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A phonological analysis of Asu

James Passetti

A PHONOLOGICAL ANALYSIS OF ASU

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by

James Passetti
Bachelor of Religious Education, Practical Bible College, 1997

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This thesis, submitted by James Passetti in partial fulfillment of the requirements for the Degree of Master of Arts in Applied Linguistics from the University of North Dakota, has been read by the Faculty Advisory Committee under whom the work has been done and is hereby approved.

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James S. Roberts

____

Stephen A. Marlett

____

Katrina E. Tang

This thesis is being submitted by the appointed advisory committee as having met all the requirements of the School of Graduate Studies at the University of North Dakota and is hereby approved.

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Chris Nelson, Dean of the School of Graduate Studies

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James Robert Passetti
7/20/22

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This thesis would not have seen the light of day, if it were not for several several people. But before I thank them, I wanted to thank the Designer of human communication, who expressed only a sliver of all His wisdom in the order and design of languages. His creativity has kept many linguists occupied for their lifetimes describing His handiwork.

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ABSTRACT

This thesis provides an analysis of the phonology of Asu, a small and endangered Nupoid language of Nigeria. The corpus of data used for the analysis comes from more than two hours of recordings of a word list for the language, provided to me by the historian and anthropologist Constanze Weise.

The Asu language recognizes only two syllable structures, CV and CGV. The only syllables without onsets are formed by four noun class prefixes [è-,ē-, à-,ā-], that create Asu nouns without onsets word-initially.

The phonemic inventory of consonants consists of seven pairs of corresponding voiced-voiceless obstruents at the labial, alveolar, labial-velar and velar points of articulation. In addition, there are six voiced sonorants. Front vowels cause palatalized allophones of many of the non-labial consonants.

Asu has five oral phonemic vowels [i,e,a,o,u], and three nasal vowels [ã,ĩ,ũ]. There is a co-occurrence restriction on which vowels can occur in CV.CV roots. Those roots do not contain the expected random combination of vowels. The vowel harmony prevents front and back vowels from being present in the same root.

There are three phonemic tones H, M, L. Two surface contours [HL] and [LH] are analyzed to be allophonic surface representations rather than phonemes.

The acoustic section covers VOT of voiced and voiceless stops. It describes the acoustic difference between the phoneme /j/ and an allophonic [^{j}] which surfaces in palatalized allophones. The allophonic difference in final vowel duration is documented. An allophonic short pre-tap vowel is described and pitch level differences between H, M, L are documented.

CHAPTER 1
Introduction

1.1 Objective and motivation

The objective of this work is to provide a phonological description and analysis of a small Nigerian language named Asu (ISO 639-3 [aum]), as identified in the Ethnologue by Eberhard et. al. (2022). To my knowledge, little has been published regarding Asu in general. No detailed descriptions have ever been published. By describing the phonology of Asu, this work seeks to add to the body of information that already exists on other Nupoid languages. This work is motivated by the hope that the data can be used comparatively, to support other research on this language family and this language in particular.

Many thanks are due to Constanze Weise for her field notes and recordings of Asu. She generously provided for me her recordings of Asu, her comparative word list, and her supporting field notes. This description is based upon that material. It should be noted that the data collected by Weise was collected to complement her work in anthropology. A phonological description was not her primary goal.

1.2 Identification and location

Asu is located in a part of West Africa which, as a whole, has exceptional opportunities for linguistic documentation. Roughly 42% of Nigeria's 550 languages are undocumented (Blench 2012:vi). Asu is included among that 42%.

Asu belongs to the Benue-Congo language family. According to the Ethnologue, the Benue-Congo family is composed of 978 languages (Eberhard et. al. 2022). As of this writing, the

Nupoid family, of which Asu is a member, contains eleven languages. Those eleven languages, as reported by Ethnologue (Eberhard et. al. 2022), are shown in Figure 1.

- Benue-Congo (978)
  - Nupoid (11)
    - Ebira-Gade (2)
      - Ebira [igb]
      - Gade [ged]
    - Nupe-Gbagyi (9)
      - Dibo [dio]
        - Gbagyi-Gbari (2)
          - Gabgyi [gbr]
          - Gbari [gby]
        - Nupe (6)
          - Asu [aum]
          - Gupa-Abawa [gpa]
          - Kakanda [kka]
          - Kami [kmi]
          - Kupa [kug]
          - Nupe-Nupe-Tako [nup]

Figure 1. The Nupoid position within the Benue-Congo language family

The Nupoid languages are historically classified as a "Niger-Kaduna sub-branch of the Kwa family" (Hyman 1972:175). Hyman named the Niger-Kaduna sub-branch after two rivers that are located in the Nupe territory. Bennett and Sterk (1977) suggested major changes to the Niger-Kordofanian phylum. Bender-Samuel and Hartwell (1989), spring-boarding off Bennett and Sterk, renamed the entire phylum to what is known today as "Niger-Congo". Williamson (1992:11) rejected a distinction between some elements of the Kwa and Benue-Congo and subcategorized the "Nupoid" languages as part of the Benue-Congo family rather than the Kwa family. Blench (1989:305) explains the "Nupoid" term as replacing Hyman's "Niger-Kaduna" term which replaced Koelle's earlier (1854) "Niger-Dshadda" term.

Asu is a very small Nupoid language, and like some other smaller languages, its use is in decline as languages of wider communication encroach upon it. This small language is known alternatively as Abewa and Ebe (Eberhard et. al. 2022).

In 1989, the Asu people lived in about six different villages. Those villages are located along the Mokwa road which runs north-south (Blench 1989:7). According to a working document, roughly 25 years later, the people who spoke Asu occupied ten different villages south of Kontagora (Blench 2013:2). Those ten villages are in two different Local Government Areas (LGA's). The first LGA is Mariga (Blench 2012:7). The second is further south and is called the Mashegu. It was in this second LGA, in a village called Maza-kuka, where the recordings used for this description were acquired by Constanze Weise in 2009 and 2010. This location is roughly 100 km east of the Kainji Reservoir and 100 km north of the Niger River. In 2020, Asu had fifteen villages: Adogo, Afanze (Farje), Asanho (Sahon Rami), Batamana, Degida, Echanin, Gbanti, Kaboji (Abudzi), Kizhi, Likoro, Manin (Manigi), Maza-Kuka (Edei), Mulai, Mulo and Robu (Decker 2021). In Figure 2, the map from Nations Online Project (2014) has the Asu region indicated with a circle. The circle is on the northern periphery of the Nupoid area. The most influential Nupoid language in the Niger state is Nupe [nup], with a population numbering near 1,206,728 speakers (Rafiu 2011:33).

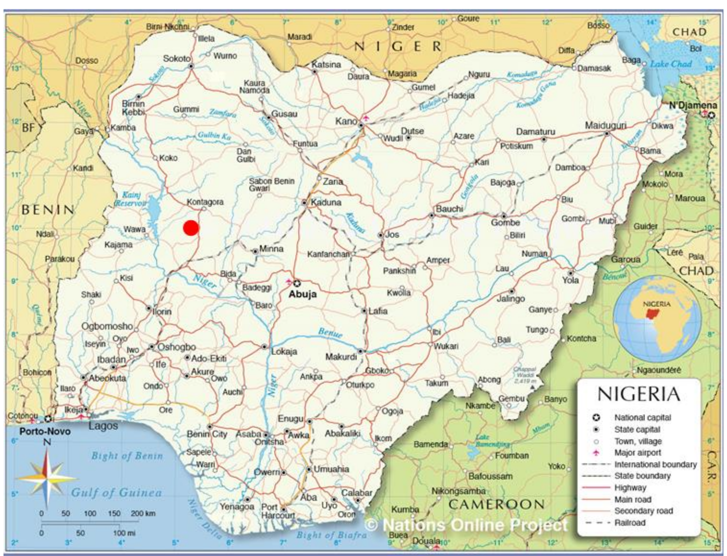


Figure 2. Location of Asu villages based on Blench (1989:308)

The Nupe area is highlighted in Figure 3. Asu is highlighted and located just to the northwest of the forested area indicated on the map (Blench 1989:308). Its neighboring languages, both

Nupoid and non-Nupoid, are delineated. Blench lists the non-Nupoid languages in all capital letters and encloses them in parentheses on the map below. The Nupoid languages, on the other hand, are written with only the first letter capitalized and without parentheses. I have highlighted those which Blench proposes as Nupoid.[1]

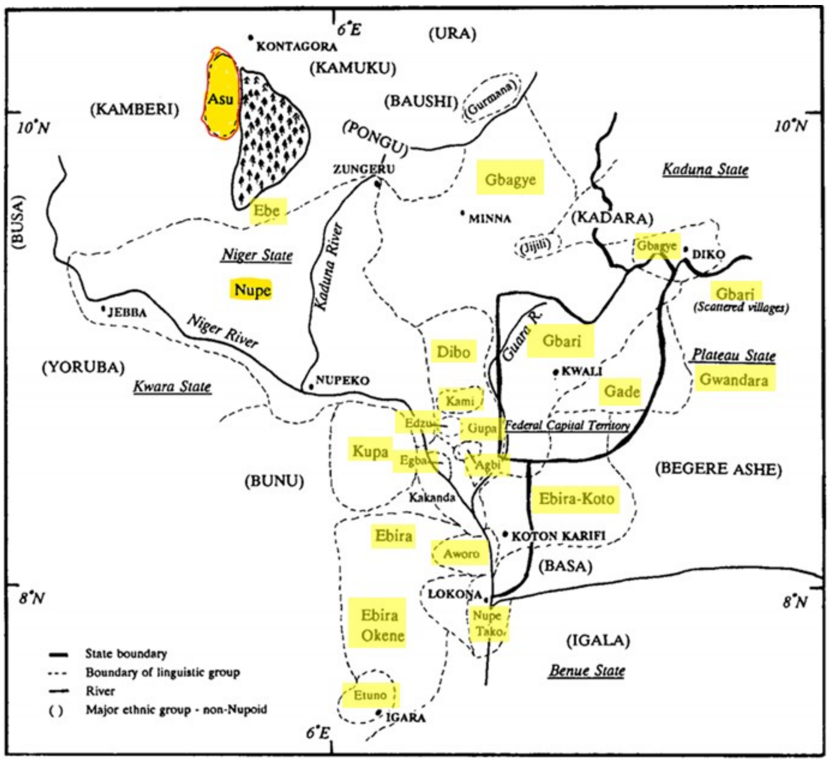


Figure 3. Asu location

[1] There is a discrepancy in the quantity of Nupoid languages between those that Blench lists (16), and those that the Ethnologue lists, (11). That difference of five languages is explained here. Blench's classification is based upon an 80 word noun list and he says his results should be taken with a certain skepticism because of the quality and size of the data used. 1). Blench includes Gwandara (or Kwandara) is a Nupoid language based upon cognate ranges of 65-70% with nouns only in Gupa, Kami, Dibo, Asu, Nupe-Tako and Nupe, whereas Ethnologue classifies Kwandara as Afro-Asiatic, Chadic, West, A, A.1. 2). Blench lists Ebe on his map as contiguous to the Asu location. It appears as an apparent unique language, yet in other parts, he lists it as an alternative name for Asu, whereas the Ethnologue lists Ebe only as an alternative name for Asu. 3). Blench lists Aworo and Egba as a Nupoid languages and the Ethnologue lists them as a dialects of Yoruba. Blench proposes that Egba has features in common with Kakanda according to infomants (but not comparative data). 4) Blench lists Agbi as a Nupoid language related to Gupa, but this language does not yet appear in Ethnologue under this name.

1.3 Existing phonological studies

To date, there has been very little, if anything, written on the phonology of the Asu language. There is a piece of comparative research written on Proto-Nupoid (Blench 1989:318-319) which includes an Asu phonemic vowel chart. Apart from that work, no other published or peer reviewed phonological analyses are found.

There has been much more work done on the Nupoid family, to which Asu belongs. Koelle (1854) had some of the earliest writings published on Nupoid languages. In the early 1900s, Banfield (1914) compiled both a dictionary of the Nupe language and he, together with MacIntyre (1915), published a grammar. George (1970) and Peng (1992) addressed Nupe tone.

1.4 Sociolinguistic context

Asu is being heavily influenced by Nupe (Rafiu 2013:41). Nupe is a large and geographically close language. It is also a language of wider communication (LWC). It is spoken by over a million people living just to the south of Asu. The effect Nupe has had on the Asu language is remarkable. The intergenerational transmission of Asu is in the process of being broken. Rafiu (2013:46) has describes the decrease of Asu speakers as "astronomical." He provides the data in Table 1 as support for this assessment.

The table below points out that only 5% of children use Asu with their parents in the home. The remainder use only Nupe. When you add all of percentages for all the people that children speak to in the home, only slightly more, 14.6% of children, report using Asu with any of these relatives within the home. They prefer Nupe. Adults reported only slightly more use of the Asu in the home. In fact, only 32% of adults report using Asu in their home with spouses, children, relations or neighbors (Rafiu 2013:46). Nupe has become the norm in virtually all other domains such as in the media, marketplace, recreational centers, playgrounds, and worship centers (Rafiu 2013:41-42).

Table 1. Asu use in the home

Parents' self-report on language use:	
Language of wider communication:	Nupe
When speaking with spouse	10.0%
When speaking with neighbors	9.2%
When speaking with children	9.0%
When speaking with relations	3.8%
Average	8.0%
Children's self-report on Language use:	
Language of wider communication:	Nupe
When speaking with parents	5.0%
When speaking with grandparents	3.0%
When speaking with siblings	3.7%
When speaking with neighborhood children	2.9%
Average	4.0%

Asu is threatened by several factors. First, in the past twenty-five years, the prestige of Nupe has eclipsed Asu. Nupe has relegated Asu to almost practical obsolescence. Nupe's influence has definitely threatened Asu's viability. Rafiu writes, "...competence in a prestige language like Nupe is a mark of upward (social) mobility. This invariably puts the low prestige language in further jeopardy of loss" (2013:44). Obsolescence is "a term used to describe the gradual loss of a language which takes place when its transmission between generations ceases and the number of native speakers diminishes" (Crystal 2008:338). Some of the factors which lead to language loss are economic factors, mass media, and prestige of languages of wider communication (Fishman 1991).

Prestige is not the only factor to threaten Asu. A second threat is the restricted domains where Asu is used. In Table 2, Rafiu (2013:42) shows how Asu is waning in its use in the home, the marketplace, in media, in education and in recreational centers .

Table 2. Domain of use by children

Domain	Percentage of use
Home	14.6%
Market	3%
Recreation Center	2%
Playground	2%
School	0%

A third threat to Asu is the shrinking user population in comparison to surrounding LWC's. "Asu, a Nupoid language, suffers from a shrinking number of speakers, while the neighboring larger languages such as Nupe or Hausa are swiftly expanding their numbers of speakers and continuing to threaten Asu" (Weise 2013:24). In 1991, the Asu population was estimated at 5,000 (Blench 1991). Currently, the Ethnologue cites 4,200 users as an estimate of Asu L1 speakers (Eberhard et. al. 2022). Rafiu proposes that only 1,501 speakers remain (Rafiu 2013).

A fourth threat comes from the absence of an orthography. The missing orthography prevents the language from being used in schools and further limits its domain of use. "Very few of the languages in the Niger state have been reduced to writing" (Rafiu 2011:176). Of the languages in the Niger state, "only Nupe and Gbagyi have standardized orthographies" (Rafiu 2011:164).

These statistics coupled with the break in the intergenerational transmission of the language, the restrictions in the domains of use, and a lack of an orthography have come together to form a "perfect storm" that threatens Asu's viability.

1.5 Language data

The data analyzed for this description (Weise 2009) was originally collected as part of a dissertation project by Constanze Weise entitled, "Governance and ritual sovereignty at the Niger-Benue Confluence: A political and cultural history of Nigeria's Igala, Northern Yoruba and Nupoid-speaking peoples to 1900 CE" (Weise 2013). Weise collected oral data throughout the Niger-Benue confluence during different phases of her fieldwork. She made research visits to Nigeria in 2000, 2009 and again in 2010 (Weise 2013:10). She writes, "I was able to elicit word lists of 100 words core and 1500 words of cultural vocabulary from all Nupoid, Northern Yoruba and Igala people, and in some cases, also from major dialects of these languages. The 1500-word lists are grouped into semantic fields such as agriculture, politics, plants, animals, etc." (Weise 2013:23). It is believed that core cultural vocabulary resists language change. Ehret points out that "...core meanings are more resistant to replacement than any other part of the lexicon and that they are rarely affected by word borrowing" (2011:171). Using core vocabulary was important to this phonology to reduce the chances of inadvertently including borrowings that might skew the results.

While I was doing my graduate work at the University of North Dakota, Weise graciously provided me with her recordings and her permission to analyze Asu language data in exchange for providing her a copy of the phonetic transcriptions. Mosaey Gimba is the Asu speaker who provides the data in the recordings. He was born in 1973 and was thirty-six years old at the time of the recording. He had three wives and 20 children. His native language is Asu, but he also speaks Nupe, Hausa, and English. Both of his parents are native Asu speakers. Mosaey was born in Mazakuka, where the recordings were originally made. Mazakuka is located in the Niger state, in the Mashegu Local Government Area located in the Zurgurma district.

Weise originally recorded the Asu data in the village. Subsequently, she made improved recordings of the same word lists in a more quiet hotel room location outside the village. English prompts were provided and afterwards, one or two repetitions of the Asu word was recorded. The recordings were made in 2009. She used a Zoom H4n recorder to capture the audio. The recorder utilized PCM codecs with a sampling rate of 44.1kHz and bit depth of 16 bits and two channels. No information is recorded about microphone usage. This procedure produced three audio recordings totaling 2 hours and 26 minutes, and this data forms the basis for my analysis in the present thesis.

In addition to the recordings, Weise provided a paper version of the cultural vocabulary word-list of approximately fifty pages (Weise 2009). Those pages included the cultural vocabulary list which served as prompts for the elicited material. There are approximately 1,100 items filled in on the list. Another 371 prompts did not yield a response. There are 35 prompts that elicited more than one response. For each of his responses, Mosaey also provided a transcription of each utterance using English letters. His transcriptions provide some insight into what he considers to be the same or different sounds. The spoken and written document correspond rather consistently. He used a modified English alphabetic transcription without any diacritics. He utilized five vowels "a, e, i, o, u" and twenty-four consonant symbols. Weise did not include any comments regarding the accuracy of Mosaey's transcriptions. See Table 3.

Although Mosaey used some tone diacritics, they were not consistent enough throughout the data to give an accurate glimpse of his consciousness of tone. Mosaey documented nasalized vowels by placing an <n> following the nasal vowel. In one case, he wrote <nyan> for the word 'to dance'. Phonemically the word is /jã/, which I transcribed as [j̃ã]. He used an <n> to mark both the nasalized vowel as well as the phonetic nasalization of the approximant /j/. He wrote <ny> to reflect the phonetic [j̃] and for the phonemic /ã/, he wrote <an>.

Table 3 provides a correspondence between Mosaey's transcription and the IPA symbol that is most appropriate. The IPA column of the table is not a phoneme list since some of Mosaey's symbols are actually allophones of other phonemes (e.g. <ch>, <sh> and <zh>).

Table 3. Mosaey's transcription convention

Asu Speaker's Transcription	Corresponding IPA
a	ɑ
b	b
ch	t͡ʃ
d	d
e	e
f	f
g	ɡ
gb	ɡ͡b
h	h
i	i
j	d͡ʒ
k	k
kp	k͡p
l	l
m	m
n	n or Ṽ
o	o
p	p
r	ɾ
s	s
sh	ʃ
t	t
ts	t͡s
u	u
v	v
w	w
y	j
z	z
zh	ʒ

1.6 Methodological procedures

As the first step in my preparation for analysis, I segmented and labeled the 2 hours and 26 minutes worth of recordings using Audacity. Then I exported those sound files as individual .wav files. The .wav files contain either one or sometimes two repetitions of each word. Through this process, I generated slightly more than 1,100 files of the individual utterances.

Subsequently, I selected 516 words which seemed to be morphologically simple. Words with three or fewer syllables were chosen. Words with four or more vowels were set aside since they more likely to be constructed. The few instances of duplicates were eliminated. Then I made a narrow phonetic transcription of those words in the audio recordings. Transcribing directly from audio tapes is discouraged by some field methods classes (Munro 2003:134), yet Johnston & Boyce demonstrated little difference in accuracy between live transcription and audio or visual recordings. They wrote, "The accuracy of one's transcriptions can be improved through repeated reviews of audio or videotapes" (Johnston & Boyce 2007:3). Using acoustic phonetic software can improve the transcription and accuracy even further. It is with these facts in mind that I transcribed the individual audio files and then verified their accuracy with Praat (Boersma & Weenink 2016). Praat was utilized to confirm voicing, aspiration, vowel quality, vowel duration and pitch in the Asu words.

Field Language Explorer was used to file the 516 transcriptions.[2] The transcribed words were entered into the Lexicon portion of FLEx. FLEx was also used to link each transcription with the corresponding audio of that transcription. With this data, I made my analysis of Asu phonology. Chapter 2 addresses "Structural Considerations". The syllabic and morphological structures of Asu provide a framework for understanding the phonology. Any morphological discoveries I made were not based on any paradigms collected. They are incidental and are a result of noticing recurrent morphology and the recurring meaning. Some reduplication morphemes were also discovered.

Chapter 3 "Consonants," contrasts the consonant phonemes by manner and point of articulation. The various contexts where those phonemes and their phonetic realizations occur are shown as well as the frequency of each phoneme. Table 4 presents the phonemes as I have analyzed them.

[2] Field Language Explorer (FLEx) is software produced by SIL International.

Table 4. Asu consonant phonemes

	Labial	**Alveolar**	**Palatal**	**Velar**
Simple Plosives	p b	t d		k g
Complex Plosives	k͡p ɡ͡b			
Affricates		t͡s d͡z		
Fricative	f v	s z		
Nasal	m	n		
Tap		ɾ		
Lateral		l		
Approximant	w		j	

Chapter 4 "Vowels" describes the vowel phonemes and gives the area of production on the vowel chart of these vowel phonemes. The chapter also discusses the allophones of each phoneme and the contexts where those occur. A histogram representing the frequency of each vowel phoneme is provided. My analysis presents the following phonemic vowels for Asu as shown in Table 5.

Table 5. Asu vowel phonemes

	Front	**Central**	**Back**
Close	i ĩ		u ũ
Close-Mid	e		o
Open		ɑ ɑ̃	

This chapter also addresses a front-back vowel harmony.

Chapter 5 addresses the analysis of tone. Tonal contrast is demonstrated. I show contrast in both nouns and verbs. Allotones along with their phonological cause are presented and frequencies of occurrence of each tone are discussed. My tone analysis demonstrates contrast between three tones /L/, /M/, and /H/.

Chapter 6 "Acoustic Description" presents acoustic support for the phonemes, tonemes, their allophones, as well as the Voice Onset Time (VOT) of the plosives. This description shows differences in duration between phonemic palatal consonants and allophonic palatalization of consonant phonemes. It presents measurements of allophonically increased vowel duration and also shows vowel quality as plotted by F1 and F2. In addition, the chapter describes a short non-phonemic vowel that appears prior to word-initial taps. Finally, it shows the pitch characteristics of the three level tone phonemes.

In Chapter 7, I provide a summary of the findings. The chapter also gives some direction for future investigation.

CHAPTER 2

Structural considerations

An understanding of the syllabic and the morphological structures of Asu supplies the framework for understanding the Asu phonology. The interpretation of several of the ambiguous sequences discussed in Chapter 3 is constrained by syllable structure. An introduction to basic noun morphology is necessary to explain the contexts used to demonstrate contrast between the phonemes in the different tables.

2.1 Syllable structure

Asu recognizes only open syllables. Syllables require onsets and therefore, the Obligatory Onset Parameter (Marlett 2016:34) is set to "ON". Example (1) shows the very common CV syllable shape.

(1)	a.	/tā/	'make'
	b.	/ɾí/	'eat'
	c.	/lò/	'fly (v.)'[1]
	d.	/kū/	'gather'
	e.	/kā.dú/	'go'
	f.	/zé.dù/	'say'
	g.	/sī.sè/	'filter (v.)'

At this point, I have only documented the initial syllable of certain noun classes as missing an onset. In several noun classes, we find initial syllables of the shape V as shown in (2).

[1] In an effort to remove ambiguity, I have added a (n.) or (v.) after the gloss when necessary to correspond to the word classes of "noun" and "verb."

(2) a. /ā.bà/ 'forest'
b. /ā.dà/ 'shoe'
c. /ē.jà/ 'drum (n.)'
d. /ē.sì̃/ 'broom'

These exceptional syllables in (2), with their missing onsets, I interpret to be noun class prefixes. For that reason, I do not include them in the general statement about all Asu syllables having onsets. I will discuss this decision in more detail in Section 2.2.1. In non-initial positions, one never finds any syllables without onsets. For example, words like */be.u/ do not exist.

In addition to the simplest syllable structure, CV, I propose that there is an additional syllable type CGV, illustrated in (3) and (4).

(3) a. /vjá/ 'provide'
b. /pjā/ 'glance (v.)'
c. /fjé/ 'thresh'
d. /gjē/ 'be good'

(4) a. /mwã́/ 'maker'
b. /mwī/ 'palm'
c. /bwó/ 'fieldgrass'

The alternative analysis which analyzed the C + approximant complex as phonemically a /C^j/ and /C^w/ would effectively triple the consonant inventory, since /w/ and /j/ follow all consonants except themselves. In Asu we do find phonetic forms of [C^j], which is a surface representation of palatalization of the preceding consonant by a front vowel which follows. However, the C + approximant is not a predictable allophone [C^j], caused when /C/ precedes a front vowel. The /Cj/ even occurs as an onset before non-front vowels /ɑ, ɑ̃/ as demonstrated in (3a) and (3b).[2] In these examples, the open vowel cannot reasonably condition a palatalized approximant consonant. Neither do the front vowels always condition the presence of the palatal approximant, as demonstrated in (4b) and also in Table 6.

[2] There are acoustically measurable differences between /Cj/ and [C^j] which will be discussed in Section 6.2.

Table 6. Front vowels do not always condition the /j/

Contrast	CV	Gloss	CjV	Gloss
t-tj	/wùtētē/	'sun'	/tjē/	'testicle'
v-vj	/ví/	'young'	/àvjí/	'horns'
g-gj	/gēlé/	'carrying cloth'	/gjē/	'be good (v.)'

The same is true for the labial approximant /w/. Back round vowels do not always condition the labial approximant, as demonstrated in Table 7. CV and CwV syllables are placed alongside each other in order to demonstrate that the back vowels do not predictably condition the /w/.

Table 7. Back round vowels do not always condition the /w/

Contrast	CV	Gloss	CwV	Gloss
t-tw	/tū̄/	'log'	/ā-twű/	'five'
k-kw	/mấkó/	'female'	/kā̄kwó/	'eagle'
b-bw	/bō/	'pan'	/bwó/	'fieldgrass'
d-dw	/dō/	'take out (v.)'	/dūdwō/	'appease gods (v.)'
g-gw	/ɾōgó/	'cassava'	/à-gwō/	'heart'

Not only do back vowels not always condition the /w/, but one actually finds a few examples of the labial-velar approximant before front vowels and the palatal approximant before back vowels, such as shown in (5).

(5) a. /ɑmwí/ 'grass for thatching'
b. /mwī/ 'palm'
c. /kīt͡sjúmú/ 'small'

The principal reason for interpreting the complex plosives /t͡s, d͡z, k͡p, ɡ͡b/, as units or segments is that in all clear and unambiguous instances of CGV syllables, there is an approximant following the first C. The /j/ is seen to follow the simple consonants /p, t, d, g, f, v, z, l/. If the complex plosives /t͡s, d͡z, k͡p, ɡ͡b/ are analyzed as single segments, three of the four are also followed by the /j/ and fit into the CGV syllable template.[3] This analytical choice results in an economy of phonemes. My analysis of the complex plosives as single segments causes the labial-velar and affricate segments to follow the general pattern of CGV where all plosives occur preceding /j/.

When analyzed as segments, the complex plosive phonemes occur as onsets in the CV column of Table 8, and they occur as the first consonant segment in Cj onsets as shown in the CjV column of Table 8.

Table 8. Complex plosives in CV and CGV onsets

Contrast	**CV**	**Gloss**	**CjV**	**Gloss**
t͡s-t͡sj	è-t͡sȁ	'tribal marks'	ā-t͡sjāɾá	'frog'
t͡s-t͡sj	è-t͡sù	'king'	kīt͡sjúmú	'small'
k͡p-k͡pj	k͡pē	'know (v.)'	k͡pjēɾē	'piece'
k͡p-k͡pj	k͡pē	'know (v.)'	ā-k͡pjē	'hoof'
g͡b-g͡bj	g͡bà	'dig (v.)'	g͡bjāg͡bjā	'mouse'
g͡b-g͡bj	g͡bèɾē	'root'	kàg͡bjé	'clear field (v.)'

In the corpus, the /w/ follows the simple consonants /b, t, d, k, g/. There are no examples of the complex plosives combined with /w/.

To analyze the complex plosives as sequences /ts, dz, kp, gb/ is rejected. This analysis requires an expansion of the maximal syllable template to CCGV when these sequences are followed by an approximant. No evidence suggests that obstruents can or should occupy the second position of a three-segment onset-cluster.

Analyzing Asu complex plosives followed by the approximant /j/ as even more complex segments, /t͡sʲ, d͡zʲ, k͡pʲ, g͡bʲ/, is also rejected on the basis of the economy of phonemes. This analysis triples the phoneme inventory of the consonants.

