The Tonal System of Baan Language

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Abstract

Despite its classification as a distinct language within the Ogonoid cluster, Baan language spoken in the Baan-Ogoi community of Tai Local Government Area of Rivers State, Nigeria, remains severely under-documented. The tonal system has not been studied and this research fills this gap in the description of the Baan language. The study adopted the Autosegmental Phonology framework in addition to an instrumental investigation using the Praat software. Data were elicited from six native speakers using established linguistic tools, including the SIL Comparative African Wordlist and Lingua Descriptive Studies Questionnaire. Pitch track analyses were conducted to measure the fundamental frequencies (F_0) of the tones, with tokens segmented and analyzed within a pitch range of 75–500 Hz. F_0 measurements were taken from the steady-state portion of vowels to avoid transitional pitch fluctuations, and acoustic findings were cross-verified with auditory judgments. The findings revealed three distinct level tones—High (H), Mid (M), and Low (L)—with measured pitch ranges of 143–172 Hz, 123–134 Hz, and 96–118 Hz, respectively. Both lexical and grammatical functions of tone were identified. Lexically, tone distinguishes identical words which differ only in their tone pattern. Grammatically, tone plays a crucial role in marking aspectual contrasts, notably distinguishing progressive from perfective, and in facilitating word class derivation, such as converting nouns to verbs. The study also revealed that monosyllabic nouns permit all three tone types (H, M, L), while monosyllabic verbs occur with only M and L tones. Additionally, tonal processes were documented, including mid tone spreading**,** high tone spreading**,** tone elision, and tone copying. The study contributes richly to the documentation and preservation of the Baan language as well as tone studies in African languages. It is recommended that further studies be conducted on the morphosyntax, pragmatics, and sociolinguistics of Baan to support comprehensive language revitalization.

Keywords: *Tone, Ogonoid, fundamental frequencies (F_0), Baan, tonal processes*

Introduction

Tone is one of the most important suprasegmental features in many African languages. It plays a crucial role in distinguishing lexical items, grammatical categories, and syntactic structures. In tone languages, variations in the fundamental frequency (F_0) of the voice are used to convey differences in meaning that are as important as consonant

and vowel contrasts. Nigerian languages, particularly those belonging to the Niger-Congo family, are predominantly tonal, and their tonal systems exhibit varying levels of complexity ranging from simple two-level systems to highly intricate systems involving multiple level and contour tones.

In the study of African languages, tonal analysis has evolved significantly over the past few decades; from impressionistic descriptions based on auditory observation to more objective**,** instrument-based analyses using acoustic measurements of fundamental frequency (F_0). Early African tone research (e.g., Pike, 1948; Welmers, 1973) relied primarily on auditory judgments, which, while insightful, often failed to capture the fine-grained phonetic distinctions that characterize tone in many African languages. With the advent of acoustic phonetics and the use of tools such as Praat and speech analysis software, researchers can now measure F_0 patterns with precision, enabling a clearer understanding of pitch behavior across tonal categories. Such instrumental analyses have provided robust evidence for the phonetic realization of level and contour tones, as well as for tonal processes (cf. Laniran, 1992; Connell & Ladd, 1990; Akinlabi & Liberman, 2000). These developments have deepened our understanding of how tone functions both phonologically and grammatically in African languages, particularly in those belonging to the Niger-Congo family, where tone serves to mark lexical contrasts, grammatical categories, and syntactic relationships (Hyman, 1972).

Within this broader framework, the present study focuses on Baan, a language spoken in the Ogoni area of Rivers State, Nigeria. Baan is classified as an Ogonoid language, a member of the Cross-River branch of the Benue-Congo family within the Niger-Congo phylum (Williamson & Blench, 2000). Like many Ogonoid and Niger-Congo languages, Baan is tonal. Despite its linguistic significance, the Baan language remains under-documented, particularly in the area of tone. Previous studies, such as Naatabe (1993) and Ngulube (2001), have described Baan as possessing a discrete tonal system with three level tones. However, these claims have not been verified through instrumental acoustic analysis, and little is known about the pitch ranges or phonetic realizations of tones across different vowels and syllables in the language.

