In this section, I will briefly discuss how tone is also associated with morphosyntax. As I show, data suggest that phrases and clause types can be distinguished according to tone.

6.14.1. The Noun Phrase

Nambikwara is a head-marking language, and the nucleus of the noun phrase occupies the final position (Silva 2021). As can be observed in the examples below, the noun phrase is typically marked with an /LH/ tone:

a) Head only (N):

	[L.**LH**]
(1443)	([ˈũː.**a**])$_{\text{NP}}$
	N
	(ũ -a)$_{\text{NP}}$
	capybara-REF
	‘capybara’
	/∅.LH/
	/ũ.a/

b) Head + Modifier (N + MODF):

When a nominal modifier is added, it is also marked with an [LH] tone:

	[LH.HL.**LH**]	[L.**LH**]
(1444)	([aˈlũː.**a**]	[ˈi^{d}n.**da̰**])$_{\text{NP}}$
	MODF	N
	(alũ -a	inˀti- a)$_{\text{NP}}$
	tapi-REF	man-REF
	‘male (adult) tapir’	
	/∅.HL.LH/	/∅.∅.LH/
	/a.lũ.a/	/in.ˀti.a/

c) Head + Relative (N + REL)

In head + relative constructions, /LH/ tones can be found in both:

	[L.L.**LH**]	[LH.LH.**LH**]
(1445)	([kaˈdḛː.ha]	[ˌkãjːˈdẽː.na])$_{\text{NP}}$
	N	REL
	(katḛh -a	kãĩn-tena)$_{\text{NP}}$
	calabash-REF	to be big-DEM.NEAR
	‘this big calabash’	

/∅.∅.LH/	/LH.LH.LH/
/ka.tḛh.a/	/kãĩn.te.na/

d) Head + Relative + Head

In more complex NPs, all heads are marked with an /LH/ tone:

	[L.L.LH]	[L.L.HL]	[LH.LH.**LH**]
(1446)	([aˈlãː.a]	[heˈheᵍŋˈkʰajʔ]	[ˈˀnẽː.te.su])NP
	N	Rel	N
	(alã -a	hehen-kʰajʔ	ˀne-te-su)NP
	macaw-REF	to be red-P.EMP	COP-NZ-REF
	‘a very red macaw’		
	/∅.∅.LH/	/∅.∅.HL/	/LH.LH.LH/
	/a.lã.a/	/he.hen.kʰajʔ/	/ˀne.te.su/

The typical final [LH] marker in the noun phrase is replaced by [HL] if a modifier such as numerals{kanaki}, ‘one,’ and {hali}, ‘two’ or pronoun {a̰ḭo̰haka}, ‘all,’ follows the nucleus: Note that in both cases, the modified noun is still morphologically marked with an [LH] tone:

	[L.**LH**]	[LH.LH.L.**HL**]
(1447)	[ˈwẽː.**sa**]	[ˌaːˈḭo̰ː.ha.**ka**])NP
	N	MODF
	(ũẽs -a	a̰ḭo̰haka)NP
	child-REF	all
	‘all children’	
	/∅.LH/	/LH.LH.∅.HL/
	/ũẽs.a/	/a.ḭo̰.ha.ka/

(1448)	[L.**LH**]	[HL.**HL**]
	[ˈhoː.**sa**]	[ˈhaː.li])NP
	N	MODF
	(hos -a	hali)NP
	child-REF	two
	‘two monkeys’	
	/∅.LH/	/HL.HL/
	/hos.a/	/ha.li/

The only exception for the [LH] marker in the head is found with the demonstrative suffix {-aili}:[150]

[150] In this example, it is possible that final referential suffix {-a}^{LH} underwent elision because following morpheme is /a/ initial. If that is the case, both the head and modifier are marked by a /LH/ tone.

(1449) [L.**L**.LH.**LH**]
[waˈ**li**ː.ˌˀnajː.**ɾi**])NP

N MODF
(ualiˀn -aili)
manioc -DEM.V.PROX
'this manioc'

/∅.∅.∅.LH/
/ua.liˀn.ai.li/

As shown, the noun phrase is typically characterized by an [LH] tone.

6.14.2. Clause Types

Main clauses are typically marked by an /LH/ or an /HL/ tone attached to aspectual/gender indexation morphemes.

- [LH] final main clauses:

a) Perfective aspect: {-ɾa}, {-na}

(1450) [L.L.**LH**]
[ˈeː.ˌnaː.**ɾa**]
e -∅ -na -ɾa
to speak-3S-PRS.V.EV-PFV.M
'he's speaking' (said to a man)

/∅.∅.LH/
/e.na.ɾa/

b) Imperfective aspect: {-ua}, {-ʔa}

(1451) [L.HL.HL.**LH**]
[ˈw̃ãː.ˌnaːˈtuː.**ʔa**]
ũã -na -tu -ʔa
to come-1S-FUT-PFV.F
'I'll come' (said to a woman)

/∅.HL.HL.LH/
/ũã.na.tu.ʔa/

- [HL] final main clauses

Aspectual morphemes[151] can also display an [HL]. The [HL] can also mark main clauses:

c) Imperfective aspect: {ui}

[151] Aspectual morphemes with an [HL] tone seem to be genderless, but gender indexation for these morphemes could not be confirmed.

{-ui} indicates a direct speech quotation:

(1452)
[L.HL.HL.**HL**]
[ˈw̃ãː.ˌnaː.ˈtuː.**wi**]
ũã -na -tu -ui
to come-1S-FUT-DS.NPFV
'I'll come' (as I said)

/LH.HL.HL.HL/
/ũã.na.tu.ui/

d) Imperfective aspect: {-ʔã}

{-ʔã} indicates that the sentence is a thought, and it is not addressed to an interlocutor, as a direct speech quotation:

(1453)
[L.LH.HL.HL.**HL**]
[hoˈʔiː.naˌtuː.**ʔã**]
hoʔi-na-tu-ʔã
to bathe-1S-FUT-PENS
'I will bathe' (I thought)

/∅.LH.HL.HL.HL/
/ho.ʔi.na.tu.ʔã/

Based on the tonal patterns of final suffixes, we can identify phrases, as illustrated in the sentence below:

	[L.L.**LH**]	[L.HL.**L**][152]	[L.LH.LH.**LH**]
(1454)	([ˈhoː.**sa**])$_{NP}$	[waˈsuː.**di̯**]$_{AdvP}$	[kaˈlaː.ˌnaː.**ɾa**])$_{VP}$
	N	Adv	V
	[(hos -a)$_{NP}$	(uasu-ˀti)$_{AdvP}$	(kala -∅ -na^{LH} -ɾa)$_{VP}$]
	monkey-REF	to be fast-ADVZ	to climb-3S-PST.V.EV-PFV.M
	the monkey	fast	(it's) climbed
	'the monkey climbed very fast'		
	/∅.LH/	/∅.HL∅/	/∅.LH.*LH*.LH/
	/hos.a/	/ua.su.ˀti/	/ka.la.na·ɾa/

6.14.3. Coordination and Switch Reference

Coordination constructions can also be indicated by the tonal pattern of morphemes. If clauses share the same subject, the first sequential clause is indicated by a toneless syllable. If the subject changes, an /HL/ is used to signalize that the subject of the following clause will change.

[152] As mentioned in this chapter, adverbs are usually derived from verbs or nouns. The adverbial phrase seems to be marked by a final [L] belonging to suffix {-ˀti}.

6.14.3.1. Toneless Suffix {-katu}: Same Reference

{-katu}$^{\varnothing.\varnothing}$ is added to a clause, indicating that sequential events share the same subject. Subject markers are indicated with a superscript number in the glosses. Note that {-katu} follows the subject marker:

	[L.L.LH]	[L.HL.HL.L.**L**]	[L.LH.HL.HL.LH]
(1455)	[aˈhũː.la]	[ˌiːˈsajːˌnaː.ka.**tu̯**]	[hoˈʔiː.naˌtuː.wa]
	(ahũl-a	i-sai-na^{1}-katu̯)$_{\text{clause 1}}$	(hoʔi-na^{1}-tu-ʔa)$_{\text{clause 2}}$
	water-REF	to fetch-to take-1S-SR.SEQ	to bathe-1S-FUT-NPFV.F
	‘I will fetch water and bathe’		
	/∅.∅.LH/	/∅.HL.HL.∅.∅/	/∅.LH.HL.HL.LH/
	/a.hũl.a/	/i.sai.na.ka.tu̯/	/ho.ʔi.na.tu.ʔa/

6.14.3.2. HL-Toned Suffix {-nahate}: Switch Reference

{-na.ha.te}$^{\varnothing.\text{HL}.\text{HL}}$ is a switch reference marker attached after the subject marker. In a sequence of clauses with two references for the third-person subjects, it shows that the subject of the following clause refers to a different individual. Note that in the example below, the /HL/ is used to signalize the switch reference:

	[L.L.LH]	[L.LH]	[HL.L.HL.**HL]**
(1456)	([ta̰ˈka̰ː.la̰]	[ˈjajː.ɗa]	[ˈweː.taˌhaː.**te**])$_{\text{clause 1}}$
	ta̰kaˀla	iainˀti-a	uet -∅^{1} -nahate
	3S.F	to eat-NZ-REF	to make-3S-SRb.CN
	‘she’s making food’		
	/∅.∅.∅.∅.LH/	/∅.∅.LH/	/HL.∅.HL.HL/
	/te.a̰.ka̰.ˀlo.a/	/iain.ˀti.a/	/uet.na.ha.te/

[LH.L.L.LH]	[L.L.HL.L.LH]
([ˌhãː.kaˈnẽː.ˀɾa]	[w̰a̰ˌniːˈɾodˌnaː.ɾa])$_{\text{clause 2}}$
a-kanẽˀl-a	u̯a̰nilon -∅^{2} -na -ɾa
3S.POS-daughter-REF	to play-3S-PRS.V.EV-PFV.M
‘her daughter is playing’	

‘she’s cooking (while) her daughter is playing’

/LH.∅.∅.LH/	/∅.∅.HL.∅.LH/
/a.ka.nẽˀl.a/	/u̯a̰.nil.on.na.ɾa/

As illustrated in this section, examples suggest that tone is not only relevant to morphophonology, but also to syntax, since the tone of final suffixes can be used to determine phrases.

6.15. Tone in Verbal Morphemes

For a better understanding of tone phenomena in verbal morphemes, we should first address the classification of verb stems into classes. In accordance with Kroeker (2001), verb stems should be arranged into two classes according to their degree of openness, i.e. depending on whether they “are closed by a final consonant” (Kroeker 2001: 68)[153]. In other words, stems can be classified as either vowel or consonantal final. Consonant final stems belong to Class 1, while vowel final stems usually belong to Class 2. Table *81* provides an overview of the stem classification and summarizes the allomorphic forms of first-person singular morphemes. The table is based on Kroeker (2001), but the information in *italics* is based on my own fieldwork:

Table 81: Stem classes and 1S allomorphs.

Stems		**1S Constructions**		
		Affirmative	**Negative**	
	Stem Final Syllable	1S suffix	1S suffix	Negation suffix
Class 1	Consonant final, some vowel final, *if stem is monosyllabic and onsetless*	{-a}$^{\text{HL}}$	{-a}$^{\varnothing}$	{-ʔ}
Class 2	Vowel final	{-na}$^{\text{HL}}$	{-na}$^{\varnothing}$	adds an /n/ to the stem followed by negation suffix {-*ʔ*}

Table *82* illustrates the implications of the information provided in Table *81*. Note that Class 2 stems in the first-person negative become closed, so that the negation suffix {-ʔ} is attached to the first-person singular morpheme {-na}. In the same class, constructions with the third person show that the stem is open:

Table 82: Comparative allomorphic implications in affirmative and negative constructions in the 1S and 3S.

Stems			**Affirmative**		**Negative**	
	Template	Example	1S	3S	1S	3S
Class 1	{(σ)σ**C**}	{uil-}	/uil-**a**-ua/	/uil-∅-na-ɾa/	/uil-**ʔa**-ua/[154]	/uil-∅-ˀna-ua/
	{V}	{ĩ-}	/ĩ-**a**-ua/	/ĩ-∅-na-ɾa/	/ĩ-**ʔ**a-ua/	/ĩ-∅-ˀna-ua/
Class 2	{(σ)(C)V}	{ioli-}	/ioli-**n**a-ua/	/ioli-∅-**n**a-ɾa/	/ioli**n**-ˀna-ua/	/ioli-ˀna-ua/

The classification of verb stems into classes not only provides a more precise description of the allomorphy of first-person singular morphemes, but also poses implications for the tone description in verbs. While consonant final stems can display syllables specified with /HL/ and /LH/ tones or be unspecified for tone, vowel final stems only occur with a stem final /LH/. Furthermore, tonal sandhi is attested in vowel final stems. In vowel final /LH/ stems, the /LH/

[153] The classification shown in Table 81 was not used in the most recent descriptive works on Southern Nambikwara.
[154] As shown in Chapter 4, codas are resyllabified at morpheme boundaries. In example /uil-**ʔa**-ua/, phonetic realizations are: [ˈwiːˌ**ˀɾa**ːwa], [ˈwiːˌ**ɾˀa**ːwa], or [ˈwiːˌ**ɾa̰**ːwa]. This shows that, when they occur on the surface, glottal plosives may follow or be followed by a consonant. In all cases where a glottal plosive is inserted between the coda of the last syllable of a stem and a following vowel initial morpheme, syllabification still occurs and generates a glottalized consonant followed by a vowel or a plain consonant followed by a creaky voice vowel. This strategy ensures that glottal plosives are assigned to a syllable.

tone is perceived in constructions with third person singular, which are typically followed by a toneless syllable. In constructions with the first- and second-person singular, the stem is followed by an /HL/-toned syllable, which marks person. In this environment, I assume that the non-realization of stem final /LH/ in this class is motivated by the /HL/ tone which belongs to the syllable for the first- and second-person singular. Some examples of consonantal final and vowel final stems are provided in Table *83*. Note that Class 1 is predominantly comprised of consonant final stems, but it also includes vowel final stems:

Table 83: Consonant and vowel final stems and tone patterns.

Class 1 (consonant final)		Class 2 (vowel final)
/∅/	{ĩ} 'to bite' {ail} 'to go hunting' {hain} 'to sing' {iain} 'to eat' {hoh} 'to wander' {ali} 'to leave' {heˈhen} 'to be red'	-
/HL/	{uil} 'to be good' {uih} 'to get in' {uet} 'to do' {heh} 'to be' {ˀton} 'to grow'	-
/LH/	{ĩ} 'to see' {ũãt} 'to burn' {kãĩn} 'to be big' {hoh} 'to swim'	{tau} 'to chop' {nã} 'to drink' {kaˈla} 'to climb' {ˈi̯u̯hˀli} 'to be afraid'

As seen in Table *83*, both stem classes are predominantly monosyllabic. For Class 2 stems, the /LH/ is associated with the final syllable, regardless of stress.[155]

6.15.1. Class 1

Class 1 verbs display no change in the tone of the stem. Furthermore, no nasal consonant {-n} is added to the stem in negative constructions with first-person subject suffix. Note that, in accordance with Table *82*, first-person subject suffix is {-a}.
The following examples are presented according to the tones of the final syllable of the stem to illustrate that no sandhi is attested in the stems belonging to this verbal class.

a) /∅/ Stems

- Stem: {heˈhen} 'to be red'

Stems unspecified for tones may be followed by any tonal pattern. Note that first and second person subject markers in the negative verbal morphology are also unspecified for tone. Furthermore, evidentiality morpheme in the negative construction for the third-person singular is {-a} instead of {-na} because the stem is /n/ final.

[155] This analysis considers that stems such as {ˈi̯u̯hˀli} are not polymorphemic constructions.