The possibility of an analyzing the glide as a vocalic element of a complex syllable nucleus or rime, i.e. CVV, is also rejected. This analysis would require an expansion of the maximum

[3] Only the /d͡z/ is not attested in the corpus.

syllable template to CCVV to accommodate /tsjV, dzjV, kpjV, gbjV/. Asu has no phonemically long vowels, where I might be able to argue for a V+V nucleus, but neither does Spanish and yet the VV analysis is commonly accepted there.[4] However, in the case of Spanish a single V alternating with a VV as shown in example (6) suggests the VV analysis.

(6)	a.	contar	'to count'	cuenta	'he/she counts'
	b.	soñar	'to dream'	sueña	'he/she dreams
	c.	dormir	'to sleep'	duerme	'he/she sleeps'
	d.	poder	'to be able'	puede	'he/she is able'
	e.	doler	'to hurt'	duele	'he/she hurts'

In my data, there is no morphological evidence that a single vowel alternates with V+V, as it does in Spanish within the same nucleus. I choose the CGV analysis over the CV alternative with a complex nucleus. For the time being, the CGV analysis results in all open syllables, good phonotactics, and simple syllable nuclei. For these reasons, I have analyzed the approximants /j/ and /w/ as consonantal elements within the onset and not as vocalic elements within the nucleus.

Hyman (1970), in his analysis of a closely related Nupoid language, Nupe, proposes a CV template for all syllables of the language.[5] He interprets the Asu CGV sequence as CV in Nupe. The Nupe palatalized and labialized consonant segments predictably occur only before front or back vowels respectively. Hyman's /C^j/ analysis does not work for Asu.

It is noted that Asu has a clear acoustic distinction between the palatal glide and palatalized portion of a [C^j]. In phonetic transcription, I distinguish between the sequence of [Cj] and allophonic palatalization of [C^j] by superscripting the semivowels for the palatalized allophonic forms and leaving the palatal semivowel as [j], as shown in (7).

[4] There is an automatic and non-phonemic lengthening of vowels in Asu in the word-final position, as discussed in Section 4.1 and Section 6.3.

[5] To explain why C^jɑ and C^wɑ also occur, Hyman postulates that the phonetic vowel [ɑ] that follows both glides is underlyingly three different vowels /ɛ, ɔ, ɑ/. Contrast between those three vowels is completely neutralized on the surface, so /ɛ, ɔ/ are purely theoretical and are never found in the surface form. He proposes two additional vowel phonemes so that all palatalized allophones are conditioned by the front vowels /i, e, ɛ/, and all labialized allophones are conditioned by /u, o, ɔ/.

(7) a. /tjē/ [t^{hj}jē] 'testicles'
b. /tēzī̄/ [t^{hj}ēʒī̄] 'clay'

The distinction between these two types of palatalization is shown spectrographically in Chapter 6. The transcription difference above reflects the difference in the duration of palatalization. My transcriptions do not reflect a corresponding distinction in degrees of labialization. Regarding symmetry between the behavior of the /j/ and /w/, I predict that prior to rounded vowels, consonants would likely appear as rounded allophones of the consonant phoneme. However, since these transcriptions are made from digital recordings and not in person, the expected rounding of the consonant cannot be verified visually or acoustically. Therefore, a corresponding [^{w}] is not included in my transcription. There are twelve examples in the corpus of consonants with a labial off-glide, and all of them are transcribed phonetically as [w]. Ambiguous Asu labialized and palatalized consonants pattern better as sequences of CGV than they do as complex segments C^jV or C^wV.

The data do not support an analysis that an additional short vowel is phonemically present before the glide in these complexes. This type of analysis adds an extra syllable to each word that contains a glide, e.g. 'fieldgrass' /bwó/ would become /búwó/ and 'be good' /gjē/ would become /gījē/. This analysis results in dozens of words with three or four syllables, when most other roots in the language never have more than two (or perhaps three) syllables.

I propose a maximal syllable template of CGV. In Asu words, the first C can be any phonemic consonant. The second C is restricted to glides, /j/ or /w/. This template results in the formation of several CG clusters, as illustrated in Table 9. I view the gaps in the chart below as accidental and attributable to the amount of data collected.

Table 9. CGV cluster examples

	G is /j/	Gloss	G is /w/	Gloss
/p/	ā.mą̄́.pjē	'womb'		
/b/			lù.bwó	'flour'
/t/	tjē	'testicles'	twũ̄.bà	'seven'
/d/	djà	'this (dem.pn.)'	dū.dwō	'appease gods (v.)'
/k/			kũ̀.kwã́	'deep'
/g/	gjá.mã́	'chameleon'	à.gwō	'heart'
/k͡p/	k͡pjē.ɾē	'piece'		
/g͡b/	kà.g͡bjé	'clear field'		
/t͡s/	kī.t͡sjú.mú	'small'		
/f/	fjé	'thresh'		
/v/	vjá	'provide'		
/m/			mwī	'palm'
/l/	sù.ljá	'bush pig'		

2.2 Morphological structure

No paradigms are included in the corpus. Any morphological and morphophonemic analysis should be viewed from that perspective. All morphological conclusions are based only upon recurring syllables or incidental inclusion of similar items in the corpus.

2.2.1 Nouns

I divide nouns into simple and complex nouns. Simple nouns are noun roots without any known compounding, reduplication, or inflectional affixes. The examples in (8) are typical of simple nouns in Asu.

(8) a. /pú/ 'handle (n.)'
b. /dā/ 'garb'
c. /t͡sé/ 'extra (n.)'
d. /bwó/ 'fieldgrass'
e. /mwī/ 'palm'
f. /tjē/ 'testicles'
g. /dōfá/ 'livestock greens'

h. /g͡bèɾē/ 'root (n.)'
i. /mā̃ní/ 'caterpillar'

Table 10 provides examples of Asu noun roots.[6]

Samples of morpheme profiles are provided, along with the frequency of each profile

Table 10. Morpheme profiles of noun roots

Morpheme profile	Asu	Gloss	Frequency
CV	t͡sù	'termite hill'	20
	fū	'drink'	
CGV	mwī	'palm'	4
	tjé	'winnowing tray'	
CV.CV	tézī	'clay'	89
	kúvī	'corpse'	
CCV.CV	k͡pjēɾē	'piece'	2
	gjámā̃́	'chameleon'	
CV.CGV	sùljá	'bush pig'	3
	lùbwá	'flour'	
CV.CV.CV	fókóní	'light (n.)'	9
	bàbúfú	'hunting medicine'	

The Asu data contain complex nouns, that is, nouns that have two or more morphemes. Approximately half of the nouns begin with the exceptional syllable shape V, having no onset. In these nouns, only two different vowels precede the noun root. The high frequency of these two word-initial vowels, (/ɑ/=114 and /e/=77), is atypical and suggests that they constitute morphemes. These word-initial vowels are only found on nouns. The vast majority of Benue-Congo (de Wolf 2017:15) and other Nupoid languages (Hyman and Magaji 1970) have nominal class prefixes. On account of these recurrent syllables, and due to the presence of noun class systems in the language family, these are analyzed as prefixes. Example (9)a-c shows words with the pre-nominal prefix /è-/ and Example (9)d-e show words with the pre-nominal prefix /ē-/.

[6] There are 41 examples of CV.CV.CV in the corpus. Of those examples, 12 contain reduplication, 10 are compounds, 7 have inflectional affixes, 3 are Hausa borrowings. That leaves only nine words that could potentially be morphologically simple and yet still have a CV.CV.CV profile.

(9) a. /è-kú/ 'water (n.)'
b. /è-lú/ 'bird'
c. /è-gɑ̀/ 'gall bladder'
d. /ē-mì/ 'dog'
e. /ē-tí/ 'paddle (n.)'

Similarly, Examples (10)a-c gives words that contain the pre-nominal prefixes/ɑ̄-/ and Examples (10)d-e give words with the pre-nominal prefix /ɑ̀-/.

(10) a. /ɑ̄-bɑ̌/ 'forest'
b. /ɑ̄-bɑ̄/ fish (PL) (n.)'
c. /ɑ̄-g͡bɑ̄/ 'grass'
d. /ɑ̀-fí/ 'hair, mane'
e. /ɑ̀-kú/ 'river'

Other languages in the Nupoid family have noun classes. Comparative data from two Nupoid languages exhibit pre-nominal morphology. Peng (1992) shows nominal prefixes with the same morphological form, /ē-/and /è/. Example (11) shows Peng's Nupe [nup] nouns. The words in his list can be compared to cognates in Asu shown in (9).

(11) a. /è-kù/ 'water (n.)'
b. /ē-lú/ 'bird'
c. /ē-mì/ 'dog'
d. /ē-tè/ 'paddle (n.)'

The Asu prefix /ɑ̀-/, shown in (12), seems to mark a plural class. This is not unusual in the language family. In Gwari [gby], another Nupoid language, Hyman and Magaji (1970:7) show a similar situation where all nouns take a plural nominal prefix /ɑ-/ .

(12) a. /è-nɑ́/ 'cow'
b. /ɑ̀-nɑ́/ 'cows'
c. /ē-bɑ̏/ 'fish (sg.) (n.)'
d. /ɑ̄-bɑ̏/ 'fish (pl.) (n.)'
e. /è-k͡pɑ̄/ 'shoulder'
f. /ɑ̀-k͡pɑ̄/ 'shoulders'

Additional examples of data from the different noun classes are given in Table 11. The ē-Class and è-Class nouns are given. In the header row, the number in parenthesis reflects the total number of examples in the corpus.

Table 11. Asu ē-Class and è-Class nouns with frequency (in parentheses)

ē-Class (53)	**Gloss**	**è-Class (24)**	**Gloss**
ē-bù	'belly'	è-pú	'hut'
ē-dɑ̄̀	'mudfish'	è-gɑ̀	'gall bladder
ē-fé	'storm'	è-sē	'fence'
ē-dē	'bean'	è-jɑ̀	'dance'
ē-jɑ̀	'canoe'	è-t͡sɑ̄̀	'scars'
ē-ɾɑ̄	'fire'	è-mì	'rope'
ē-tù	'cobra	è-nɑ́	'cow'
ē-pɑ̄	'skin,hide'	è-jē	'eye'

Table 12 illustrates the ɑ̄-Class and ɑ̀-Class nouns. The header row includes the frequency in parentheses that reflects the number of examples in the data.

Table 12. Asu ɑ̄-Class and ɑ̀-Class noun with frequency (in parentheses)

ɑ̄-Class (97)		**ɑ̀-Class (17)**	
ɑ̄-gū̀	'wildcat'	ɑ̀-jì	'name'
ɑ̄-sɑ̄	'grass'	ɑ̀-k͡pɑ̄	'shoulders
ɑ̄-mī	'riverbank'	ɑ̀-jɑ̄̄	'jewelry'
ɑ̄-mū̀	'mosquitos'	ɑ̀-sí	'cricket'
ɑ̄-pɑ̄	'dung'	ɑ̀-fī́	'hair'
ɑ̄-ɾī	'tsetse fly'	ɑ̀-bí	'spider'
ɑ̄-jī	'blood'	ɑ̀-tí	'needle
ɑ̄-gī́	'weaverbird'	ɑ̀-sé	'gravel'

Table 13 presents the word profiles of ē-Class nouns.

Table 13. Syllable profiles and frequency of ē-Class nouns

Profile	Asu	Gloss	Frequency
V.CV	ē-jȁ	'drum"	68
	ē-ké	'hoe'	
V.CGV			0
V.CV.CV	ē-kádì	'horse'	7
	ē-bùbū	'hut for cows'	

Table 14 shows the word profiles for è-Class nouns.[7]

Table 14. Syllable profiles and frequency of è-Class nouns

Profile	Asu	Gloss	Frequency
V.CV	è-pí	'melon"	27
	è-kú	'liquid'	
V.CGV	è-vjē	'year'	1
V.CV.CV	è-jògú	'territory'	2
	è-mīgí	'cream'	

The profiles of nouns that take the /ā-/ prefix is presented in Table 15.

Table 15. Syllable profiles and frequency of ɑ-Class nouns

Profile	Asu	Gloss	Frequency
V.CV	ā-g͡bȁ̄	'grass'	37
	ā-dȉ	'feather'	
V.CGV	ā-bwò	'ceremony'	2
	ā-kwā	'spear'	
V.CGV.CV	ā-tjēbīn	'mist'	3
	ā-gwòɾi[8]	'arrow barb'	
V.CV.CV	ā-bìtā	'clan'	43
	ā-lùg͡bá	'dust'	
V.CV.CV.CV	ā-mìlàwō	'worm'	1

[7] The word è-mīgí 'cream' contains the derivational suffix -gi.
[8] The word ā-gwòɾī 'arrow barb' contains the derivational suffix -ɾi

The fourth class with a prefix is the à-Class. The syllable profiles of nouns in that class are presented in Table 16.

Table 16. Syllable profiles and frequency of à-Class nouns

Profile	Asu	Gloss	Frequency
V.CV	à-bí̋	'forehead"	17
	à-ɾē	'rain'	
V.CGV	à-mwí	'grass'	4
	à-gwō	'heart'	0
V.CV.CV	à-kùg͡bá	'priestess'	7
	à-lèfá	'greens'	
V.CGV.CV	à-t͡sjàɾá	'frog'	1

There is also a fifth class shown in Table 17. This class, which I call the 0-Class, does not take any overt prefix, but it does contains trisyllabic roots.[9]

Table 17. Syllable profiles and frequency of 0-Class nouns

Profile	Asu	Gloss	Frequency
CV.CV	dùgā	'roof'	105
CCV.CV	gjāmā	'chameleon'	3
CV.CV.CV	pāpāɾà	'tilapia'	41

Moving on from noun classes, there is a derivational suffix that occurs on the end of ten different noun roots. When this suffix, /-kwó/, 'AUGMENTATIVE', is added to a noun, the result creates a noun stem. This derivational process forms a new noun which designates a larger scale version of the original noun root. I do not analyze this as a compound since the second morpheme is not seen to function independently in my data. The effect of adding this morpheme is shown in examples (13) and (14).

[9] There is one piece of data in the form CV.CV.CV.CV kȁtíkȁtí 'ant', where there is reduplication involved. There are also five words with the CV.CV.CGV profile, such as gàbàkwó 'lion', which includes the -kwo suffix.

(13) lùkwó
lù-kwó
bird-AUGMENTATIVE
'ostrich'

(14) wɑ̀kwó
wɑ̀-kwó
snake-AUGMENTATIVE
'python'

Another derivational morpheme added to Asu roots is /-gí/ 'DIMINUTIVE''. This morpheme behaves as a polar opposite of /-kwó/ above. Examples (15), (16) and (17) illustrate this morpheme. This morpheme has not been seen to function independently and sometimes, when it attaches, as in (17), it causes a change of meaning that goes beyond just size.

(15) tísègí
tīsè-gí
comb-DIMINUTIVE
'small comb'

(16) tòbígí
tòbí-gî
dress-DIMINUTIVE
'skirt'

(17) èmīgí
èmī-gí
oil-DIMINUTIVE
'cream'

Another Asu derivational suffix is the /-tɑ/ 'LOCATION'. This morpheme is not seen to function independently. It is derivational in nature, and functions to convert a verb into a location or place.

(18) āk͡pātā
ā-k͡pā-tā
ā-CLASS-cross-LOCATION
'bridge'

(19) tātá
tā-tâ
be.on-LOCATION
'stool'

(20) āk͡pā̄tá
ā-k͡pā̄-tâ
ā-CLASS-frame-LOCATION
'wall'

The final nominal suffix discussed for Asu is the derivational suffix /-ɾi/ 'NOMINALIZER'. It is seen added to verb roots 28 times. The meaning of this suffix is uncertain but seems to involve the idea of 'one who VERBS, one that VERBS'. I analyze this as a derived stem based upon the nominalized forms given in (21).

(21) a. jà + -ɾī give + NOMINALIZER (friend)
b. bá + -ɾī be.diligent + NOMINALIZER (husband)
c. kō + -ɾī cut + NOMINALIZER (firewood type a)
d. pā̄ + -ɾī roof + NOMINALIZER (rafter)
e. sò + -ɾī load + NOMINALIZER (beam)
f. wā + -ɾī remove + NOMINALIZER (fingers)
g. tā + -ɾī raze + NOMINALIZER (bow for arrows)

Cognates of the above three nominal suffixes are also productive in Nupe (Blench 1989:317). Blench shows the cognate form of the Asu /-kwó/ 'AUGMENTATIVE' as /-ko/ in Nupe (1989:317). He labeled the /-gi/, which I call 'DIMINUTIVE' as 'small' in Nupe. Finally, what Blench glosses as 'place' in Nupe, /-tɑ/, I glossed as 'LOCATION' in Asu. Table 18 compares the cognates in Nupe and Asu.

Table 18. Comparison of Cognate Derivational Suffixes in Nupe and Asu

Nupe Suffix	Asu Suffix	Nupe Gloss	Asu Gloss
-ko	-kwó	'large'	AUGMENTATIVE
-gi	-gí	'small'	DIMINUTIVE
-ta	-tá	'place'	LOCATION

2.2.2 Verbs

Asu verbs, like nouns, can appear as one syllable or two syllable words. Representative syllable profiles of the simple verb roots are shown.[10] Each syllable profile's frequency is noted in Table 19. It is possible that some of the verbs that I considered to be monomorphemic are actually complex. Some CV.CV and CV.CGV verbs also may not be monomorphemic.[11] The corpus does not permit me to identify all of the component parts.

All CGV syllables found in verbs are in a word final context.

Table 19. Syllable profiles in Asu verbs

Profile	Asu	Gloss	Frequency
CV	zȁ	'wander (v.)'	40
	wó	'be able (v.)'	
CGV	pjā	'glance (v.)'	4
	fjé	'thresh (v.)'	
CV.CV	zé.dù	'say (v.)'	34
	kā.dú	'go (v.)'	
CV.CGV	dū.dwō	'appease gods (v.)'	5
	sī.zjā	'lead (v.)'	

There are no trisyllabic verbs.

[10] There is only one verb /wálìlì/ 'lying down' in the data with more than two syllables. Based upon the aspectual continuous meaning of this word and the fact that Nupe also contain this same reduplication marking the same meaning, this word seems to be constructed. Reduplication that marks the progressive aspect is discussed in example (22).

[11] These are either an unusual compound verb or a syntactic noun plus a verb. The apparent verb /kùbwó/ 'sweep' is either a compound of the verb /kù/ 'gather' and the direct object /bwó/ 'fieldgrass' or is simply two words. The etymology of the other CV.CGV verbs cannot be ascertained with this corpus.

Some verbs, if they even are verbs, appear to be complex. There appears to be a form of reduplication. The glosses provided with these words appear to indicate either an aspectual meaning that is marked by the English -ing suffix or a type of verbal noun. Other simple verbs do not contain this continuous meaning in the gloss.

(22) a. wɑ́wɑ́ 'moving'
b. pṹpṹ 'sifting grain'
c. līlī 'sleeping'
d. tĩ́tĩ́ 'sewing'
e. gũgṹ 'tailoring'
f. dídì 'standing'

This kind of verb root reduplication in verbs is common in other Nupoid languages. Blench (1989:317) writes, "Stem reduplication in verbs is a common method of creating verbal nouns or continuatives in the language groups of this area. It is found in Nupe, Gwari, and Ebira, as well as Yoruba and Edoid." These words are quite possibly not verbs at all, if this reduplication is derivational in nature. No other obvious grammatical morphemes are identified on the verbs found in the corpus.

CHAPTER 3

Consonants

The Asu consonant system has the bulk of its phoneme inventory being produced at the labial and alveolar places of articulation. There are 20 phonemes in all. Fourteen are obstruents with seven voiced and voiceless pairs. The six sonorants are all voiced: two nasals, two approximants and two liquids. Table 20 presents the inventory of Asu consonant phonemes according to my analysis.

Table 20. Asu consonant phonemes

	Labial	**Alveolar**	**Palatal**	**Labial-velar**	**Velar**
Plosives	p b	t d		k͡p g͡b	k g
Affricates		t͡s d͡z			
Fricative	f v	s z			
Nasal	m	n			
Tap		ɾ			
Lateral		l			
Approximant			j	w	

Contrast for the phonemes shown in the table above is demonstrated first in each section. The consonants are arranged first by sections according to their manner of articulation. Then, within each section they are further arranged according to place of articulation.

All Asu phonemes occur as single segment onsets in one of three positions. They occur word initial, root initial or intervocalic but not root initial. I will not repeat these three contexts in each section. For each of the tables, I show contrast word-initially, lexeme-initially and lexeme-medially, before various vowels. Finally, in the last part of each section, I describe and demonstrate the allophones, their complementary distributions, and symmetry, if relevant.

3.1 Plosives

The voiced and voiceless plosives contrast in Table 21.[1]

Table 21. Contrast of simple plosives /p/, /b/, /k/, /g/

	/p/		**/b/**		**/k/**		**/g/**	
Word-initial:	pāpārà	'tilapia'	bādá	'bog'	kà	'coil'	gādā	'cutlass'
					kèrē	'rain (v.)'	gēlé	'carrier'
	pī	'trap'	bìsē	'fowl'	kīdɑ̏	'walk (v.)'	gīrāgí	'hawk'
			bō	'pan'	kōrō	'navel'	gò	'brace (v.)'
	pú	'handle'	bùbù	'white'	kʊ́t͡sʊ̀	'pig'	gùlú	'vulture'
Word-medial: (lexeme-initial)	ā-pá	'dung'	ā-bà	'forest	ā-kà	'cuts'	ā-gā	'fishnet'
					ē-ké	'hoe'		
	ā-pī	'kidney'	ā-bí	'spider'			ā-gí	'quail'
			ā-bóró	'barrel'	ā-kōlō	'heart'		
	à-pú	'weevil'	ē-bù	'belly'	à-kú	'river'	à-gú	'custom'
Word-medial (lexeme-medial)	pāpārà	'tilapia'	ā-gàbá	'diaphragm'	ā-fàká	'fallow'	tágādà	'textbook'
	sópɪ̄́	'donkey'	bàbīnī	'dragonfly'	múlìkì	'yam'	gīrāgí	'hawk'
			gèbó	'big'	fókóní	'light'		
			bàbúfú	'medicine'	dùrùkú	'tortoise'	dāgʊ̏	'flat'

All simple voiceless plosives, /p, t, k/, are aspirated in all the contexts mentioned above. Measurements of the VOT supporting this assertion will be demonstrated in Section 6.1. Aspiration is noted in the phonetic forms when provided. The labial plosives /p/, /b/, have no phonetic variation or special detail to mention other than the aspiration of the /p/.[2]

Contrast for the /t/ and /d/ will be given in Table 24.

The /k/ has three allophones: [k^h], [h] and [ɦ], but Asu has no /h/ phoneme. If one proposes an /h/ phoneme, this phoneme ends up being the only phoneme in the language to only appear before back vowels. This option is not ideal. The presence of the word-initial [h] require another

[1] There is one word where there is variation demonstrated between the [p^h] ∼ [f]. That word is [ʃĩk^{h}áp^{h}á]∼[ʃĩk^{h}áfá] 'rice'. This is atypical. The /f/ and /p/ are separate phonemes.

[2] There is a case of idiosyncratic free variation of the [p^h]∼[f] in [ʃink^{h}áp^{h}á]∼[ʃink^{h}áfá]

explanation. The variation documented between the [k^h]~[h] leads me to consider the [h] as an allophone of the /k/. The [h] and [ɦ] both appear in very limited contexts, only before the rounded back vowels /u,o,w/. Figure 4 demonstrates an instance of free variation of the [k^h]~[h]. This variation occurred in two successive repetitions of the same word /kúwèɾī/ 'valley'. The burst of the velar stop can be seen on the first recording of the word and is missing on the second recording of the word.

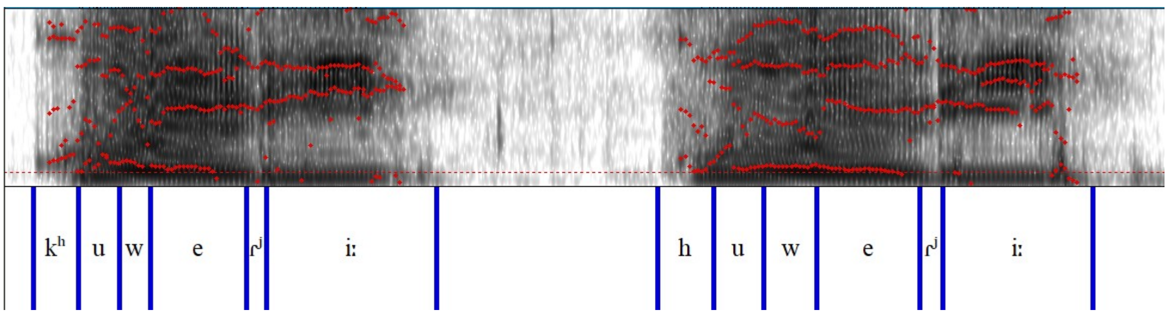


Figure 4. Free variation of [k^h] ~ [h] in /kúwèɾī/ 'valley'

Even though I am not able to show both allophones in the same word more than once, I analyze the [h] as a allophone of the /k/ in the word-initial context before rounded vowels. Additional examples of the [h] are shown in (23).

(23) a. /kókòmã́/
[hóɦòmã̌]
'large'

b. /kùkó/
[hùɦǒː]
'old'

c. /kókwà/
[hóɦwà]
'sour'

Example (24) shows additional examples of the word-initial [h] that precede back round vowels.

(24)	a.	/kúvī/	[húvī]	'corpse'
	b.	/kōɾī/	[hōⁱɾʲī]	'firewood type a'
	c.	/kū/	[hū]	'gather (v.)'
	d.	/kókòmɑ̃́/	[hóɦòmɑ̃̌]	'large'
	e.	/kùkó/	[hùɦǒː]	'old'
	f.	/kókwà/	[hóɦwà]	'sour'
	g.	/kùbwó/	[hùbwǒː]	'sweep (v.)'

The voiceless glottal fricative [h] is restricted to only appearing word-initially. In that context, it can only appear before round back vowels. However, intervocalically, the [k^h] sporadically weakens to an [ɦ] prior to rounded and back vowels /u,o,w/. This voiced environment explains the voicing of the /k/ allophone. The plausible features contributing to the lenition are limited to either back and/or round features. Asu has strong aspiration on simple stops. The back or round features, or perhaps both, are causing the [k^h] to be phonetically represented as [ɦ]. Example (25) provides three examples of this context.

(25) a. /mɑ̃́kó/
[mɑ̃́ɦóː]
'female'

b. /ā-g͡bɑ̃̀kwó/
[āg͡bɑ̃̀ɦwǒ]
'first weeding of field

c. /ā-kúg͡bá/
[āɦúg͡bâ]
'oath'

Additional evidence of the [k^h]~[ɦ] free variation can be seen in Table 22, where the first segment of the /-kwó/ 'AUGMENTATIVE' morpheme begins with a /k/. Within that morpheme, the /k/ phoneme is realized as [k^h] in some words and as [ɦ] in other words. In the Table 22a-c, the /k/ phoneme is realized as [k^h]. In Table 22d-f, the /k/ is phonetically realized as [ɦ]. Considering there is no phoneme /h/, and also considering the variation shown here and in other examples of free variation within the same word, I analyze this as free variation despite not having acquired recorded proof for each token.

Table 22. Alternation of [k^h] and [ɦ] word-medially

	Stem	Gloss	Augmentative Suffix	Gloss
a.	gàbà	'feline'	/-kwó/ [k^{h}wó]	'lion'
b.	ēlú	'bird'	/-kwó /[k^{h}wó]	'ostrich'
c.	jābá	'banana'	/-kwó/ [k^{h}wǒ]	'plantain'
d.	ēwà	'snake'	/-kwó/ [ɦwǒ]	'python'
e.	g͡bàɾì	'knife'	/-kwó/ [ɦwǒ]	'sword'
f.	āg͡bȁ	'grass'	/-kwó/ [ɦwǒ]	'first weeding'

This sporadic lenition process of the /k/, which is realized aspirated most of the time, does not apply to the /g/. For this reason, the description cannot be generalized further to include "velar stops weakening" in this context.

There are also palatalized allophones of the /k/ and /g/ realized as [c] and [ɟ]. These are discussed in Section 3.6.

Moving on to voiced plosives, Asu has three simple voiced plosives, /b, d, g/. These three are symmetrical to the places of articulation of the voiceless stops mentioned above. The palatal allophone of the /g/ that surface phonetically as [ɟ] is discussed in Section 3.6.

The labial-velar plosives are included in Table 23. The /k͡p/ is not aspirated. The lack of aspiration on the labial-velar plosive does not follow the pattern of the other simple voiceless plosives in Asu. Having aspirated stops and unaspirated labial-velars is documented for other languages in Africa and even in Nupoid languages (Cahill 2018). The /g͡b/ does have prevoicing or negative VOT like the other simple voiced plosives. The labial-velars /k͡p/ and /g͡b/ have no phonetic variation or special detail to mention.