Furthermore, while tone in Baan is shown to carry lexical distinctions (Ngulube, 2001), the grammatical function of tone in the language has not been explored. Also, there is no account of tonal processes in the language. These gaps serve as motivation for this study. Thus, the study seeks to provide an acoustic description of

Baan tones, examine the tone types attested, and explore the tonal processes operational in the language in order to proffer an accurate description of the Baan tone system which will in turn contribute to comparative studies within the Ogonoid and Niger-Congo tonal typology.

Literature Review: Tone

Tone refers to pitch variations used within words to distinguish lexical meaning or mark grammatical features (Katamba, 1999; Hayes, 2009). It is a phonological category relevant to languages where pitch carries linguistic significance (Yip, 2002). The perception of tone depends on pitch, which in turn is determined by F0. As Yip (2002, p.289) explains, "For distinct tones to be perceived, the signal must contain F0 fluctuations large enough to be perceptible as pitch differences."

The study of tone has long fascinated phonologists. Languages that employ pitch contrastively to distinguish meaning are classified as *tonal languages*. Pike (1948, p.3) defines a tonal language as one "having lexically significant, contrastive, but relative pitch on each syllable." Although pioneering, this definition has been critiqued for implying that all syllables carry contrastive pitch. Later studies show that many languages have toneless syllables and that pitch variation can result from factors like speaker voice quality, emotion, and environment (Welmers, 1973). Nevertheless, Pike's definition remains foundational, shaping subsequent research on tone.

Later scholars refine the concept, emphasizing the lexical and grammatical roles of tone. Tone has been defined as "variations in pitch which affect the meaning of words" (Yul-Ifode, 2008, p.77); as a system where "pitch phonemes and segmental phonemes enter into the composition of at least some morphemes" (Welmers, 1973, p.80); and as a situation where "the pitch of the word can change the meaning of the word" (Yip, 2002, p.1). These definitions collectively underscore tone's role as a central phonological feature through which pitch variation carries meaning in tonal languages.

Pitch and Fundamental Frequency (F_0)

Pitch and fundamental frequency (F_0) are crucial parameters in describing tonal phenomena such as tone, stress, and intonation. Variations in pitch convey both linguistic and non-linguistic information. *Pitch* is a perceptual term referring to how sounds are placed on a scale from low to high, while *fundamental frequency* (F_0) refers

to the rate of vibration of the vocal folds within the larynx. Although pitch and F0 are often used interchangeably in general phonetic literature (Ladd, 2008), they are distinct: pitch is auditory, whereas F_0 is acoustic (Yip, 2002; Ladd, 2008). As Ladd (2008, p.5) observes, "Strictly speaking, F_0 is a physical property and pitch is its psychophysical correlate, but in many contexts outside psychophysics little ambiguity arises if the terms are used interchangeably." Since this research adopts an acoustic approach, linguistic pitch and F0 are used interchangeably in the analysis.

Fundamental frequency (F_0) is the acoustic measure of the number of vocal fold vibration cycles per second; the number of pulses in the speech signal (Yip, 2002). It is measured in Hertz (Hz), where one Hertz equals one cycle per second. F0 is primarily determined by vocal fold vibration (Ladefoged, 1975; Yip, 2002; Gussenhoven, 2004) and is considered a central prosodic parameter in determining pitch contours (Hirst & Di Cristo, 1998; Rossi, 2000; Fox, 2000).

In literature, pitch is commonly defined as an auditory sensation. It refers to the listener's perception of how high or low a sound is (Yip, 2002), or as Gussenhoven (2004, p.1) defines it, "the auditory sensation of tonal height." Similarly, Yul-Ifode (2008, pp.74–75) describes pitch as "the auditory phonetic attribute of a sound that enables a listener to place it on a scale from high to low." These definitions highlight the subjective nature of pitch perception, as what one listener perceives as high may be judged moderate or low by another. Moreover, as Roach (2000, p.15) notes, the use of "high" and "low" as endpoints on the pitch scale is arbitrary.