	Affirmative		Negative
1S			
(1457)	[L.L.**HL**.LH] [heˈheːˌ**na**ː.wa] hehen -a -ua RED.to be red-1S.PRS-NPFV.M ‘I’m red’ (I can’t change it)[156] /∅.∅.HL.LH/ /he.hen.a.ua/	(1458)	[L.L.**L**.LH] [heˈheːˌn**a̰**ː.wa] hehen -ʔ -a -ua RED.to be red-NEG-1S.PRS-NPFV.M ‘I’m not red’ /∅.∅.∅.LH/ /he.hen.ʔa.ua/
2S			
(1459)	[L.L.**HL**.LH] [heˈheːˌ**nḭ**ː.ɾa] hehen -i -ɾa RED.to be red-2S.PRS-PFV.M ‘you’re red’ /∅.∅.HL.LH/ /he.hen.i.ɾa/	(1460)	[L.L.**L**.LH] [heˈheːˌn**a̰**ː.ɾa] hehen -ʔ -a -ɾa RED.to be red-NEG-2S.PRS-PFV.M ‘you’re not red’ /∅.∅.∅.LH/ /he.hen.ʔa.ɾa/
3S			
(1461)	[L.L.**L**.LH] [heˈhedˌnaː.ɾa] hehen -∅ -na -ɾa RED.to be red -3S-PRS.V.EV-PFV.M ‘he’s red’ /∅.∅.∅.LH/ /he.hen.na.ɾa/	(1462)	[L.L.**L**.LH] [heˈheːˌn**ʔa̰**ː.wa] hehen -ʔ -∅-a -ua RED.to be red-NEG-3S-PRS.V.EV-NPFV.M ‘he’s not red’ /∅.∅.∅.LH/ /he.hen.ʔa.ua/

One example for the stem unspecified for tone {heˈhen} followed by an /LH/ tone is observed when the recent past tonal morpheme **/**LH/ is attached to the unspecified tone unit /na/ below. The /LH/ tone morpheme is indicated in *italics* in the phonemic representation:

(1463)
[L.L.**LH**.LH]
[heˈhedˌnaː.ɾa]
hehen -∅ -na^{LH} -ɾa
RED.to be red -3S-REC.PST.V.EV-PFV.M
‘he was red’

/∅.∅.*LH*.LH/
/he.hen.na.ɾa/

---

[156] If the state of being red is a temporary condition, the following construction would be used:

[heˈhe^{d}nˌ^{t}saˌ^{h}naː.wa] [L.L.L.LH.LH]
/he.hen.sa.^{h}na.ua/ /∅.∅.∅.LH.LH/
hehen -sa -^{h}na -ua
to be red-1O-PRS.N.V.EV-NPFV.M
‘I’m red’ (temporarily)

b) /HL/ Stems

- Stem: {ˈuil}^{HL} ‘to be good’

As shown in (1464) and (1466), sequences of /HL/ tones do not trigger sandhi. Note that tense/evidentiality suffix for the third-person singular is {-na} since the verbal stem is /l/ final:

		Affirmative		Negative
1S	(1464)	[**HL**.HL.LH] [ˈwiːˌɾaː.wa] uil -a -ua to be good-1S.PRS-NPFV.M ‘I’m good’ /HL.HL.LH/ /uil.a.ua/	(1465)	[**HL**.L.LH] [ˈwiːˌɾʔa̰ːwa] uil -ʔ -a -ua to be good-NEG-1S.PRS-NPFV.M ‘I’m not good’ /HL.∅.LH/ /uil.ʔa.ua/
2S	(1466)	[**HL**.HL.LH] [ˈwiːˌɾḭː.ɾa] uil -i -ɾa to be good-2S.PRS-PFV.M ‘you’re good’ /HL.HL.LH/ /uil.ɾi.ɾa/	(1467)	[**HL**.L.LH] [ˈwiːˌɾʔa̰ː.ɾa] uil -ʔ -a -ɾa to be good-NEG-2S.PRS-PFV.M ‘you’re not good’ /HL.∅.LH/ /uil.ʔa.ɾa/
3S	(1468)	[**HL**.L.LH] [ˈwiː.naː.ɾa] uil -∅ -na -ɾa to be good-3S-PRS.V.EV-NPFV.M ‘he’s good’ /HL.∅.LH/ /uil.na.ɾa/	(1469)	[**HL**.L.LH] [ˈwiː.ʔna̰ː.wa] uil -ʔ -∅ -na -ua to see-NEG-3S-PRS.V.EV-NPFV.M ‘he’s not good’ /HL.∅.LH/ /uil.ˀna.ua/

If an /HL/ stem is followed by an /LH/ tone, no sandhi occurs:

(1470) [HL.**LH**.LH]
[ˈwiːˌnaː.ɾa]
uil -∅ -na^{LH} -ɾa
to be good -3S-REC.PST.V.EV-PFV.M
‘he was good’
/HL.*LH*.LH/
/uil.na.ɾa/

c) **/LH/ Stems**

There are two subtypes of /LH/, depending on whether the final syllable has a coda. As mentioned, no tone rule is attested, regardless of the syllable structure of the stem.

- /LH/ stem *without* a coda: {ĩ}^{LH} ‘to see’

Allomorphic forms of suffixes are also observed in Class 1 vowel final /LH/ stems. Note that in the negative form for the first-person singular, person marker is {-na} instead of {-a}, as seen in (1472). In the third-person negative form shown in (1476), the negative morpheme is {-a}, instead of {-na}. This strategy seems to be used to avoid the same morpheme/phonetic form {-na} being used in two different constructions, namely the first- and third-person negative forms.

		Affirmative		**Negative**
1S	(1471)	[LH.**HL**.LH] [ˈĩːˌ**a**ː.wa] ĩ -a -ua to see-1S.PRS-NPFV.M ‘I’m seeing’ /LH.HL.LH/ /ĩ.a.ua/	(1472)	[**LH**.L.LH] [ˈ**ĩ**ːˌna̰ː.wa] *[ˈĩːˌʔa̰ː.wa] ĩ -ʔ -na -ua to see -NEG-1S.PRS-NPFV.M ‘I’m not seeing’ /LH.∅.LH/ /ĩ.ˀna.ua/
2S	(1473)	[LH.**HL**.LH] [ˈĩːˌ**ḭ**ː.ɾa] ĩ -i -ɾa to see-2S.PRS-PFV.M ‘you’re seeing’ /LH.HL.LH/ /ĩ.i.ɾa/	(1474)	[**LH**.L.LH] [ˈĩːˌʔa̰ː.ɾa] ĩ -ʔ -a -ɾa to see -NEG-2S.PRS-PFV.M ‘he’s not seeing’ /LH.∅.LH/ /ĩ.ʔa.ɾa/
3S	(1475)	[**LH**.L.LH] [ˈ**ĩ**ː.naː.ɾa] ĩ -∅ -na -ɾa to see -3S-PRS.V.EV-PFV.M ‘he’s seeing’ /LH.∅.LH/ /ĩ.na.ɾa/	(1476)	[**LH**.L.LH] [ˈ**ĩ**ː.ʔa̰ː.wa] *[ˈĩːˌʔna̰ː.wa] ĩ -ʔ -∅ -a -ua to see-NEG-3S-PRS.V.EV-NPFV.M ‘he’s not seeing’ /LH.∅.LH/ /ĩ.ʔa.ua/

As described for the other stems in Class 1, the tone of the /LH/ stem is not affected if the following morpheme displays an /LH/ tone:

(1477) [**LH.LH**.LH]
[ˈĩː.naː.ɾa]
ĩ -∅ -na^{LH} -ɾa
to see -3S-REC.PST.V.EV-PFV.M
'he saw' (recently)

/LH.*LH*.LH/
/ĩ.na.ɾa/

- /LH/ stem *with* a coda: {ˈkãĩn}^{LH} 'to be big'

In contrast with /LH/ stems without a coda, the tense/evidentially morpheme for the third person singular negative is {-na}. Furthermore, the first-person singular marker follows the general rule for this class, and it is realized as {-a}, regardless of polarity, as shown in (1478) and (1479):

		Affirmative		**Negative**
1S	(1478)	[LH.**HL**.LH] [ˈkãj̃ːˌ**na**ː.wa] kãĩn -a -ua to be big-1S.PRS-NPFV.M 'I'm big' /LH.HL.LH/ /kãĩn.a.ua/	(1479)	[**LH**.L.LH] [ˈ**kãj̃**ːˌnʔaː.wa] kãĩn -ʔ -na -ua to be big-NEG-1S-NPFV.M 'I'm not big' /LH.∅.LH/ /kãĩn.ʔa.ua/
2S	(1480)	[LH.**HL**.LH] [ˈkãj̃ːˌ**ni̯**ː.ɾa] kãĩn -i -ɾa to be big-2S.PRS-PFV.M 'you're big' /LH.HL.LH/ /kãĩn.i.ɾa	(1481)	[**LH**.L.LH] [ˈ**kãj̃**ːˌna̯ː.ɾa] kãĩn -ʔ -a -ɾa to be big-NEG-2S.PRS-PFV.M 'he's not big' /LH.∅.LH/ /kãĩn.ʔa.ɾa/
3S	(1482)	[**LH**.L.LH] [ˈ**kãj̃**ː.naː.ɾa] kãĩn -ʔ -∅ -na -ɾa to be big-3S-PRS.V.EV-PFV.M 'he's big' /LH.∅.LH/ /kãĩn.na.ɾa/	(1483)	[**LH**.L.LH] [ˈ**kãj̃**ː.ʔna̯ː.wa] kãĩn -ʔ -∅ -na -ua to be big-NEG-3S-PRS.V.EV-NPFV.M 'he's not big' /LH.∅.LH/ /kãĩn.ˀna.ua/

As seen in Chapter 4, morpheme final consonants are very often resyllabified, even if the following morpheme is consonant initial. In Chapter 5, I described how morpheme final /t/ becomes resyllabified when followed by the portmanteau morpheme {-na}. In this context, the [+nasal] feature of /n/ is assimilated by the nucleus and /t.na/ sequences become [tãː]. There are some exceptions to this rule, and data suggests that exceptions are related to the cases where ambiguity would be raised by very similar phonetic forms. See examples below:

Stem: {ˈuet}^{HL}
Tense evidentiality suffix: {-a} 'PRS.V.EV'

		Affirmative		Negative
1S		[HL.**H**L.LH]		[HL.L.LH]
	(1484)	[ˈweːˌ**ta**ː.wa]	(1485)	[ˈweːˌ**tʔã**ː.wa]*[ˈweːˌ**tʔa̰**ː.wa]
		uet -a -ua		uet -ʔ -a -ua
		to do-1S-NPFV.M		to do-NEG-1S-NPFV.M
		'I'm doing		'I'm not doing'
		/HL.HL.LH/		/HL.∅.LH/
		/uet.a.ua/		/uet.ʔã.ua/
3S		[HL.**L**.LH]		[HL.**L**.LH]
	(1486)	[ˈweːˌ**ta**ː.ɾa]	(1487)	[ˈweː.**tʔa̰**ː.wa] *[ˈweːˌ**tã**ː.wa]
		uet -∅ -a -ɾa		uet -ʔ -∅ -a -ua
		to do-3S-PRS.V.EV.NPFV.M		to drink-NEG-3S-PRS.V.EV.NPFV.M
		'he's doing'		'he's not doing'
		/HL.∅.LH/		/HL.∅.LH/
		/uet.a.ɾa/		/uet.ʔa.ua/

One may notice that /t.n/ sequences would generate ambiguity in the negative forms for first-person singular and third-person singular. In the examples, negative forms for first-person and third-person singular are just distinguished by the nasalization of the person marker occurring in the former case. This phenomenon is observed in Class 1 /t/ final stems, whose first-person singular marker is {-a}, as described. Nasalization of the nucleus of the portmanteau tense/evidentiality morpheme in the third-person subject singular affirmative does not occur because of allomorphy. In this context, allomorph of {-na} is {-a}.

6.15.2. Class 2

In contrast with Class 1, Class 2 verbs display tonal alternations in the stem final syllable[157], depending on the tone of following morpheme. We can observe two main types of sandhi rules in this class.

a) Tonal sandhi 1: Elision of /LH/ tone

The following tonal sandhi rule is only observed in stems displaying a final /LH/ tone. When a Class 2 verb displays a final /LH/ tone, it becomes [L] if the following morpheme has an /HL/ tone.

Sandhi: stem^{LH} > L _[HL

[157] According to Kroeker (2001), the rule for the Class 2 verbs is as follow: "Class 2 stems always add n to the stem before the negative form and perturb the final stem tone to tone 2" (Kroeker 2001:69). Tone 2 from Kroeker's notation is represented by an /LH/ in this study.

- Stem: {nã}^{LH} ‘to drink’

In the examples below, note that the /LH/ tone in {nã} is realized as [L] in the first-person affirmative form. This seems to be motivated by the adjacent /HL/ tone for the first-person singular subject. Note that this rule is not applied when the following morpheme is unspecified for tone, as in (1489), (1490), and (1491):

		Affirmative		Negative
1S	(1488)	[L.**HL**.LH] [ˈnãː ˌ**na**ː.wa] nã -na -ua to drink-1S.PRS-NPFV.M ‘I’m drinking’ /LH.HL.LH/ /nã.na.ua/	(1489)	[**LH**.L.LH] [ˈnã**n**ːˌʔnaː.wa] nã -n -ʔ -na -ua to drink-NEG-NEG-1S-NPFV.M ‘I’m not drinking’ /LH.∅.∅.LH/ /nã.n̩.ˀna.ua/
3S	(1490)	[**LH**.L.LH] [ˈ**nã**ː.naː.ɾa] /nã.na.ɾa/ nã -∅ -na -ɾa to drink-3S-PRS.V.EV-PFV.M ‘he’s drinking’ /LH.∅.LH/ /nã.na.ɾa/	(1491)	[**LH**.L.LH] [ˈ**nã**ː.ʔna̰ː.wa] /nã.ˀna.ua/ nã -ʔ -∅-na -ua to drink-NEG-3S-PRS.V.EV-NPFV.M ‘he’s not drinking’ /LH.∅.LH/ /nã.ˀna.ɾa/

To illustrate that the sandhi rule described above is not conditioned by the segmental structure/ the [+voice] feature of following morpheme, see examples when morphemes display an initial voiceless consonant.

- Stem: {tau}^{LH} ‘to chop’

In the examples below, the same sandhi rule, which prevents sequences of /LH.HL/ from occurring in the surface representation is attested in the affirmative third-person singular of future constructions. Note that the future suffix {tu}^{HL} also affects the realization of the /LH/ tone in {tau}L^{H}, as shown in bold in (1493) and (1495):

		Affirmative		Negative
1S	(1492)	[**L**.HL.HL.LH] [ˈtawːˈnaːˌtuː.wa] tau -na -tu -ua	(1493)	[**LH**.L.L.LH] [ˈtawᵇm.naˌʰl̥oː.ɾa] tau -n -na -ʰlo -ɾa[158]

[158] I transcribe the phonemic representation of negative future morpheme [ʰl̥o] as /ʰlo/ because I have no evidence for describing it as derived from morphophonological rules. You may notice that aspirated liquid /ʰl/ occurring in this morpheme is not included in the description of the segmental phonology. I suspect that /ʰl/ is phonemic in this morpheme because it behaves similarly to the aspirate /ʰn/: 1) it becomes devoiced, and 2) it is restricted to a morphological environment. You may recall from Chapter 3 that /ʰn/ is also attested word-initially, though very rarely, but this is not the case of /ʰl/, probably because no Nambikwaran word begins with a liquid.

to chop-1S.FUT-NPFV.M
'I will chop'

/LH.∅.HL.LH/
/tau.na.tu.ua/

to drink-NEG-1S-NEG.FUT-PFV.M
'I will not chop'

/LH.∅.∅.LH/
/tau. n̩.na.ʰlo.ɾa/

3S

(1494) [**L**.HL.LH]
[ˈtawː.ˌtuː.wa]
tau -∅ -tu -ua
to chop-3S-FUT-NPFV.M
'he will chop'

/LH.HL.LH/
/tau.tu.ua/

(1495) [**LH**.L.L.LH]
[ˈtawː.na.ˌʰl̥oː.ɾa]
tau -∅ -naʰlo -ɾa
to chop-3S-NEG.FUT-PFV.M
'he will not chop'

/LH.∅.∅.LH/
/tau.ˀna.ʰlo.ɾa/

6.15.2.1. Tonal Reversal

One exception to the sandhi rule described for Class 2 verbs is observed with the verb {so}^{HL}, 'to take, to grab.' In the examples below, note that the /HL/ tone in the stem {so} becomes [LH] if the following TBU is unspecified for tone.