Table 23. Contrast of k͡p and g͡b

	/k͡p/		**/g͡b/**	
Word-initial:	k͡pàtā	'firewood'	g͡bà	'dig'
	k͡pē	'know'	g͡bèɾē	'root'
	k͡píɾī	'notch (n.)'		
	k͡pòkű	'box'	g͡bó	'be large'
Word-medial: (lexeme-initial)	à-k͡pā	'shoulders'	ā-g͡bà	'axe'
			ā-g͡béjā	'kill'
	è-k͡pō	'widow'		
Word-medial (lexeme-medial)	ā-gák͡pā	'skin'	t͡sūg͡bā	'cotton'
	ā-làk͡pã	'brick'		
			ĩt͡sùɾìg͡bó	'lizard'

Table 24. Contrast of alveolar plosives and affricates /t/, /d/ /t͡s/, /d͡z/

	/t/		**/d/**		**/t͡s/**		**/d͡z/**	
Word-initial:	tā	'make'	dá	'ferment'	t͡sá	'forge'	d͡zāgā	'strain'
	tézĩ	'clay'	dézì	'hare'	t͡sé	'see (v.)'		
	tísēgí	'comb'	dídì	'stand (v.)'	t͡sīt͡sī	'die (v)'	d͡zìká	'sack'
	tòbígí	'skirt'	dō	'remove (v.)'				
	tūk͡pá	'bed'	dūgā	'roof'	t͡sù	'leader'	d͡zú	'lift (v.)'
Word-medial: (lexeme-initial)	à-tá	'stone'	ā-dà	'brew (v.)'	è-t͡sā	'moon'		
			ē-dē	'bean'	ā-t͡sèɾī	'hunters'		
	à-tí	'needle'	è-dȉ	'market'	è-t͡sí	'flesh'		
	ē-tù	'cobra'	ā-dȕ	'squirrel'	è-t͡sù	'king'		
Word-medial (lexeme-medial)	k͡pàtā	'firewood'	bādâ	'bog'	t͡sīt͡sá	'sift (v.)'		
	wùtētē	'sun'	ādédéɾī	'star'	ɾȕt͡sē	'tail'		
	tītī	'morter'	ē-kádì	'horse'	bìt͡sì	'foot'	gūd͡zī	'fetish'
			ā-jìdó	'marsh'	t͡sūt͡sō	'be hot'		
	tȕtùɾù	'hair'	kādú	'go'	kùt͡sùkwó	'beetle'	káɾád͡zú	'rust'

Contrast between the alveolar plosives and affricates are shown in Table 24. These phonemes are found in the exact same onset positions as other consonant phonemes. The palatal allophones of these phonemes [tʲ,dʲ,t͡ʃ,d͡ʒ] are discussed in Section 3.6.

3.2 Fricatives

As with all other obstruents, the fricative inventory contains voiced and voiceless counterparts. The alveolar fricative phonemes contrast with each other in Table 25. These alveolar fricative phonemes can also be contrasted with the plosive phonemes and with the affricate phonemes in Table 24. The alveolar fricatives appear in the same contexts as all other Asu consonants. They are realized as [ʃ] and [ʒ] before front vowels and these allophones are discussed in Section 3.6.

Table 25. Contrast of alveolar fricatives /s/, /z/

	/s/		**/z/**	
Word-initial:	sá	'span (v.)'	zà	'wander'
			zē	'seed'
	sīsè	'filter (v)'	zĩ́	'return'
	sópĩ́	'donkey'		
	sùɾū	'basket'	zṹ	'cut'
Word-medial: (lexeme-initial)	ā-sá	'net'	ē-zà	'person'
	à-sé	'gravel'	ē-zé	'field'
	à-sĩ́	'cricket'	ē-zī	'town'
	ā-sùbá	'yam B'	ē-zū	'guinea'
Word-medial: (lexeme-medial)	nùsā	'elder'	fīzā	'douse'
	bìsē	'fowl'		
	à-ɾèsí	'cloud'	dézì	'hare'
	sōsōgí	'insect'	jà̃zówí	'who'
	āmūsū̃	'soil'	wū̃zī̃	'captive'

The labial-dental fricatives contrast with the labial plosives as shown in Table 26.

Table 26. Contrast of labial phonemes /f/, /v/, /p/, /b/

	/f/		**/v/**		**/p/**		**/b/**	
Word-			váɾī	'husband'	pāpāɾà	'tilapia'	bādá	'bog'
initial:	fédū̃	'sit (v.)'						
	fīzā	'put out'	ví	'young'	pī	'set trap'	bìsē	'fowl'
	fókóní	'light (n.)'					bō	'pan'
	fū	'drink'			pú	'handle (n.)'	bùbù	'white'
Word-	ā-fà	'field'	è-vá	'buffalo'	ā-pā	'dung'	ā-bà	'forest'
medial:	ē-fé	'storm'						
(lexeme-	ā-fì̃	'weed'			ā-pī	'kidney'	à-bí	'spider'
initial)							ā-bóɾó	'barrel'
					ē-pú	'turtle'	ē-bù	'belly'
Word-	à-lèfá	'greens'			pāpāɾà	'tilapia'	ā-sùbá	'yam'
medial:								
(lexeme-	kù̃fíɾí	'roach'	kúvī	'orphan'	sópí̃	'donkey'	tòbígí	'skiɾt'
medial)	kòfō	'arrow'					gèbó	'big'
	bàbúfú	'medicine'					kā̃bú	'guard'

The labial-dental fricatives occur in the same contexts as other phonemes and do not show any variation. There is a case of idiosyncratic free variation in one word 'rice' of the [p]~[f] inter-vocalically, as previously demonstrated in Section 3.1. The labial-dental fricatives, /f/ and /v/, are less common than some of other Asu phonemes. The /f/ occurs uniquely sixteen times in all the database. All examples are given in (26). Some of the words that contain /f/ are certainly borrowed.

(26)	a.	/fū/	[fūː]	'drink (n.)'
	b.	/fúskā/	[fúskʰāː]	'face'
	c.	/fūká/	[fūkʰâː]	'raw'
	d.	/fókóní/	[fókʰónîː]	'light'
	e.	/è-fī̄/	[ʔèfī̄ː]	'chaff'
	f.	/ē-fé/	[ʔēfêː]	'storm, wind'
	g.	/à-lèfá/	[ʔàlèfǎː]	'edible greens'
	h.	/à-fī́/	[àfī̌ː]	'mane'
	i.	/ā-fà/	[āfàː]	'field'
	j.	/ā-fàká/	[āfàkʰǎː]	'fallow'
	k.	/dā̀fáɾá/	[dā̀fǎɾâː]	'trickster bird'
	l.	/gā̄fì/	[gā̄fìː]	'half'
	m.	/bàbúfú/	[bàbǔfûː]	'hunting medicine'
	n.	/kū̀fíɾé/	[kʰū̀fíɾʲêː]	'cockroach'
	o.	/dòfá/	[dòfǎː]	'blue'
	p.	/kòfō/	[kʰòfōː]	'field'
	q.	/ā-fà/	[āfàː]	'arrow'

Table 27 shows three borrowed Hausa words that I identified that contain the /f/, but not all words in the list above can be attributed to borrowing or ideophones. Perhaps most importantly, the remaining words contrast with the other Asu phonemes, such as the /p/ and /b/, shown in Table 26.

Table 27. Borrowed words from Hausa containing the /f/

Asu	**Hausa**	**Meaning**
fìtìlá	fitila (Robinson 1913:86)	'lamp (n.)'
fúskā	fuska (Robinson 1913:93)	'face (n.)'
fílí	fili (Robinson 1913:89)	'field (n).'

The /v/ is even less common than the /f/. It occurs only ten times in all the data. Example (27) documents those tokens.

(27) a. /vjá/ [vjâː] 'people'
b. /ví/ [vʲîː] 'young'
c. /vā/ [vāː] 'twins'
d. /và/ [vàː] 'you.SG'
e. /váɾī/ [váⁱɾʲīː] 'husband'
f. /è-vjē/ [ʔèvjēː] 'year'
g. /è-vá/ [èvǎː] 'buffalo'
h. /à-vjí/ [àvjǐː] 'horns'
i. /à-vjé/ [àvjěː] 'breasts'
j. /kúví/ [kúvíː] 'corpse'

These words are not obvious borrowings or ideophones. Once again, there is contrast with the other labial plosives.

3.3 Nasals

There are two nasal consonants /m/ and /n/. They have no other allophones other than their base forms, and occur in all positions: word-initially, lexeme-initially and lexeme-medially preceding various vowels. Table 28 shows them in contrast.

Table 28. Examples of /m/, /n/

	/m/		**/n/**	
Word-initial:	má mī múɾā	'1.SG' 'form (v.)' 'drought'	nàkàɾī nī nùsā	'scorpion' 'with' 'elder'
Word-medial: (lexeme-initial)	ā-má à-mī ā-mūsṻ	'womb' 'oil' 'soil'	à-ná ē-níjā	'cows' 'entrails'
Word-medial: (lexeme-medial)	dīmā wàmí kùmùgṹ	'that' 'be gentle' 'be rough'	ā-zánā̄ ā-wónì	'woven grass' 'cowry'

3.4 Liquids

The /ɾ/ appears in the same contexts as all the other consonant phonemes mentioned above. Table 29 demonstrates contrast between the tap and the /d/, /t/, as well as the /l/.

Table 29. Contrast of /ɾ/ with /d/, /t/, /l/

	/ɾ/		**/d/**		**/t/**		**/l/**	
Word-	ɾɑ̃̄kũ̀	'knee'	dɑ́	'ferment'	tɑ̄	'make'		
initial:			dézì	'hare'	tézĩ̄	'clay'		
	ɾīgɑ̃̄	'lizard'	dídì	'stand'	tísēgí	'comb'	līlī	'sleep'
	ɾōgó	'cassava'	dō	'remove'	tòbígí	'skirt'	lò	'fly (v.)'
	ɾūɾù	'heavy'	dūgɑ̄	'roof'	tūk͡pɑ́	'bed'	lùbwɑ́	'flour'
Word-	è-ɾɑ̄	'fire'	ɑ̄-dɑ̀	'brew (n.)'	ɑ̀-tɑ́	'stone'	ɑ̀-lɑ́	'grass'
medial:	ɑ̀-ɾē	'rain'	ē-dē	'bean'				
(lexeme-	ɑ̄-ɾī	'tsetse'	è-dĩ̀	'market'	ɑ̀-tí	'needle'	ɑ̄-lí	'style'
initial)			ē-dɑ̃̀	'mudfish'				
	ɑ̄-ɾũ̄kɑ̀	'ring'	ɑ̄-dũ̀	'squirrel'	ē-tù	'cobra'	ɑ̄-lū	'pot'
Word-	múɾɑ̄	'dry'	bɑ̄dɑ́	'bod'	k͡pɑ̀tɑ̄	'wood'	bōlɑ̀bōlɑ̀	'fresh'
medial:	kèɾé	'rain'	ɑ̄-dédéɾī	'star'	wùtētē	'sun'	gēlé	'cloth'
(lexeme-	wɑ̄ɾī	'digit'	ē-kɑ́dì	'horse'	ɑ̀-wùtí	'mat'	wɑ́lìlì	recline'
medial)	bōɾó	'locust'	ɑ̄-jìdó	'marsh'	tūtùɾù	'hair'	lúlò	'flying'
	ɾūɾù	'heavy'	kɑ̄dú	'go'	tĩ̀tĩ́	'braid'	gùlú	'vulture'

Despite being difficult to hear because of the speed of the tap, acoustically, the tap does have a palatalized allophone [ɾ^{j}] that is discussed in Section 3.6. The tap is also phonetically realized five other ways [^{ɑ}ɾ, ^{o}ɾ, ^{u}ɾ, ^{i}ɾ, $^{\tilde{u}}$ɾ]. There is a period of vocalization prior to the release of the tap. Vago & Gósy (2007:505) note the same type of vocalization in the realization of Hungarian trills. In the Hungarian case, the variant pre-tap vocalic element is always a schwa [^{ə}r]. A similar type of pre-tap vocalic sound occurs in Asu, only the quality of the vowel preceding the tap in Asu is not always a schwa. Spectrograms of these pre-tap vocalic elements are included in Section 6.4.

The quality of the transitional vowel before the tap is a very slightly centralized form of the vowel following the tap. Example (28) illustrates how the /ɾ/ has five different phonetic realizations word-initially. Each phonetic realization has a different quality to the pre-tap vowel preceding the /ɾ/. I have called these phonetic realizations because their form is dependent on the quality of the vowel following the tap.

(28)	a.	/ɾí/	[ⁱɾʲíː]	'eat'
	b.	/ɾōgó/	[ᵒɾōgóː]	'cassava'
	c.	/ɾūɾù/	[ᵘ̃̄ɾūɾùː]	'heavy'
	d.	/ɾɑ̀kū̃mī/	[ᵅɾɑ̀kū̃mīː]	'camel'
	e.	/ɾùt͡ʃē/	[ᵘɾùt͡ʃēː]	'tail'

With additional data, I would expect to encounter the three missing allophones [ᵉɾ, ᵅ̃̄ɾ, ⁱ̃̄ɾ] to form a complete set of pre-tap vowels that directly correspond to the phonemic vowels. In the consultant's speech in this data set, there is always a pre-tap vocalic element preceding a phonemic /ɾ/. It is worth mentioning that the mean duration of the pre-tap vowel is 58 ms. The longest pre-tap vowel token measures 110 ms.

The /l/ contrasts with /t/, /d/, and /ɾ/ in Table 29. This lateral phoneme appears in the same contexts as all the other Asu phonemes. The [l] allophone appears before all non-front vowels, as demonstrated in (29).

(29)	a.	/fìtìlɑ́/	[fìtʰʲìlɑ̌ː]	'lamp'
	b.	/ɑ̀-lɑ́/	[ɑ̀-lɑ̌ː]	'grass for fishbasket'
	c.	/lúlò/	[lúlòː]	'fly (v.)'
	d.	/ɑ̄kōlō/	[ɑ̄kʰōlōː]	'heart'
	e.	/gùlú/	[gùlǔː]	'vulture'

The palatalized allophone [lʲ], of the lateral is discussed in Section 3.6.

3.5 Approximants

The approximants are contrasted in Table 30. They appear in the same three contexts as all the other phonemes mentioned above. They also appear as the second consonant in a complex onset CGV as shown in Chapter 2.1.

Table 30. Contrast of approximants /j/, /w/

	/j/		**/w/**	
Word-initial:	jà	'give'	wā	'take (v.)'
	jījá	'new'		
	jũ̄wà̃	'dry''	wò	'hear (v.)'
			wú	'thrash (v.)'
Word-medial: (lexeme-initial)	ē-jà	'canoe'	ē-wà	'snake'
	è-jē	'eye'		
	è-jí	'corn'		
			ā-wónì̃	'cowry'
	à-jú	'Adam's apple'	ē-wù	'sheep'
Word-medial (lexeme-medial)	ē-níjā	'entrails'	wùwá	'dry'
	ījè	'good'		
	sájē	'pole'	jà̃zówí	'who'
	bōsījō	'spleen'	ā-mìlàwō	'worm'
			kàwú	'sieve'

Both of the approximants /j/ and /w/ have slightly nasalized allophones, which only precede nasalized vowels. This is demonstrated in (30) and (31).

(30) /jà̃sī̃/
[j̃æ̃̀ʃī̃ː]
'wealth'

(31) /jũ̄wà̃/
[j̃ũ̄w̃ɔ̃̀ː]
'dry'

3.6 Palatalization

Asu exhibits a regressive palatalization of all non-labial simple obstruents. The front vowels /i,e,ĩ/ and glide /j/ are the triggers. When the /k/ and /g/ precede a front vowel or glide, they are realized as [c] and [ɟ], respectively. Examples (32)a-e and (33)a-c show the effect of palatalization on these plosives; (32)f-h and (33)d-f show the same plosives unaffected before non-front vowels.

(32)	a.	/kíkɑ̄/	[cʰíkʰɑ̄ː]	'clearing'
	b.	/é-kē/	[écʰēː]	'hoe'
	c.	/kèɾé/	[cʰèɾʲěː]	'rain'
	d.	/kī͡tsúmú/	[cʰī͡tʃjúmûː]	'small'
	e.	/kīdɑ̏/	[cʰīdɑ̏ː]	'walk'
	f.	/ɑ̄-kɑ̀/	[ɑ̄kʰɑ̀ː]	'cuts (n.)'
	g.	/ɑ̄-kōlō/	[ɑ̄kʰóló:]	'heart'
	h.	/ɑ̀-kú/	[ɑ̀kʰǔː]	'river'

Example (33) shows the allophones of /g/.

(33)	a.	/gjɑ̄mɑ̄̄/	[ɟjɑ̄mɑ̄̄ː]	'chameleon'
	b.	/gēlé/	[ɟēlêː]	'carrying cloth'
	c.	/tísēgí/	[tʰʲíʃēⁱɟîː]	'comb'
	d.	/ɑ̄-gɑ̄/	[ɑ̄gɑ̄ː]	'fishnet'
	e.	/ɾōgó/	[ō̯ɾōgôː]	'cassava'
	f.	/ɑ̀-gú/	[ɑ̀gǔː]	'custom'

All the palatalized obstruents in Asu cause the vowel which precedes it to glide toward the close-front [i] position. Example (34) also shows the allophone, [ɟ], causing the vowel preceding it, /o/, to be realized as [oⁱ]. This process creates complex phonetic vowels such as the [oⁱ] shown in (34). These glided vowel allophones are discussed in Section 4.1.

(34) /͡gbōgí/
[͡gbōⁱɟî]
'baboon'

The /t/, /d/, /͡ts/, and /͡dz/ also have palatalized allophones. These allophones, [tʰʲ], [dʲ], [͡tʃ] and [͡dʒ], occur preceding front vowels. I transcribe this slight palatalization, which measures 30 ms, with a superscripted [ʲ]. This slight palatalization contrasts with the palatal approximant /j/. The /j/ found in consonant clusters measures 60 ms. I transcribe the palatal approximant with [j]. The acoustic contrast between the two palatal sounds is shown in Section 6.2. Example (35) gives the phonetic realizations of the [tʰʲ] which appear before front vowels.

(35)	a.	/kɑ̀tíkɑ̀tí/	[kʰɑ̄̀tʰʲǐkʰɑ̄̀tʰʲǐ́ː]	'white ant'
	b.	/tézī̄/	[tʰʲéʒī̄ː]	'clay'
	c.	/tìtí/	[tʰʲī̀tʰʲī̌ː]	'braided'
	d.	/tísēgí/	[tʰʲíʃēɟîː]	'small comb'
	e.	/è-tí/	[ètʰʲǐː]	'head'

The [tʰ] appears before non-front vowels as shown in example (36).

(36)	a.	/tāṫá/	[tʰātʰâː]	'stool'
	b.	/tūtùɾù/	[tʰūtʰùɾù̀ː]	'hair'
	c.	/tòbígí/	[tʰòbǐɟîː]	'skirt'

Similarly, example (37) shows the phonetic realization [dʲ] of /d/.

(37)	a.	/dīdí/	[dʲīdʲîː]	'bad'
	b.	/ēdē/	[ēdʲēː]	'bean'
	c.	/dī̀/	[dʲī̀ː]	'carve'
	d.	/dìdì/	[dʲìdʲìː]	'dark'
	e.	/ɑ̄dédéɾī/	[ʔɑ̄ⁱdʲédʲéɾʲīː]	'evening star'

Example (38) shows the allophone [d] that appears before all non-front vowels.

(38)	f.	/dɑ́/	[dɑ́ː]	'ferment'
	g.	/dō/	[dōː]	'take out'
	h.	/dūgɑ̄/	[dūgɑ̄ː]	'roof'

The /t͡s/ also has a palatalized realization before front vowels. In this environment it is realized as [t͡ʃ] as shown in (39).

(39)	a.	/t͡sìkɑ̄́/	[t͡ʃìkʰɑ̄̌ː]	'bush'
	b.	/tɑ̄t͡sī́/	[tʰɑ̄ⁱt͡ʃîː]	'center'
	c.	/t͡sèɾī/	[t͡ʃèɾʲīː]	'food'
	d.	/kīt͡sjúmú/	[cʰīt͡ʃjúmûː]	'small'
	e.	/ɾùt͡sē/	[ṳ̄̀ɾū̀t͡ʃēː]	'tail'

When the /t͡s/ is followed by non-front vowels, it surfaces as [t͡s] as shown in example (40).

(40)	a.	/t͡sɑ́/	[t͡sɑ̂ː]	'forge'
	b.	/t͡sūt͡sū/	[t͡sūt͡sōː]	'be hot'

The /d͡z/ is realized as [d͡ʒ] before front vowels as shown in example (41).

(41)	a.	/gūd͡zī/	[gūⁱd͡ʒīː]	'fetish'
	b.	/d͡zìkɑ́/	[d͡ʒìkʰɑ̌ː]	'sack'
	c.	/g͡bjèd͡zìgí/	[g͡bjèd͡ʒìɟǐː]	'rattlesnake'

Elsewhere, the /d͡z/ is realized as [d͡z] when preceding non-front vowels as in example (42).

(42)	a.	/d͡zɑ̄gɑ̄/	[d͡zɑ̄gɑ̄ː]	'strain'
	b.	/d͡zú/	[d͡zûː]	'lift'
	c.	/d͡zɑ̀ɾī/	[d͡zɑ̀ⁱɾīː]	'bells'

The /s/ is realized phonetically as [ʃ] when it precedes front vowels, as illustrated in example (43).

(43)	a.	/bìsēː/	[bìʃēː]	'fowl'
	b.	/sīsèː/	[ʃīʃèː]	'filter'
	c.	/ē-sī̀ː/	[ēʃī̀ː]	'broom'
	d.	/ɑ̀-séː/	[ɑ̀ⁱʃěː]	'gravel'
	e.	/ɑ̄-kùsìː/	[ɑ̄kʰùⁱʃìː]	'wooden bowl'

Preceding non-front vowels, the /s/ is realized as [s] as shown in example (44).

(44)	a.	/bɑ̀sɑ̄̄ː/	[bɑ̀sɑ̄ː]	'side'
	b.	/sōsōgí/	[sōsōⁱɟîː]	'insect'
	c.	/sū̄sū̄ː/	[sū̄sū̄]	'seed'

The Asu /z/ is realized as [ʒ] when it precedes front vowels as illustrated in example (46).

(45)	a.	/zí́/	[ʒí́ː]	'return'
	b.	/zē/	[ʒēː]	'seed'
	c.	/ē-zì/	[ēʒìː]	'rainy season'
	d.	/è-zī̄/	[èʒī̄ː]	'arrow'
	e.	/ē-zé/	[ēʒêː]	'field'
	f.	/gùzjɑ́/	[gùⁱʒjɑ̌ː]	'groundnut
	g.	/sīzjɑ̄/	[ʃīʒjɑ̄ː]	'leads' (v.)

Elsewhere it surfaces as [z] before non-front vowels as in example (46).

(46)	a.	/ɑ̀-zɑ̄̄/	[ʔɑ̀zɑ̄̄ː]	'tongue'
	b.	/jɑ̄̀zówíː/	[jɑ̄̀zǒwîː]	'who'
	c.	/zū̄zū́́/	[zū̄zû̂ː]	'ant'

The palatalization on the tap is nearly impossible to hear audibly. I transcribe with the same palatalization as other consonants, primarily because the vowel preceding the tap contains a palatalized off-glide. The spectrogram in Figure 5, shows the /ɑ/ preceding the tap being realized phonetically as a [ɑⁱ].

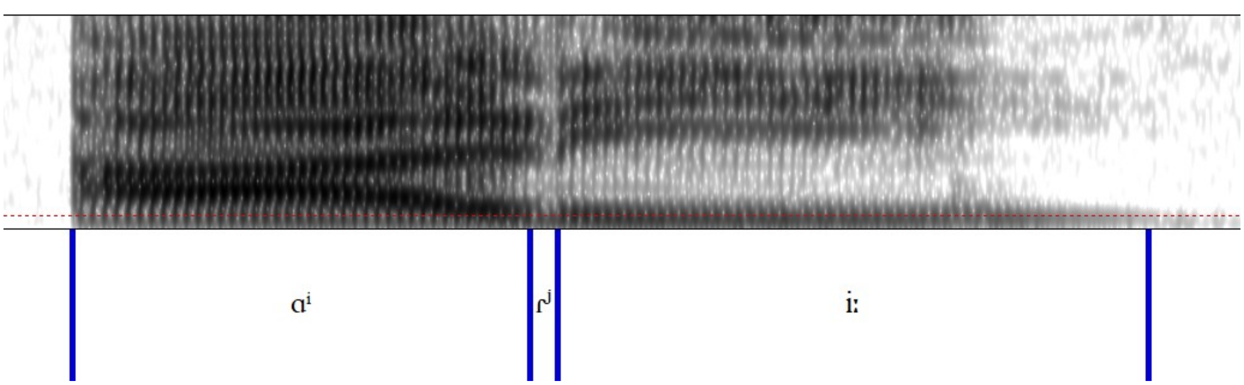


Figure 5. Palatalization of the tap in /ɑ̄ɾ̄i/ 'tsetse fly'

A histogram showing overall frequency of each phoneme is provided in Figure 6.[3] This histogram includes all occurrences, regardless of each phoneme's context. Less common phonemes like /d͡z/ and /v/ were discussed above.

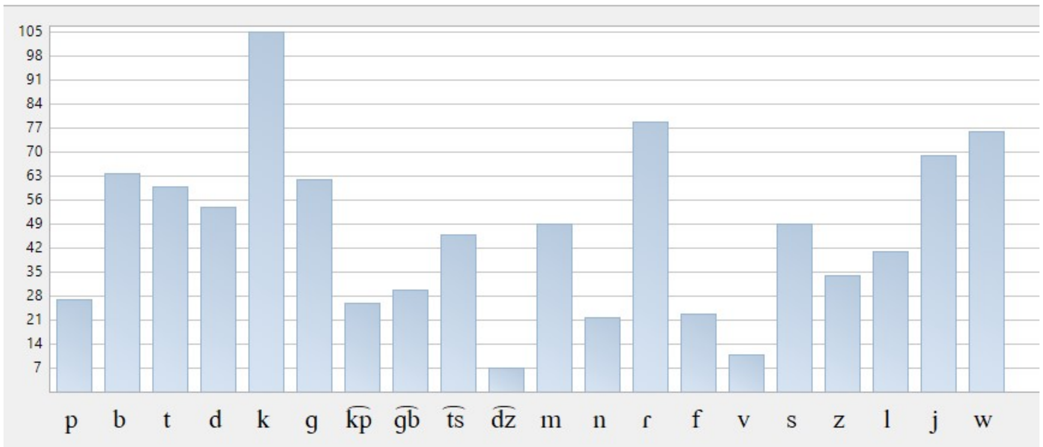


Figure 6. Asu consonant histogram

[3] The consonant histogram is produced by SIL International's Phonology Assistant software.

CHAPTER 4

Vowels

The Asu vowel system has eight phonemic vowels. Five vowels are oral and three are nasal. The placement of nasal phonemes on the IPA trapezoid in Figure 7 reflects the fact that nasalization causes a slight centralization in the vowel space. The actual vowel production location plotted according to F1 and F2 is given in Sections 4.1 and 4.2.

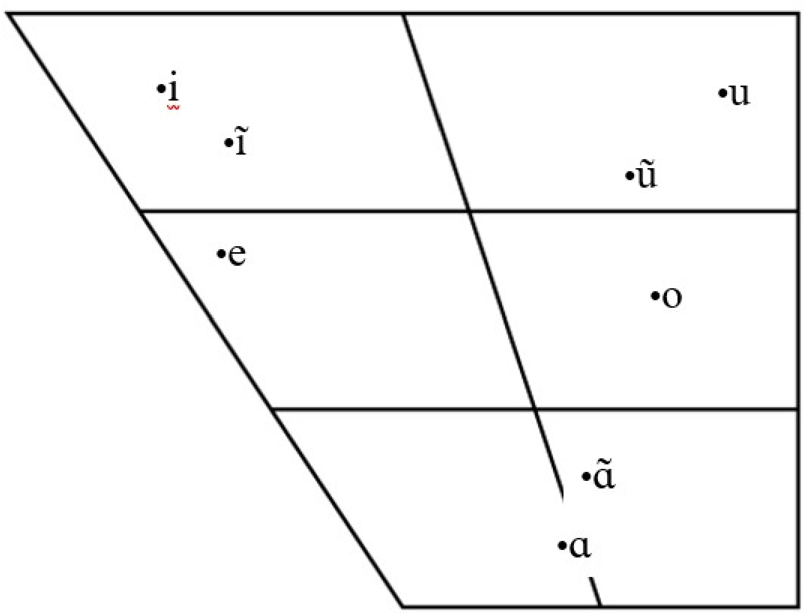


Figure 7. Asu vowel phonemes

Table 31 contrasts the oral vowel phonemes in the word-final and lexeme-medial positions.

Table 31. Examples of oral vowel phonemes

	Word-finally		Lexeme-medially	
/i/	ā-pī	'kidneys'	pípȁ	'pound (v.)'
	è-tí	'head'	tītī	'morter'
	ē-zī	'town'	sīsè	'filter (v.)'
	è-t͡sí	'flesh'	t͡sīt͡sī	'die (v.)'
	ē-mì	'dog'	mīmȁ	'measure (v.)'
	ā-ɾī	'tsetse flies'	ɾīgā̄	'chameleon'
	è-jí	'corn'	jījá	'new'
/e/	ē-fé	'wind'	fédū̄	'sit (v.)'
	ē-dē	'bean'	wùtētē	'sun'
	ē-ké	'hoe'	kèɾé	'rain'
	t͡sé	'see'	t͡sèká	'hunting'
	gēlé	'carrying cloth'	wàlélé	'salamander'
	à-ɾē	'rain'	à-ɾèsí	'rain cloud'
	è-jē	'eye'	kújèɾī	'valley'
/ɑ/	ē-pɑ̄	'hide (n.)'	pɑ̄pɑ̄ɾɑ̀	'tilapia'
	ē-kɑ́	'chore'	ē-kɑ́dì	'horse'
	ā-sɑ́	'net'	ā-sɑ́ɾɑ́	'tobacco'
	è-t͡sɑ̄	'moon'	t͡sɑ̄ɾízɑ̄	'blacksmith'
	è-nɑ́	'bovine'	nɑ̀kɑ̀ɾī	'scorpion'
	è-ɾɑ̄	'fire'	kɑ́ɾɑ́d͡zú	'rust'
	ē-jɑ̀	'canoe	jɑ̄bá	'banana'
/o/	bō	'pan'	bōɾó	'locust'
	gò	'brace (v.)'	gōɾó	'hook'
	g͡bó	'be large'	sōsōgí	'insect'
	t͡sūt͡sō	'be hot'	fókóní	'light'
	lò	'fly (v.)'	wōkȕ	'hole'
	gōɾó	'hook (n.)'	ɾōgó	'cassava'
	bōsījō	'spleen'	è-jògű	'territory'
/u/	è-pú	'calf hut'	ē-bùbū	'cow hut'
	ē-tù	'cobra'	gédūdū	'many'
	ā-dúkú	'sweet potato'	ā-gúɾú	'furnace'
	ē-zū	'guinea fowl'	sùɾū	'fish basket'
	è-t͡sù	'king'	lúlò	'fly'
	kīt͡sjúmú	'small'	nùsā	'elder'
	ɾūɾù	'very heavy'	ɾūɾù	'very heavy'
	à-jú	'larynx''	kīt͡sjúmú	'small'

Figure 8 is a histogram that represents the overall frequency of every instance of each Asu vowel phoneme in my corpus.[1] Excluding the occurrence of /ɑ/ and /e/ in prefixes, 75% of all vowels are oral (759) and 25% of all vowels are nasal (188). All vowel phonemes are well attested with at least 32 occurrences of each in the corpus.[2]

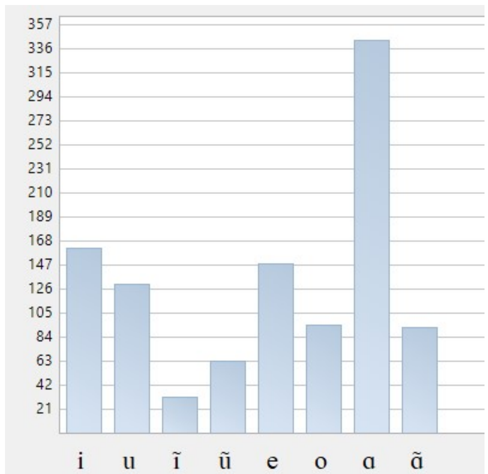


Figure 8. Asu vowel histogram

I discuss the vowels in two groups, oral and nasal, in the subsections below. I show contrast between all the oral phonemes in Table 31. Nasal vowels will be handled separately in Section 4.2.