Exception: {ˈso}^{HL} > {ˈso}^{LH} _ [σ$^{\varnothing}$

Affirmative / **Negative**

1S

(1496) [**HL**.HL.LH]
[ˈsoː.ˌnaː.wa]
so -na -ua
to take-1S.PRS-NPFV.M
'I'm taking'

/HL.HL.LH/
/so.na.ua/

(1497) [**LH**.L.LH]
[ˈsoᵈn.ˌʔnaː.wa]
so -n -ʔ -na -ua
to take-NEG-NEG-1S.PRS-NPFV.M
'I'm not taking'

/HL.∅.∅.LH/
/so.n̩.ˀna.ua/

3S

(1498) [**LH**.L.LH]
[ˈsoː.naː.ɾa]
so -∅ -na -ɾa
to take-3S-PRS.V.EV-PFV.M
'he's taking'

/HL.∅.LH/
/so.na.ɾa/

(1499) [**LH**.L.LH]
[ˈsoː.ʔna̰ː.wa]
so-ʔ -∅ -na -ua
to take-NEG-3S-PRS.V.EV-NPFV.M
'he's not taking'

/HL.∅.LH/
/so.ˀna.ua/

Note that in the negative construction with the first-person, the negative morpheme is attached to the syllable {-n}. In this environment, /HL/ moves to the following syllable and becomes [LH]. More examples are given below:

		Negative		Affirmative
1S		[L.**LH**.L.LH]		[L.**L**.HL.LH]
	(1500)	[joˈ**li^{d}n**ˌʔnaː.wa]	(1501)	[joˈ**li**ːˌnaː.wa]
		ioli -n -ʔ -na -ua		ioli -na -ua
		to cut-NEG-NEG-1S.PRS-NPFV.M		to cut-1S.PRS-NPFV.M
		'I'm not cutting'		'I'm cutting'
		/∅.LH.∅.∅.LH/		/∅.LH.HL.LH/
		/io.li.n̩.ˀna.ua/		/io.li.na.ua/

6.15.2.2. Elision of Stem Final /LH/ Tones

You may recall that one syllable can occur at most with one contour tone. In the following examples, we will see that stem final /LH/ tones can be elided, affecting the realization of the stem melody.

b) Tonal sandhi 2: change of the tonal pattern of stem after elision

When the final vowel of a Class 2 stem is [+coronal], the stem can undergo tonal sandhi, if the following morpheme is second-person singular suffix {-i}^{HL}. In this environment, second-person singular suffix {-i} is elided by the stem-final [+coronal] vowel. After elision, the tone of the person marker {-i}^{HL} moves to the stem and the /LH/ tone of the stem is elided, as two contour tones cannot occur within the same syllable.

Rule: {stem}^{LH} i, e] > {stem}^{HL} _ ^{HL}[i

i. Example with stem final /i/:

- *Stem*: **{ʰnaˈˀti}**$^{∅.LH}$ 'to be dirty'

(1502)
[L.**HL**.LH]
[ʰnaˈ**ɗi**ː.ɾa]
ʰnaˀti -i -ɾa
to be dirty-2S-PFV.M
'you're dirty'

/∅.LH.HL.LH/
/ʰna.ˀti.i.ɾa/

(1503)
[L.**L**.HL.LH]
[ʰnãˈ**ɗi**ːˌnaː.wa]
ʰnaˀti -na -ua
to be dirty-1S-NPFV.M
'I'm dirty'

/∅.LH.HL.LH/
/ʰna.ˀti.na.ua/

(1504) [L.**LH**.L.LH]
[ʰnãˈ**dĩ**ːˌnaː.ɾa]
ʰna.ˀti. -∅ -na -ɾa
to understand-3S-PRS.V.EV-PFV.M
'he's dirty'

/∅.LH.∅.LH/
/ʰna.ˀti..na.ɾa/

In examples (1502), (1503), and, (1504), Class 2 stem {ʰnaˈˀti} is realized with three different melodies, namely, [L.HL], [L.L], and [L.LH], respectively.
In the negative form, the same patterns observed for the other Class 2 verbs are attested, and the stem melody is the same ([L.LH]). The tone of the stem does not undergo sandhi since the following syllable is toneless:

- *Stem*: **{ʰnaˈˀti}**$^{\varnothing.\mathrm{LH}}$ 'to be dirty'

(1505) [L.**LH**.**L**.LH]
[ʰnãˈdĩᵈnˌˀnaː.wa]
ʰnaˀti -n -ʔ -na -ua
to cut-NEG-NEG-1S.PRS-NPFV.M
'I'm not dirty'

/∅.LH.∅.LH/
/ʰna.ˀti.n̩.ˀna.ua/

(1506) [L.**LH**.L.LH]
[ʰnãˈ**dĩ**ːˌn̪aː.ɾa]
ʰnaˀti -ʔ -na -ɾa
to be dirty-NEG-2S-PFV.M
'you're not dirty'

/∅.LH.∅.LH/
/ʰna.ˀti.ˀna.ɾa/

(1507) [L.**LH**.L.LH]
[ʰnãˈdĩːˌʔnaː.wa]
ʰnaˀti -ʔ -∅ -na -ua
to be dirty-NEG-3S-PRS.V.EV-NPFV.M
'he's not dirty'

/∅.LH. ∅.LH/
/ʰna.ˀti.ˀna.ua/

ii. Example with stem final /e/:

- *Stem:* **{aneˈue}**$^{\varnothing.\varnothing.\mathrm{LH}}$ 'to understand'

(1508) [L.L.**HL**.LH]
[aˌneːˈ**we**ː.ɾa]
aneue -i -ɾa
to understand-2S-PFV.M
'you're understanding'

/∅.∅.LH.HL.LH/
/a.ne.ue.i.ɾa/

(1509) [L.L.**L**.HL.LH]
[aˌneːˈ**we**ːˌnaː.wa]
aneue -na -ua
to understand-1S-NPFV.M
'I'm understanding'

/∅.∅.LH.HL.LH/
/a.ne.ue.na.ua/

(1510) [L.L.**LH**.HL.LH]
[aˌneːˈ**we**ːˌnaː.ɾa]
aneue -∅ -na -ɾa
to understand-3S-PRS.V.EV-PFV.M
'he's understanding'

/∅.∅.LH.∅.LH/
/a.ne.ue.na.ɾa/

We can also observe three tone melodies in the stem {aneˈue}[159], namely [L.L.HL], [L.L.L], and [L.L.LH]. Note that only the tone of the final syllable of the stem is altered.

- Copula **{ˀne}**^{LH}

In constructions with copula {ˀne}^{LH}, the sandhi rule described above is also observed. Only the tone of the copula is affected:

Stem: {haˈnṵ̃ˈˀne}$^{∅.∅.LH}$ 'to threaten'
to threaten-COP

(1511) [L.L.**HL**.LH]
[haˌnṵ̃ːˈ**ˀne**ː.ɾa]
hanṵ̃ -ˀne -i -ɾa
to threaten-COP-2S-PFV.M
'you're threatening'

/∅.∅.LH.HL.LH/
/ha.nṵ̃.ˀne.i.ɾa/

[159] Stem {aneˈue} is likely polymorphemic, but I could not test this hypothesis with a native speaker. The rule described in this section operates regardless of the morphological structure of this stem, as it is applied to the tone belonging to its last syllable, /ue/, in this case.

If the following syllable is toneless, elision does not apply:

[L.L.**LH**.L.LH]
(1512) [haˈnṵ̃ːˈneː.naː.ɾa]
hanṵ̃ -ˀne -∅ -na -ɾa
to threaten-COP-3S-PRS.V.EV-PFV.M
'he's threatening'

/∅.∅.LH.∅.LH/
/ha.nṵ̃.ˀne.na.ɾa/

Some verbal stems display characteristics of both Classes 1 and 2. This is the case for {hoˈʔi}$^{\varnothing.LH}$ 'to swim,' and {ãũˈʔi}$^{\varnothing.LH}$, 'to sleep, to be sleepy.' In these stems, we do not observe the typical sandhi rule, which characterizes Class 2: an /LH/ stem-final tone cannot occur before a suffix initial /HL/ tone of the first-person singular {-na}^{HL}. The non-attestation of the tone rule may suggest that these stems belong to Class 1, but two typical features of Class 2 are observed in them:

(1) sandhi does not occur when stems are followed by the first person suffix {-na}^{HL}, similar to what happens in Class 1 since no tone rule is attested.
(2) sandhi occurs when stems are followed by second person suffix {-i}^{HL}, in contrast to Class 1, where no tone rule is attested.
(3) First-person subject (1s) is {-na}^{HL}, instead of typical {-a}^{HL} of Class 1 stems.
(4) {-n} is added to the stem in the negative form of first-person singular, a typical feature of Class 2 stems.

In this work, I include {hoˈʔi}$^{\varnothing.LH}$ and {ãũˈʔi}$^{\varnothing.LH}$ as a special case within Class 2 and list them under "exceptions." One may notice that both stems display the same final syllable /ʔi/, but is not clear whether there is a correlation between the rules described in this group of stems and their shared final syllable.
It is also possible that there are other verbs whose tone patterns and morphological structure behave like the ones observed in {hoˈʔi}$^{\varnothing.LH}$ and {ãũˈʔi}$^{\varnothing.LH}$. This would suggest that there is a third or "intermediate" class of verbal stems which combines features of both classes. However, this question is left unanswered for the time being. Examples below show that tonal sandhi is observed in the second person singular, as described for the stems from the previous section:

Stem: {**hoˈʔi**}$^{\varnothing.LH}$

[L.**HL**.LH]
(1513) [ˌhoːˈḭː.ɾa]
hoʔi -i -ɾa
to bathe-2S.SG-PFV.M
'you're bathing'

/∅.LH.HL.LH/
/ho.ʔi.i.ɾa/

If the stem {hoˈʔi}$^{\varnothing.LH}$ is followed by the first-person singular morpheme {-na}^{HL} or a toneless syllable, no sandhi is attested:

(1514)
[L.**LH**.HL.LH] *[L.**L**.HL.LH]
[hoˈʔiːˌ**na**ː.wa]
hoʔi -na -ua
to bathe-1S-NPFV.M
'I'm bathing'

/∅.LH.HL.LH/
/ho.ʔi.na.ua/

(1515)
[L.**LH**.L.LH]
[hoˈʔiːˌ**na**ː. ɾa]
hoʔi -∅ -na -ɾa
to bathe-3S-PRS.V.EV-PFV.M
'he's bathing'

/∅.LH.∅.LH/
/ho.ʔi.na.ua/

Stem: {**ãũˈʔi**}$^{\varnothing.LH}$ 'to sleep'

(1516)
[L.**LH**.L.LH]
[ˌãw̃ːˈ**ʔi**ːˌnaː.ɾa]
to sleep -∅ -na -ɾa
to sleep-3S-PRS.V.EV-PFV.M
'he's sleeping'

/∅.LH.∅.LH/
/ãũ.ʔi.na.ɾa/

(1517)
[L.**HL**.LH]
[ˌãw̃ːˈ**ʔi**ː.ɾa] ~ [ˌhãw̃ːˈ**i̯**ː.ɾa]
to sleep -i -ɾa
to sleep-2S-PFV.M
'you're sleeping'

/∅.LH.HL.LH/
/ãũ.ʔi.i.ɾa/

(1518)
[L.**LH**.HL.LH] *[L.**L**.HL.LH]
[ˌãw̃ːˈʔiːˌ**na**ː.wa]
ãũʔi -na -ua
to sleep-1S-NPFV.M
'I'm sleeping

/∅.LH.HL.LH/
/ãũ.ʔi.na.ua/

6.15.3. Change of the Tonal Pattern of Stems: Interrogative x Non-Interrogative

Change in the tone pattern of vowel final stems is also attested in the interrogative forms.[160] Once again, tonal sandhi affects the realization of the stem final /LH/ tone. In the interrogative form, stem final /LH/ tone becomes [HL]. This tonal alternation seems to be motivated by the tone of the following syllable. If it is toneless, the final tone of the stem is realized as [LH]. If the following syllable is specified with an /LH/ tone, the position of the H target in /LH/ changes and becomes [HL], as a consequence of the OCP:

Sandhi rule: {σ.σ}$^{\varnothing.LH}$ stems > {σ.σ}$^{[L.HL]}$ in present tense questions[161]

Stem: {i̯a̰ˈlu-}$^{\varnothing.LH}$ 'to be thirsty'

(1519)
[L.**LH**.L.LH.LH]
[ja̰ˈluː.saˌʰnãː.wa]
i̯a̰lu -sa -ʰna -ua
to be thirsty-1O-N.V.EV-NPFV.M
'I'm thirsty'

/∅.LH. ∅.LH.LH/
/i̯a̰.lu-sa-ʰna-ua/

(1520)
[L.**HL**.LH.HL.LH]
[ja̰ˈ**lu**ː.ˀnaˌtʃiː.wa]
i̯a̰lu -ˀna -tii -ua
to be thirsty.2O-INT.PRS-NPFV.M
'are you thirsty?'

/∅.LH.LH.HL.LH/
/i̯a̰.lu.ˀna.tii.ua/

Stem: {ãũˈʔi-}$^{\varnothing.LH}$ 'to sleep, to be sleepy'

(1521)
[L.**HL**.LH.HL.LH]
[ˌhãw̃ːˈʔiːˀnaˌtʃiː.wa]
ãũʔi -ˀna -tii -ua
to be thirsty.2O.SG-INT.PRS-NPFV.M
'are you sleepy/sleeping?'

/∅.LH.LH.HL.LH/
/ãũ.ʔi.ˀna.tii.ua/

[160] Nambikwara displays a myriad of morphemes used for interrogative constructions. Interrogative morphemes may encode other grammatical information such as tense and evidentiality. There are also wh-questions, and when they are employed, interrogative suffixes are also used.
[161] In this study, I will only use the interrogative morpheme /tii/, which is used in polar questions in the present tense. Note that aspectual/gender indexation of the addressee morpheme {-ua} follows the interrogative morpheme. For questions addressing a woman, /-ua/ must be replaced by {-ʔã}.

[L.**LH**.LH.L.LH.LH]
(1522) [ˌhãw̃ːˈʔiː.sa.ˀnãˌʰnaː.wa]
ãũʔi -sa ˀna -ʰna -ua
to be sleepy.1O-NEG-N.V.EV-NPFV.M
‘I’m not sleepy’

/∅.LH.LH.∅.LH.LH/
/ãũ.ʔi.sa.ˀnã.ʰna.ua/

If the following syllable has an /HL/ tone, the rule described above is not attested:

[L.**LH**.**HL**.LH] *[L.HL.HL.LH]
(1523) [ˌãw̃ːˈ**ʔi**ːˌ**na**ː.wa]
ãũʔi -na -ua
to sleep-1S-NPFV.M
‘I’m sleeping

/∅.LH.HL.LH/
/ãũ.ʔi.na.ua/

You may notice that in examples (1519) and (1522), the first-person object suffix {-sa}^{LH} undergoes a tonal alternation. Changes of the tone pattern in this morpheme are covered in section 6.17.2.

6.15.4. Tone Preservation After Elision of TBUs

We have seen in Chapter 5 that elision of segments (and syllables if the segments elided are a vowel) may occur. When a TBU is elided, its tone moves to the TBU on the left.