4.1 Oral vowels

Asu oral vowels exhibit a five-vowel system. The five-vowel system matches one of three types of oral vowels systems found in the Nupoid language family. The Asu vowel system is shown at the right of Figure 9. Asu has the same oral vowel system as Dibo, Gwari, Kami and Nupe (Blench 1989:313).

[1] The overall frequency of the /ɑ/ and the /e/ include numerous examples of the prenominal prefixes. The /ɑ-/ prefixes appeared 122 times and the /e-/ prefixes appeared 86 times. For this reason the frequency of those two vowel phonemes is exaggerated.

[2] The vowel histogram is produced using SIL International's Phonology Assistant Software.

Oral Vowels

i	u	i	u	i	u
ɩ = ị	ʊ = ụ				
e	o	e	o	e	o
ɛ	ɔ	ɛ	ɔ		
a		a		a	
Ebira, Gade		Gupa[?], Kupa, Kakanda, Nupe Tako		Dibo, Asu, Gwari, Kami, Nupe	

Figure 9. Nupoid oral vowel systems (Blench 1989:313)

In Table 31, the oral vowel phonemes are contrasted with each other in two different contexts: word-finally and lexeme-medially contiguous to assorted consonants. The word-initial position is not presented here because it is primarily limited to class markers. See Chapter 2.

The average F1 and F2 values of ten tokens of oral vowels are plotted in Figure 10 to demonstrates the zone of production for each oral vowel.[3] The location of the vowel symbol, represents the mean value of F1 and F2 for the ten measurements. The circle around it represents two standard deviations from the mean value. The F2 values, on the horizontal axis, correspond to vowel frontness. The F1 results, on the vertical axis, inversely correspond to vowel height. Both axes are plotted on a non-linear Bark scale (Casali 2019).

[3] This Figure is produced by FPlot® software created by Rod Casali.

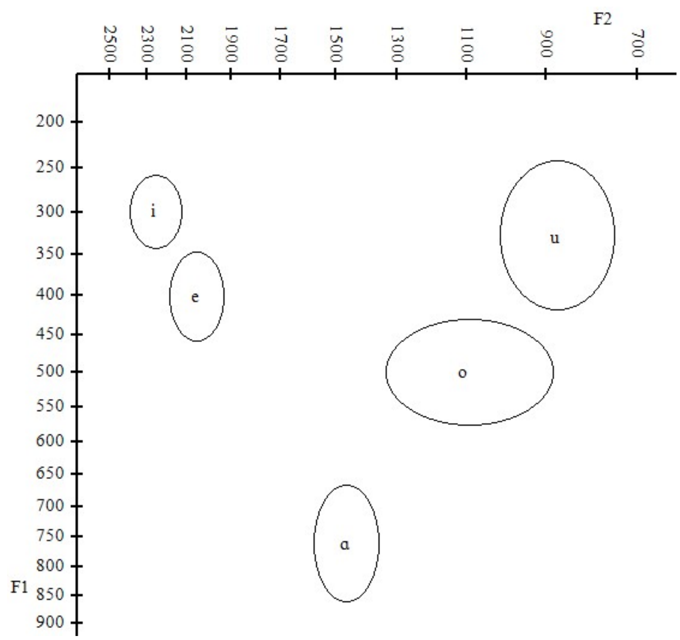


Figure 10. Asu oral vowels

There is no overlapping of the vowel space for any of the oral vowels. Mean F1 and F2 values are shown in Table 32.

Table 32. Mean F1 and F2 of oral vowels

	F1	**F2**
/i/	300	2250
/e/	400	2100
/ɑ/	760	1460
/o/	500	1150
/u/	325	875

Each of the oral vowels have a number of allophones that I will now discuss. The first non-distinctive feature is the glottal stop that occasionally epenthesized before a word-initial vowel. This glottal stop is noted in different repetitions of the same word. Essentially, the glottal-vowel sequence is in free variation with the modal vowel. But regardless of how one analyzes the glottal, it is a non-phonemic transitional sound between silence and vocalization. Because the glottal stop is not a phoneme in Asu, and because this phonetic realization needs to be analyzed somewhere, I analyze it here as a surface representation of the phonemic vowels. Examples of pre-glottalized vowels are given in (47).

(47)	a.	/ɑ̀-kùg͡bɑ́/	[ʔɑ̀ɦùg͡bɑ̆ː]	~	[ɑ̀ɦùg͡bɑ̆ː]	'priestess'
	b.	/è-vjē/	[ʔèvjēː]	~	[èvjēː]	'year'
	c.	/ɑ̄-jī/	[ʔɑ̄jīː]	~	[ɑ̄jīː]	'blood'
	d.	/ɑ̀-mṹ/	[ʔɑ̀mũ̌ː]	~	[ɑ̀mũ̌ː]	'mushroom'

Vowels in the final position of the word are regularly and noticeably lengthened as in example (48). I say word-final rather than utterance final because the few words that I have recorded more than once had longer durations on both repetitions of the recorded words.

(48)	a.	/gɑ̀dù/	[gɑ̀dùː]	'arrow poison'
	b.	/ēdē/	[ēdʲēː]	'bean'

Further examples of lengthened final vowels can be seen in example (47) and in example (49).

A third phonetic representation of the vowels are off-glides that are realized when the non-front and close vowels, /ɑ,ɑ̃,o,u,ũ,e/, occur before a palatal or palatalized consonant. Approximately the final one-third of each of these Asu vowels move from their non-front close vowel positions toward the front-close vowel position. Recasens (1999::1849) describes the cause of these vowel glides in his study: "...Palatal consonants cause glide insertions to occur in VC and CV sequences with e,a, or a rounded vowel. Most insertion cases may be explained assuming that the F2 transitions in these vowel conditions have been categorized as a separate glide by listeners. These formant transitions rise from the vowel towards the consonant which leads to their categorization as palatal /j/." Some examples of the off-glides that are formed are shown in example (49).

(49)	a.	/ɑ̄-gɑ̀lí/	[ʔɑ̄gɑ̀ⁱlʲǐː]	'den'
	b.	/ɑ̄-k͡pjē/	[ʔɑ̄ⁱk͡pjēː]	'hoof'
	c.	/bōsījō/	[bōⁱʃījōː]	'spleen'
	d.	/sùljɑ́/	[sùⁱlʲjɑ̌ː]	'bush pig'
	e.	/ɑ̄jī/	[ɑ̄ⁱjīː]	'blood'
	f.	/èjí/	[èⁱjǐː]	'corn'

In the word /sōsōgí/ 'insect', the regressive palatalization, discussed in Section 3.6, results in a phonetic realization of [sōsōⁱɟîː]. In this word, the word-final [iː] causes the /g/ to be realized as [ɟ]. Next, the [ɟ] causes the final third of the preceding non-front vowel /o/, to be realized as with a gradual glide toward the /i/ position in the final one-third of the vowel. This results in an [oⁱ] off-glide. The /o/ does not permit the regressive palatalization to continue towards the front of the word. Four vowels have phonetic representations that include an off-glide, [oⁱ, ɑⁱ, ɑᵉ, uⁱ], and those four allophones are in complementary distribution with their non-palatalized counterparts /ɑ, o, u/.[4]

4.1.1 Vowel Phonotactics

Before proceeding to a discussion on nasal vowels and their allophones, there is one more co-occurrance restriction that needs to be mentioned. A type of vowel front-back harmony exists within simple roots. In other words, CV.CV roots do not contain the expected random combination of vowels. Instead, what we find are roots where the front and back vowel sets never combine. The vowel harmony sets are illustrated in Figure 11.

[4] The [ɑᵉ] glide is found in [ɑ̀ᵉɾʲè] 'rain' and a possible compound [ɑ̀ᵉɾʲèʃĭ] 'cloud'. The short duration of the tap allows the [e] to regressively assimilate the vowel before the tap.

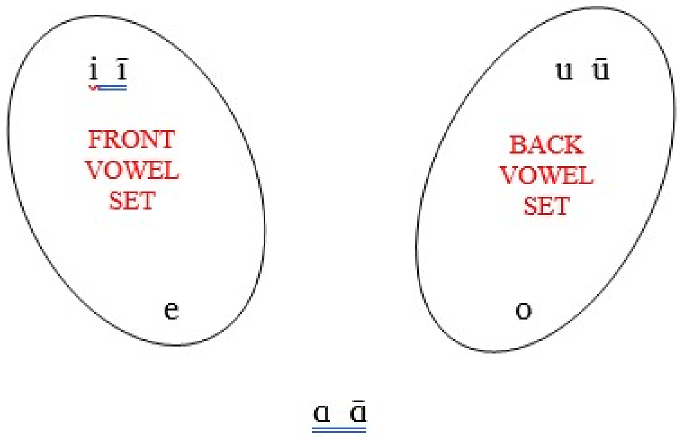


Figure 11. Vowel harmony sets in Asu

The front set contains /i, ĩ, e/ and the back set contains /u, ũ, o/. The central vowels /ɑ, ɑ̃/ are members of neither set and appear in roots with either front or back vowels. The data show that the vowels in the back vowel set never follow /i, ĩ, e/. Also, except for a few exceptions, which I discuss shortly, the front vowel set never follows /u, ũ, o/.

Data from three different noun classes contain either front or back vowels only. Roots representing each vowel combination are provided for these three noun classes, charted in Tables 12, 13 and 15. In each chart, the vertical column at the left corresponds to the vowel quality of the first syllable. The horizontal row at the top corresponds to the vowel quality of the second syllable. No oral-nasal co-occurrence restrictions were documented as oral-nasal vowels are mixed within the same root.

Figure 12 demonstrates the general pattern which is true for 92% of the 89 roots in the 0-Class. Asu has a restriction against roots containing both front and back vowels. Asu roots with a front vowel in the first syllable can include any of the other eight vowels in the second syllable except for the back vowel set shown in Figure 11. The reverse is also true for back vowels.

	i	ĩ	e	ɑ	ɑ̃	o	u	ũ
i	bìt͡sì	tīzĩ̀	bìsē	kīkɑ̀	t͡sìkɑ̃́	X	X	X
ĩ	X	X	X	X	X	X	X	X
e	dézì	tēzĩ̄	gēlê	X	X	X	X	X
ɑ	X	tɑ̄t͡sĩ̂	sɑ̄jè	jɑ̄bɑ̂	bɑ̀sɑ̃̄	jɑ̀wó	sɑ̄wû	tɑ̄kũ̀
ɑ̃	gɑ̃̄fĩ̄	jɑ̃̀sĩ̄	bɑ̃̀jé	sɑ̃̄wɑ̄	jɑ̃̀dɑ̃̀	mɑ̃̀kó	kɑ̃̀bū	ɾɑ̃̄kũ̀
o	bōt͡sî	sópí	X	X	X	kòfō	k͡pòkú	bòkũ̄
u	gūd͡zī	X	X	kùtɑ̄	tūg͡bɑ̃̀	X	wūɾū	kūt͡sũ̀
ũ	X	wũ̄zĩ̄	gũ̄lē	X	X	tũ̄wō	X	gũ̄dũ̄

Figure 12. Vowel combinations in CV.CV 0-Class nouns

Approximatly 8% of words, those found in the lower left portion of the chart, seem to be exceptions to this vowel harmony. I suggest that these are either not simple roots or are borrowed. An exhaustive list of counterexamples is presented in example (50).

(50)
a. g͡bōgí 'baboon'
b. kòt͡sī 'navel'
c. sópí 'donkey'
d. wũ̄zĩ̄ 'captive'
e. ɾùt͡sē 'tail'
f. gũ̄lē 'north'
g. gūd͡zī 'fetish'

Even though I do not have the data to explain all of these exceptions, the word for baboon appears to contain the derivational affix {-gí} discussed in Section 2.2.1. This one example certainly does not conclusively prove that the remaining seven words are also constructed. It does warrant further investigation to determine if the other seven are also complex.

The co-occurrence pattern is further collaborated in ɑ̄-Class noun roots in Figure 13. In this class, 91% of the roots demonstrate the front-back vowel harmony. The upper-left box contains front vowel roots, and the lower-right box contains back vowel roots.

	i	ĩ	e	ɑ	ɑ̃	o	u	ũ
i	ɑ̄bìnī	X	X	ɑ̄bìtɑ̄	ɑ̄jīdɑ̃̀	ɑ̄jìdó	X	X
ĩ	X	X	X	X	X	X	X	X
e	ɑ̄ɾésí	X	X	ɑ̄g͡béjɑ̄	X	X	X	X
ɑ	ɑ̄gɑ̀lí	X	X	ɑ̄fɑ̀ká	ɑ̄lɑ̀k͡pɑ̃̄	X	X	X
ɑ̃	ɑ̄gɑ̃̀mī	ɑ̄gɑ̃̀sĩ́	X	ɑ̄pɑ̃̄tá	ɑ̄k͡pɑ̃̄tɑ̃́	X	X	ɑ̄gɑ̃̀ɾṹ
o	ɑ̄wónì	X	X	X	X	ɑ̄bóɾó	ɑ̄kòlū	ɑ̄bókũ̄
u	ɑ̄kùsì	X	X	ɑ̄kúg͡bá	X	X	ɑ̄dúkú	ɑ̄mūsṹ
ũ	X	X	X	ɑ̄ɾũ̄kà	ɑ̄kũ̀nɑ̃̄	X	X	X

Figure 13. Vowel combinations in CV.CV a-Class nouns

There are only three exceptions represented by the three tokens which fall outside of the two boxes. These exceptions are listed in example (51).

(51) a. ɑ̄-wónì 'cowery
b. ɑ̄-kùsì 'wooden bowl'
c. ɑ̄-jìdó 'marsh'

Although there are fewer examples in this class, the same co-occurrence restriction is also found in ē-Class nouns. Figure 13 illustrates the pattern. Here, 100% of the examples follow the front-back vowel harmony pattern. There are no counterexamples. The combinations of front vowels, enclosed in the upper left box, as well as the back vowel set, enclosed in the lower right box, illustrate the front-back vowel harmony. The general pattern is clear within this class. In this class, the corpus contains fewer examples.

	i	ĩ	e	ɑ	ɑ̃	o	u	ũ
i	X	X	X	ēníjɑ̀	X	X	X	X
ĩ	X	X	X	X	ēzĩ́wɑ̄	X	X	X
e	X	X	X	X	X	X	X	X
ɑ	ēkɑ́dì	X	X	X	X	X	X	X
ɑ̃	X	X	X	X	X	X	X	X
o	X	X	X	X	X	X	X	ējògṹ
u	X	X	X	X	X	X	ēbùbū	X
ũ	X	X	X	X	X	X	X	X

Figure 14. Vowel combinations in CV.CV ē-Class nouns

This front-back vowel co-occurence restriction is not limited exclusively to nouns. It also extends to verbs. In Figure 15, 87% of the CV.CV verb roots display the front-back harmony.

	e	i	ĩ	ɑ	ɑ̃	o	u	ũ
i	sīsè	dídì	X	bíbɑ̀	dídɑ̃̄	X	X	X
ĩ	X	X	tĩ́tĩ̄	X	X	X	X	X
e	kèré	X	X	t͡sèkɑ́	X	X	zédù	fédũ̄
ɑ	X	wɑ̀mí	X	d͡zɑ̄gɑ̄	wɑ́g͡bɑ̃́	wɑ̄lò	kɑ̄dú	X
ɑ̃	X	X	X	X	jɑ̃̀sɑ̃̄	X	X	X
o	X	X	X	X	X	X	X	X
u	X	X	X	X	X	lúlò	X	X
ũ	zṹjè	mũ̀t͡sí	X	X	X	X	X	gũ̀gũ

Figure 15. Vowel combinations in CV.CV verbs

There are four exceptions shown in example (52).

(52) a. fédũ̄ 'sit'
b. zédù 'say'
c. mũ̀t͡sí 'be sellable'
d. zṹjè 'shame'

The possibility exists that these exceptions are complex words, but the corpus does not have the necessary data to prove this. The co-occurrence restrictions seem to reflect a strong tendency, although not a hard-and-fast rule.

4.2 Nasal vowels

I have analyzed Asu as having three nasal vowels /ĩ, ã, ũ/. The nasalized vowels are shown in Figure 16.

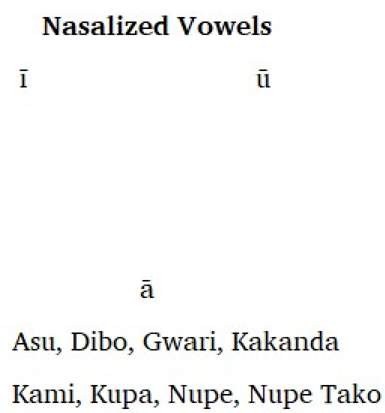


Figure 16. Nupoid nasal vowels (Blench 1989:313)

The three nasal vowels contrast with their corresponding oral vowels as shown in Table 33.

Table 33. Contrast between oral and nasal vowels

	Oral		Nasal	
/i/-/ĩ/	à-bí	'spider'	à-bĩ́	'forehead'
	tītī	'morter'	tĩ́tĩ́	'sewing (v.)'
	dī	'for'	dĩ̀	'carve'
	ē-zī	'town'	è-zĩ̄	'arrow'
	ā-jī	'blood'	à-jĩ́	'teeth'
/ɑ/~/ɑ̃/	ā-bà	'forest'	ā-bɑ̃̄	'fish.PL'
	má	'1.SG'	mɑ̃́	'bring (v.)'
	è-t͡sā	'moon'	è-t͡sɑ̃̀	'tribal marks'
	ē-já	'grain'	ē-jɑ̃̀	'drum'
	ē-pā	'hide'	ē-pɑ̃̄	'hill'
	à-ná	'cow.PL'	ā-nɑ̃̀	'age mate'
	sá	'span (v.)'	sɑ̃̀	'filter (v.)'
	ā-sá	'fishing net'	ā-sɑ̃̄	'sweet grass'
/u/-/ũ/	pú	'handle'	pũ̄	'drum'
	ē-zū	'guinea fowl'	ē-zũ̀	'hind'
	à-gú	'custon'	ā-gũ̀	'wildcat'
	è-kú	'water'	è-kũ̄	'meat'
	ē-bù	'belly'	ē-bũ̄	'warlock'
	à-kú	'river'	ā-kũ̄	'knife'
	wú	'thrash'	wṹ	'own'
	tàkú	'hump'	tákũ̄	'rock'

Additional examples of the three nasal vowels in different contexts are provided in Table 34. Examples are shown word-finally and lexeme-medially after various consonants (plosive, fricative, nasal, tap, approximant).

Table 34. Examples of nasal vowels

	Word-finally		**Lexeme-medially**	
/ĩ/	è-pĩ́	'melon seeds'		
	tĩ́	'sandy soil'	tĩ́tĩ́	'sewing (v.)'
	ɑ̄-gĩ́	'quail'		
	zĩ́	'return'	zĩ̀zĩ́	'red livestock'
	tɑ̄t͡sĩ́	'center'		
	ɑ̄-nĩ̄	'four'		
	ɑ̄-fĩ̀	'weeds'		
	ɑ̀-jĩ́	'teeth'		
/ɑ̃/	ē-pɑ̃̄	'hill'	ɑ̄-k͡pɑ̃̄tá	'particians'
	ɑ̄-jīdɑ̃̀	'termite'	dɑ̃̀fáɾá	'trickster'
	è-kɑ̃́	'monkey'	kɑ̃̀bū	'wrist guard'
	ɑ̄-sɑ̃̄	'sweet grass'	sɑ̃́wɑ̄	'mamba'
	t͡sɑ̃̀	'marks'	ɑ̄-k͡pɑ̃́ɾɑ̃̄	'tick'
	ɑ̄-nɑ̃̀	'age mate'	mɑ̃̄mɑ̃̄	'sweet'
	ɑ̄-k͡pɑ̃́ɾɑ̃̄	'tick'	ɾɑ̃̄kũ̀	'knee'
	ē-jɑ̃̀	'drum'	jɑ̃̀sĩ̄	'wealth'
/ũ/	pũ̄	'drum'	pṹpṹ	'sift'
	tũ̄	'log'	tũ̄wō	'ear'
	t͡sṹkũ̀	'bone'	kũ̀fíɾé	'cockroach'
	zṹ	'cut'	zũ̄zṹ	'ant'
	kút͡sũ̀	'pig'	t͡sṹkũ̀	'bone'
	ē-mṹ	'horse'	mũ̀t͡sí	'be sellable'
	ɑ̄-gɑ̃̀ɾṹ	'foreigners'	ɾũ̀t͡sē	'tail'
	wṹ	'own'	wũ̄zĩ̄	'captive'

Figure 17 plots the average F1 and F2 values of the three nasal vowels.[5] Ten tokens of each of the three nasal vowels are used to create the chart below. Each vowel symbol is plotted at the mean value point of the ten tokens measured. The circle around the vowel symbol represents two standard deviations of all the measurements from that mean value. The vowel production spaces are distinct. These nasal vowels can be compared to the oral vowels in Figure 10 in Section

[5] This Figure is produced by FPlot® software created by Rod Casali.

4.1. The place of production of the nasal vowels is slightly centralized as compared with the oral vowels shown in Figure 10.

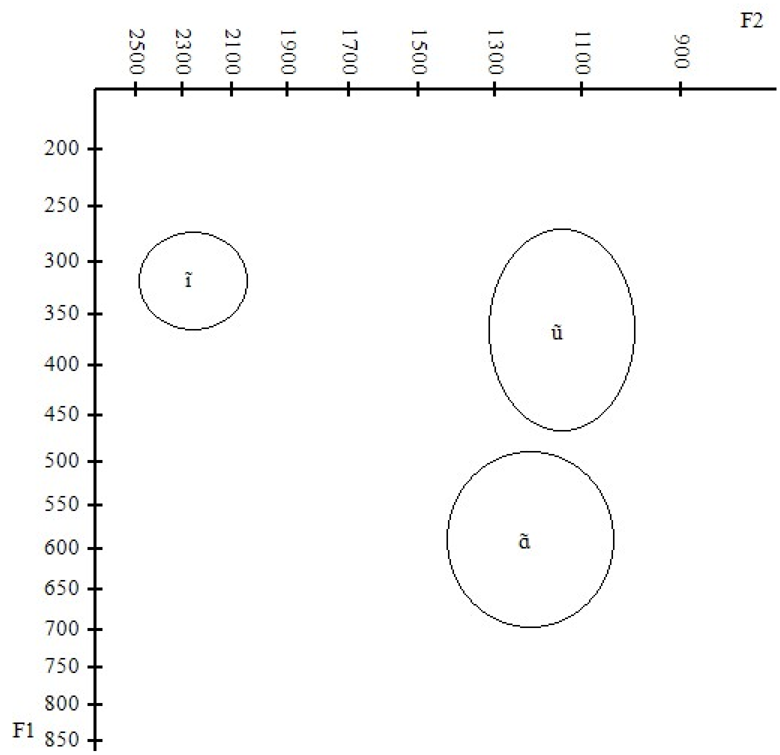


Figure 17. Asu phonemic nasal vowels

Table 35 shows a numerical comparison of the F1 and F2 formants of corresponding oral and nasal vowels.

Table 35. Mean F1 and F2 differences between oral and nasal vowels

	F1	**F2**
/i/	300	2250
/ĩ/	325	2275
/ɑ/	760	1460
/ɑ̃/	600	1225
/u/	325	875
/ũ/	375	1150

The Table shows virtually no difference between the /i/ and /ĩ/. The /ũ/ moves towards a central position in both F1 and F2 as compared to /u/. The nasal /ɑ̃/ moves toward the central position only in the F1 dimension. Its F2 actually moves back slightly in comparison to the /ɑ/. There is no overlap, in the location of production, between corresponding nasal and oral vowels.

There are no allophones of either the /ĩ/ or the /ũ/. The /ɑ̃/ is in a complementary distribution with the [ɔ̃], and [æ̃], [ɑ̃ⁱ] and [ɑ̃].[6] The /ɑ̃/ is realized phonetically as [ɔ̃] only when following the backed and rounded /w/. Example (53) shows several words illustrating this allophone.

(53) a. [mwɔ̃̂] 'maker'
b. [kʰũ̏kʰwɔ̃̌] 'deep'
c. [w̃ɔ̃̄wɔ̃̏ɾɑ̌] 'centipede'
d. [ēʒĩ́wɔ̃̄] 'arrow bundle'
e. [jūw̃ɔ̃̀] 'dry'

A second phonetic realization of the /ɑ̃/ is the [æ̃]. The /ɑ̃/ is fronted and realized as [æ̃] only when it follows the palatal approximant /j/. There is only one example of this in the data. This allophone is illustrated in example (54). It should be mentioned that, in this example, there are palatalizing environments both before and after the targeted nasal vowel, and regressive palatalization is seen to create other palatalized allophones.

(54) /jɑ̃sĩ/
[j̃æ̃̀ʃĩ̄]
'wealth

A third phonetic realization of both the /ɑ̃/ and the /ũ/ are off-glides caused by regressive palatalization. Both the /ɑ̃/ and the /ũ/ have these off-glides. The allophone for /ɑ̃/ is shown in Figure 18.

[6] The two palatalized allophones were not used to tabulate the mean values of F1 and F2 used in Table 35 or Figure 17.

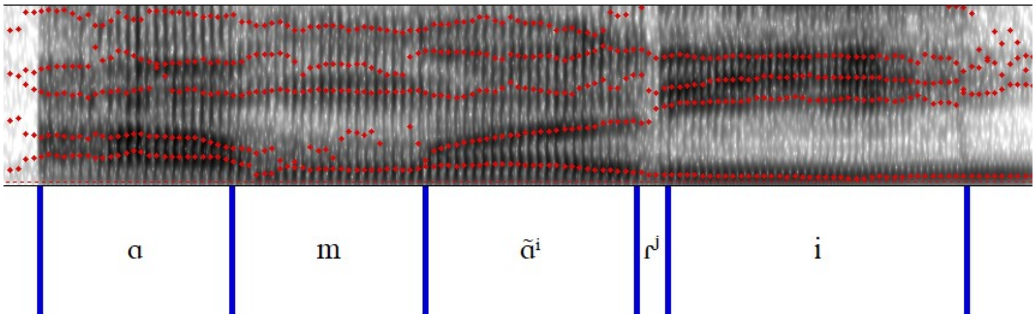


Figure 18. Regressive palatalization in /ɑ̄mɑ̀ɾí/ 'witch'

The /ũ/, like the /ɑ̃/, has a palatalized allophone [ũ͡ĩ] as given in example (55).

(55) a. [mũ̀͡ĩt͡ʃí] 'be sellable'
b. [wũ̄͡ĩʒī] 'captive'

Symmetry between the palatalized [æ̃] and labialized [ɔ̃] allophones of the /ɑ̃/ might cause one to expect the corresponding allophones of the oral /ɑ/, i.e. [ɔ] and [æ], but I have no relevant data in the corpus to support this. The corresponding oral allophones are not attested.

Incidentally, this same system parallels that of Dibo, Gwari, Kakanda, Kami, Kupa, Nupe and Nupe Tako (Blench 1989).

CHAPTER 5

Tone analysis

In this tonal description, there is a distinction made between the terms "pitch" and "tone." The term "pitch" corresponds to "phonetic" and "tone" corresponds to "phonemic."

According to my data, Asu has three clear phonemic contrasting level tones. I use diacritics above the vowels to mark the tones: the acute /ɑ́/ depicts /H/; the grave /ɑ̀/ depicts /L/; the macron /ɑ̄/ depicts /M/. The contrast between these three tones is illustrated in example (56).

(56) a. tɑ́ 'stopper'
b. tũ̄ 'log'
c. tĩ̀ 'sandy soil'

These same three level tones are documented in other Nupoid languages. George (1970) contrasts these three phonemic tones, and proposes two contour tones, with a proposed minimal quintuplet in Nupe. See Example (57).