Elision of /-a/ _ [low central vowels (optional)

Before elision:

[L.L.**LH**]
(1524) [aˈlãː.**a**]
alã -a
macaw-REF
‘macaw’

/∅.∅.LH/
/a.lã.a/

After elision:

[L.**LH**]
(1525) [aˈ**lã**ː]
alã (-a)
macaw-REF
‘macaw’

Before elision:

[L.**HL**.L.LH]
(1526) [ˈãːˌaːˈheː.ɾa]
ã -a -he -ɾa
to fish-1S-PST.V.EV-PFV-M
‘I went fishing’

/∅.HL.∅.LH/
/ã.a.he.ɾa/

After elision:

[**HL**.L.LH]
(1527) [ˈ**ã**ːˌheː.ɾa]
ã -a -he -ɾa
to fish-1S-PST.V.EV-PFV-M
‘I went fishing’

6.15.5. Tone Spreading

/LH/ tones can spread if the following syllable is toneless. Tone spreading is attested if the stressed syllable has a [+voice] coda, which became resyllabified after an unstressed suffix/vowel was elided. Compare (1528) and (1529):

With no spreading:

	[LH.L]	[**L**.L.LH]
(1528)	[ˈuːli]	[**aj**ːˌnaːɾa]
	ul -i	ail -∅ -na -ɾa
	to be far-ADVZ	to go-3S-PRS.V.EV-PFV.M
	‘he’s going far’	

With spreading:

	[LH.**LH**.L.LH]	
(1529)	[ˌuːˈlajːˌnaː.ɾa]	
	ul -i	ail -∅ -na -ɾa
	to be far-ADVZ	to go-3S-PRS.V.EV-PFV.M
	‘he’s going far’	
	/LH. ∅.∅.∅.LH/	
	/u.li.ail.na.ɾa/	

As shown in (1528), spreading of /LH/ does not occur when the following syllable becomes specified for tone at the word boundary. In (1529), suffix {-i} is elided, and /LH/ spreads to the following syllable. Note that /LH/ spreading is blocked on the penultimate syllable. This may be related to the fact that penultimate syllables of the verbal stem may bear grammatical tones. If /LH/ spread to {-na}, the clause would be translated as “he went far’ because it marks the recent past tense when attached to {-na}, as described in the following section.

6.16. Grammatical Tone (GT)

As in many tone languages, tone is used to mark grammatical features in Kithãulhu. We have seen so far that tone can be used to mark word classes – in this case, the final syllable of a GW. For instance, I showed that nominal referential suffixes {-a} and {-su} display an /LH/ tone. As discussed, every tone must be associated with a TBU. In the case of {-a} and {-su}, both morphological structures correspond to a TBU, which can be represented as follows:

Phonological level		/LH/	/LH/
	suprasegmental	a. /σ/	b. /σ/
	segmental	/-a/	/-su/
Morphological level		{-a}	{-su}

In contrast with what is attested in {-a} and {-su}, there is no direct association between a GT/tonal morpheme with a specific TBU in the underlying representation. That is why tonal morphemes are also regarded as floating tones in the literature (Gussenhoven 2004). A visual representation of grammatical tone (GT) is given in Figure *38*:

Figure 38: Visual representation of floating tones.

Phonological level		/∅/	GT
		|	
	suprasegmental	a. /σ/	
		|	
	segmental	/CV(C)/	

Based on *Figure 38*, we can also differentiate GTs from lexical tones: the former is not associated with a specific TBU in the lexical representation, while the latter is. This topic raises the question of whether some verbal morphemes such as first-person suffix {-(n)a}, which are marked by an /HL/ tone, have its tone lexically assigned or whether the tone marked in such morphemes is a consequence of GTs. I will address this issue later in this section.
There are two subtypes of grammatical tone in Kithãulhu: /HL/ and /LH/, both of which are attested in certain verbal suffixes occurring at the penultimate stressed position within an inflected verbal word. Table *84* shows the template of verbal words and presents the main grammatical categories occurring in Kithãulhu verbal words, according to position (initial, intermediate, penultimate and ultimate) in relation to the stem:

Table 84: Template of verbal words in Kithãulhu.

<table>
<tr><th colspan="5">Position</th></tr>
<tr><th colspan="2">initial</th><th rowspan="2">intermediate</th><th rowspan="2">penultimate</th><th rowspan="2">ultimate</th></tr>
<tr><td>(-1)</td><td>0</td></tr>
<tr><td>Instrumental
Stative
Noun
Incorporation</td><td>root$_1$ (root)$_2$</td><td>Person (O/S)
Desiderative
Irrealis
Reflexive
Imminentive
Applicative
Reciprocal
Stative
Causative
Negation</td><td>Person (S)
Negation
Interrogative
Tense
Mood
Evidentiality
Aspect</td><td>Aspect
Gender
Direct speech</td></tr>
<tr><th rowspan="2">prefixes</th><th rowspan="2">stem</th><td colspan="3">suffixes</td></tr>
<tr><th colspan="3">verbal string</th></tr>
</table>

The multiple categories displayed in Table *84* under the columns initial, intermediate, penultimate and ultimate, do not correspond with the order in which these morphemes are attested in a word. They are shown this way to illustrate which categories are attested in each position. Some of the categories displayed in the penultimate position, for instance, may be indicated by the same morpheme. This is the case for the suffix {-na}, which marks evidentiality and tense. The same can be observed for the morpheme {-ua} occurring in the ultimate position, which may mark aspect and gender of the addressee. In the case of GT, attention is given to the penultimate and ultimate position of verbal constructions, as they are the most relevant positions for our current analysis. In the penultimate position, we can have up to three tonal contrasts in the surface representation, whereas there are only two attested contrastive tones in the ultimate position. As I show in the following section, GTs may indicate tense, mood, person, and evidentiality.

6.16.1. Tense

Tense can be marked with an /LH/ or an /HL/ tone in the penultimate position of the verbal string.

i. Present x recent past

An /LH/ tone associates with the toneless syllable of the tense/visual evidentiality suffix {-na}, to indicate the recent past tense.[162] Compare examples below. GTs are indicated in *italics*:

Present: {-na}$^{\varnothing}$

(1530)
[LH.**L**.LH]
[ˈĩː.ˌ**na**ː.ɾa]
ĩ -∅ -na -ɾa
to see-3S-PRS-PFV.M
‘he’s seeing’

/LH.∅.LH/
/ĩ.na.ɾa/

(1532)
[L.L.**L**.LH]
[waˈkod.ˌ**na**ː.ɾa]
uakon -∅ -na -ɾa
to work-3S-PRS-PFV.M
‘he’s working’

/∅.∅.∅.LH/
/ua.kon.na.ɾa/

Recent Past: {-na}^{LH}

(1531)
[LH.***LH***.LH]
[ˈĩː.ˌ**na**ː.ɾa]
ĩ -∅ -na^{LH} -ɾa
to see-3-REC.PST-PFV.M
‘he saw it (recently)’

/LH.*LH*.LH/
/ĩ.na.ɾa/

(1533)
[L.L.***LH***.LH]
[waˈkod.ˌ**na**ː.ɾa]
uakon -∅ -na^{LH} -ɾa
to work-3S-REC.PST-PFV.M
‘he worked’

/∅.∅.*LH*.LH/
/ua.kon.na.ɾa/

As seen in (1530) – (1533), there is no segmental difference for the present and recent past inflection of the verbal. Change of tense is only indicated by the /LH/ tone.

6.16.2. Future Non-Imperative x Present Imperative

Apart from tense, tone can also be used to distinguish imperative[163] and non-imperative mood in affirmative constructions. In affirmative imperative present constructions, the suffix {-tu} is toneless. In non-imperative future constructions, an /HL/ is attached to {-tu}:

[162] In examples (1530) – (1533), I did not gloss the visual evidentiality information to focus on tense. In all the cases, where you read ‘PRS’ (present), it should be ‘PRS.V.EV’, while the recent past form (REC.PST) should be ‘REC.PST.V.EV’.

[163] There are multiple morphemes for imperative constructions, which are used according to the imperative type, the number of addressees, among others, and which are not covered in this study. The available literature on

Imperative present: {-tu}$^{\varnothing}$

(1534) [L.**L**.LH]
[ˈhajᵍŋ.**du**ː.a]
hain -tu -ua
to sing-IMP-NPFV.M
'sing!'

/hain.tu.ua/
/∅.∅.LH/

(1536) [L.LH.HL.**L**.LH]
[ˌũː.haˈliːˌ**tu**ː.a]
ũh- hali -∅ -tu -ua
INST-to paint-IMP-NPFV.M
'draw!'

/ũh.ha.li.tu.ua/
/∅.∅.HL. ∅.LH/

(1538) [HL.**L**.LH]
[ˈweʔˌtuː.a]
uet -∅ -tu -ua
to do-IMP-NPFV.M
'do!'

/HL.∅.LH/
/uet.tu.ua/

Future: {-tu}^{HL}

(1535) [L.***HL***.LH]
[ˈhajᵍŋ.**du**ː.a]
hain -∅ -tu -ua
to sing-3S-FUT-NPFV.M
'he'll eat'

/hain.tu.ua/
/∅.HL.LH/

(1537) [L.LH.HL.***HL***.LH]
[ˌũː.haˈliːˌ**tu**ː.a]
ũh- hali -∅ -tu -ua
INST-to paint-3S-FUT-NPFV.M
'he'll draw'

/ũh.ha.li.tu.ua/
/∅.∅.HL.*HL*.LH/

(1539) [HL.***HL***.LH]
[ˈweʔˌtuː.a]
uet -tu -ua
to do-3S-FUT-NPFV.M
'he'll do'

/HL.*HL*.LH/
/uet.tu.ua/

As seen in (1534), (1535), (1538), and (1539), the cases in which tonal contrasts are attested are mostly comprised of consonant final stems, but vowel-final stems are also possible, as in (1536) and (1537).

6.16.3. Evidentiality

GT is also attached to unspecified TBUs to indicate evidentiality in past constructions with tense/person/evidentiality suffixes. Examples below only include suffixes {ˈna-ˈhe}$^{HL-\varnothing}$[164], which mark the past tense for the first-person singular subject.
Since two GTs can be attached to /-he/, there can be three tonal contrasts in the surface realization of this morpheme. When the GTs are attached, no sandhi is attested to the first-person subject singular morpheme {-na}^{HL}. In the glosses, I will not classify the evidentiality morphemes, but the information related to the changes in meaning caused by the attached GTs is provided in brackets.

Southern Nambikwara shows different explanations for the phenomena observed. See Kroeker (2001), Silva (2021) and Belo (2021) for more details.

[164] Silva (2021) analyzes {-nahe} as one single morpheme. I gloss {nahe} as two separate morphemes because I assume that {-na}^{HL} is the typical first-person singular subject marker observed for verbal constructions with vowel-final stems, as is the case for {ũã}, 'to come,' in the examples presented.

i. **{-ˈhe}**$^{\varnothing}$

When {-ˈhe} is toneless, it indicates a customary action in the past that might be verified by an eyewitness:

	[L.HL.**L**.LH]
(1540)	[ˈw̃ãːˌnaːˈ**he**ː.ɾa]
	ũã -na -he -ɾa
	to come-1S-PST.EV-PFV.M
	‘I came’ (someone might have seen me)
	/∅.HL.∅.LH/
	/ũã.na.he.ɾa/

	[LH.LH]	[LH.L.LH]	[L.HL.**L**.LH]
(1541)	[ˈɗajna]	[ˈsˀḭːˈhjeː.na]	[ˈa̰j̰ː.naˌ**heː.**ɾa]
	ˀtajna	ˀsih-ien-a	ail̃ -na -he -ɾa
	1S	house-CL.circular-REF	to go-1S-PST.EV-PFV.M
	‘I went to the village’ (someone might have seen me)		
	/LH.LH/	/LH.∅.LH/	/∅.HL.∅.LH/
	/ˀtai.na/	/sˀih.ien.a/	/ail.na.he.ɾa/

ii. **{-ˈhe}**^{HL}

GT /HL/ is attached to {ˈhe} to indicate that the action was not visually witnessed:

	[L.HL.***HL***.LH]
(1542)	[ˈw̃ãːˌnaːˈ**he**ː.ɾa]
	ũã -na -he -ɾa
	to come-1S-PST.EV-PFV.M
	‘I came’ (I was there, nobody saw me)
	/∅.HL.*HL*.LH/
	/ũã.na.he.ɾa/

	[LH.LH]	[LH.L.LH]	[L.HL.***HL***.LH]
(1543)	[ˈɗajna]	[ˈsˀḭːˈhjeː.na]	[ˈa̰j̰ː.naˌ**he**ː.ɾa]
	ˀtajna	ˀsih-ien-a	ail̃ -na -he -ɾa
	1S	house-CL.circular-REF	to go-1S-PST.EV-PFV.M
	‘I went to the village’ (I was there, nobody saw me)		
	/LH.LH/	/LH.∅.LH/	/∅.HL.*HL*.LH/
	/ˀtai.na/	/sˀih.ien.a/	/ail.na.he.ɾa/

iii. {-ˈhe}^{LH}

Finally, the GT /LH/ is added to {-ˈhe} to suggest that an action was carried out, but it is likely not visually witnessed by the addressee:

(1544)
[L.HL.***LH***.LH]
[ˈw̃ãːˌnaːˈ**he**ː.ɾa]
ũã -na -he -ɾa
to come-1S-PST.EV-PFV.M
‘I came’ (there were a lot of people, you probably didn’t notice me)

/∅.HL.*LH*.LH/
/ũã.na.he.ɾa/

(1545)

[LH.LH]	[LH.L.LH]	[L.HL.***LH***.LH]
[ˈɗajna]	[ˈsˀḭːˈhjeː.na]	[ˈa̰j̰ː.naˌ**he**ː.ɾa]
ˀtajna	ˀsih-ien-a	ail̃ -na -he -ɾa
1S	house-CL.circular-REF	to go-1S-PST.EV-PFV.M

‘I went to the village’ (there were a lot of people, you probably didn’t notice me)

/LH.LH/	/LH.∅.LH/	/∅.HL.*LH*.LH/
/ˀtai.na/	/sˀih.ien.a/	/ail.na.he.ɾa/

In the third person singular subject, the tense/evidentiality suffix is {-nahe}. In such constructions, there is a tonal alternation in /-na/ when the evidentiality GT /HL/ is attached to {-ˈhe}. Compare (1546) and (1547):

Rule: {naˈhe}$^{LH.\varnothing}$ > {naˈhe}$^{HL.HL}$

(1546)
[L.**LH**.**L**.LH]
[ˈw̃ãː**na**ˈ**he**ː.ɾa]
ũã -∅ -nahe -ɾa
to come-3S-PST.EV-PFV.M
‘he came’ (I saw him)

/∅.LH.∅.LH/
/ũã.na.he.ɾa/

(1547)
[L.**HL**.**HL**.LH]
[ˈw̃ãːˌ**na**ːˈ**he**ː.ɾa]
ũã -∅ -nahe -ɾa
to come-3S-PST.EV-PFV.M
‘he came’ (I didn’t see him)

/∅.LH.*HL*.LH/
/ũã.na.he.ɾa/

As seen in (1546), when no GT is attached, [na] has an [LH] tone. When the GT /HL/ associates with [ˈheː], the H target in [LH] is deallocated and becomes [HL], as shown in (1547). For more information on the evidentiality system, see Kroeker (2001) and Silva (2021).

6.17. Other Tonal Alternations

6.17.1. Applicative {-ki}

{-ki} is an applicative, which indicates the source, goal, benefactive, and comitative (Silva: 2021). In most constructions, {ki} is marked with an /LH/ tone. In some examples, the /LH/ tone in {-ki} can become [HL]. Example (1548) shows {-ki} with an /LH/ tone:

[L.L.**LH**.LH.LH]
(1548) [waˈkoᵍŋˌ**ki**ˌnaː.ɾa]
uakon -ki -∅ -∅ -na^{LH} -ɾa
to work-APP-3O-3S-REC.PST.V.EV-PFV.M
‘he worked for someone’

/∅.∅.LH.*LH*.LH/
/ua.kon.ki.na.ɾa/

Examples of {-ki} displaying an [HL] are observed in constructions with the second-person singular subject or object:

2S → 1O

[LH.HL.**HL**.HL.HL.LH]
(1549) [saˈsoː.**ki**ˌsaᵈnˈduː.wa]
sa- so -ki -sa -n[165] -tu -ua
INST-to take-APP-1O-2S-FUT-NPFV.M
‘you will take from me’

/LH.HL.LH.HL.HL.LH/
/sa.so.ki.sa.n̩.tu.ua/

2S → 3O

[LH.HL.**HL**.HL.LH]
(1550) [saˈsoːˌ**kiᵈn**ˈduː.wa]
sa- so -ki -∅ -n -tu -ua
INST-to take-APP-3O-2S-FUT-NPFV.M
‘you’ll take from him’

/LH.HL.LH.HL.HL.LH/
/sa.so.ki.n̩.tu.ua/

[165] In this type of constructions, second-person subject singular suffix is {-n}^{HL}, instead of {-i(n)}^{HL}. I initially assumed that the coronal vowel /i/ in this suffix was elided, but I found no evidence for it in the other examples.