(57) a. bá 'to be sour'
b. bā 'to cut'
c. bá 'to pray'
d. bǎ 'negative emphatic particle'
e. bâ 'defamation' (from Hausa ba'a)

The same two pitch contours that George illustrates above do occur in Asu. However, these surface realizations are limited in where they can occur and are analyzed to be allotones.

The Asu corpus contains predominantly nouns and fewer verbs. To illustrate the phonetic realizations of Asu tones, I analyzed the words by classes, and by word and syllable profiles.

Snider (2014:735) defines syllable profile as, "the number of TBU's in the morpheme as well as the sonorancy of any codas." With few exceptions, [H] pitches are found in non-final syllables. Likewise, contour tones are found in the final syllable with few exceptions. The [LH] only follows a /L/ and the [HL] never follows a /L/. The /M/ and /L/ tones are not restricted as to where they can appear.

Evaluation of the interaction of tonal melodies is limited for two reasons. First, most of the data have only one repetition of each word. This restriction makes it nearly impossible to observe any possible variation. Second, no paradigms are collected. The corpus lacks data with words in a larger morphological or syntactic context. I could only examine the tone of words in isolation. This limits the analysis. Nevertheless, I am able to contrast the tones in nouns and verbs of various syllable shapes in isolation and with some affixes. This provides some helpful insight for at least the tones that distinguish themselves in the isolation context. Additionally, some constructions are identified and interactions between the tones are evaluated in those contexts as well. This description is not an "ideal tone analysis" as defined by Snider (2011:1).

> "The ideal tone analysis discovers the inventory of contrastive melodies assigned to each grammatical category of morphemes (e.g., noun roots, verb roots, person markers, tense/aspect markers, etc.) and identifies and explains any phonological alternations these melodies undergo in the different phonological and grammatical environments in which they are found."

Further research is needed particularly in relation to the very restricted [HL] phonetic contour, as we shall see.

In the next section, I begin the tone description. I begin with disyllabic words, then proceed to trisyllabic words and finally address monosyllabic words.

5.1 Disyllabic words

I analyze /L/, /M/ and /H/ as phonemic tones. These three tones are expressed on each of the syllables in CV.CV profiles. In Asu, on CV.CV nouns of the 0-Class, /L/, /M/ and /H/, are not restricted as to where they can occur. All nine possible combinations of the phonemic tones are found.[1]

Table 36 demonstrates the nine contrasting tone patterns possible for 0-class nouns with the CV.CV profile. In the table, the phonetic representations are shown with bar notation, and the proposed phonemic forms are represented both in the title of each example as well as with diacritics in the phonemic representation.

Table 36. CV.CV 0-Class nouns with (frequency)

LL /gàdù/ (3) 'poison'	LM /k͡pàtā/ (19) 'wood type'	LH /tàkú/ (12) 'vulture'
ML /tūg͡bȁ/ (6) 'tree'	MM /wūɾū/ (20) 'top'	MH /tāt͡sí/ (19) 'center'
HL /kút͡sȕ/ (4) 'pig'	HM /sa̋wā/ (15) 'mamba'	HH /kóɾó/ (2) 'ram's horn'

[1] There is one exceptional piece of data with a [H.H] in CV.CV 0-Class nouns. The word [ma̋ɦó] 'female' appears to contrast with the [H.HL] pitch. But variation has been documented for [H]~[HL] phrase-finally as shown further below in the discussion of pitch contours.

All three Asu tones can appear on either syllable of a noun root with the shape CV.CV. The syllable serves as the tone bearing unit, and all nine possible combinations of /L/. /M/ and /H/ are attested in CV.CV nouns of 0-Class.

At this point, I address the surface contours. There are two different pitch contours in the CV.CV 0-Class nouns: a [LH] such as in the word /tàkú/ 'vulture' and a [HL] such as occurs in /tā͡tsí/ 'center' and /kóɾó/ 'ram's horn'. I propose that both of these contours are in complementary distribution and are allotones of the /H/ tone.

First, consider the [LH] contour. I propose that a phonetic representation like [L.LH] is actually /L.H/. This [LH] contour is predictably conditioned when a /H/ tone follows a /L/ tone. The [LH] contour occurs twelve times in CV.CV 0-Class nouns. Apart from one exception, noted in footnote[2], this contour is found when a /H/ tone syllable follows a /L/ tone syllable. Example (58) illustrates the environment where the [LH] is realized.

(58)	a.	/t͡sùɾá/	[t͡sùɾǎː]	'bitter leaf'
	b.	/kàwú/	[kʰàwǔː]	'basket for sieving'
	c.	/bȁjé/	[bȁᵉjěː]	'east'
	d.	/gùlú/	[gùlǔː]	'vulture'
	e.	/jàwó/	[jàwǒː]	'bride'
	f.	/tàkú/	[tʰàkʰǔː]	'cow's hump'
	g.	/k͡pòkú/	[k͡pòkʰǔː]	'box'

In these examples, the /L/ tone spreads to the following /H/ syllable.

[2]See footnote 3 in chapter 5.

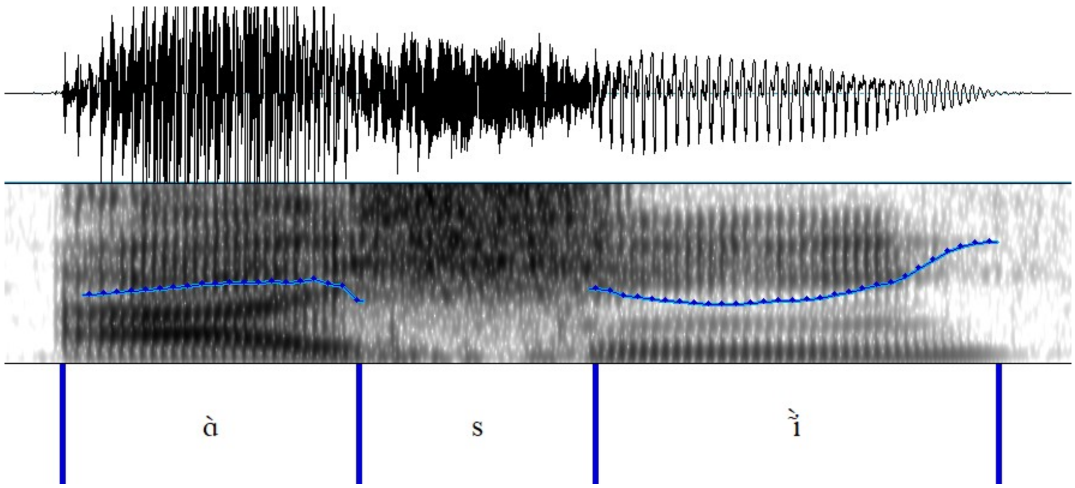


Figure 19. /H/ realized as [LH] after a /L/ tone in /àsí/'cricket'

The /L/ tone conditions a /H/ to be realized phonetically as a [LH] contour glide in the environment following said /L/. The /L/ spreads forward regardless of the voicing on the onset consonant of the following syllable as in Figure 20.

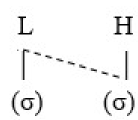


Figure 20. Low tone spread

The appearance of the surface contour [LH] in the first syllable of a CV.CV root is precluded because the triggering sequence of /L/ followed by a /H/ is impossible in word-initial contexts with the data I have. I do not know if the [LH] can occur across word boundaries.[3, 4]

[3] One CV.CV counterexample is present in the data. A [LH] contour tone appeared once on the first syllable. That occurred on the word [dězī] 'hare'. But since a few nouns have been seen to appear both with and without its class prefix, I suggest this is a situation where the Low spreads before the segmental prefix optionally deletes. If this hypothesis is correct, the CV.CV root would actually belongs to the ɑ̀-Class or è-Class of nouns and the /L/ tone of the dropped noun class prefix explains the contour in this context.

[4] One CV counterexample is present also in the data. The word [nɑ̌] 'woman' contains a [LH] contour glide which is normally found finally only when a /H/ follows a /L/. In other places in the corpus, we have seen nouns appear with and without their vocalic noun class prefixes. This exceptional word is apparently a case where the vocalic segment of the noun class marker was elided but the floating /L/ from that segment still triggered the tone contour, even though it appears as a single syllable word.

Next, consider the second phonetic contour, the [HL]. Similar to the [LH] contour, this contour only appears on the final syllable of nouns in the 0-Class CV.CV root profile.[5] This [HL] contour, which occurs on the final syllable of nouns in the 0-Class, is the normal realization of the /H/ tone in the word-final context when a /H/ does not follow a /L/ tone. Except for one piece of exceptional data, mentioned in footnote 1, the [HL] contour in 0-Class, is in a complementary distribution with the [H] tone of the initial syllable of CV.CV 0-Class roots. In this context the [HL] appears after both /M/ and /H/ tones. In Example (58), the [HL] contour follows a /M/ tone. The [HL] never follows a /L/ tone.

(59)	a.	/g͡bōgí/	[g͡bōⁱɟî]	'baboon'
	b.	/tɑ̄tɑ́/	[tʰɑ̄tʰɑ̂]	'stool'
	c.	/sɑ̄wú/	[sɑ̄wû]	'crow'
	d.	/tūk͡pɑ́/	[tʰūk͡pɑ̂]	'bed'
	e.	/gēlé/	[gēlê]	'carrying cloth'
	f.	/t͡sūkú/	[t͡sūkʰû]	'stick'
	g.	/mɑ̃̄ní/	[mɑ̃̄nî]	'edible caterpillar'
	h.	/bɑ̄dɑ́/	[bɑ̄dɑ̂]	'bog'
	i.	/tɑ̄t͡sĩ́/	[tʰɑ̄ⁱt͡ʃĩ̂]	'center'
	j.	/gōɾó/	[gōɾô]	'hook'

There are two word-final examples where the [HL] appears following a /H/ tone. Example (60) shows the first example of this [H.HL] surface pattern.

(60) /sópĩ́/ [sópĩ̂] [¯ \ ] 'donkey'

The second example is illustrated in Figure 21.

[5] The description of the [HL] fall on the final syllable includes the monosyllabic words as well.

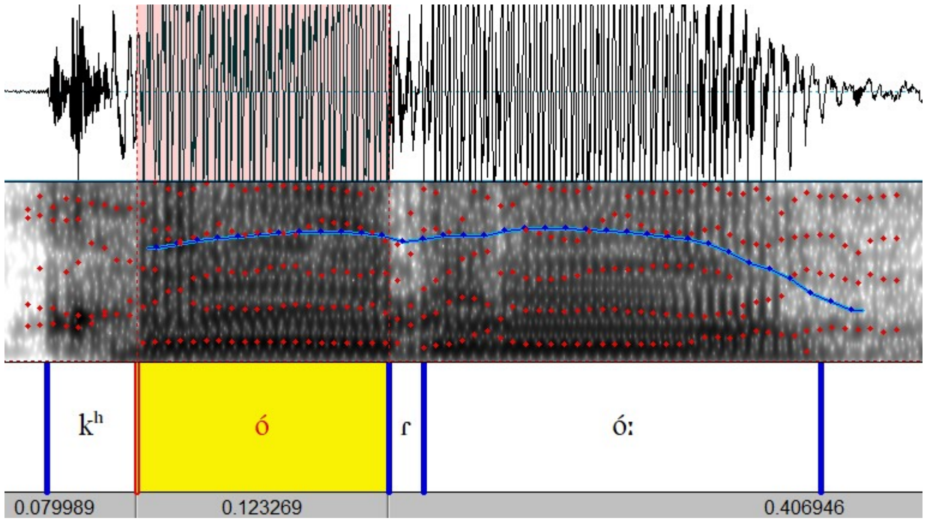


Figure 21. /H.H/ realized as [H.HL] in /kóɾó/'ram's horn'

In this CV.CV 0-Class, there is one exceptional case where a level [H] appeared after a /H/. This is illustrated in Example (61).[6]

(61) [mɑ̋ɦó] 'female'

The few examples in the corpus of disyllabic noun stem of the form CV.CGV fit within the pattern established above. No new surface forms are added when the 'AUGMENTATIVE' derivational suffix /kwó/ is added to a noun root. The /L/ tone spread is attested in the first and last two examples where the [LH] surface contour appears, as shown in example (62). Examples of the /H/ tone preceding the suffix were not present in the data.

[6] There is one word that, because of its semantic meaning, I did not include as a CV.CV noun that did appear with a [H] following a /M/ tone. That is the word /jījá/ 'new'. If that word somehow turns out to be a noun, then I would propose that this recording captured the less common free variation form.

(62)

Tone	Phonemic	Pitch	Gloss
L-H	/wà-kwó/	[_ /]	'python'
L-H	/k͡pà-kwó/	[_ /]	'door'
M-H	/kā̄-kwó/	[¯ \ ]	'eagle'
M-H	/bō-kwó/	[¯ \ ]	'thigh'
L.L-H	/kùt͡sù-kwó/	[_ _ /]	'large beetle'
L.L-H	/gàbà-kwó/	[_ _ /]	'lion'

The CGV.CV nouns behave like other disyllabic nouns. Likewise, the V.CV nouns in Table 37 also follow the pattern. The same overall tone pattern attested in all bisyllabic words established earlier for CV.CV 0-Class nouns. When the first syllable of a root is /H/ and follows a prefix with a /L/ the first syllable of the root is realized as [LH]. See Figure 19 above. Roots ending with /H/ that follow /M/ or /H are realized as [HL].

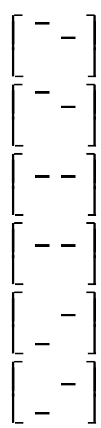
Table 37. CV nouns with /M/ and /L/ prefixes

	ā-CV (19)	**à-CV (23)**	**ē-CV (29)**	**è-CV (31)**
L	/ā-gū̀/ (6) [¯ _] 'wildcat'	/à-jì/ (1) [_ _] 'name'	/ē-bà/ (12) [¯ _] 'fish'	/è-mì/ (6) [_ _] 'rope'
M	/ā-bā̄/ (12) [¯ ¯] 'fish'	/à-jā̄/ (9) [_ ¯] 'jewelry'	/ē-bū̄/(15) [¯ ¯] 'warlock'	/è-jē/ (14) [_ ¯] 'eye'
H		/à-jú/ (13) [_ /] 'Adam's apple'		/è-ū́/(11) [_ /] 'horse'
HF	/ā-gī́/ (1) [¯ \ ] 'quail'		/ē-lú/ (2) [¯ \ ] 'bird'	

Disyllabic words containing a root and the nominal suffix /-ɾī/, meaning 'AGENTIVE', were discussed in Section 2.2.1. Those words exhibit the same tonal pattern. The addition of the /M/ tone derivational suffix does not alter the phonetic realization of /L/, /M/ or /H/ on nouns derived from verb roots. One could propose that the nine combinations of tone seen on disyllabic CV.CV nouns in Table 42 are somehow truncated or unrealized in monosyllabic nouns shown in the same table. However, in nouns with a word profile CV.CV, the data shows the first syllable to be incapable of supporting a contour. The word list analyzed does not support phonemic contours in the first syllable. Contours are only phonetic realizations of phonemic tones. The data supports a system with three level tones that has few, or no, restrictions on where those three tones can occur.

(63)

Tone	Phonemic	Pitch	Gloss
H-M	/bá-ɾī/		'male (one who tattles)'
H-M	/vá-ɾī/		'husband (one who leads)'
M-M	/k͡pī-ɾī/		'arrow notch (that which ?s)'
M-M	/wā-ɾī/		'finger (that which takes out)'
L-M	/zè-ɾī/		'south (that which ?s)'
L-M	/sò-ɾī/		'beam (that which loads)'



Just as the different profiles of the nouns reveal the same three tones /L/, /M/, and /H/, on each syllable of the noun, the same is true of the disyllabic verbs. We find eight of nine phonetic realizations of the same three tones in the CV.CV verb roots as we did in the noun roots. Table 43 demonstrates all three tones being realized on the more common CV verb roots. The /H/ is realized as a [LH] surface contour following a /L/ tone. All but one of the expected combinations of /L/, /M/, and /H/ appear on each of the two syllables of the verb root.

Table 38. CV.CV verbs with frequency

LL	LM	LH
/gàmã̀/ (1)	/sàɾā/ (2)	/mũ̀t͡sí/ (2)
[_ _]	[_ ‾]	[_ /]
'give'	'break'	'be sellable'
ML	MM	MH
/sīsè/ (4)	/fīzā/ (4)	/kādú/ (2)
[‾ _]	[‾ ‾]	[‾ \ ]
'filter'	'extinguish'	'go'
HL	HM	HH
/zṹjè/ (7)	/fédū/ (4)	
[‾ _]	[‾ _]	
'shame'	'sit	

There are eight CV.CV verbs that are phonetically realized as a [LH] contour pitch on the final syllable. Some of those verbs could be complex. Regardless, these verbs behave as we expect. See example (64).

(64) a. /kù mã́/
[kù mã̌]
water bring
'stream'

b. /jà wó/
[jà wǒ]
give be able
'bride'

Although there are five examples of the CV.CGV profile in verbs, the examples given in Table 39 reveal the same three tones, /L/, /M/ and /H/, occurring on the first and second syllables.

Table 39. CV.CGV verbs with frequency

HL	MM	LH
/gúgwò/ (1)	/sīzjā/ (2)	/kàg͡bjé/ (2)
[‾ _]	[‾ ‾]	[_ /]
'grind grain'	'lead'	'clear field'

Given the possible phonetic representations, one syllable verbs of the CV and CGV profiles have three tones, /L/, /M/ and /H/. On CV.CV verbs, we saw all nine possible combinations. On CV.CGV verbs we see no new patterns. In isolation, and when not following a /L/ tone, a final /H/ tone on verbs is realized phonetically as a [HL]. This pattern matches the contour in nouns, as described above.

The [HL] contour as explained by George (1970) for Nupe is created by a floating tone. I have no evidence for positing floating tones with the data I possess. I propose that the word-final or phrase-final [HL] surface contour is the normal phonetic realization of a /H/ tone when not following a /L/ tone. In a very limited number of cases the [H] and [HL] are documented to be in a state of free variation. Better documentation of multiple repetitions of each word are necessary to confirm my proposal.

5.2 Trisyllabic words

There are 39 CV.CV.CV 0-Class nouns. Four of these nouns contain the derivational suffix /-gi/, and three others contain the derivational suffix /-ɾi/. These affixes are referred to in Section 2.2.1. These words are complex and therefore are not included in Table 40. Of the remaining 32 CV.CV.CV nouns, there are 17 of the 27 expected combinations found in the data. The [LH] and [HL] phonetic realizations of pitch contours occur where expected. One token, /káɾád͡zú/ 'rust' has already been shown to vary between [H] and [HL] on the final syllable in Figure 23. The small overall number of tokens in this class explains the gaps, which I see as accidental.

The corpus contains 29 examples of V.CV.CV nouns with the ā-Class prefix. This trisyllabic noun also follows the pattern established earlier in disyllabic nouns, specifically that there are no tone restrictions of the /L/, /M/, and /H/ on any of the syllables. All nine possible combinations of /L/, /M/ and /H/ are attested on the roots of V.CV.CV roots with /M/ and /L/ prefixes. on the noun class marker. Gaps are viewed as accidental based on the overall size of the corpus. See Table 41.

Table 40. CV.CV.CV nouns with frequency

LLL	LLM /k͡pàk͡pàɾā/ (2) 'mat'	LLH /kùmùgű/ (5) 'roughness'	LML	LMM /ɾùwōkã̄/ (5) 'buttock'	LMH /bìsāɾá/ (1) 'cup'	LHL	LHM	LHH /bàbúfú/ (6) 'medicine'
MLL /tūtùɾù/ (1) 'hair'	MLM /kāg͡bàlē/ (2) 'cloth'	MLH /wã̄wȁɾá/ (1) 'centipede'	MML /pāpāɾà/ (1) 'tilapia'	MMM /bōsījō/ (1) 'spleen'	MMH /tākũ̄ná̋/ (3) 'millipede'	MHL	MHM /t͡sāɾízā/ (1) 'blacksmith'	MHH /bīséɾé/ (1) 'camel'
HLL /tűg͡bàtà/ (2) 'neck'	HLM /tágàdā/ (3) 'textbook'	HLH	HML	HMM	HMH /tísēgí/ (1) 'comb'	HHL	HHM	HHH /fókóní/ (2) 'light'

Table 41. V.CV.CV nouns with /M/ and /L/ prefixes

Root tones	ā-CV.CV (29)	à-CV.CV (7)	ē-CV.CV (4)	è-CV.CV (2)
LL	/ā-kùsì/ (1) 'bowl'			
LM	/ā-bìtā/ (4) 'clan'		/ē-bùbū/(1) 'cow hut'	
LH	/ā-gàbá/ (11) 'diaphragm'	/à-kà͡tsí/ (6) 'termite'		/è-jògú/(1) 'territory'
ML	/ā-rūkà/ (2) 'ring'			
MM	/ā-kōlō/ (3) 'heaps'	/à-lājī/ (1) 'amulet'		
MH	/ā-k͡pātá/ (1) 'river'			/è-mīgí/ (1) 'cream'
HL	/ā-wónì/ (1) 'cowry'		/ē-kádì/ (1) 'horse'	
HM	/ā-bókṹ/ (5) 'pasture'		/ē-níjā/ (2) 'entrails'	
HH	/ā-dúkú/ (1) 'sweet potato'			

Also, in some of the other trisyllabic noun classes, there are a few apparent examples which might argue for including the [HL] surface contour as its own tone. There are two or perhaps three nouns with exceptional word-final [H] pitches that do not fall. These are illustrated in example (65).[7]

(65) a. [āk͡pātá] 'partitions'
b. [āk͡pātá] 'river'
c. [kʰáɾád͡zú] 'rust'

Because these exceptions occur in the same word-final context, additional data collection is required to be certain that this is a case of variation. What I can show at this point are documented cases of variation between the [H] and the [HL]. The best example is Figure 22, where the ā-Class marker appears on the first repetition and disappears on the second and third repetitions.[8] Note the [HL] pitch contour on the last syllable of the first repetition and a [H] on the last syllable of the last two repetitions.

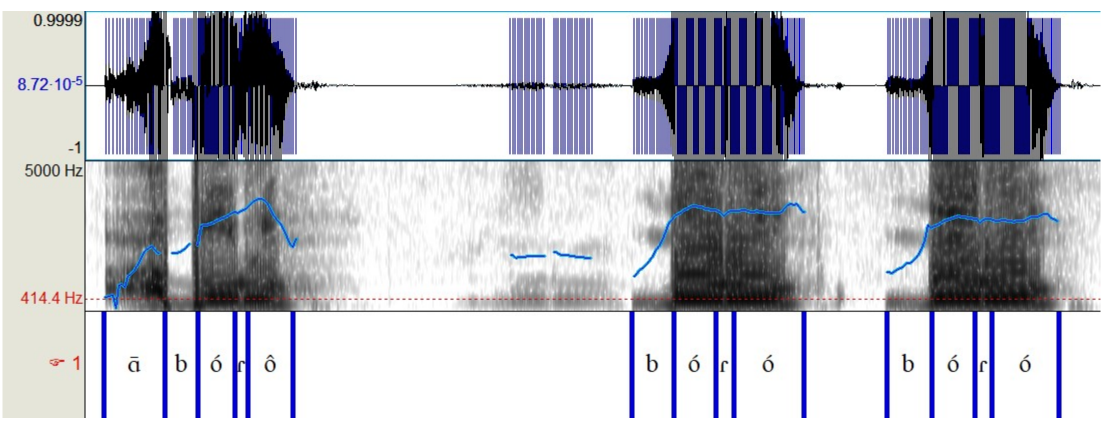


Figure 22. Variation between [HL] ~ [H] in 'barrel'

[7] It is possible that the first two words in the example are different senses of the same word and that there are only two words that are exceptional in the CV.CV 0-Class nouns.

[8] The noun class marker is seen to disappear in a few other contexts. It is missing in the word /ēzà/ 'person', perhaps for morphophonemic reasons in compound words. It is also missing on the word /sī́/ 'waist' which appears as [ʃǐ]. The unexpected [LH] contour in the first syllable suggests that this CV root belongs to either the è-Class or the à-Class and the segment is elided but the /L/ tone triggers the [LH] contour.

A second instance of variation between [H] and [HL] is the word for 'rust'. In this second example, the pitch contour fall is not quite as dramatic as the example above. Figure 23 shows the second repetition with falling pitch. The first repetition shows a level [H] pitch. I included this example because the vowel went voiceless at the end and the trajectory of the pitch was downward at the point where voicing stopped.

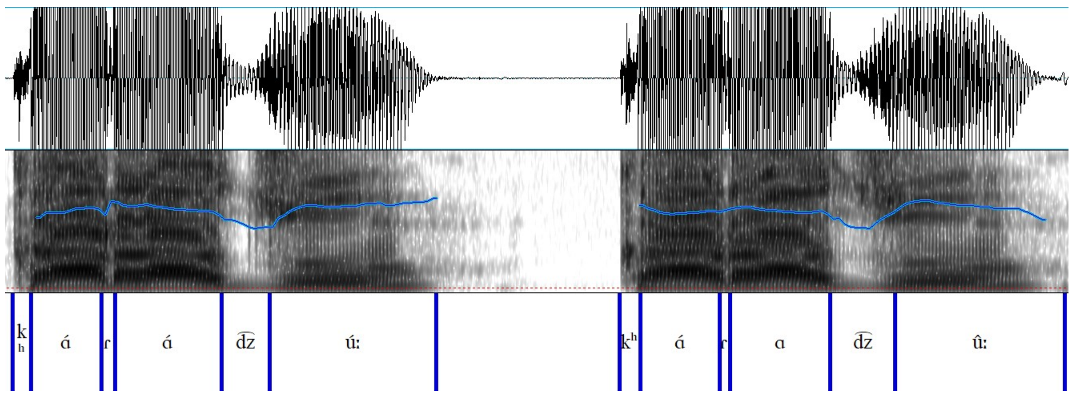


Figure 23. Variation between [HL] ~ [H] in 'rust'

While these two instances of variation are not conclusive, they do give some evidence that there may not be contrast between [H] and [HL]. The level [H] never occurs finally. In the final context, the [HL] contour is found. Apart from four exceptional cases, the word-final [HL] is in a complementary distribution where the [H] always appears in non-final syllables. This complementary distribution suggests that the [HL] contour is not a phonemic tone. Instead, a /H/ is realized as [HL] in the word-final or phrase-final context.

A comparison of the sheer frequency of the final [HL] surface contour and the final [H] in all the noun classes is helpful to support my analysis. There are 136 nouns with a /H/ word-finally. Of those final /H/ tones, 87 follow a /L/ tone and are realized as a [LH] contour. Another 46 [HL] contours occur in the word-final position following M or H tones. The final [H] pitch form occurs only four times in all noun classes combined. The [HL] is by far the most common form in the word-final context. This fact, plus fairly solid evidence of variation shown in Figure 22, which is one of the remaining four examples, and potential variation in another exception in Figure 23, leads me to believe that with 25-50% of the four final [H] allophones alternating, they belong to the same phoneme.

5.3 Monosyllabic words

Noun classes are described in Section 2.2.1. Coda sonority is irrelevant for Asu. However, consideration of the shape of the root or word as a sorting criteria was relevant. The most common 0-Class noun profile in monosyllabic roots is CV. Examples of nouns sorted by root profile are given in Table 42. The pattern on monosyllabic 0-Class CV nouns shows three tones, /L/, /M/ and /H/. Nouns of a CGV syllable profile follow the same pattern, with the exception of an accidental gap caused by under sampling in the corpus.

Table 42 illustrates the pitch found on the two monosyllabic noun root profiles. Pitch is shown in bar notation as used by Snider (2018), indicating the position and shape of the pitch level or contour. The numbers in parentheses to the right of the phonemic representation reflect the frequency of tokens of each of the given examples.

Table 42. Phonetic realization of tone in monosyllabic nouns

CV (34)	**CGV (4)**
/tĩ̀/ (12) [_] 'sandy soil'	
/tũ̄/ (16) [¯] 'log'	/tjē/ (3) [¯] 'testicles'
/k͡pã́/(6) [\ ] 'basin'	/mwá/ (1)[9] [\ ] 'winnowing tray'

The examples reflect a /L/, /M/ and /H/ on one-syllable CV nouns. The final syllable tone contours were discussed above.

There are very few monosyllabic verbs in the corpus. Those that do appear follow the same pattern as monosylabic nouns.

The word-final level [H] phonetic realization that appeared in CV.CV nouns is not attested at all in verbs. Only the /M/ and /H/ tones are noted on the more rare CGV syllable. See Table 43. The missing /L/ tone in the CGV profile is not surprising with the limited number of tokens. I hold this to be an accidental and not a systematic gap.

[9] There are two words, /bwó/ 'fieldgrass' and /tjé/ 'winnowing tray', that appear without noun class prefixes with a LH contour tone. The [LH] occurs when an /H/ tone is preceded by a /L/ tone demonstrated in Section 5.4. I have documented some nouns that have appeared in the corpus with and without the noun class prefixes. Since the two words appear with a [LH] glide, the prefixes that are apparently dropped would have to be either ὰ- or è-. Since I cannot know for sure which of the two possibilities it is, I choose to exclude them from the 0-Class nouns.

Table 43. Phonetic realization of tone in monosyllabic verbs

CV (13)	**CGV (3)**
L /wò/ (5) [_] 'hear'	
M /k͡pē/ (5) [-] 'know'	M /pjā/ (2) [-] 'glance'
H /d͡zú/ (3) [\ ] 'lift'	H /vjá/ (1) [\ ] 'provide'

5.4 Status of contours in Nupe and Asu

In Nupe, a related language, tone has been under investigation for quite some time. What is relatively consistent throughout the years is that all authors agree that there are /L/, /M/ and /H/ tones. All authors also agree that there are two surface pitch contours. But there is disagreement with how each author treats the surface pitch contours.