1S → 2O

(1551)
[LH.HL.**HL**.LH.HL.HL.LH]
[saˈsoː.**ki**.ˀnaˌhaːˈtuː.wa]
sa- so -ki -ˀna -ha[166] -tu -ua
INST-to take-APP-2O.1S-FUT-NPFV.M
'I'll take it from you'

/LH.HL.LH.LH.HL.HL.LH/
/sa.so.ki.ˀna.ha.tu.ua/

3S → 2O

(1552)
[LH.HL.**HL**.LH.HL.LH]
[saˈsoː.**ki**.ˌˀnaːˈtuː.wa]
sa- so -ki -ˀna -∅ -tu -ua
INST-to take-APP-2O-3S-FUT-NPFV.M
'he'll take it from you'

/LH.HL.LH.LH.HL.LH/
/sa.so.ki.ˀna.tu.ua/

In constructions without the second-person singular suffixes, {-ki} has its typical [LH] tone:

1S → 3O

(1553)
[LH.HL.**LH**.HL.HL.LH]
[saˈsoː.**ki**.naˈtuː.wa]
sa- so -ki -∅ -na -tu -ua
INST-to take-APP-3O-1S-FUT-NPFV.M
'I'll take it from him'

/LH.HL.LH.HL.HL.LH/
/sa.so.ki.na.tu.ua/

3S → 1O

(1554)
[LH.HL.**LH**.L.HL.LH]
[saˈsoː.**ki**.saˈtuː.wa]
sa- so -ki -sa -∅ -tu -ua
INST-to take-APP-1O.3S-FUT-NPFV.M
'he'll take it from me'

/LH.HL.LH.∅.HL.LH/
/sa.so.ki.sa.tu.ua/

[166] {-ha}^{HL} seems to be another allomorph of first-person singular suffix {-na}^{HL}, which is typically attested following vowel final stems like {-so}^{HL} in affirmative constructions.

3S → 3O

[LH.HL.**LH**.HL.LH]
(1555) [saˈsoː.**ki**ˈtuː.wa]
sa- so -ki -∅ -∅ -tu -ua
INST-to take-3O-3S-FUT-NPFV.M
‘he’ll take it from him’

/LH.HL.LH.HL.LH/
/sa.so.ki.tu.ua/

As shown in (1553), the change of the tonal pattern of {-ki}^{LH} seems to be related only to the person marker of the second person and not the tone of adjacent morphemes.

6.17.2. Tone Alternation in Suffix {-sa} and Polarity

{-sa} marks the first-person object singular (1O). The tone pattern of {-sa} changes depending on the polarity of the clauses. If {-sa} occurs in affirmative clauses, it is toneless:

Suffix string: {sa-ʰna-ua}$^{\varnothing.LH.LH}$
1O-NV.EV-NPFV.M

Stem: **{ãũˈʔi}**$^{\varnothing.LH}$ ‘to sleep, to be sleepy’

[L.LH.**L**.LH.LH]
(1556) [ˌãw̃ːˈʔiː.saˌʰnaː.wa]
ãũʔi -sa -ʰna -ua
to be sleepy-1O-N.V.EV-NPFV.M
‘I’m sleepy’

/∅.LH.∅.LH.LH/
/ãũ.ʔi.sa.ʰna.ua/

Stem: **{hˀiˈtʰa}**$^{LH.\varnothing}$[167] ‘to be tired’

[LH.L.**L**.LH.LH]
(1557) [ˌhˀiː.ˈtʰaː.saˌʰnaː.wa]
hˀitʰa -sa -ʰna -ua
to be tired-1O-NV.EV-NPFV.M
‘I’m tired’

/LH.∅.LH.LH.LH/
/hˀi.tʰa.sa.ʰna.ua/

[167] The stem {hˀiˈtʰa}, ‘to be tired,’ seems to be a compound. The first part of the stem is the nominal root {hˀi}^{LH}, ‘hand.’ That is probably why both syllables of the stem are stressed, although only the first one has an /LH/ tone.

Stem: **{ĩˈton}**$^{\varnothing.\varnothing}$ ‘to be sick’

(1558) [L.L.**L**.LH.LH]
[ĩˈtoᵈn.ᵗsaːˈʰnaː.wa]
ĩton -sa -ʰna -ua
to be sick-1O-N.V.EV-NPFV.M
‘I’m sick’

/∅.∅.∅.LH.LH/
/ĩ.ton.sa.ʰna.ua/

Stem: **{ˈol}**^{LH} ‘to be scared’

(1559) [LH.**L**.LH.LH]
[ˈoː.ʰl̥aˌʰnaː.wa]
ol -sa -ʰna -ua
to be scared-1O-N.V.EV-NPFV.M
‘I am scared’

/LH.∅.LH.LH/
/ol.sa.ʰna.ua/

Note that in all examples, {-sa} is toneless, regardless of whether it follows LH-toned or toneless syllables. In all the examples, the following morpheme {ʰna}^{LH} displays an /LH/ tone. If {-sa} occurs in negative clauses, it becomes {-sa}^{LH}, with a rising tone [LH]:

Suffix string: {sa-ˀna-ʰna-ua}$^{LH.\varnothing.LH.LH}$
1O-NEG-NV.EV-NPFV.M

(1560) [L.LH.**LH**.L.LH.LH]
[ˌhãw̃ːˈʔiː.**sa**.ˀnãˌʰnaː.wa][168]
ãũʔi -sa -ˀna -ʰna -ua
to be sleepy-1O-NEG-N.V.EV-NPFV.M
‘I’m not sleepy’

/∅.LH.*LH*.∅.LH.LH/
/ãũ.ʔi.sa.ˀna.ʰna.ua/

(1561) [LH.L.**LH**.L.LH.LH]
[ˌˀhiːˈtʰaː.sa.ˀnãˌʰnaː.wa]
hˀitʰa -sa -ˀna -ʰna -ua
to be tired-1O-NEG-N.V.EV-NPFV.M
‘I’m not tired’

/∅.LH.*LH*.∅.LH.LH/
/ãũ.ʔi.sa.ˀna.ʰna.ua/

[168] Negative suffix {ˀna} is realized with a nasal vowel in this type of construction. It is unclear whether the [+nasal] feature in the nucleus of this morpheme is due to a rule/phonetic implementation or if nasality also signals negation. Silva (2021) also observed a similar phenomenon in negative constructions.

[L.L.**LH**.L.LH.LH]
(1562) [ĩˈtoᵈn̩ˌ**ᵗsa**ː.ˀnãˌʰnaː.wa]
ĩton -sa -ˀna -ʰna -ua
to be sick-1O-NEG-N.V.EV-NPFV.M
'I'm not sick'

/∅.∅.*LH*.∅.LH.LH/
/ĩ.ton.sa.ˀna.ʰna.ua/

[LH.**LH**.L.LH.LH]
(1563) [ˈoː.**ʰl̥a**.ˀnãˌʰnaː.wa]
ol -sa -ʔ -na -ʰna -ua
to be scared-1O-NEG-N.V.EV-NPFV.M
'I am not scared'

/LH.*LH*.∅.LH.LH/
/ol.sa.ˀna.ʰna.ua/

As shown in all examples of negative constructions with {-sa}, the negation is indicated with the negative morpheme {ˀna}, which is toneless. The /LH/ tone occurring in negative constructions with {-sa} may also be another indicator for negation in this type of verbal construction. Let us see a final example with {-sa}, this time followed by the /HL/-toned morpheme {-n}:

Rule: $\{\text{-sa}\}^{\varnothing} > \{\text{-sa}\}^{HL}$ _ $[n^{HL}$

[LH.HL.HL.**HL**.HL.LH]
(1564) [saˈsoː.kiˌ**saᵈn**ˈduː.wa]
sa- so -ki -sa -n -tu -ua
INST-to take-APP-1O-2S-FUT-NPFV.M
'you will take from me'

/LH.HL.LH.∅.HL.HL.LH/
/sa.so.ki.sa.n̩.tu.ua/

As shown in (1564), {-sa} becomes [HL]-toned when the /HL/-toned second-person suffix is attached to it in the affirmative form. This observation also suggests that {-sa} is in fact toneless in affirmative constructions. It should be noted that further tests should be carried out to determine if {-sa} can get its tone pattern from other types of morphemes.

6.17.3. Tone Alternation and the Negative Suffix /-ʔ/

As previously discussed, negation is usually marked by the negative suffix /-ʔ/ attached to the subject person markers, when they are segmentally available. When /-ʔ/ is followed by the first person suffix $\{\text{-a}\}^{HL}$, it causes the first-person suffix to be realized as an [L]. Compare the affirmative and negative examples below:

Rule: {-a}^{HL} > {-a}^{L} _ [ʔ

	Affirmative		*Negative*
	[L.L.**HL**.LH]		[L.L.**L**.LH]
(1565)	[saˈkãw̃ːˌ**ta**ː.wa]	(1566)	[saˈkãw̃ːˌ**ta̰**ː.wa]
	sakãũt -a -ua		sakãũt -ʔ -a -ua
	to drip-1S-NPFV.M		to drip-NEG-1S-NPFV-M
	'I'm dripping'		'I'm not dripping'
	/∅.∅.HL.LH/		/∅.∅.HL.LH/
	/sa.kãũt.a.ua/		/sa.kãũt.ʔa.ua/

As seen in (1565) and (1566), the distinction between the first-person singular present affirmative and negative forms are also indicated by tone. In first-person singular affirmative constructions in the present and recent past, the tone of first-person singular suffix {-a}^{HL} is the same, namely /HL/.

This observation contrasts with constructions in the present and recent past for the third-person singular, which is indicated by an /LH/ tone for the recent past, as discussed. Since the first-person singular suffix {-a}^{HL} does not change its tone in the recent past, the recent past form is only distinguished from the present form by the final aspect/gender marker. While the present form is marked by the imperfective aspect {-ua}, the recent past is indicated by the perfective aspect {-ɾa}, as illustrated in the examples below:

	Present:		*Recent Past*:
	[L.L.**HL**.LH]		[L.L.**HL**.LH]
(1567)	[saˈkãw̃ːˌtaː.**wa**]	(1568)	[saˈkãw̃ːˌtaː.**ɾa**]
	sakãũt -a -ua		sakãũt -a -ɾa
	to drip-1S-PRS.NPFV.M		to drip-NEG-1S-REC.PST.PFV.M
	'I'm dripping'		'I dripped
	/∅.∅.HL.LH/		/∅.∅.HL.LH/
	/sa.kãũt.a.ua/		/sa.kãũt.a.ɾa/

6.17.4. Emphatic

The last tonal alternation attested in the data is related to the stem. Some state verbs can become [HL]-toned to indicate emphasis. You may recall from Chapter 2 that Kithãlhu has an emphatic suffix {kʰaiʔ}^{HL}, which is attached to the verbal stem in affirmative constructions. Before describing the tonal alternation in the stem, let us see an example of a stem followed by {kʰaiʔ}^{HL}:

	[L.L.**HL**]	[LH.L.LH]
(1569)	[wiˈwiᵍŋˈ**kʰaj**ː]	**[**ˈˀneːˌnaː.ɾa]
	uiuin -kʰaiʔ	ˀne -∅ -na -ɾa
	RED.to be blue-P.EMP	COP-3S-PRS.V.EV-PFV.M
	‘it’s very blue’	
	/∅.∅.HL/	/LH.∅.LH/
	/ui.uin.kʰaiʔ/	/ˀne.na.ɾa/

As seen in (1569), when {kʰaiʔ} is attached to the stem {uiuin}, it must be followed by the copula {ˀne}. This is in accordance with what has been described by Silva (2021). Another strategy that can be used in some stative verbs to convey emphasis to an affirmative clause is to change the tonal pattern of the stem to [HL]. When the tonal pattern of the stem is changed, no copula is necessary. Change of the tonal pattern of stems to indicate emphasis can be used for monosyllabic or polysyllabic stems. Although it is not clear whether a stem with an /HL/ can be changed to another pattern such as [LH], we can observe toneless final syllables of stems becoming specified with an [HL] tone or /LH/ stems inverting the H target to [HL]. In the examples below, note that the nucleus of the stressed syllables becomes more lengthened than typical lengthening caused by stress. Extra lengthening is indicated by [ːː]:

a) /∅/ stems:

Stem: **{ˈul}**$^{\varnothing}$ ‘to be lazy’

[**L**.L.LH.LH]
(1570) [ˈ**u**ːˌʰl̥aˌʰnaː.wa]
ul -sa -ʰna -ua
to be lazy-1O-N.V.EV-NPFV.M
‘I am lazy’

[**HL**.L.LH.LH]
(1571) [ˈ**u**ːːˌʰl̥aˌʰnaː.wa]
ul -sa -ʰna -ua
to be lazy-1O-N.V.EV-NPFV.M
‘I am *very* lazy’

/∅.∅.LH.LH/
/ul.sa.ʰna.ua/

No copula is necessary if the predicate is a stative verb. Note that the stem is still toneless:

[L.**HL**.L.LH.LH]
(1572) [ˈuːˈkʰajːˀsaˌʰnaː.wa]
ul -kʰaiʔ -sa -ʰna -ua
to be lazy-EMP-1O-N.V.EV-NPFV.M
‘I’m *very* lazy’

/∅.HL.∅.LH.LH/
/ul.kʰaiʔ.sa.ʰna.ua/

Stem: {**he**ˈ**hen**}$^{\varnothing}$ ‘to be red’

If the stem is polysyllabic, only the stressed syllable becomes [HL]-toned. Note that the nucleus of the stressed syllable becomes lengthened even if followed by a coda:

(1573) [L.**HL**.L.LH]
[heˈ**he**ːdˌnaː.ɾa]
hehen -∅ -na -ɾa
RED.to be red-3S-PRS.V.EV-PFV.M
‘it’s really red’

(1574) [L.**L**.L.LH]
[heˈ**hed**ˌnaː.ɾa]
hehen -∅ -na -ɾa
RED.to be red-3S-PRS.V.EV-PFV.M
‘it’s red’

/∅.∅.∅.LH/
/he.hen.na.ɾa/

b) /LH/ stems:

The H target of /LH/ stems moves to the beginning of the syllable and is realized as [HL] to indicate ‘very’:

Stem: **{ˈul}**^{LH} ‘to be far’

(1575) [**LH**.L.LH]
[ˈuːˌnaː.ɾa]
ul -∅ -na -ɾa
to be far-3S-PRS.V.EV-PFV.M
‘it’s far’

(1576) [**HL**.L.LH]
[ˈuːːˌnaː.ɾa]
ul -∅ -na -ɾa
to be far-3S-PRS.V.EV-PFV.M
‘it’s very far’

/LH.∅.LH/
/ul.na.ɾa/

Stem: **{kãĩn}**^{LH} ‘to be big’

If the nucleus is a diphthong, both vowels get lengthened after the /LH/ becomes [HL]:

(1577)
[**LH**.L.LH]
[ˈkãȷ̃ː.ˌnaː.ɾa]
kãĩn -∅ -na -ɾa
to be far-3S-PRS.V.EV-PFV.M
'it's far'

(1578)
[**HL**.L.LH]
[ˈkãːȷ̃ː.ˌnaː.ɾa]
kãĩn -∅ -na -ɾa
to be far-3S-PRS.V.EV-PFV.M
'it's *very* far'

/LH.∅.LH/
/kãĩn.na.ɾa/

The change of the tonal pattern of the stem can also have a pragmatic meaning if the subject is the second person:

(1579)
[**HL**.HL.LH]
[ˈ**u**ː.ˌliː.ɾa]
ul -i -ɾa
to be red-2S-PFV.M
'you're very lazy' (meaning: you're such a lazy person, huh?!)