Blench's position is that "All Nupoid languages studied to date have at least five surface tones, three level tones, and two glides. Allowing for loan words and ideophones, these can all be analyzed as three level tones, with rising and falling tones as allotones of the level tones." (Blench 1989:314). Asu closely follows this position, with a /L/, /M/, and /H/ level tones and two surface allotones.

George (1970) simplified earlier tonal descriptions of Nupe to three level tones by proposing seven rules which explain the two contour glides as allotones. George described the [LH] glide as "a high tone will become a glide following a low tone and a voiced consonant" (1970:111). The [LH] surface contour in Asu is also triggered by the /H/ following a /L/. Peng (1992) also claims that the [LH] contour is conditioned by voiced consonants.

George (1970) and Peng (1992), described a /L/ tone spread that was conditioned on a voiced consonant in the onset of the second /H/ tone syllable. However, in Asu, the [LH] contour is not conditioned by voiced consonants. The /L/ tone in Asu spreads onto a following /H/ regardless of the voicing of the onset of the second syllable. Examples of the [LH] with voiceless onsets are shown in examples (66a)-(66d). The remaining examples (66e)-(66h) illustrate the [LH] surface contour with voiced onsets.

(66) a. [ɑ̀-p^{h}ǔ] 'weevil'
b. [è-kɑ̆̌] 'monkey'
c. [ɑ̀^{i}-ʃĭ̌] 'cricket'
d. [ɑ̀^{i}-fĭ̌] 'mane'
e. [ɑ̀^{i}-bǐ] 'forehead'
f. [ɑ̄-gĭ̌] 'quail'
g. [è-vɑ̌] 'buffalo'
h. [ɑ̀-lɑ̌] 'grass for fishbasket'

I propose the second phonetic representation, the [HL], to be an allotone of the /H/. In example (65), I show a few examples of word final level [H] tones that seem to contrast with the [HL] contour. Conversely, I also show a couple of examples of variation between the level [H] and the [HL]. I propose the final [HL] contour is a surface representation of a /H/ tone. This same /H/ is sometimes also represented phonetically as a level [H]. This claim needs to be substantiated better with recordings that contain at least three repetitions of each word so that the nature and context of this variation can be better described.[10]

[10] The third and final repetition will likely contain features of list intonation, so collecting three repetitions increases the chances of getting two good repetitions containing less list intonation features.

CHAPTER 6

Acoustic description

The following acoustic description supports the phonetic transcription used as the starting point for my phonemic analysis. This description supports the phonemic analysis by providing descriptions of and objective measurements for five Asu acoustic phonetics features. First, I describe the Voice Onset Time (VOT), measured in milliseconds, for all Asu stops, both voiceless and voiced. Second, to show the acoustic difference between [tje] and [tʲe], I describe the differences in duration between the phonemic palatal approximant and the palatalized portion of the palatalized stops, which are allophones of the corresponding stops. Third, to illustrate the allophonic nature of the final vowels, I measure vowel duration . Fourth, I describe the predictable and non-phonemic short vowel sound that precedes word-initial taps. Finally, I describe the pitch characteristics in Hertz of the three phonemic tones. These measurements support the phonetics behind the analysis of the phonemes proposed and discussed in the previous chapters. Specific recording information is provided earlier in Section 1.5 "Language Data."

6.1 VOT description

Voice Onset Time is defined as "the temporal relation between the moment of the release of the stop and the onset of glottal pulsing" (Abrahamson & Whalen 2017). For the VOT measurements, I chose ten tokens of each stop phoneme in different vowel contexts. I measured 286 tokens from the corpus to determine average VOT of each stop phoneme and to distinguish between the voiced and voiceless stops. I adopt the proposed standardized labeling features of Abrahamson and Whalen (2017:82-82)). The labels beneath the spectrograms contain the following abbreviations:

Table 44. Labeling conventions for spectrograms

Abbreviation	Meaning
V1	Vowel preceding
V2	Vowel following
VDCL	Voiced closure
VLCL[1]	Voiceless closure
ASP	Aspiration
R	Release

All VOT measurements are made beginning at the leftmost point of the release. From there I measure rightward, in the case of voiceless aspirated stops, until arriving at the zero crossing point of the first fully-formed sine wave of V2. For voiced stops, I begin at the leftmost portion of the release and proceeded leftward to the zero crossing of either the first fully-formed sine wave of the lead voicing for the initial plosives or to the last fully formed sine wave of V1 for intervocalic stops. There are occasions when the release itself appears imprecise or sloppy, and the burst occupies several milliseconds. In these instances I always use the leftmost portion of the release as the beginning measuring point. There were times when I needed to make the boundaries for the label wider in order to accommodate the label.

In voiceless consonants, the release happens before voicing of V2. After the release, there is a voicing lag prior to the beginning of voicing, as shown in Figure 24. Here, the measurement of the voicing lag indicates a VOT of 71 ms.

[1] The majority of the Asu words are collected in isolation. For consistency's sake, I have labeled the end of the voiceless closure period of word-initial voiceless plosives. The release marks the end of the "voiceless closure" VLCL period, which was not measured. This labeling method is consistent in labeling the VOT components of the word-initial and intervocalic plosives. In both contexts, it allows the plosive to correspond to the closure period and the aspiration to correspond to the post release and pre-vocalic period.

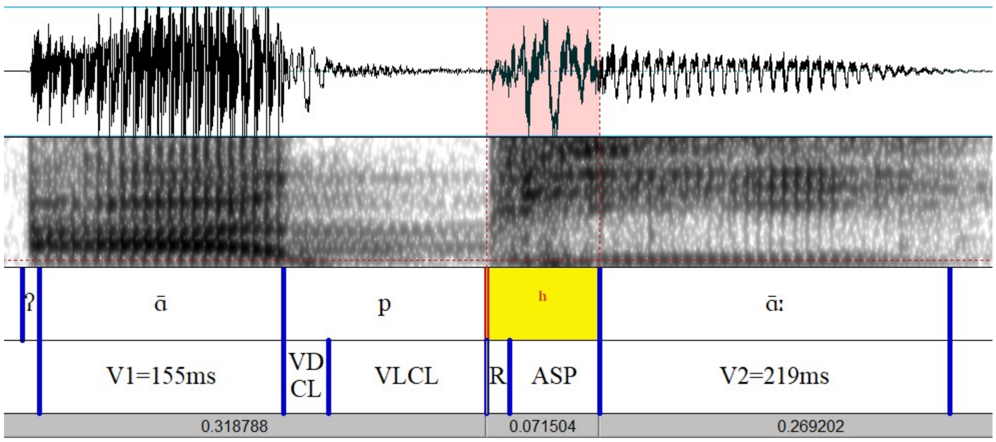


Figure 24. VOT of 71 ms of /p/ in /āpā/ 'kidney"

In voiced plosives, a voicing lead occurs prior to the release. That voicing lead is characterized by glottal pulses or periodicity that actually begins prior to the release of the stop. The result is a negative VOT. Some stops are sloppy in the sense that the following vowel does not have discernible glottal pulses until several milliseconds after the initial part of the release. It could be argued that there is a short measurable gradual release of the stop. The convention used for my measurements is to begin them at the earliest point of the release. This allows for more easily reproducible measurements. In Figure 25, the lead prior to the release is -110 ms.

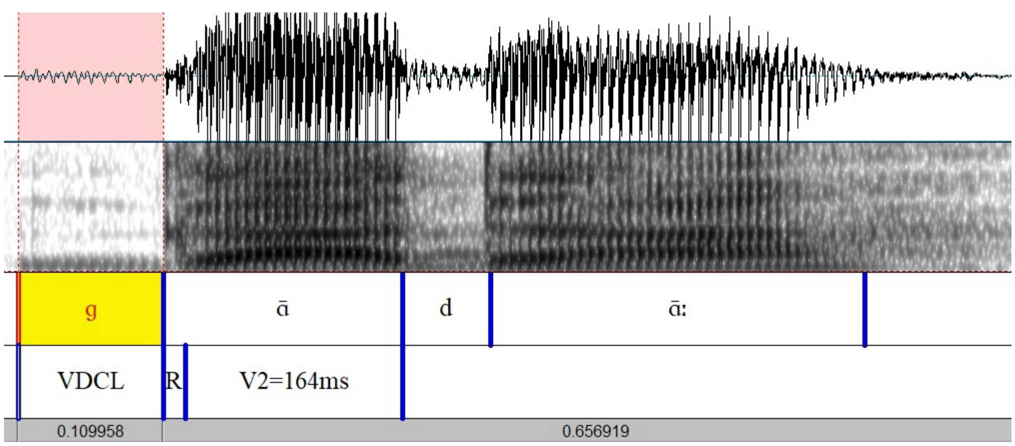


Figure 25. VOT of -109 ms of /d/ in /gāmā/ 'cutlass'.

6.1.1 Voiceless plosives /p, t, k, k͡p/

As described above, all VOT measurements begin at the leftmost point of the release. From there, I measure rightward, in the case of voiceless aspirated stops, until arriving at the zero crossing point of the first fully-formed sine wave of V2. In some cases, the period of aspiration is as short as 8 ms.

The lack of aspiration on the k͡p as compared to the other voiceless stops in African languages is not unheard of.[2] Cahill writes, "Aspiration in /k͡p/ is almost always absent or severely reduced when compared to other voiceless stops in a given language" (2018:154). Smith (1967) reports aspiration on all Nupe consonants, but specifically says that the labial-velar is lacking aspiration. Table 45 gives the VOT duration of the voiceless plosives.

Table 45. VOT of voiceless plosives

Phoneme	Environment	# Measured	Low VOT	High VOT	Mean VOT
p	Word-Initial	6	25	59	36
p	Intervocalic	7	32	45	37
t	Word-Initial	10	16	41	29
t	Intervocalic	10	27	38	33
k	Word-Initial	10	30	57	36
k	Intervocalic	10	25	47	35
k͡p	Word-Initial	8	8	17	12
k͡p	Intervocalic	10	9	22	15

Mean VOT of the voiceless simple plosives word-initially is relatively consistent despite the fact that cross-linguistically, one expects the mean voice onset times to increase as the closure point of articulation gets farther back in the mouth (Cho & Ladefoged 1999). This cross-linguistic tendency is not realized in Asu.

[2] Cahill lists Konkomba, Kusaal, Nafaara, Nupe, Sisaala-Pasaale, as well as other languages where the /k͡p/ stands alone among the voiceless stops as far as missing aspiration Cahill (2018).

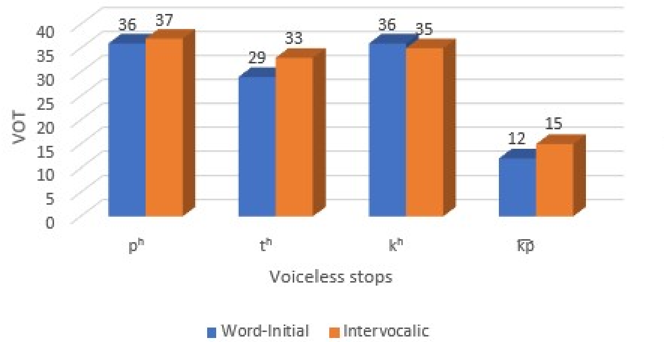


Figure 26. VOT of voiceless plosives

The VOT of the voiceless plosives are shown in Figure 26 for the word-initial and intervocalic contexts. A comparison of the VOT times of the simple plosives reveal similar measurements. Conversely, the complex labial-velar plosive, like the Nupe labial-velar, is not aspirated.

The VOT times of the simple plosives are interpreted in my transcription as voiceless aspirated plosives. The labial-velar is interpreted as a voiceless unaspirated plosive. There are no contrasting aspirated and unaspirated voiceless phonemes, and the VOT measurements confirm my transcription.

Voiceless bilabial plosive /p/

In the word-initial environment, the mean VOT of /p/ is 36 ms. A token of /p/ with a VOT of 38 ms is provided in Figure 27.

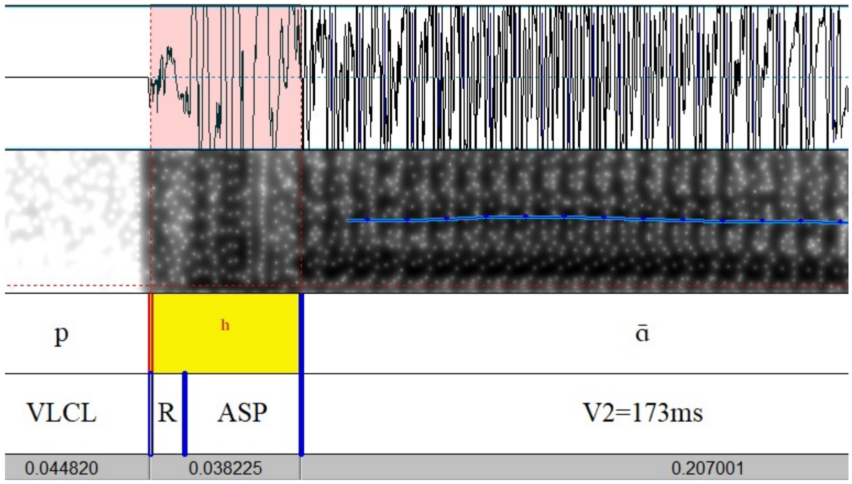


Figure 27. VOT of 38 ms of word-initial /p/ in /pākṳ̀/ 'shoulder bag'.

Intervocalically, the /p/, has a mean VOT of 38 ms. Figure 28 illustrates a voiceless bilabial plosive with a VOT of 32 ms.

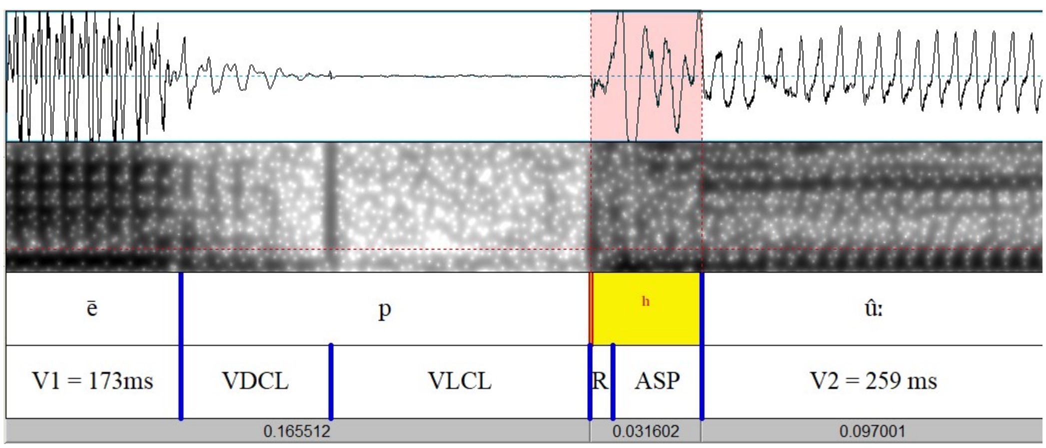


Figure 28. VOT of 32 ms of intervocalic /p/ in /ēpú/ 'turtle'

As one might expect, the final two-thirds of the closure prior to the release is voiceless. However, during the first portion of the closure period some voiced closure is present. This voiced closure could be explained as echo from the preceding vowel. The unusual voiced closure is marked with VDCL.

Voiceless alveolar plosive /t/

The mean VOT for the [t^h] is 29 ms in the word-initial context. In this environment, the closure period prior to the voiceless stop is voiceless. It is impossible to mark the beginning of this voiceless closure. In Figure 29, the VOT of the word-initial /t/ has a VOT of 20 ms.

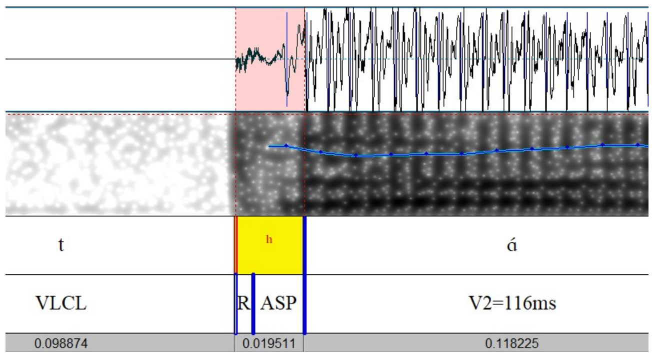


Figure 29. VOT of 20 ms of word-initial /t/ in /tágàdā/ 'log'.

In an onset word-internally, the /t/, has an average VOT of 33 ms. Figure 30 gives a duration of aspiration of 37ms. It also shows the voiced closure period VDCL extending about halfway through the total closure period.

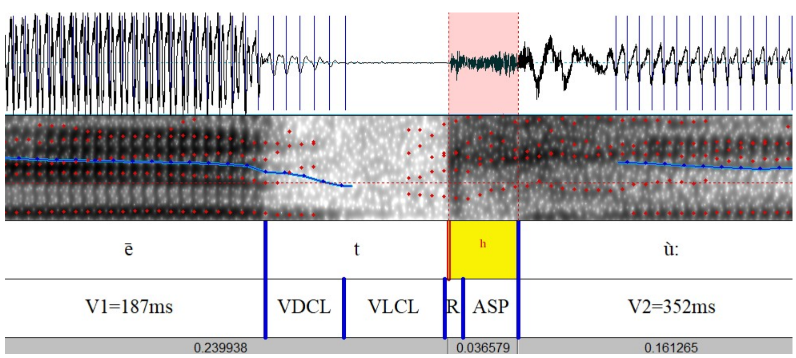


Figure 30. VOT of 37 ms of intervocalic /t/ in /ētù/ 'cobra'

In some instances of the /t/, the duration of the vowel trails off, extending almost to the release. This periodicity is likely echo from V1 preceding the plosive, since the vowel formants continue into the closure period. If this is indeed echo, it is much longer than the echo duration of the vowel preceding other stops, as shown in Figure 28 above for /p/. In this example, voiced closure accounts for less than half of the closure period. Figure 31 gives the intervocalic /t/ with a VOT of 30ms and with almost no voiceless closure. Other possible explanations of this apparently voiced closure could be ambient noise. In any event, contrast is maintained with the /d/ through aspiration following the release.

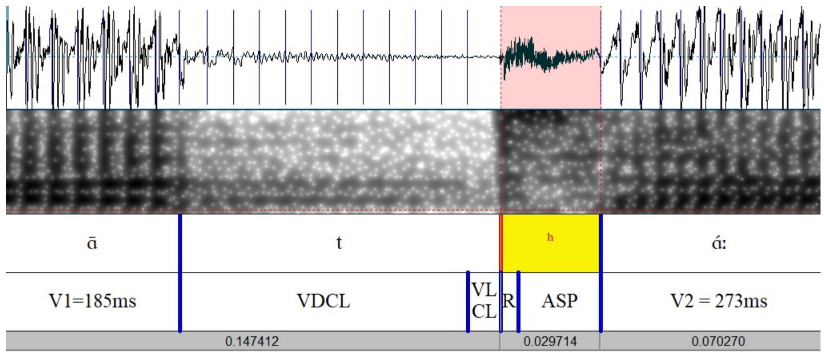


Figure 31. Vot of 30 ms of intervocalic /t/ in /ātá/ 'grindstone'

Voiceless velar plosive /k/

The word-initial /k/ has a mean VOT of 36 ms. Figure 32 shows /k/ with a VOT of 36 ms.

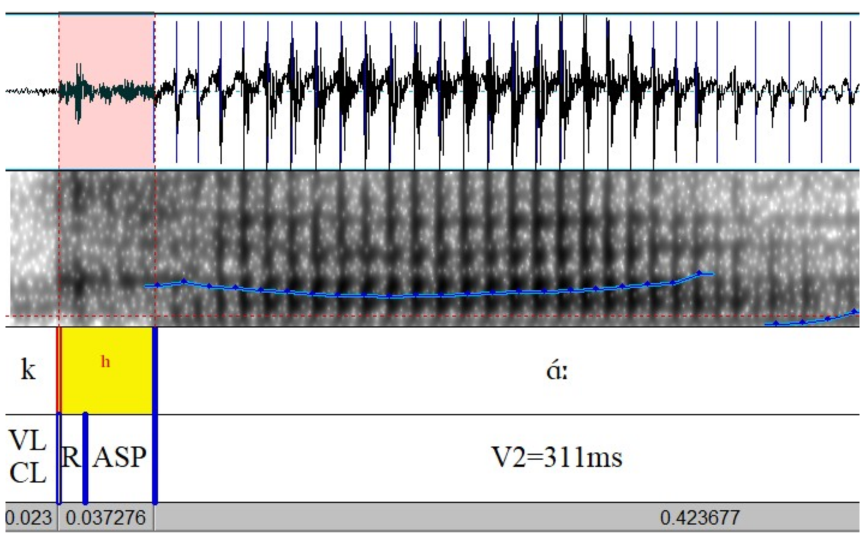


Figure 32. VOT of 37 ms of word-initial /k/ in /ká/ 'waiting'

In the onset position intervocalically, the /k/, has a mean VOT of 35 ms. As expected, there are instances in the data where there is only VLCL prior to the release of the voiceless velar stop.

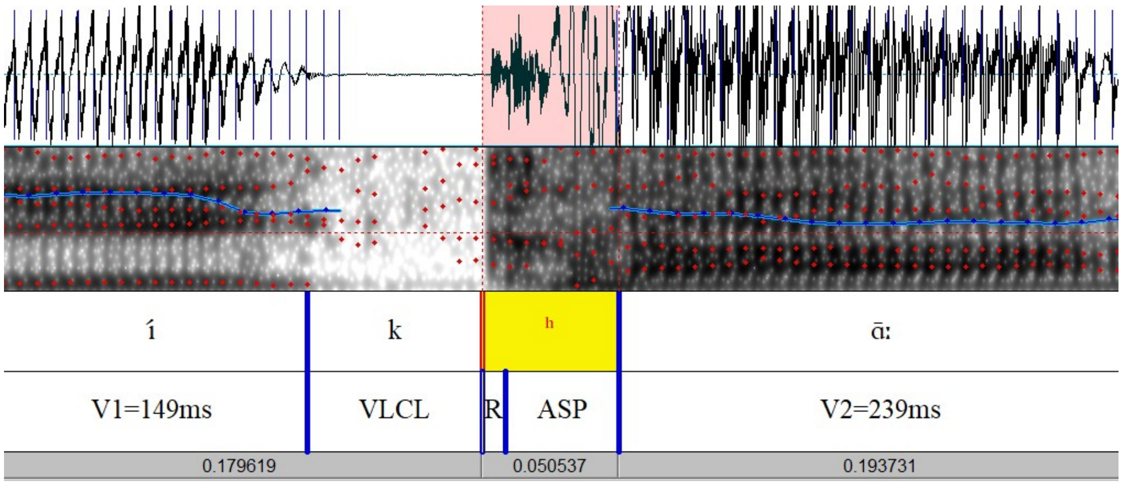


Figure 33. VOT of 51 ms of intervocalic /k/ in /kíkɑ̄/ 'clearing'

There are unusually long VDCL periods for the /k/ similar to those mentioned previously while describing the /t/ above in Figure 34.

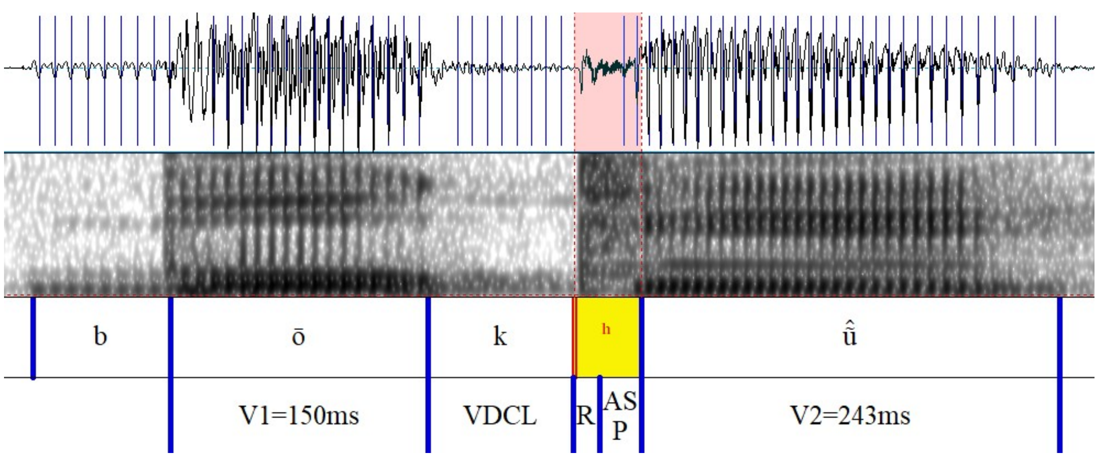


Figure 34. VOT of 40 ms of intervocalic /k/ in /bōkű̂/ 'back'

This VDCL period is present on many other intervocalic voiceless velar stops, such as the one shown in Figure 35. This Figure shows /k/ as a single onset segment in the word 'sweet potato'.

The VDCL seems to neutralize contrast between the /k/ and /g/, while aspiration maintains the contrast in this context.

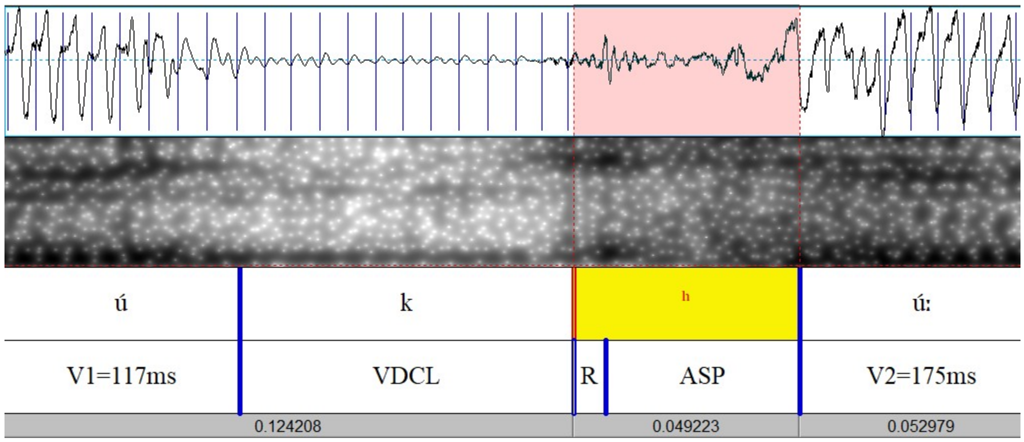


Figure 35. VOT of 49 ms of intervocalic /k/ in /ādúkú/ 'sweet potato'

Voiceless labial-velar plosive /k͡p/

The VOT of the /k͡p/ is measured from the release to the zero crossing of the first fully formed sine wave of V2. The release is not to be confused with the light shadow that begins the VDCL. Measurements of VOT were marked from the darker and more pronounced release, which is marked as "R" in Figure 36. The word-initial /k͡p/ has a mean VOT of 12 ms, which is less than half the VOT times of the simple plosives.

There are two differences between the simple plosives and labial-velar plosives. First, the labial-velar has an extremely short period of aspiration. Second, /k͡p/ has two gestures. Figure 36, shows the VOT of the word-initial /k͡p/ as 8 ms.

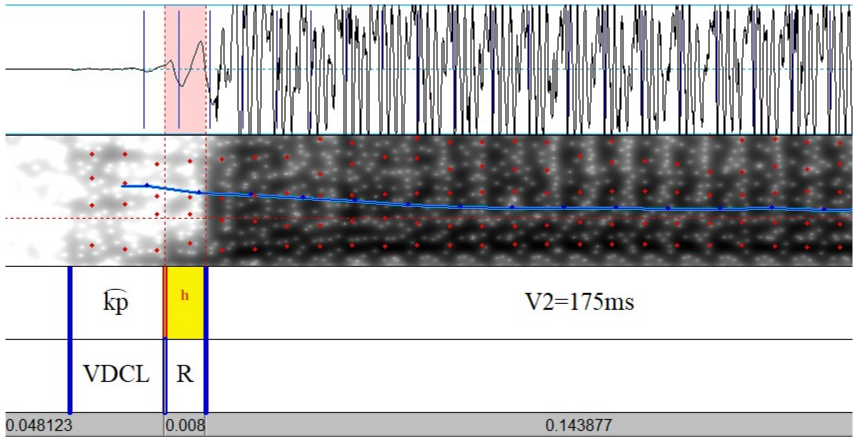


Figure 36. VOT of 8 ms of word-initial /k͡p/ in /k͡pàtā/ 'firewood type B'

Intervocalically, the /k͡p/ has a mean VOT of 15 ms. Figure 37 illustrates the VOT of the intervocalic /k͡p/ as 13 ms.

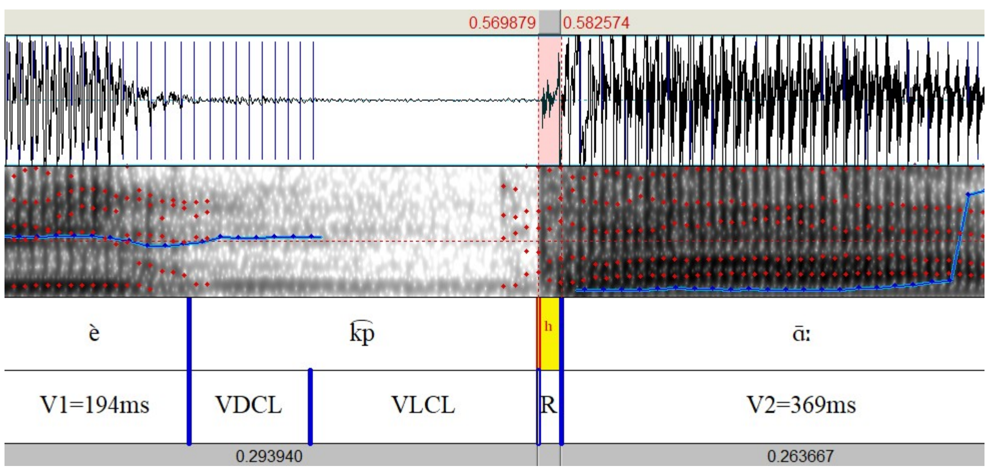


Figure 37. VOT of 13 ms of intervocalic /k͡p/ in /èk͡pā/ 'shoulder'

6.1.2 Voiced plosives /b, d, g, g͡b/

The voiced plosives have a negative VOT because the voicing begins prior to the release of the plosive, as evidenced by the voicing bar. Baart (2010:57) describes the voicing bar as "...a band of energy near the bottom of the spectrogram (the voice bar). This low-frequency energy band represents the relatively strong fundamental frequency of the signal. Even when higher frequencies are too weak to show up clearly in a spectrogram, the fundamental frequency will normally still be seen."

I marked the VOT of the voiced plosives starting at the release or burst and continuing left-ward to the beginning of the first fully-formed sine wave of the voiced closure VDCL. Table 46 gives VOT measurements of the voiced plosives. They are measured word-initially as well as in-tervocalically. In general, the mean duration of the voicing of voiced plosives in the intervocalic context is 35 ms shorter in duration than the mean VOT in the word-initial context.

Table 46. VOT of voiced plosives

Phoneme	**Environment**	**# Measured**	**Low VOT**	**High VOT**	**Mean VOT**
b	Word-Initial	10	-95 ms	-160 ms	-126 ms
b	Intervocalic	10	-58 ms	-118 ms	-88 ms
d	Word-Initial	10	-88 ms	-135 ms	-113 ms
d	Intervocalic	10	-52 ms	-98 ms	-76 ms
g	Word-Initial	10	-77 ms	-143 ms	-111 ms
g	Intervocalic	10	-45 ms	-96 ms	-69 ms
g͡b	Word-Initial	5	-96 ms	-141 ms	-117 ms
g͡b	Intervocalic	10	-62 ms	-107 ms	-82 ms

All of the negative VOT measurements of plosives are interpreted as voiced plosives, and these contrast with the voiceless aspirated plosives with positive VOT described. Figure 38 is a graph illustrating the comparison of the VOT times measured word-initially as well as intervocalically.

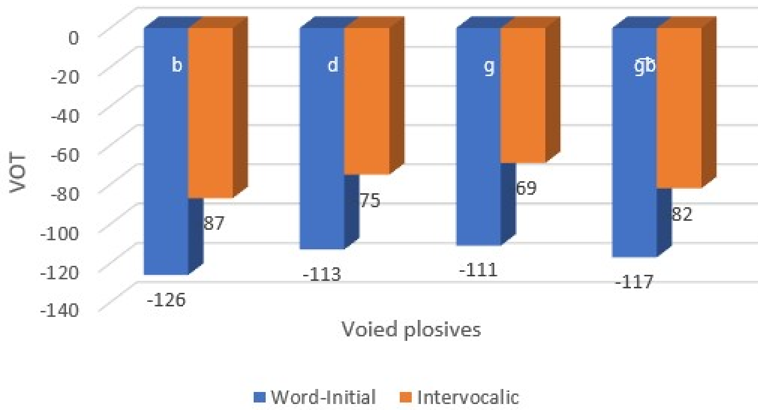


Figure 38. VOT of voiced plosives

Voiced bilabial plosive /b/

The /b/ is realized phonetically as a voiced bilabial plosive with egressive pulmonic air. In Figure 39, prior to the release of the word-initial voiced bilabial plosive, there is 120 ms of voicing prior to the release of the plosive.

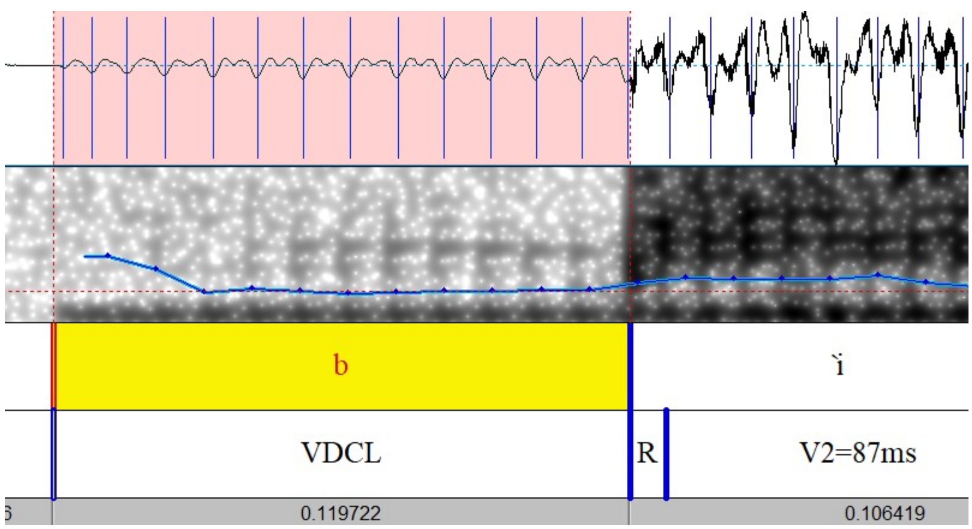


Figure 39. VOT of -120 ms of /b/ in /bìsāɾá/ 'bleeding cup'

Intervocalically, the /b/ has a shorter mean VOT than in the word-initial context. In Figure 40, the VOT is -61 ms, whereas the mean VOT of the word-initial /b/ is -88 ms.

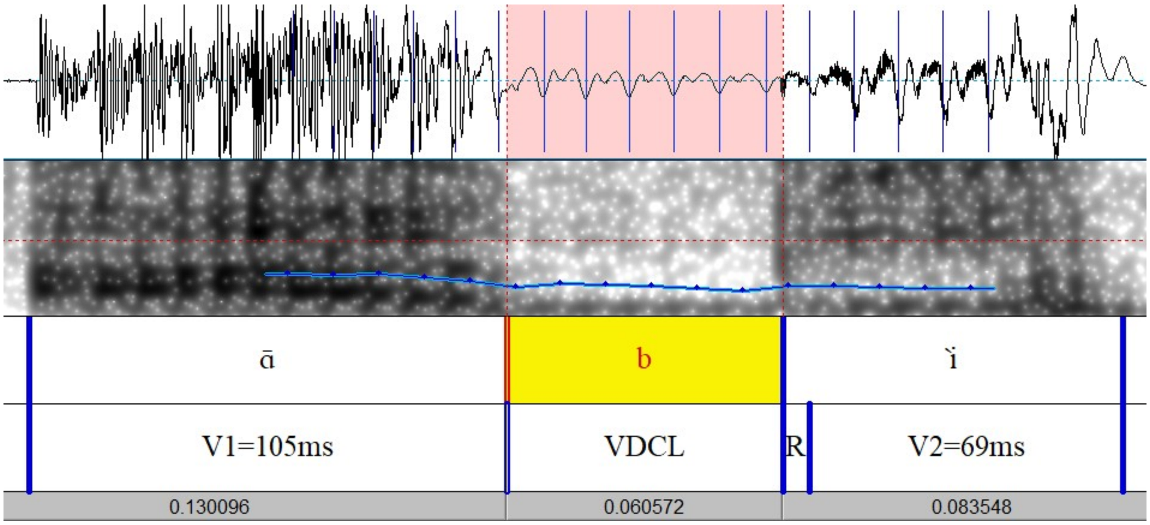


Figure 40. VOT of -61 ms of intervocalic /b/ in /ābìtā/ 'clan'

Voiced alveolar plosive /d/

Figures 41 and 42 illustrate the /d/ in both the word-initial, and intervocalic environments respectively. Word-initially, the /d/ has a mean VOT of -113 ms.

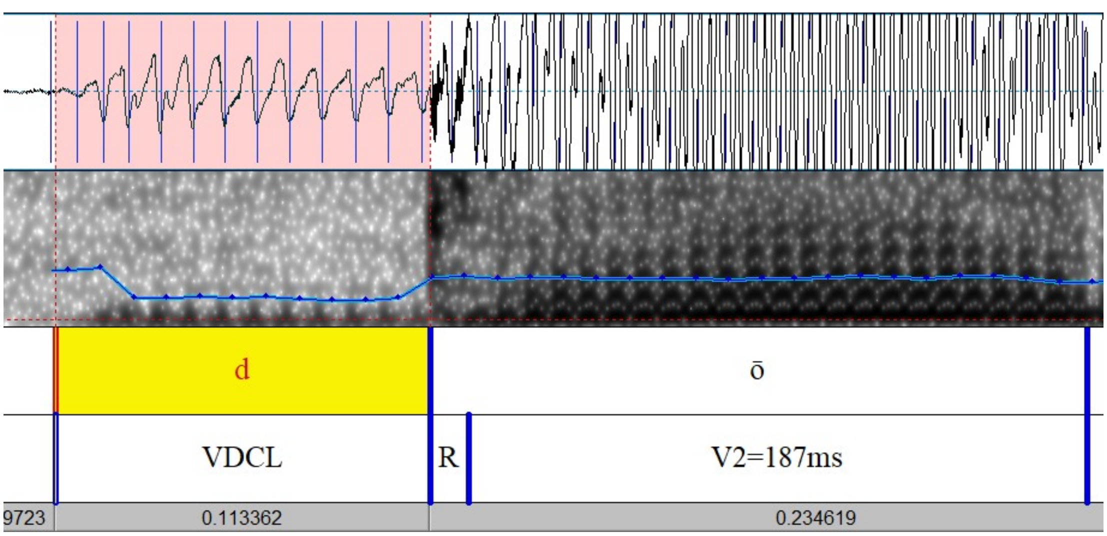


Figure 41. VOT of -114 ms of word-initial /d/ in /dōfá/ 'electric eel'

Intervocalically, the /d/ has a mean VOT of -76 ms. Figure 42 illustrates an intervocalic /d/ with a VOT of -62 ms.

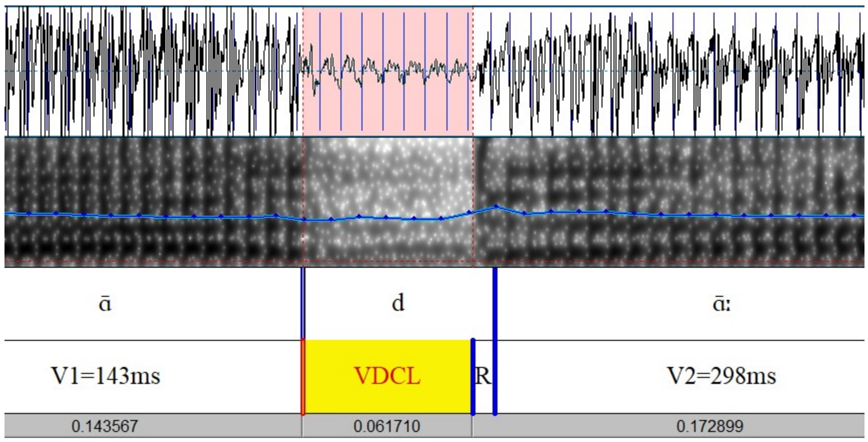


Figure 42. VOT of -62 of intervocalic /d/ in /gādā/ 'cutlass'

Voiced velar plosive /g/

Figure 43 shows the word-initial VOT of /g/ as -96 ms. The mean VOT of /g/ measures -111 ms.

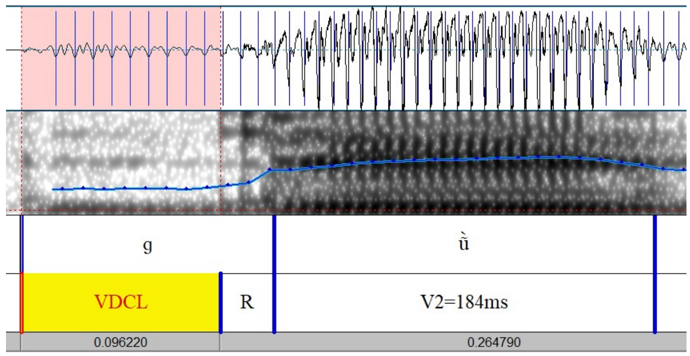


Figure 43. VOT of -96 ms of word-initial /g/ in /gù̃gù̃/ 'assembly'

Figure 44 shows the /g/ as an onset intervocalically. In that context, the /g/ has a VOT of -60 ms. The intervocalic tokens of the voiced velar plosive have a mean VOT of -69 ms.

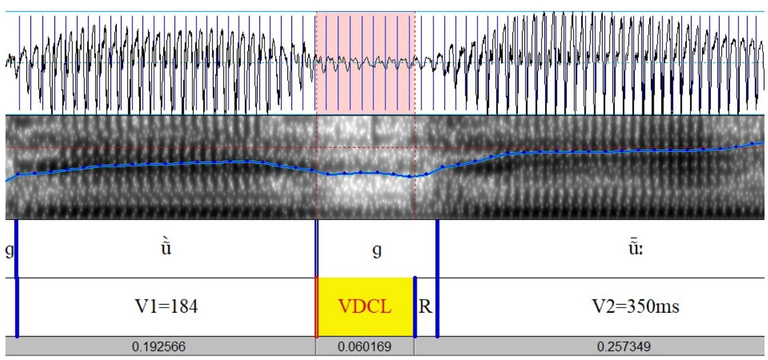


Figure 44. VOT of -60 ms of intervocalic /g/ in /gù̃gù̃/ 'assembly'

Voiced labial-velar plosive /g͡b/

Ten tokens of the word-initial voiced labial-velar plosive /g͡b/ have a mean VOT of -117 ms. Figure 45 illustrates a word-initial voiced labial-velar plosive with a VOT of -127 ms.

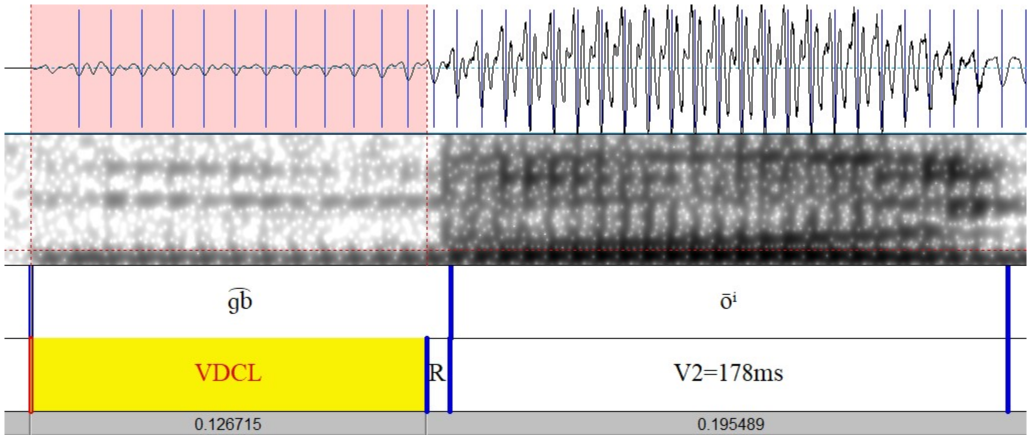


Figure 45. VOT of -127 ms of word-initial /g͡b/ in /g͡bōgí/ 'baboon'

The voiced labial-velar plosive also is found intervocalically as the onset of a word-internal syllable. In this context, ten tokens have a mean VOT of -82 ms. Individual measurements range from -62 ms to -105 ms. Figure 46 illustrates the intervocalic voiced labial-velar stop with a VOT of -112 ms.

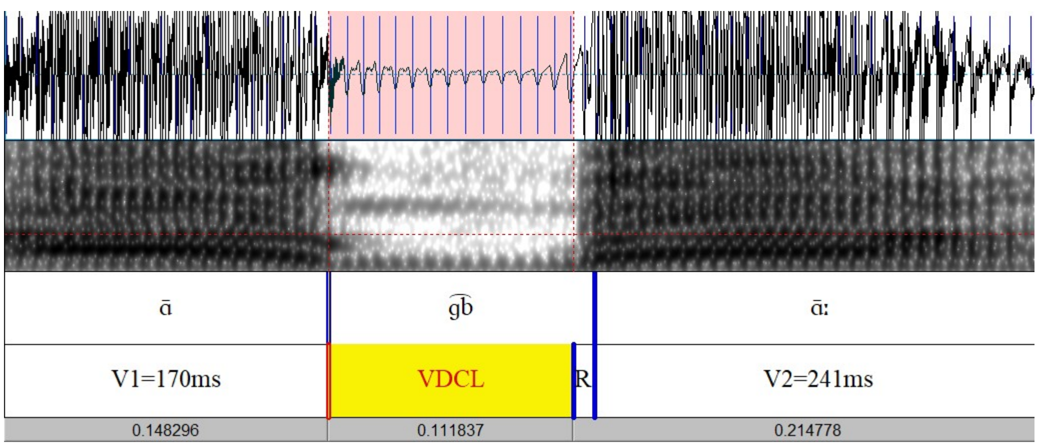


Figure 46. VOT of -112 ms of intervocalic /g͡b/ in /āg͡bā/ 'axe'

6.2 Palatal approximant description

The primary reason for including this section is to contrast the difference between the palatalized portion of the allophones [t^{j},d^{j}, k͡p^{j}, g͡b^{j}, etc.] of phonemes /t,d,k͡p,g͡b, etc./, and the phonemic

/j/, which follows consonants in CjV syllables [tj, dj, k͡pj, g͡bj, etc.], and is phonemically /tj, dj, k͡pj, g͡bj, etc./. To show the contrast, I measured tokens of the palatal approximant in each of the three contexts. The first context was the single segment onset word-initially. Here, the /j/ had a mean duration of 125 ms, as shown in Table 47.

Table 47. Duration of word-initial /j/

Phoneme	Asu	Gloss	Duration
/j/	/jābá/	'banana'	110 ms
/j/	/jàwó/	'bride'	119 ms
/j/	/jȁsā̃/	'to divine'	141 ms
/j/	/jàɾī/	'friend'	137 ms
/j/	/jījá/	'new'	116 ms
/j/	/jā/	'1.PL'	120 ms
/j/	/jȁ/	'bake'	124 ms
/j/	/jā̃dā̃/	'large turtle'	134 ms
		Mean =	125 ms

The second context measured is where the palatal approximant appears as an onset intervocalically. In this environment, the palatal approximant has a mean duration of 94 ms as shown in Table 48.

Table 48. Duration of intervocalic /j/

Phoneme	Asu	Gloss	Duration
/j/	/āg͡béjā/	'kill'	87 ms
/j/	/àjì/	'name'	96 ms
/j/	/ājī/	'blood'	115 ms
/j/	/àjī́/	'teeth'	104 ms
/j/	/ājīdȁ/	'winged termite'	106 ms
/j/	/ājìdó /	'marsh'	75 ms
/j/	/àjú/	'adam's apple'	79 ms
/j/	/àlājī /	'amulet'	85 ms
/j/	/bȁjé /	east“	82 ms
/j/	/ējà /	'canoe'	107 ms
		Mean =	94 ms

The third and final context measured is where the /j/ appears in the CGV syllables described in Section 2.1. In this context, the palatal approximant has a mean of 90 ms, as shown in Table 49.

Table 49. Duration of /j/ in CG onsets

Phoneme	**Asu**	**Gloss**	**Duration**
/j/	/āk͡pjē /	'hoof'	74 ms
/j/	/āmā́pjē/	'womb'	77 ms
/j/	/āták͡pjé/	'post'	98 ms
/j/	/ātjēbī̄/	'mist'	85 ms
/j/	/àt͡sjàɾá/	'frog'	82 ms
/j/	/àvjé/	'breasts'	153 ms
/j/	/djà/	'this'	76 ms
/j/	/fjé/	'thresh'	77 ms
/j/	/g͡bjāg͡bjā/	'mouse'	86 ms
/j/	/gjāmã̄/	'chameleon'	87 ms
		Mean =	90 ms

A two-sample t-test was performed to compare the mean duration of 96.9 ms that occurs in a jV and the mean duration of 87.2 ms that occurs in a CjV sequence. There was not a significant difference in duration between 96.9 ms and 87.2 ms. The results yielded a t-value of 0.120879.

Summarizing the duration measurements, the word-initial context mean duration is 125 ms, the intervocalic context mean duration is 94 ms, and CG context mean duration is 90 ms. With the order of magnitude of these values in mind, I now shift focus to the allophonic palatalized portions of plosives [C^j].

To be able to identify an F1 shift caused by gliding from one vowel height to another, I chose contexts where the lower F1 of the palatalized stops would give some contrast to the higher F1 of /e/. The mean duration of the palatalized portion of a [C^j] allophone measures 24 ms. See Table 50. That duration is less than one-third the length of the corresponding phonemic palatal consonant in CGV syllables.

Table 50. Duration of the palatal portion of the allophonic [C^j]

Phoneme	Environment	Phonetic	Gloss	Duration
[C^j]	Simple Onset	[d^jéʒī]	'hare'	25 ms
[C^j]	Simple Onset	[t^{hj}éʒī]	'mud'	20 ms
[C^j]	Simple Onset	[g^jēlê]	'carrying cloth'	29 ms
[C^j]	Simple Onset1	[$wu^it^{hj}et^{hj}e$]	'sun'	20 ms
[C^j]	Simple Onset2	[$wu^it^{hj}et^{hj}e$]	'sun'	24 ms
			Mean =	24 ms

A two sample t-test was performed to compare the duration of the phonemic palatal approximant found in cluster C+j and the allophonic palatalized portion of C^j that is triggered by front vowels.

There was a statistically significant difference in duration between Cj and C^j. The results yielded a t-value of 0.000000471. The statistical t-test applied to this acoustical evidence supports the phonemic distinction I propose between /CV/ realized as [C^jV] and /CjV/ realized as [CjV]. Therefore, duration provides one objective measurement to distinguish between the palatal approximants and the palatal portion of the palatalized stops.

6.3 Vowel duration

Most of the words collected in this study were recorded in isolation. Word-final vowels, which technically are phrase final vowels as well, have a predictable increased duration. This increase is present on morphemes regardless of their segmental structure and the phonetic realization of tone. Vowel duration was measured in milliseconds. The mean was established using the values of ten vowels each of words with profiles of CV.CV and CV.CV.CV. These profiles give good contrasting measurements of non-final and final vowel durations. I measured the distance from the first fully formed sine wave after the plosive to the last fully formed sine wave of the vowel. Figure 47 illustrates the vowel duration difference between two syllables that have level low tones. The vowel in the final syllable measures 254 ms, as compared to 144 ms for the vowel in the first syllable.

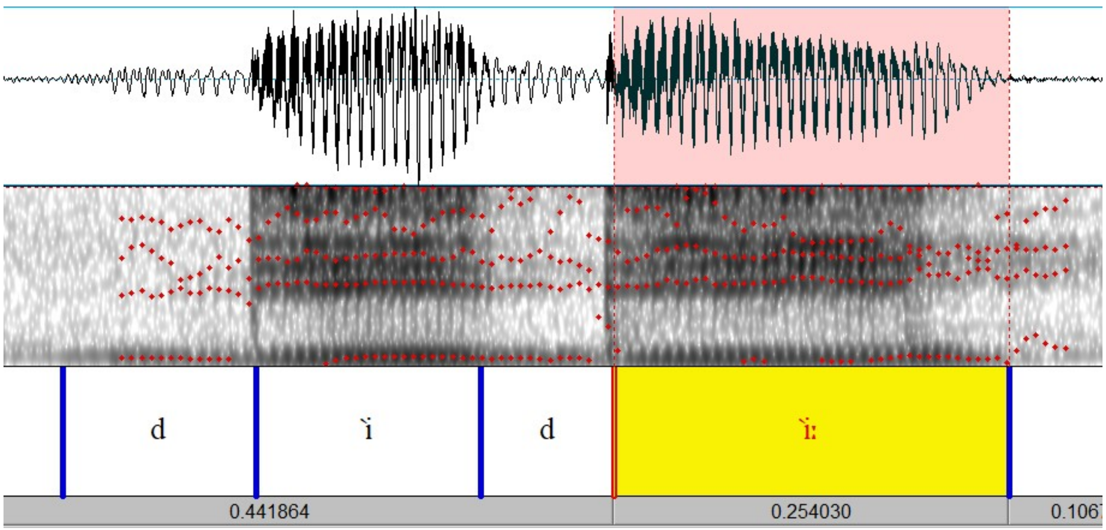


Figure 47. Increased duration, 254 ms, in the final vowel in /dìdì/ 'black'.

I measured ten tokens of final vowels found in CV.CV words that contain obstruents or taps as onsets.[3] I also selected and measured words with level tones in both syllables, so as to preclude the argument that the contour tone is responsible for the increased duration. Separately, I measured ten randomly selected words with final vowels that contain tone contours. The mean value of the tokens measured 253.4 ms. This duration of final vowels with contour tones is almost identical to the duration of final vowels with level tones, which measure 258 ms. The combined results show the final vowel with an increased duration of 85% over the first vowel. My measurements are included in Table 51.

Table 51. Vowel duration measurements in CV.CV words

Token	**Gloss**	**V1 ms**	**V2 ms**	**% Difference**
/kòfō/	'ant'	135	277	+105%
/gũ̏gũ̄/	'assembly'	189	287	+52%
/t͡sūt͡sō/	'be hot'	103	245	+137%
/dìdì/	'black'	144	254	+76%
/t͡sṹkũ̏/	'bone'	90	164	+82%

[3] I avoided measurements in words with nasals, laterals and approximants as onsets because of the ambiguity or difficulty distinguishing the starting and ending points of the sine waves when sonorants precede or follow vowels.

Token	Gloss	V1 ms	V2 ms	% Difference
/tī̀tī́/	'braided'	127	261	+105%
/tézī̄/	'mud'	203	302	+49%
/kíkā/	'clearing'	127	248	+95%
/bíbà/	'counting'	138	230	+67%
/gādā/	'cutlass'	175	309	+77%
	MEAN	143	258	+85%

Similar results were found in trisyllabic words. The increased duration of the final vowel is illustrated in Figure 48.

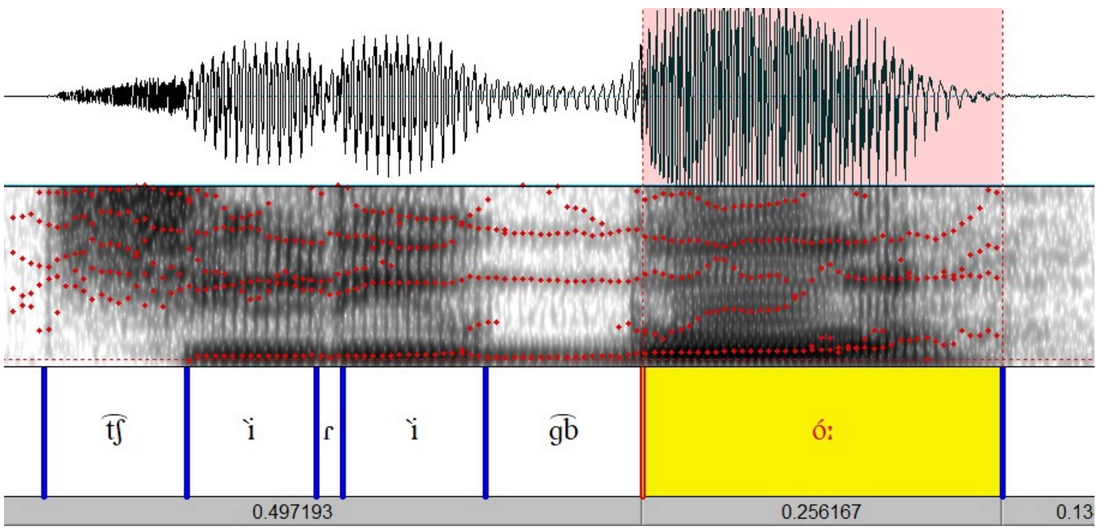


Figure 48. Increased duration, 256 ms, in the final vowel in /t͡sɪ́ɾɪ̀g͡bó/ 'lizard'

I measured the vowel duration in ten words. The results are shown in Table 52. The final vowel duration is approximately twice the duration of either of the first two syllables.

Table 52. Vowel duration measurements in CV.CV.CV words

Token	Gloss	V1 in ms	V2 in ms	V3 in ms
/t͡sʊ̀bʊ̀tá/	'ash'	62	61	204
/tūtʊ̀ɾʊ̀/	'hair'	56	67	125
/kūdàg͡bā/	'hippopatamus'	76	161	249
/t͡sɪ̀ɾɪ̀bó/	'lizard'	101	102	251

Token	Gloss	V1 in ms	V2 in ms	V3 in ms
/k͡pàk͡pàɾā/	'mat'	119	144	262
/túg͡bàtà/	'neck'	60	115	177
/tágàdā/	'textbook'	118	121	322
/pāpāɾà/	'tilapia'	115	140	222
/káɾád͡zú/	'rust'	129	184	276
/gédūdū/	'many'	85	96	287
	MEAN	92	119	238

Longer durations were also found on the final vowels of monosyllabic words. In that context, final vowels have similar durations to final vowels in disyllabic and trisyllabic words. Figure 49 illustrates a longer duration of 272 ms on the final vowel of a monosyllabic word.