/LH.HL.LH/
/ul.i.ɾa/

If the stem is an action verb, the tonal alternation within the stem is not observed. Furthermore, some state verbs such as {uiuin}, presented in the beginning of this section, are also not allowed to become [HL]-toned:

Stem: **{ˈnã}**^{LH} 'to drink'

(1580)
*[**HL**.L.LH]
*[ˈ**nã**ː.ˌnaː.ɾa]
nã -∅ -na -ɾa
to drink 3S-PRS.V.EV-PFV.M
*'he's drinking a lot'

Stem: /uiuin-/$^{\varnothing.\varnothing}$ 'to be blue'

(1581)
*[L.**HL**.L.LH]
*[wiˈ**wi**ː**d**ˌnaː.ɾa]
uiuin -∅ -na -ɾa
RED.to be blue 3S-PRS.V.EV-PFV.M
*'it's *very* blue'

In all cases where there is the tonal alternation to indicate emphasis, the H pitch has a much higher value than what is typically attested for the phonetic realization of lexical and grammatical /HL/ tones. In an earlier publication (Netto 2018), I described this tonal alternation for emphasis as a very H tone because it has a much higher F_0 value than the typical [HL] tone, which may suggest that it is related to intonation. Costa (2020) noticed the inversion of the tonal patterns [LH] > [HL] in the verbs {kãĩn} and {ul} and suggested that such alternation may be related to intonation.

Chapter Summary

This chapter presented the tone system in Kithãulhu. I showed that there are three phonetic tone/pitch patterns attested in the data, namely a low-level tone [L] and two contour tones [HL] (falling) and [LH] (rising). All syllables are marked by a phonetic tone/pitch in the surface representation, and all three tone patterns are attested in most word classes. Pitch is contrastive in the surface representation, but contrastive [LH] x [HL] are rare in stems and relatively frequent in verbal suffixes due to grammatical tone. I also showed that tone is independent from vowel quality, although vowel quality can affect the distribuition of tones with a H target, and that the stressed syllable is the environment in which tone is contrastive. As discussed, tone is also related to morphology, as final tones of GWs, mostly related to the final suffix added to stems, can be used to determine word classes. This is the case for nouns, which are always marked with an /LH/ tone. When discussing the tone-bearing units (TBUs), we saw that the syllable is the best candidate for tone assignment. Stressed syllables usually attract contour tones, but there are examples of unstressed syllables marked with a contour tone. I showed that not every TBU is specified for tone, and distinguished /T/-specified TBUs from unspecified /∅/ ones. There are two types of specified TBUs, namely /HL/ and /LH/. In the surface representation, however, unspecified TBUs receive phonetic tones [T], mostly via phonetic implementation. [L] tones are assigned to unspecified TBUs by default, but [LH] tones are also possible if an unspecified TBU in the polysyllabic stem is followed by a stressed /HL/-toned syllable with a voiced onset. Since the assignment of tones in underspecified TBUs is predicted, we can determine the melody of stems in relation to the tone pattern of the stressed syllable. Occurrences of /HL/ and /LH/ tones, however, are unpredictable (lexical). Following the discussion, we saw that tone is also an indicator of morphosyntax because some phrases and syntactic constructions can be characterized by tone. The occurrence of both morphological and syntactical tone-related phenomena is rare in the literature of tone languages. I also showed that while noun stems have "stable" tones, i.e., no tonal alternation/sandhi is attested, some verbal stems are prone to undergoing tonal sandhi. To determine which stems undergo tonal rules, I used Kroeker's (2001) classification for stems which were confirmed in this study with some adaptations, such as evidence that suggests that there might be an intermediate class of verbs based on tonal alternations. Overall, tonal alternations are usually observed in vowel final stems with a final /LH/ tone. In contrast with vowel final stems, no tonal sandhi was attested with consonant final stems. Grammatical functions are also determined by tone in the penultimate syllable of inflected verbal words. As discussed, tone is used to indicate polarity, tense, and mood. Finally, I presented examples in which tonal alternations within the stems may suggest that tone can also be used pragmatically. This shows that the tone system requires further investigation, and that current description is the first step for more detailed studies on complex tonal phenomena in the language.

Final considerations, outlook and recommendations

The description of the Phonology of Nambikwara included challenges related to a plethora of interesting phenomena. Initially, I showed in Chapter 1 that the word Nambikwara is a term with multiple meanings. In this view, what is commonly referred to in the literature as the Nambikwara language is an amalgamation of lects/ languages spoken by various indigenous groups sharing the same ethnicity and cultural background.

Although all lects labeled as 'Nambikwara' can be varieties of the same language – and most times it is regarded as one language by native speakers regardless of the level of intelligibility – there are worth noticing variations that may affect one's description and analysis of the structure of the language – such as the Phonology in the case of this dissertation. Since most of the previous descriptions, including one of my own, made use of data collected among multiple groups – a decision which probably resulted in the (very) different proposals for the phonological system – I decided to exclusively focus on one group and describe the Phonology of the Southern Nambikwaran language spoken by the Kithãulhu. By doing this, we could check with further studies in the area, how different and intelligible Southern Nambikwaran lects are, and to what extent there is phonological variation among them.

Nambikwara has been described as a polysynthetic language. As described, much of the phonology-related phenomena occur at morpheme boundaries, so it is essential to be exposed to basic Nambikwaran morphology to understand the morphology-phonology interface frequently referred to in this dissertation. To familiarize readers with the morphological structures of Kithãulhu used in the phonological description, Chapter 2 was built. It provided an overview of the main morphological structures of Kithãulhu, based primarily on the works of Silva (2021) and Kroeker (2001), and also included some information from my analysis.

Thereafter, the phonological description starts in Chapter 3. As discussed, Kithãulhu has a complex segmental phonology, comprised of series of simple and complex segments. In the section on the vowel description, I decided to analyze phonetic glides as initial or final vowels of diphthongs, or both in the case of triphthongs. Opting for describing the glides as phonemic could have seemingly been a more practical solution, but it would have had a significant impact on the description of the syllable – not only in terms of the number of segments allowed to occur within it but also in terms of syllabification. Including complex vowel segments in the phonological description is also very helpful in determining why sequences of vowels are always syllabified in a certain way, such as in the case of /ĩã.ũã.ĩã.ũã-ˀki-sã/, 'to be smooth', which is consistently realized in the surface representation as [j̃ã.w̃ã.j̃ã.w̃ã.ˀki.sã], instead of *[j̃ãw̃.ã.j̃ãw̃.ã.ˀki.sã] or *[ĩ.ãw̃.ãj̃.ãw̃.ã.ˀki.sã], for instance, when all these syllables types are allowed in the surface representation and attested in other morphemes.

Furthermore, deciding on a glide-vowel analysis could also be problematic. Kroeker (2001) described the phonology of Nambikwara including a series of glottalized glides. Although attested in the phonetic realizations of the data used in this dissertation, including a glottalized glide series would also pose a challenge to the phonemic description, as I could not find any contrasting examples of plain glides versus glottalized glides in the data. Hence, I assumed that glottalized glides are phonetic reflexes of underlying creaky voice diphthongs and triphthongs. The phonemic glides versus only phonetic glides issue is not solved. Further investigation must be done to address this issue. As for the consonantal inventory, I also decided to analyze glottalized and aspirated consonants as complex segments instead of consonant clusters, based on phonotactic constraints and syllabification. However, there is still one topic to be covered concerning the segmental phonology related to complex consonants: the pre-aspirated alveolar lateral consonant 'ʰl'. The complex consonant 'ʰl' is attested across stems as the result of a phonological rule, but the phonological derivation cannot be accounted for in occurrences of 'ʰl' in the verbal strings in constructions such as [ˈtawː.naˌʰl̥oː.ɾa], 'I will not chop'. As indicated in a footnote in Chapter 6, ‘ʰl’ behaves similarly to /ʰn/: it is pre-aspirated and may become voiceless. However, I could not find any substantial evidence to include it in the description of the segmental phonology.

In Chapter 4, I demonstrated that Kithãulhu has asymmetrical phonetic and phonemic syllable structures. As shown, the challenges related to the asymmetry of the syllable structures mainly lie in whether complex segments are analyzed as one or more segments. Since surface forms of syllables are easily predicted from a given lexical form, I opted to analyze the lexical syllable structure of Nambikwara as $(C)^{V(V)(V)}(C)$. This structure type explains why complex codas cannot occur in the surface representation, except if comprised of a glide followed by a glottal or nasal segment, including their allophones.

I also demonstrated in Chapter 4 that Kithãulhu has a remarkable way of syllabifying coda segments across morphemes to form [CV] syllables. To the best of my knowledge, no other language in the world has been described in this manner, displaying this intriguing strategy to form permissible syllable structure across words. This typological phenomenon related to the syllable structure should also be further explored.

In Chapter 5, I showed that the description of phonological-related rules is also dependent on morphological structure – hence morphophonological. Although I described the most frequent morphophonological rules of the language, reduplication was not included due to some complications related to the phenomena observed. Reduplication was mentioned and used in the description of stress, but it requires a more in-depth description.

When addressing tone in Chapter 6, the challenges related to its description initially lie in how to analyze the attested contour tones. I showed that rising and falling contour tones have different distributions and provided evidence to analyze them as two different tonemes, namely /LH/ and /HL/. The low-level pitch [L] perceived in the phonetic realization of syllables is analyzed as phonetic implementation occurring in toneless units or the outcome of sandhi. I also discussed that examples suggest that tone in Nambikwara is morphologically and morphosyntactically relevant. Tonal languages making use of both morphological and morphosyntactic tones are relatively rare.

Another challenge related to the tone description is primarily related to the lacuna caused by the non-inclusion of intonation in the phonological description. Among the problems that arise from this lacuna is the one related to the fact that it is not clear whether tones occurring at the end of utterances are strictly lexical or whether/ to what extent they are influenced by prosodic boundaries.

I argue that word-final tones of grammatical words are lexically assigned based on the examples with the nominal referential suffix {-su}. In examples with {-su}, the inherited /LH/ tone remains unaltered even when occurring in intermediate positions within a sentence, in copula-like constructions. In coordinating clauses, /HL/ tones within suffix {-nahate} signalize switch reference, whereas toneless morpheme {-katu̯} indicates that the reference is the same. However, both claims related to word-final tones can be controversial, especially because the intonation system was not described.

Therefore, current observations included in this dissertation should be used as starting points to further investigate the phonology of Nambikwara. It is worth noticing that attention must be given to the phonological phenomena above the word level, to describe the prosodic structure of the language, and establish the correlation between the phonology, morphology, morphosyntax, and other levels of linguistic analysis.

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Appendix

Nambikwara – English Vocabulary

This vocabulary encompasses all Nambikwaran lexical items collected in the fieldwork sessions with The Kithãulhu that were used in the examples in this dissertation, followed by corresponding English translations. All words are presented in their phonemic forms and tone is also indicated by superscript LH (rising contour) and HL (falling contour) when lexemes have identical segmental structures. I also decided to include syllable (.) and morpheme (-) boundaries for easier identification of morphophonology and information on word classes.
The order in which the phonemic transcriptions of the Nambikwaran vocabulary are given in this appendix is relatively similar to the order in which segments were presented in Chapter 3, instead of the typical alphabetical order. Exceptions to this presentation lie in the consonants, which are arranged according to the following series: plain, aspirated (if available), and glottalized. For a quick reference, you can use the following order as a starting point to look up words in this list:

i - ḭ - ĩ - ḭ̃ - e - ḛ - ẽ - ḛ̃ - a - a̰ - ã - ã̰ - o - o̰ - u - ṵ - ũ - ṵ̃ - p - pʰ - ˀp - t - tʰ - ˀt - k - kʰ - ˀk - ʔ - s - sˀ - h - hˀ - n - ʰn - ˀn - l - ˀl

Nominal stems are provided followed by the final suffix {-su} and less frequently {-a}, while verbal stems are presented followed by the final suffix {-sã} instead of typical and most frequent inflectional suffixes. Furthermore, nouns are presented in two classes, based on inalienability, indicated in the transcriptions with a <-> before the roots of inalienable nouns.

List of abbreviations used in this section:

adv. adverb
conj. conjunction
inal. n. inalienable noun
n. noun
nm. numeral
part. particle
quant. quantitative
v. verb

/i/

/i-sã/ *v.* to fetch.
/-iet-su/ *n.* nest.
/-iek(i)-ki-su/ *inal. n.* eye.
/ieh.ˀni-sã/ *v.* to nest.
/ie-han-sã/ *v.* to be blind (lit. bright eye).
/-iel-su/ *inal. n.* bladder.
/iain-sã/ *v.* to eat.
/iain-ih.no-su/ *n.* leech.
/ianḭli-sã/ *v.* to wish.
/iainˀti-su/ *n.* food.
/ia.ˀpãn-su/ *n.* taioba (*Xanthosoma sagittifolium*), a tropical flowering plant.
/ia.tḛl.su/ *n* fish, sp.
/ia.tel-su/ *n.* fish, sp.
/iaʔ.ual-a-wih-ẽn-su/ *n.* possum, sp.
/iah.lo-su/ *n.* old man.
/ian-sã/ *v.* to eat.
/ian-su/ *n.* jenipap, the fruit of a tropical tree (*Genipa americana*).
/ia.nal-su/ *n.* jaguar.
/ia.nal-a-kãũl-su/ *n.* ocelot (*Leopardus pardalis*), a small wild cat.

/ia.nal-a-nḛ.nḛ̃-su/ *n*. cougar (*Puma concolor*).

/ia.na̰l-su/ *n*. lizard, sp.

/ia.lan-su/ *n*. toucan (general), sickle.

/ialan-a-tũtũˀt-ki-su/ *n*. *araçari*, a bird species.

/ia.lan-ka.lo-su/ *n*. *cocar* (traditional headdress).

/ia.lan-a-hain-ḭa̰ṵ-su/ *n*. toucan, sp.

/ia.lau-su/ *n*. ring.

/ia.lã̰ṵ̃-su/ *n*. palm tree, sp.

/iauk(i)-a-ṵḭ-su/ *n*. grater.

/iok-a-nek(i)-su/ *n*. tree, sp.

/iu-su/ *n*. worm.

/iu-su/ *n*. bee, sp.

/iul-su/ *n*. mouse, sp.

/iˀt-sã/ *v*. to wind, to blow.

/iˀt-su/ *n*. wind.

/in-sã/ *v*. to fly.

/in.ˀti-su/ *n*. man, male.

/in-ka.lo-su/ *n*. airplane.

/il-sã/ *v*. to be breastfed.

/il-sã/ *v*. to breastfeed.

/il-su/ *n*. howler monkey.

/ḭ/

/ḭ.sã/ *v*. to light up.

/-ḭḛ-su/ *inal*. *n*. scream.

/ḭḛ.ḭḛn-sã/ *v*. to feel sick.

/-ḭḛt-a-kaˀt-su/ *inal*. *n*. neck.

/ḭa̰ḭl-su/ *n*. bee, sp.

/ḭa̰ṵ-ka.lo-su/ *n*. bench.

/ḭa̰.tḛt-su/ *n*. tick, sp.

/ḭa̰ˀk(i)-su/ *n*. mouse, sp.

/ḭa̰-nṵ̃-ki-su/ *n*. ashes, charcoal.

/ḭa̰.lã̰ṵ̃-su/ *n*. arrowroot.

/ḭa̰.lu-sã/ *v*. to be thirsty.

/-ḭa̰ˀl-a/ *inal*. *n*. friend.

/-ḭo̰-su/ *inal*. *n*. mouth.

/-ḭo̰-ṵḛt-su/ *inal*. *n*. beard (lit. mouth hair).

/-ḭo̰-ka.lo-su/ *inal*. *n*. chin.

/ḭo̰-ka̰ṵ.ka̰ṵt-su/ *n*. *guariroba* (*Syagrus oleracea*), a palm tree species.

/-ḭo̰ˀk(i)-su/ *inal*. *n*. intestine, guts.

/-ḭṵˀk(i)-su/ *inal*. *n*. foot.

/-ḭṵ-si-ˀtũ-su/ *inal*. *n*. heel.

/**ḭṵl-su/** *n*. knife.

/ḭṵh.ˀli-sã/ *v*. to be afraid.

/ĩ/

/ĩ-sã/ *v*. to bite.

/ĩ^LH-sã/ *v*. to see.

/ĩ-io.li-sã/ *v*. to swallow.

/ĩãĩ-sã/ *v*. to sew.

/ĩũ.ĩũ-ki-kan-te-su/ *n*. *embuá*.

/ĩãũ-kaˀt-su/ *n*. spirit, reflection, shadow.

/-ĩãũs-su/ *n*. flower.

/ĩãũn-sã/ *v*. to refuse.

/ĩ-ĩãt-sã/ *v*. to breathe.

/ĩ.ton-sã/ *v*. to be sick.

/ĩã.lã̰.son-sã/ *v*. to be thin.

/ĩũ-su/ *n*. tick (general).

/ĩ-tṵ̃n-sã/ *v*. to lick.

/-ĩˀl-a/ *n*. name.

/-ĩãk(i)-su/ *inal*. *n*. lung.

/ĩã.ũã.ĩã.ũã-ˀki-sã/ *v*. to be smooth.

/ĩũ.ĩũ-ki-su/ *n*. earthworm.

/ĩũn-sã/ *v*. to have, there to be.

/tĩũ-sã/ *v*. to be small.

/ḭ̃/

/ḭ̃-sã/ *v*. to plant.

/-ḭ̃ḛ̃-su/ *inal*. *n*. thorn.

/ḭ̃ã̰ṵ̃n-sã/ *v*. to deny.

/e/

/e-sã/ *v*. to speak, to tell. Also to chirp, to sing, to roar, depending on the subject.

/et-sã/ *v*. to grate.

/ehˀ-su/ *n*. ax.

/el-sã/ *v*. to make honey.

/ẽ/

/ẽ.ˀkị-sã/ *v*. to heat up.

/ḛ/

/ḛ-su/ *n*. swallow, sp.

/ḛs-su/ *n*. tobacco.
/ḛl-su/ *n*. cashew.
/ḛl-a-ki-a-ua.nã-ki-su/ *n*. cashew nut.

/a/

/ail-sã/ *v*. to go hunting.
/ain.ki-sã/ *v*. to hear, to listen.
/a.ḭo̰.ha.ka/ *quant.* all, everything.
/a.ˀtĩ-su/ *n*. ani, sp.
/a̰.ka.ˀlo-su/ *n*. old Woman.
/ah-su/ *n*. spider, sp.
/ah-su/ *n*. ant, sp.
/a.hũl-ḭa̰ṵ-su/ *n*. water.
/a.hũl-ien-su/ *n*. lake.
/an-sã/ *v*. to shoot, to kill with a weapon.
/an-ii-sã/ /*v*. to stop.
/an-ka.lut-sã / *v*. to be wet.
/an-ʰnit-sã/ *v*. to follow.
/a.nih-sã/ *v*. to run.
/a.li-sã/ *v*. to leave.
/a.li-te-su/ *n*. broom (lit. sweeping thing).
/a.lã-su/ *n*. macaw (general).
/a.lã-te-su/ *n*. the Alãtesu, a Southern Nambikwaran group.
/a.lã-he.hen-te-su/ *n*. red-and-green macaw (*Ara chloropterus*).
/a.lo̰-su/ *n*. *tucumã*, a fruit from a palm tree species (*Astrocaryum aculeatum*).
/a.lai-su/ *n*. sloth.
/a.lã̰-su/ *n*. pink trumpet tree (*Handroanthus impetiginosus*).
/a.lu-sã / *v*. to be long.
/a.lu-su/ *n*. mouse (general).
/a.lu-ien.ki-su/ *n*. partridge.
/a.lu-a-ta̰-su/ *n*. Brazilian guinea pig (*Cavia aperea*), a rodent species.
/a.luh-sã/ *v*. to puke.
/a.lũ-su/ *n*. tapir.
/a.lũ-nṵ̃-su/ *n*. clay.
/a.ˀlu-su/ *n*. mantis.

/a̰/

/a̰l-su/ *n*. armadillo, sp.
/a̰.la̰-su/ *n*. guan (general).
/a̰.la̰-a-ta̰-su/ *n*. guan, sp.
/a̰.lṵt-su/ *n*. armadillo, sp.
/a̰ḭˀk(i)-su/ *n*. bird (general).
/a̰ḭn-su/ *n*. fish (general).
/a̰ḭn-tak(i)-su/ *n*. crab (lit. grasshopper fish).
/a̰ṵn-sã/ *v*. to fester.

/ã/

/ãũ.ʔi-sã/ *v*. to sleep.
/ã-kẽ.kẽn-ih-sã/ *v*. to be mixed up.

/ã̰/

/ã̰.ˀli-sã/ *v*. to be different.
/ã̰ṵ̃-sã/ *v*. to be hungry for meat.
/ã̰ṵ̃ˀl-su/ *n*. parrot (general).

/o/

/on-sã/ *v*. to be left, to remain.
/ohˀ-su/ *n*. sky.
/ohˀ.sĩn-su/ *n*. cloud (lit. sky meat).
/ol-sã/ *v*. to get startled.

/o̰/

/o̰n-sã/ *v*. to burn, to be burnt.

/u/

/uit(i)-su/ *n*. curassow, a species of of cracid birds.
/uil-ũn-sã/ *v*. to smell good.
/uet-sã/ *v*. to do, to make.
/uen-sã/ *v*. to be dizzy.
/uen-su/ *n*. *bacava*, a palm tree species (*Oenocarpus bacaba*).
/ua.ii-su/ *n*. palm tree, sp.
/ua.iil-su/ *n*. hawk, sp.
/uai.uait-sã/ *v*. to be narrow.
/ua.ḭḭˀl-su/ *n*. ant, sp.
/uai-a.ˀli-su/ *n*. dog.
/uai-a.ˀli-a-kãũ.kãũt-a.ˀli-su/n. fox.

/ua.iai.iain-sã/ *v*. to be roomy.
/uaik-ki-su/ *n*. peanut.
/uai-su/ *n*. toad, sp.
/uais-a-nek(i)-su/ *n*. lagoon.
/uain-ˀti/ *adv*. correctly.
/uain-sã/ *v*. to be straight, to be right.
/uail-su/ *n*. thorn.
/uau.uaun-sã/ *v*. to be flat.
/uau-ka.lo-su/ *n*. hoe.
/ua.tu.ua.tun-sã/ *v*. to flicker.
/ua.tuk-kaˀt-su/ *n*. lightning.
/ua.kãl-su/ *n*. heron, sp.
/uaʔ.ial-a-ka.lo-su/ *n*. cockroach.
/ua.ho-su/ *n*. bamboo.
/uah.k(i)-a.ˀli-su/ *n*. caiman.
/ua.si.ua.sin-sã/ *v*. to be brown.
/ua.si.sin-sã/ *v*. to be dry.
/ua.su-sã/ *v*. to be fast.
/ua.liˀt-su/ *n*. rubber.
/uˀt-a-ṵa̰l-su/ *n*. great potoo (*Nyctibius grandis*), (lit. screaming potoo).
/uan-sã/ *v*. to be swollen.
/ua.lṵ.ua.lṵn-sa/ *v*. to be loose.
/ua.uaun-sã/ v. to be flat.
/ua.tãĩ.tãĩ-sã/ *v*. to be thin.
/ua.kon-sã/ v. to work.
/ua.liˀn-su/ *n*. manioc.
/ua.li(ˀn).ka̰l-su/ *n*. manioc, sp.
/ua.lut-su/ *n*. paca (*Cuniculus paca*), a mammal species.
/ua.luhˀ-su/ *n*. vulture (general).
/uˀt-su/ *n*. common potoo, (*Nyctibius griseus*) a bird species.
/u.ˀki-sã/ *v*. to go down.
/us-su/ *n*. tayra (*Eira barbara*), a mammal species.
/ul-sa/ *v*. to be lazy.
/ul^{LH}-sa/ *v*. to be far.
/uil-sã/ *v*. to be good, to be pretty, to be well.
/ui.uin-sã/ *v*. to be blue
/ua.iai-a.ˀli-su/ *n*. rattlesnake.
/ua.io.ion-sã/ *v*. to be wide, to be loose.
/ua.tĩ.tĩ-su/ *n*. dragonfly.
/ua.tḛ.tḛ̃-su/ *n*. butterfly.
/ua.tãũ.ua.tãũn-sã/ *v*. to be round.
/ua.tũt-su/ *n*. tadpole.
/ua.su-ˀti/ *adv*. quickly, suddenly.
/ua.ˀnĩn-sã/ *v*. to practice *pajelança*, to do magic.
/uaun-ˀti-su/ *n*. whirlwind.
/uo.uon-sã/ *v*. to hurt, to feel pain.
/uu.uun-sã/ *v*. to be clumsy.
/uien-a-ki-su/ *n*. sun.
/uh-sã/ *v*. to dig.

/ṵ/

/-ṵḭ-su/ *inal*. *n*. tooth.
/-ṵḛt-su/ *inal*. *n*. body hair, fur.
/ṵa̰-su/ *n*. frog, sp.
/ṵa̰ḭh-su/ *n*. straw.
/ṵa̰-uain-sã/ *v*. to scratch.
/ṵa̰-tʰin.ˀki-sã/ *v*. to shoot.
/ṵa̰ʔ.ien-ti-su/ hawk, sp.
/ṵa̰-hin.ti-sã/ *v*. to wash.
/ṵa̰-hoh-sã/ *v*. to swim.
/ṵa̰n-sã/ *v*. to scream.
/ṵa̰-nil-on/ v. to play.
/ṵa̰.lṵl-su/ *n*. armadillo, sp.
/ṵa̰.ˀloh-su/ *n*. snail.
/ṵa̰ḭ-su/ *n*. the screaming people, Kithãulhu’s original name.
/ṵa̰ḭh-a.ˀli-su/ *n*. bamboo, sp.

/ũ/

/ũ-su/ *n*. capybara.
/-ũĩn-a/ *inal*. *n*. father.
/ũẽ-su/ *n*. dove, sp.
/ũẽs-su/ *n*. child.
/ũẽ̃h-a-i̯a̰ṵ-su/ *n*. rain.
/ũẽ.ũẽ̃l-su/ *n*. wasp, sp.
/ũẽn-su/ *n*. *várzea* forest.
/ũãĩ-su/ *n*. anteater, sp., (*Tamandua tetradactyla*).
/ũãĩl^{LH}-su/ *n*. flute.
/ũãĩˀl-su/ *n*. baby, doll.
/ũãũ.ũãũn-sã/ *v*. to be worn-out.
/ũãt-sã/ *v*. to grill.
/ũã.kon-sã/ *v*. to be leftover.
/ũãs-su/ *n*. hat.
/ũãn-sã/ *v*. to burn.
/ũãn.ˀti-su/ *n*. word.

/ũãn.ˀti-a-toh.ˀli-ḭa̰ṵ-su/ *n*. gossip.
/ũãl-su/ *n*. hill.
/ũãl-a-kaˀt-su/ *n*. hill.
/ũãl-a-ka.lo-su/ *n*. cloth, clothes.
/-ũãl^{LH}-su/ *inal. n*. skin.
/-ũĩn-nũ-su/ *inal. n*. father.
/ũh-iait-sã/ *v*. to feed (animals).
/ũh-ioli-sã/ *v*. to cut.
/ũh-uauh-sã/ *v*. to fetch water.
/ũh-tãũ-sã/ *v*. to mow.
/ũh-ha.lil-sã/ *v*. to write.
/ũh-hoh-sã/ *v*. to row.

/ṵ̃/

/ṵ̃-su/ *n*. bee, sp.
/ṵ̃ḭ̃-su/ *n*. sweet potato, potato.
/ṵ̃ḭ̃^{HL}-su/ *n*. frog, sp.
/ṵ̃ḭ̃ˀt-a-ṵḭ-ḭa̰ṵ-su/ *n*. snake venom.
/ṵ̃ḛ̃n-su/ *n*. grass, sp.
/ṵ̃ã̰ḭ̃s-a-sa̰l-su/ *n*. *imbira* (a vegetal fiber used as rope).
/ṵ̃ã̰ḭ̃s-a-nek(i)-su/ *n*. *imbira*, sp.

/p/

/pit-su/ *n*. gourd.
/pau.paun-sã/ *v*. to be flattened.
/pat-su/ *n*. duck. From Portuguese ‘*pato*’, /pa.to/.
/pã.pãn-sã/ *v*. to be over (only used to address young children).
/pon-su/ *n*. ox, cattle. From Portuguese ‘*boi*’, /bo.i/

/pʰ/

/pʰi.pʰin-sã/ *v*. to be chubby.
/pʰai.pʰail-su/ *n*. frog, sp.
/pʰau.pʰaun-sã/ *v*. to be gray, to be dusty, to be grainy, to be floury.
/pʰo.pʰon-sã/ *v*. to be pot-bellied.

/ˀp/

/ˀpḭˀ.pḭt-a.ˀli-su/ *n*. finch, sp.
/ˀpḛl-su/ *n*. melon.
/ˀpa̰l-su/ *n*. Leishmaniasis.
/ˀpa̰l-a-ĩt-a-kaˀt-su/ *n*. Leishmaniasis.

/t/

/-tih-a/ *inal. n*. blood.
/tḭ.tḭn-sã/ *v*. to be black.
/tĩh.no-su/ *n*. road, trail.
/tḭ̃-sã/ *v*. to approach, to get near.
/ten-sã/ *v*. to want.
/tẽn-su/ *n*. drums.
/ta.li-sã/ *v*. to thunder.
/-ta-su/ *inal. n*. evil spirit.
/taĩãĩãĩl-su/ *n*. great kiskadee (*Pitangus sulphuratus*), a bird species.
/ta.tan-sã/ *v*. to be shallow.
/ta.ki-su/ *n*. monkey, sp.
/ta.k(i)-su/ *n*. grasshopper, sp.
/tah-su/ *n*. youngster.
/tah.ˀli-su/ *n*. stone.
/ta.lãũ-su/ *n*. lizard, sp.
/tau-sã/ *v*. to go lumbering, to chop.
/taut-su/ *n*. hawk (general).
/tãũt-sã/ *v*. to whistle.
/ta̰.ˀkã̰.ta̰.ˀkã̰-su/ *n*. hawk, sp.
/ta.leh-su/ *n*. parrot, sp.
/ta̰ḭ.ta̰ḭn-sã/ *v*. to feel cold.
/ta̰lḭh-su/ *n*. nanday parakeet (*Aratinga nenday*).
/ta̰n-sã/ *v*. to be bitter.
/ta.lãl-su/ *n*. trap.
/ta.lĩ-su/ *n*. woodpecker, sp.
/tã.tãh-su/ *n*. *curiaca* (*Theristicus caudatus*), a bird species.
/tãn-su/ *n*. frog, sp.
/tã̰ḭ̃.tã̰ḭ̃l-su/ *n*. cricket, sp.
/to.tot-sã/ *v*. to knock.
/tuh-su/ *n*. bee, honey.
/tuh-a-ta̰-su/ *n*. bee, sp.
/tuh-a-nṵ̃-su/ *n*. sugar (lit. honey granules).
/tuh-nẽn-te-su/ *n*. bee, sp.
/tun-sã/ *v*. to be violet, to be dark, to be black.
/tun-te-su/ *n*. violet (color), to be dark.

/tʰ/

/tʰe.tʰen-sã/ *v.* to be flaccid, soft. Also to feel weak because of an illness.
tʰẽ-kaˀt-su/ *n.* tree, sp.
/tʰa.tʰan-sã/ *v.* to be flexible, to be soft.
/tʰai.li-ˀki-su/ *n.* necklace.
/tʰãĩl-su/ *n.* banana leaf.
/tʰãũl-su/ *n.* quince.
/tʰu.tʰun-sã/ *v.* to be crooked, to be bent.