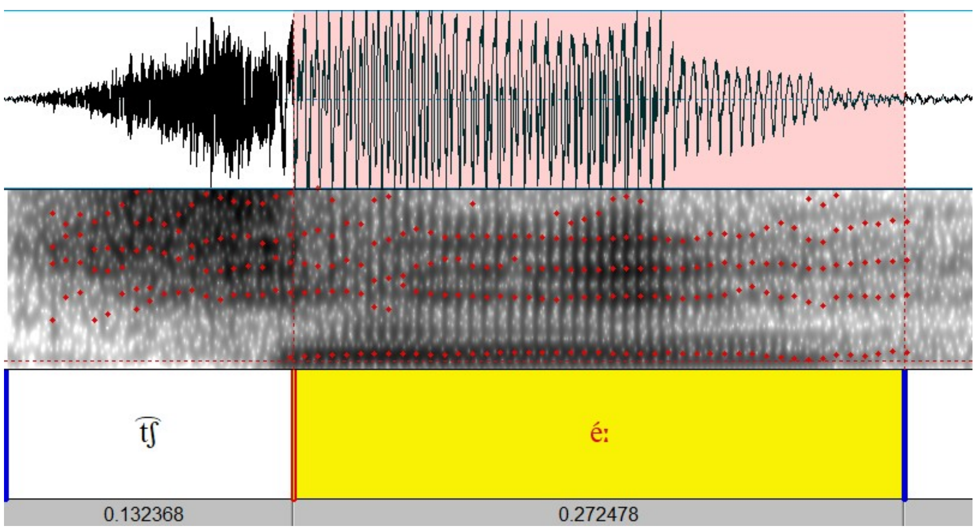


Figure 49. Increased duration, 272 ms, in the final vowel in /t͡sé/ 'extra'

Therefore, regardless of word length, the vowel of the final syllable has a predictably longer duration. In polysyllabic words, the final vowel has twice the duration as non-final vowels.

6.4 Alveolar tap transition

The following description supports my transcription of a transitional vowel sound preceding each word-initial tap. There are eight word-initial taps in the corpus. Prior to each tap, there appears a vowel that is short in comparison to all the other vowels. The mean duration of this short vowel is 58 ms. The pre-tap vocalic element is illustrated in Figure 50.

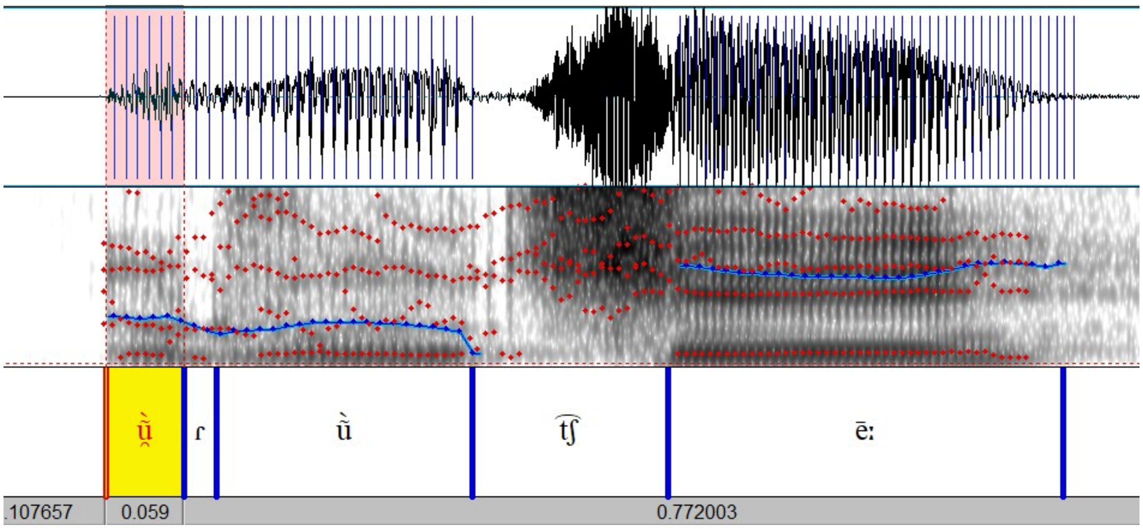


Figure 50. Pre-tap vowel in /ɾũ̀t͡ʃē/ 'tail'

This vowel measures 59 ms in the word in Figure 50. The quality of the pre-tap vowel is a somewhat centralized version of the vowel following the tap. In Figure 51, the pre-tap vowel is even longer, measuring 77ms.

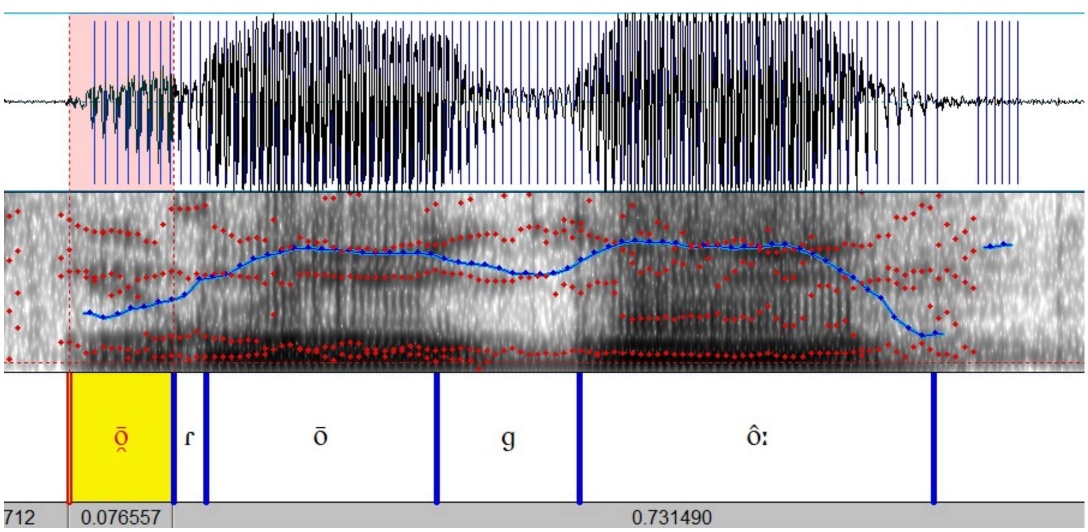


Figure 51. Pre-tap vowel in /ɾōgô/ 'cassava'

This transitional vowel is predictable and only occurs prior to the voiced tap. In the third example in Figure 52, a transitional glottal stop is visible before the transitional vowel. In this instance, the short vowel prior to the tap measures 109 ms.

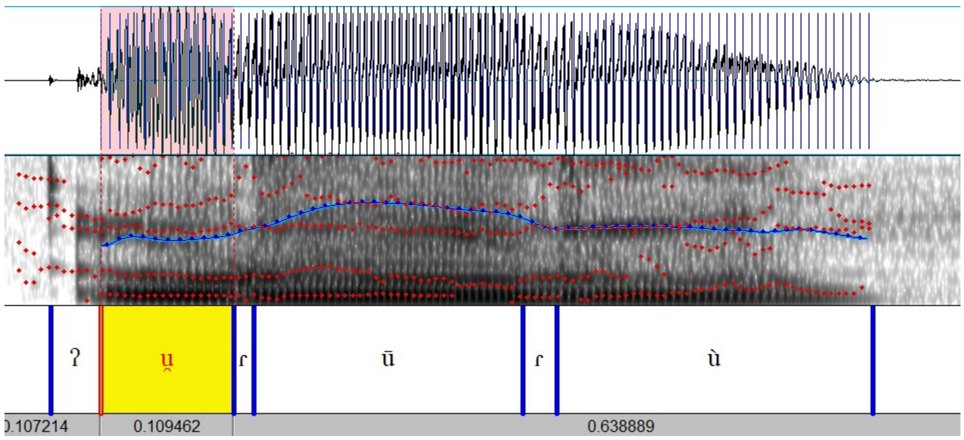


Figure 52. Pre-tap vowel in /ɾūɾù/ 'heavy'

In Table 53, the measurement of the duration of the short vowel preceding the initial tap is recorded.

Table 53. Duration of pre-tap vowels

Token	Gloss	Measurement
/ɾūɾù/	'heavy'	109 ms
/ɾȕt͡ʃē/	'tail'	59 ms
/ɾōgó/	'cassava'	77 ms
/ɾākű̄mí/	'camel'	28 ms
/ɾí/	'eat'	40 ms
/ɾīgā/	'chameleon'	67 ms
/ɾùwōkā̃/	'buttock'	37 ms
/ɾā̃kȕ/	'knee'	45 ms
	MEAN =	58 ms

Bernhardt & Stemberger (2017:8) describe a similar vocalic element between a stop and a tap: “A trill or an aerodynamic tap engages an aerodynamic mechanism (the Bernoulli effect), which requires a minimal speed for airflow. In a cluster such as /pr/, the airflow at the end of a stop is zero and takes time to build up; during that time, there will be a short vowel-like element." I propose that the short vowel-like element appearing word-initially prior to taps is similar to the short vowel-like element in complex clusters. In both cases (word-initially and between a stop and tap) the speaker begins with zero airflow and requires time to build up the pressure necessary to execute the tap or trill. The short pre-tap vowel can be thought of as a carrier signal for the tap. "The carrier signal can be either periodic or aperiodic. In producing rhotic sound the speaker must plan not only closure articulation but, if it is necessary, a generation of the carrier signal (vocalic component) as well" (Kouznetsov & Bertrán 2008:150).

Tar (2017), in her study of Hungarian, suggests that carrier signals or vowel-like elements longer than 70 ms should be considered true epenthetic vowels, and those shorter should be included as part of the articulatory target of the phoneme. Interestingly, as proof of their transitional nature, she notes that in both Hungarian and Icelandic, epenthetic vowels prior to word-initial taps are not stressed in systems where stress is found word-initially. The word-initial pre-tap vocalic segment must, therefore, be a predictable carrier signal or physiological requirement to produce the target sound after silence while pressure is built up to execute the tap or trill.

6.5 Tone description

I have described Asu syllables as having three level tones, /L/, /M/, and /H/. Lexemes contain any combination of these three tones. To describe the surface representation of the underlying tones, I used representative samples chosen from the simple CV syllable profiles containing both oral and nasal vowels. For level pitch, my measurements were made at mid-vowel. Below are examples of each of these phonemic tones in Figures 53, 54 and 55.

The /L/ tone of this male speaker in a typical single syllable word with a CV shape is phonetically realized with a slight overall pitch fall. The pitch falls for the initial 50 ms during pitch targeting. After the target is achieved, the pitch stabilizes and maintains a mean value of 119 Hz.

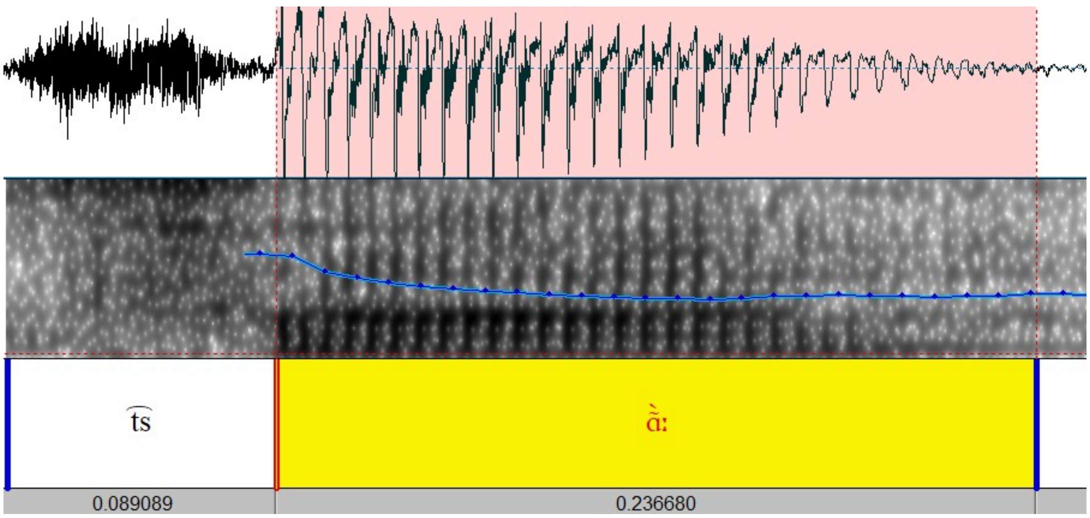


Figure 53. /L/ tone in /t͡sɑ̏/ 'marks'

The /M/ tone on single syllable words is realized with a mean frequency of 138 Hz. This is approximately 20 Hz higher than the /L/ tone.

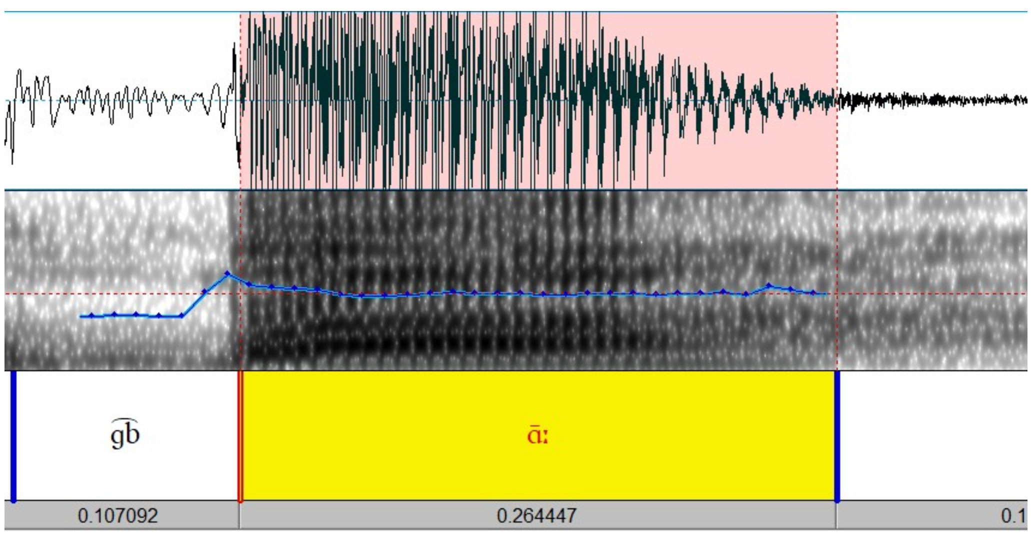


Figure 54. /M/ tone on /g͡bɑ̄/ 'cover'

The final phonemic tone is the /H/ tone. It is phonetically realized with a pitch that has a mean frequency of 161 Hz.

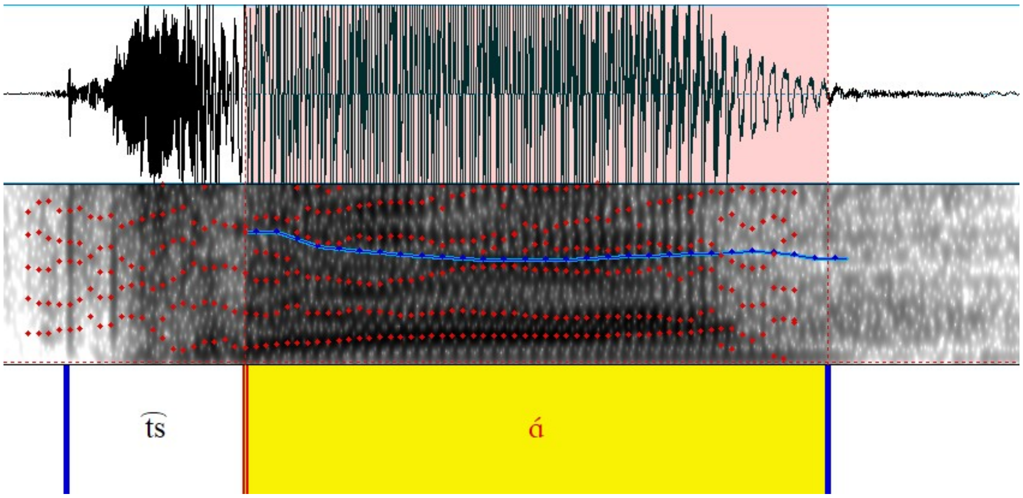


Figure 55. /H/ tone on /t͡sá/ 'to forge'

In addition to these level tones, there are two allophonic tone contours. These are illustrated in Chapter 5. One contour, the [HL] is realized when a /H/ tone falls word-finally or phrase-finally after either a /M/ or /H/ tone. The pitch starts around 150 Hz and falls to around 100 Hz. A second contour [LH] of the /H/ tone appears in a context when an /H/ follows a /L/ tone. This contour starts at 120 Hz and ends at 170 Hz.

There is a statistically significant difference in the frequency measurements of my male speaker between the /L/ tone and the /M/ tone. I used a two sample Student T-Test to determine if the difference between the means of ten randomly selected samples from my two populations /L/ and /M/ are statistically significant. The results yielded a T-value of 0.0000152 which is far below the standard significance level of 0.05.

Just as the /L/ and /M/ tones are shown to be statistically different from each other, the level /H/ tone is statistically different in frequency than the /M/ tone. The T-test value for the comparison of the mean frequency between /H/ and /M/ tones is .0000106, again significantly below the 0.05 standard.

CHAPTER 7

Conclusion

This phonology identifies the basic phonemes of Asu. My analysis of the data proposes twenty phonemic consonants and eight phonemic vowels. I made three discoveries that are of interest to me. One was a phonotactic restriction on the vowels contained in two syllable words. A second was the presence of a word-initial pre-tap vocalic element, the quality of which matches the post-tap vowel on all initial taps. Third was the discovery of complementary distributions for the contour tones that enables me to analyze the tonal system straightforwardly to be composed of a /L/, /M/ and /H/.

7.1 Phonemes

The twenty consonant phonemes supported by my analysis are shown in Table 54.

Table 54. Asu consonant phonemes

	Labial	**Alveolar**	**Palatal**	**Labial-velar**	**Velar**
Plosives	p b	t d		k͡p g͡b	k g
Affricates		t͡s d͡z			
Fricative	f v	s z			
Nasal	m	n			
Tap		ɾ			
Lateral		l			
Approximant			j	w	

In general, except for /d͡z/ and /v/, the consonant phonemes are well attested, occurring more than twenty times.

This set of consonant phonemes aligns well with other languages in the Nupoid family with the exceptions of Gbagyi and Gwari.[1] These phonemes also appear in the various contexts outlined in Chapter 3.

Asu has eight phonemic vowels. There are five oral vowels /i,e,a,o,u/, which correspond most closely with the following Nupoid languages: Dibo, Gwari, Kami and Nupe (Blench 1989:313). The Asu vowel inventory also has three phonemic nasal vowels /ĩ, ɑ̃, ũ/. A three-nasal-vowel inventory is typical of various Nupoid languages, including the following: Dibo, Gwari, Gupa, Kakanda, Kami, Kupa, Nupe, and Nupe Tako (Blench 1989:313).

7.2 Co-occurrence restrictions on vowels in 2-syllable words

One of the more interesting discoveries in this phonology is a co-occurrence restriction of vowels typically occurring in two syllable words. Roots in the corpus do not contain the expected random combination of all eight Asu vowels. The data supports two different vowel sets. The front-vowel set consists of /i, ĩ, e/, and the back-vowel set contains /u, ũ, o/. The central vowels are members of neither the front vowel nor back vowel sets and can occur with either vowel set. Two-syllable simple roots tend to be composed of either front vowels or back vowels. The restriction is demonstrated in 0-Class noun roots 92% of the time, ā-Class roots 91% and in verb roots 87% of the time. The data shows that the vowels in the back vowel set never follow /i, ĩ, e/. Also, except for a few exceptions, vowels in the front vowel set never follow /u, ũ, o/.

It has been noted by Blench that across morpheme boundaries a deviation from an otherwise strict vowel harmony can occur in other Nupoid languages such as in "Ekira-Okene and Gade, and probably other Ebira dialects. Those languages have strict vowel harmony with exceptions only at morpheme boundaries." (Blench 1989:313) Blench does not specify the type of vowel harmony to which he is referring. Additional morphological study of the few Asu exceptions to the front-back harmony may reveal yet unidentified morpheme breaks.

[1] "Gbagyi has an exceptional implosive /ɓ/ in most dialects corresponding to /b/ and /g͡b/ in other Nupoid languages." (Blench 1989:314) Gwari has post nasalized release consonants (Hyman and Magaji 1970).

7.3 Acoustic support

The description in Section 6.2 supports my proposal that there is a difference in duration between the voiced palatal approximant found in clusters Cj, and the slightly palatalized portion of the C^j triggered by front vowels. A statistically significant difference in duration is noted between Cj and C^j.

Simple plosives in Asu are demonstrated to be noticeably aspirated in all contexts. Conversely, the labial-velar is not aspirated. Due to the nature of the corpus, I cannot be certain if this aspiration feature is the norm for Asu, or if it is a particularity of the speaker's voice who was used for these recordings.

Final vowels in Asu are lengthened. The acoustic description in Section 6.3 quantifies the predictable increased duration of vowels word-finally.

In Section 6.4, there is a description of a short vowel preceding the word-initial tap. This vowel is predictable and non-phonemic. The duration measured between 60 and 109 ms. These transitional vowels have a voicing bar, and carry pitch. They also have glottal pulses the same as any other phonemic vowel. The quality of the vowel preceding the tap matches the quality of the vowel following the tap. The principal difference between the predictable pre-tap vowel and other phonemic non-final vowel is the shorter mean duration of 58 ms. Non-final vowels have a mean durations of 143 ms.

7.4 Tone contours

Asu has three clear contrasting tones, /L/, /M/ and /H/. These tones are well distributed on each syllable of Asu lexemes. The tone description in Chapter 6.5 shows a statistically significant difference between the frequencies of /L/, /M/, and /H/. Beside these three tones, two allophonic contour tones also appear in the data, [LH] and [HL]. The [LH] contour does not contrast with any of the level tones. It is in a complementary distribution with the /H/ tone. It is realized on syllables where an /H/ tone follows a syllable with a /L/ tone. Conversly, the [HL] contour appears in the word or phrase-final position after either /H/ or /M/ tones. There, I demonstrate a couple of examples of free variation between [HL] and [H]. These examples further support my free variation hypothesis, where I propose that the allotones of the /H/, specifically [H] and [HL], freely vary word or phrase-finally provided that they do not follow a /L/ tone. This Asu research concurs with what Blench, George and Peng have written about other Nupoid languages, in effect, that tone contours are not phonemic.

7.5 Direction of future investigation

Rafiu (2013:176) wrote that only two languages in the Niger state had been reduced to writing. My hope is that this work might help to fill that gap. Now that the phonemes have been identified, work can begin with local speakers to assign the graphemes which consider factors relating to neighboring languages of wider communication.

Collecting additional simple roots with three repetitions of each root would be helpful in several respects. First, it could supplement the examples of the rarer /d͡z/ and /v/ phonemes. Second, it could further document the free variation or alternation between the [h]∼[k]. Third, collecting additional roots could add further support for the four nouns where the allophonic form [ɔ̃] of the phoneme /ɑ̃/ occurs following /w/. Fourth, additional words could confirm the phonetic realization of [j̃æ̃] when the /ɑ̃/ follows the /j/. Fifth, additional words could confirm or refute the proposed analysis that [H] and the [HL] are allotones of the /H/ tone.

Asu texts and paradigms would also help to confirm these finds. Texts and paradigms would be helpful to describe the morphophonemic processes and distinguish them from the purely phonemic processes. Paradigms could help to explain the apparent counterexamples to the front-back vowel harmony if morpheme breaks are present. Also, texts could yield different contexts that could help describe the trigger of optional variation between the [HL]∼[H] which I have analyzed as /H/.

References

Abrahamson, Arthur & D. H. Whalen. 2017. Voice onset time at 50: Theoretical and practical issues in measuring voicing distinctions. *Journal of Phonetics* 63. 75-86.

Baart, Joan. 2010. *A field manual of acoustic phonetics.* Dallas: SIL.

Banfield, A. W. 1914. *Dictionary of the Nupe language.* Vol 1. Shonga, Nigeria: The Niger Press.

Banfield, A. W. & J. L. Macintyre. 1915. *A grammar of the Nupe language together with a vocabulary.* London: SPCK.

Bendor-Samuel, John & Rhonda L. Hartwell, eds. 1989. *The Niger-Congo languages.* Lanham, MD: University Press of America.

Bennett, Patrick R. & Jan P. Sterk. 1977. South-Central Niger-Congo: A reclassification. *Studies in African Linguistics* 8. 241-73.

Bernhardt, Barbara May & Joseph Paul Stemberger. 2017. Tap and trill clusters in typical and protracted phonological development: Conclusion. *Clinical Linguistics & Phonetics* 32(5-6). 1-13.

Blench, Roger. 1989. Nupoid. In Niger-Congo languages: A classification and description of Africa's largest language family. In Bendor-Samuel, John and Rhonda L. Hartell, *Nupoid,* 305-22. Lanham, MD: University Press of America.

Blench, Roger. 1991. Endangered languages in Africa. In Matthias Brenzinger, (eds.). *Language diversity endangered,* NY: Mouton de Gruyter.

Blench, Roger. 2012. An atlas of Nigerian languages. 3rd ed. http://rogerblench.info/Language/Africa/Nigeria/Atlas%20of%20Nigerian %20Languages-%20ed%20III.pdf (12/16/2015)

Blench, Roger. 2013. The Nupoid languages of West-Central Nigeria: Overview and comparative word list. http://www.rogerblench.info/Language/Niger-Congo/VN/Nupoid/Nupoid%20Overview%202013.pdf

Boersma, Paul & David Weenink. 2016. Praat: Doing phonetics by computer [Computer Program]. www.praat.org

Cahill, Michael. 2018. Labial-velars of Africa: Phonetics, phonology, and historical development. In Augustine Agwuele & Adam Bodomo, (eds.). *The Routledge handbook of African linguistics,* London: Routledge.

Casali, Roderic F. 2019. FPlot [Computer Program]. http://casali.canil.ca/ (7/10/2019)

Cho, T. and Peter Ladefoged. 1999. Variations and universals in VOT: Evidence from 18 languages. *Journal of Phonetics* 27. 207-29.

Crystal, David. 2008. *A dictionary of linguistics and phonetics.* Malden, MA: Blackwell.

Decker, Ken et. al. 2021. A sociolinguistic profile of the Asu [aum] language of Niger State, Nigeria. *Journal of Language Survey Report* 2021-043. pages.

De Wolf, Paul. 2017. *The noun-class system of Proto-Benue Congo.* Germany: De Gruyter Mouton.

Eberhard, David M. & Gary F. Simons & Charles D. Fennig. 2022. Ethnologue: Languages of the world. www.ethnologue.com

Ehret, Christopher. 2011. *History and the testimony of language.* Berkeley: University of California Press.

Fishman, Joshua. 1991. *Reversing language shift: Theoretical and empirical foundations of assistance to threatened languages.* Philadelphia: Multilingual Matters.

George, Isaac. 1970. Nupe tonology. *Studies in African Linguistics* 1. 100-22.

Hyman, Larry. 1970. How concrete is phonology. *Language* 46(1). 58-76.

Hyman, Larry M. & Daniel J. Magaji. 1970. *Essentials of Gwari grammar.* Nigeria: Ibadan University Press.

Hyman, Larry. 1972. Nasals and nasalization in Kwa. *SAL* 3. 167-205.

Johnston, Robert & Sandi C. Boyce. 2007. The accuracy of phonetic transcription from three presentation sources. www.asha.org/Events/convention/handouts/2007/0575_Johnston_Robert/

Koelle, Sigismund. 1854. *Polyglotta Africana.* London: Church Missionary House.

Kouznetsov, Vladimir B. & Antonio Pamies Bertrán. 2008. Trill with one closure. Still a trill or a tap? Data from Russian and Spanish. In Elisabeth Melguizo Moreno, *(ed.)*. *New trends in experimental phonetics: selected papers from the IVth International Conference on Experimental Phonetics,* 1, 149-60. Granada: Universidad de Granada.

Marlett, Stephen A. 2016. *Phonology from the ground up.* Digital: Not published.

Munro, Pamela. 2003. Field linguistics. In Mark Aronoff & Janie Rees-Miller, (eds.). *The handbook of linguistics,* Malden, MA: Blackwell.

Nations Online Project. 2014. Nigeria Map. www.nationsonline.org/oneworld/map/nigeria-political-map.html

Peng, Long. 1992. *A unified theory of tone-voice.* Tucson: University of Arizona dissertation.

Rafiu, Kamaru. 2013. Asu: An example of a language on the verge of total extinction in Niger State, Nigeria. *Ilorin Journal of Linguistics* 3. 38-48.

Rafiu, Kamaru Adewale. 2011. *Patterns of language loss: A study of the Benue-Congo languages in Niger State, Nigeria.* Nigeria: University of Ilorin dissertation.

Recasens, Daniel. 1999. Predicting directionality trends in segmental assimilations and insertions. *ICPhS* 99. 1847-50.

Robinson, Charles Henry. 1913. *Dictionary of the Hausa Language.* Cambridge: University Press.

Smith, N. V. 1967. The phonology of Nupe. *Journal of African Languages* 6. 153-69.

Snider, Keith. 2011. On discovering contrastive tone melodies. Berkeley Tone Workshop. University of California, Berkeley.

Snider, Keith. 2014. On establishing tonal contrast. *Language documentation & conservation* 8. 707-37.

Snider, Keith. 2018. *Tone analysis for field linguists.* Dallas: SIL.

Tar, É. 2017. Word-initial tap-trill clusters: Hungarian. *Clinical linguistics and phonetics* doi. 10.1080/02699206.2017.1363292.

Vago, Robert M. & Mária Gósy. 2007. Schwa vocalization in the realization of /r/. *ICPhS* XVI. 505-08.

Weise Constanze. 2009. Field Notes: Cultural vocabulary 1,500 word list. Compiled 7/23/2009.

Weise, Constanze. 2013. *Governance and ritual sovereignty at the Niger-Benue confluence: A political and cultural history of Nigeria's Igala, Northern Yoruba and Nupoid-speaking peoples to 1900 CE.* Los Angeles: UCLA dissertation.

Williamson, Kay. 1992. Some Bantu roots in a wider context. In E Ebermann & E.R. Sommerauer & K. E. Thomanek*Komparative Afrikanistik,* Wien: Afro-Pub.