/ˀt/

/-ˀtḭ-su/ *inal. n.* belly, abdomen.
/ˀtihˀ-su/ *n.* snake (general).
/ˀteh-su/ *n.* bee, sp.
/ˀtḛ̃ˀl-su/ *n.* fly (general).
/ta.koˀk(i)-su/ *n.* forest.
/ˀta̰-su/ *n.* greater rhea (*Rhea americana*), a bird species.
/ˀtãn-sã/ *v.* to be tight.
/ˀtãũl-su/ *n.* lizard, sp.
/ˀtã̰n-sã/ *v.* to be trapped.
/ˀto-sã/ *v.* to be sharp.
/ˀton-sa/ *v.* grow, to build.
/ˀto̰l-sa/ *v.* to feel cold.
/ˀtuh^{HL}-su/ *n.* woman.
/ˀtuhˀ-su/ *n.* annatto (*Bixa orellana*).
/ˀtṵ̃n-sã/ *v.* to suck.
/ˀtṵl-su/ *n.* agouti.

/k/

/-ki-su/ *inal. n.* seed.
/ki.kin-sã/ *v.* to have parallel strips.
/-ki.lḛ̃l-su/ *n.* sting.
/kḭ-su/ *n.* termite (general).
/kḭ.kḭt-su/ *n.* cicada (general).
/kĩn-sã/ *v.* to be tall.
/kail-su/ *n.* ant, sp.
/ka.ĩãl-su/ *n.* washed sand.
/ka.ṵ̃ã̰ˀl.su/ *n.* river.
/ka.tḛh-su/ *n.* calabash.
/ka.ˀti-su/ *n.* lizard, sp.
/ka.ˀto-su/ *n.* collared titi monkey (*Plecturocebus grovesi*).
/kaʔ.ḭṵhˀ.nṵ̃.su/ *n.* *paçoca,* a traditional dish made of ground meat.
/kaʔ.ḭṵhˀ-su/ *n.* meat, game. Animal.
/ka.li.lis-su/ *n.* cricket, sp.
/ka.lĩˀt-su/ *n.* squirrel.
/ka.lṵ̃-sã/ *v.* to sprout.
/kah-sã/ *v.* to be sour.
/kah.ual-su/ *n.* horse. From Portuguese ‘*cavalo*’, /ka.va.lo/.
/kan-sã/ *v.* to get off.
/kan^{LH}-sã/ *v.* to be hard.
/kan^{HL}-sã/ *v.* to be ripe.
/a-ka.neˀl.su/ *inal. n.* daughter.
/ka.na.ki/ *nm.* one.
/ka.na.ku/ *quant.* some.
/ka.na.ka.nat-sã/ *v.* to be one.
/ka.na.ku/ *quant.* a few, few.
/ka.nah-su/ *n.* woodpecker, sp.
/ka.ˀni-sã/ *v.* to get off.
/ka.lih-sã/ *v.* to be happy.
/ka.la.ka.la-su/ *n.* chicken.
/ka.lãĩ-su/ *n.* beetle (general).
/ka.la-sã/ *v.* to climb.
/ka.ˀla-sã/ *v.* to be many.
/ka.ˀlen-su/ *n.* frog (general).
/-ka.lo-su/ *inal. n.* husk.
/ka.lot-sã/ to drip, to leak.
/ka.ˀluhˀ-su/ *n. pantanal,* a biome in Brazil comprised of tropical wetland areas and flooded grasslands.
/kãĩt(i)-su/ *n.* mouse, sp.
/kãĩn-sã/ *v.* to be big
/kã̰ḭ̃-nṵ̃-su/ *n.* coffee.
/kã̰ṵ̃l-su/ *n.* yam, sp.
/ko̰.ko̰-su/ *n.* enemy.
/kuil-su/ *n.* catfish, sp.
/kuiˀn-a-ki-su/ *n.* bird, sp.
/kṵḭ.kṵḭˀk(i).su/ *n.* hawk, sp.
/ka.iai-su/ *n.* hawk, sp.
/ka.ian-sã/ *v.* to become wet.
/kãn-ẽn-su/ *n.* pipe. From Portuguese ‘*cano*’, /ka.no/
/kãĩ-sã/ *v.* to steal.
/kol-su/ *n.* medicine.
/-ko̰l-su/ *inal. n.* weapon.

/ku.ie-ka.lo.su/ *n*. spoon. From Portuguese *colher* /ko.ʎɛR/.
/kua.ḭa̰ˀt-su/ *n*. corn.
/kua.ḭa̰ˀt-ḭa̰ṵ-su/ *n*. *chicha*, a traditional fermented beverage. Also the Pleiades.
/kua.ḭa̰ˀt-ki-su/ *n*. corn kernel.
/kua.ḭa̰ˀt-a-ko̰-su/ *n*. corn field.
/kua.ḭa̰ˀt-sahˀ-su/ *n*. corn cob.
/kua.ḭa̰ˀt-ˀnãn-su/ *n*. corn husk (lit. corn leaf).
/kua.ḭa̰ˀt-nṵ̃-su/ *n*. corn flour.
/kua.nek(i)-su/ *n*. jandaya parakeet (*Aratinga jandaya*).
/kua.sahˀ-su/ *n*. dove, pidgeon (general).
/kua.lai-su/ *n*. spider (general).
/kua.lan-su/ *n*. armlet.
/kua.ˀlĩs-su/ *n*. *lambari*, sp.
/kũãĩkũãĩl-ahlo-su/ *n*. widower.
/kũãl-su/ *n*. bee, sp.
/kũẽn.ki-a/ *n*. year.
/kũ-nek(i)-su/ *n*. *sucupira*, a tree species (*Pterodon emarginatus*).
/kṵ̃ã̰t-su/ *n*. beans.
/kṵ̃ã̰ˀk(i)-su/ *n*. grave, tomb.
/kṵ̃ã̰ḭ̃ˀl-su/ *n*. alga, water plant.
/kṵ̃n-su/ *n*. cotton.
/kṵ̃n$^{\mathrm{HL}}$**-su/** *n*. *timbó*, a fish stupefying plant.

/kʰ/

/kʰe.sã/ *v*. to be a good, to be a skillful hunter.
/kʰa.kʰan-sã/ *v*. to be soft.
/kʰaiʔ-su/ *v*. coati.
/kʰãĩh-aˀli-su/ *n*. *pacu*, a fish species.
/kʰon-sã/ *v*. to be broken, to be rotten.
/kʰuit-su/ *n*. *gravatá*, a fruit species (*Bromelia antiacantha*).
/kʰuiˀt(i)-su/ *n*. deer, sp.
/kʰuais-su/ *n*. humming bird, sp.
/kʰṵa̰l-su/ *n*. pineapple, sp.
/kʰũẽ.kʰũẽk(i)-su/ *n*. fan.
/kʰu.kʰul-su/ *n*. owl, sp.
/kʰũn-su/ *n*. wolf apple, the fruit of a plant species (*Solanum lycocarpum*).
/kʰul-su/ *n*. turmeric.

/ˀk/

/ˀkḭ̃-su/ *n*. hawk, sp.
/ˀkḛl-su/ *n*. urine, gall.
/ˀkai.nãn.tṵ/ *conj*. if.
/-ˀkun-a/ *inal*. *n*. brow.

/s/

/sis-su/ *n*. grass (general).
/sis-a-ki-su/ *n*. rice (lit. grass seed).
/sih-su/ *n*. bullet ant (*Paraponera clavata*).
/-sĩn-su/ *n*. meat.
/sḭ̃-su/ *n*. storm.
/sil-su/ *n*. mouse, sp.
/**sa.ĩãĩ.sa.ĩãĩn-sã/** *v*. to be sticky.
/sa.uil-su/ *n*. parakeet (general).
/sa.kãũt-sã/ *v*. to drip.
/sa.ko.kot-sã/ *v*. to glow.
/sa.ˀke-sã/ *v*. to get worse.
/sa.nil.so-sã/ *v*. to pluck (lit. to break and pull).
/sa.nai-su/ *n*. armadillo, sp.
/sa.lal-su/ *n*. kingfisher, sp.
/sa-sail-sã/ *v*. to shoot.
/-sen-su/ *inal*. *n*. footprint, trace.
/sa.ṵ̃ã̰ˀn-su/ *n*. ant, sp.
/-sa.ṵ̃ḛ̃l-su/ *inal*. *n*. tail.
/sa.ˀte-sã/ *v*. to be heavy.
/sa.ˀtḛ.sa.ˀtḛn-sã/ *v*. to be green.
/saʔ.uen-su/ / *n*. jungle.
/saʔ.uen-tʰĩn-a/ *n*. village.
/saʔ.uen-a-tʰoʔ-a/ *n*. big in the jungle.
/sa-so-sã/ *v*. to take something from someone.
/-sahˀ-su/ *inal*. *n*. penis, vine.
/sãl-su/ *n* macaw, sp.
/so-sã/ *v*. to take.
/soh-a/ *n*. banana.
/-su-su/ *inal*. *n*. bone.
/sul-sã/ *v*. to beat.

/sũn-t(i)-a-t(e)-aitã/ *adv*. yesterday.

/-sṵ̃n-a/ *inal*. *n*. grandfather, god.

/sˀ/

/sˀih-su/ *n*. house.

/sˀih-ien-su/ *n*. village.

/sˀih-a-ḭo̰-su/ *n*. door (lit. house´s mouth).

/-sˀeʔ-a/ *inal*. *n*. wife.

/sˀe.sˀek(i)-su/ *n*. scorpion, sp.

/sˀah-sã/ *v*. to be laid.

/sˀṵ̃n-sã/ *v*. to be tasteless.

/sˀul-su/ *n*. mouse, sp.

/h/

/hi.ie-ka.lo-su/ *n*. car, vehicle.

/hi-ki-su/ *n*. fruit.

/his-a-ṵḭ-su/ *n*. firewood.

/his-a-kaˀt-su/ *n*. wood.

/-hḭl-su/ *inal*. *n*. liver.

/hĩ.hĩl-su/ *n*. tinamou, sp.

/hĩn-a/ *adv*. now.

/hḭ̃-sã/ *v*. to be sticky.

/he-sã/ *v*. to be.

/heh-sã/ *v*. to be hungry.

/he.hen-sã/ *v*. to be red.

/he.hen-te-su/ *n*. red.

/he.li-sã/ *v*. to fight.

/hḛl-su/ *n*. buriti (*Mauritia flexuosa*), the fruit of a palm tree species.

/hḛl.a.kaˀt-su/ *n*. buriti tree.

/ha.ia.kʰin-sã/ *v*. to be tired.

/ha.io/ *part*. hi, okay. Used as common greetings (e.g. good evening, hello, etc.) or as a sign of agreement.

/haiˀt(i)-su/ *n*. matchsticks.

/hais-su/ *n*. warrior, war.

/haiˀs-su/ *n*. crop.

/haisˀ.a.ko̰.su/ *n*. farm.

/haih-sã/ *v*. to copulate.

/hain-ḭa̰ṵ-su/ *n*. chant, song.

/hain-sã/ *v*. to sing.

/hain-ˀti-su/ *n*. song.

/ha.nṵ̃-ˀne-sã/ *v*. to threaten.

/hã̰ḭ̃l-su/ *n*. ball.

/hauˀt(i)-su/ *n*. arrow.

/ha̰ṵ-su/ *n*. maned wolf (*Chrysocyon brachyurus*). Also /ho̰-su/, standard pronunciation of the Kithãulhu.

/hãũ-su/ *n*. *lambari*, sp. (a fish species).

/ha.ti-su/ *n*. basket.

/ha.tik-a-ĩãĩ-ki-su/ *n*. turtle, sp.

/haˀt(i)-su/ *n*. bridge.

/ha.tḛh-ˀnãn-su/ *n*. money.

/haʔ.iel.su/ *n*. stinking bug.

/haˀk(i)-su/ *n*. yam.

/ha.hãĩn-te-su/ *n*. the Hahãĩntesu, a Southern Nambikwaran people.

/han-sã/ *v*. to be bright, to be clear.

/ha.li/ *nm*. two. *quant.* handful.

/ha.li-sã/ *v*. *to be* two.

/ha.li-ha.li/ *nm*. four.

/ha.li-ka.na.ki/ *nm*. three.

/ha.la/ *quant*. a few, few.

/ha.laul-su/ *n*. cane toad.

/ha.laun-sã/ *v*. to be shelly.

/ha.lo-su/ *n*. field, land, landscape.

/ha.lo-ia̰ṵ-su/ *n*. savannah.

/ha.lo-te-su/ *n*. the Halotesu (lit. the field people), a Nambikwaran people of the *Cerrado*.

/haˀnãũl-su/ *n*. fish, sp.

/ha.ˀnũl-su/ *n*. pineapple, sp.

/ha.ˀlin-su/ *n*. smoke.

/ha̰.la̰t-su/ *n*. comb. Also *pitomba* (*Talisia esculenta*), a native fruit.

/hãĩˀn-te-su/ *n*. a person, who won't change their ways. This word is used to express that someone´s nature cannot be changed.

/hãn-sã/ *v*. to be white.

/ho.ʔi-sã/ *v*. to bathe.

/hos-su/ *n*. monkey (general).

/hos-a-ta̰-su/ *n*. spider monkey.

/hos-a-ˀki-ẽh-su/ *n*. monkey teeth necklace.

/hoh-sã/ *v.* to wander.
/hoh^{LH}-sã/ *v.* to swim.
/hoh-su/ *n.* tinamou (general).
/huˀk(i)-su/ *n.* bow.
/huˀk(i)-ẽh-su/ *n.* vine.
/huˀk(i)-ẽn-su/ *n.* shotgun.
/hũn-sã/ *v.* to be pink.
/hṵ̃n-sã/ *v.* to look like.

/hˀ/

/hˀi-ḭ̃ã̰ḭ̃-ʰni-sã/ *v.* to heal.
/hˀi-tʰa-sã/ *v.* to be tired.
/-hˀiˀk(i)-su/ *inal. n.* hand.
/hˀikˀ(i)-a-ha.ti/ *num.* five (lit. one hand).
/hˀiˀk(i)-a-ha.li/ *num.* ten (lit. two hands).
/hˀan-sã/ *v.* to be over.

/n/

/nik(i)-su/ *n. breu*, a kind of resin extracted from the *breu* tree (*Protium heptaphyllum*). Candle.
/nḭs-a-nek(i)-su/ *n.* herb, sp.
/-nḭ̃t-su/ *inal. n.* rib.
/-nḭ̃t-ẽn-su/ *inal. n.* thorax.
/ni.nĩ-su/ *n.* mosquito, sp.
/nĩˀn-su/ *n.* skunk.
/-ne-ĩãũˀl-a/ *inal. n.* gill.
/-ne-ˀtau-su/ *n.* horn, antler.
/-ne.kḭ̃s-su/ *inal. n.* hair.
/ne-ke-ˀki-sã/ *v.* to think.
/nḛ-su/ *n.* the Nḛsu, a Nambikwaran people, who inhabit the Cerrado. They are popularly known as the 'Manduca' and regarded as poisoners and sorcerers.
/-nẽk(i)-su/ *inal. n.* head.
/na.nuh-su/ *n.* slug.
/-naˀn-ẽn-ka.lo-su/ *inal. n.* ear.
/-nãũʔ-su/ *inal. n.* egg. Also maggot.
/nãs-su/ *n.* tarantula.
/nã-sã/ *v.* to drink.
/nã̰-su/ *n.* otter.
/nã̰n-sã/ *v.* to cry.
/nãṵ̃n-sã/ *v.* to be sweet.
/no̰n-ḭa̰ṵ-su/ *n.* noise.
/-nãũ-kṵa̰ḭl-su/ *inal. n.* chest.
/-nũ-su/ *inal. n.* people.
/-nṵ̃-su/ *inal. n.* dough.
/nṵ̃s-su/ *n.* pestle.
/nṵ̃s-ẽn-su/ *n.* pestle.
/nṵ̃n-su/ *n.* armadillo, sp.

/ʰn/

/ʰne.kai-sã/ *v.* to disseminate, to spread.
/ʰnã.ˀti-sã/ *v.* to be dirty.

/ˀn/

/ˀne-sã/ *v.* to be like that. Also used to agree with something that was said.
/-ˀnḛˀk(i)-su/ *inal. n.* leg, thigh.
/-ˀnẽ-su/ *inal. n.* noise.
/-ˀnḛ̃ˀk(i)-su/ *inal. n.* wing.
/-ˀnãn-su/ *inal. n.* leaf.

/l/

/-lon-su/ *inal. n.* brother. Also /-lon-iah.lo-su/.