To minimize this subjectivity, some scholars describe pitch in terms of the frequency of vocal fold vibration during speech. Pitch, therefore, depends on the rate of vibration of the vocal cords (Ladefoged, 1975; Katamba, 1989) and can be regarded as "an auditory phonetic feature, corresponding to some degree with the acoustic feature of frequency" (Crystal, 2008, p.369). Hence, vocal fold vibration directly corresponds to perceived pitch in speech.

Previous studies

Baan first appeared in the literature in (Williamson, 1985**)** where a reconstruction of consonants in C2 positions was carried out for Baan, Eleme, Gokana, and Kana. The study established two morphological distributions for consonants, either as C1 or C2, and ascertained that a C2 consonant is the intervocalic onset in a CVCV syllable. Thereafter, a contrastive study of the phonology of Baan and Eleme languages

(Ngulube, 2001) was done. Ngulube (2001) identified three contrastive tones (High, Mid and Low) for Baan, noting that the language exhibits a discrete tone system. A critical assessment of the internal classification of the Ogonoid family (Bond & Anderson (2005) which includes Baan has also been done. More recently, Obikudo and Kiine (2024) conducted an instrumental phonetic investigation of vowel length in Baan using acoustic measurements derived from Praat software. Their findings show that long vowels are nearly twice the duration of their short counterparts, with measurable differences in milliseconds, confirming that vowel length in both nasal and oral vowels is contrastive. Other available works tend to address the other languages in the Ogonoid family (Kiine, 2022; Ngulube 2013; Nwí-Bàrì, 2001; Ikoro, 1996; Naatabe, 1993**)**. Although it is obvious from the existing literature that some work has been done on Baan, there is however, no detailed phonetic or phonemic analysis of Baan tones. It is to fill this gap that this paper sets out to undertake an analysis of Baan tone system.

Methodology

The study adopts the framework of Autosegmental Phonology and employs a qualitative research design. Data were elicited from six purposively selected native speakers using established linguistic tools, including the SIL Comparative African Wordlist and the Lingua Descriptive Studies Questionnaire. Pitch track analysis in Praat was conducted to measure the fundamental frequency (F_0) of different pitch levels in Baan, with tokens segmented and analyzed within a pitch range of 75–500 Hz. F_0 measurements were taken from the steady-state portion of vowels to avoid transitional pitch fluctuations, and acoustic findings were cross-verified with auditory judgments for accuracy.

Tone System of Baan

There are three contrastive tones in Baan (Naatabe, 1993; Ngulube, 2001). In addition, the present study observes that there is also a falling tone in Baan. An acoustic analysis of the different pitch levels attested in Baan is presented in the next section.

High tone

The high tone is attested in Baan language. It occurs in every environment of the word; word-initially, word-medially and word-finally. In nominal elements, its occurrence in word-initial environments is limited to a few words. It is well distributed in

monosyllabic, disyllabic, and polysyllabic words, as table 1 illustrates. We present examples from two main word classes; nouns and verbs

Table 1: High tone distribution in lexical items

Noun	Gloss	Verb	Gloss
ú	'death'	úví	'fold'
ɑlú	'mask'	ɛ́gɛ́	'get'
kɑɾ́ɑ́	'frog'	úrí	'blow'
bó:sísɔ̰́	'head of arrow'	kɛké	'hatch egg'
kpíkpɑté	'bark of tree'	zɛ́gɛbɑ́	'wave hand'
úvíbɑ́	'fist'	tɔ́wálíló	'feel one's body'
kókóró	'heart'	bówɑ́	'heal, cure'

The High tone in Baan is characterized by a consistently elevated fundamental frequency (F_0) relative to other tonal categories. Acoustic measurements show that the mean F_0 for the High tone averages around 172Hz, with values ranging between 143Hz and 172Hz. The pitch contour is typically level throughout the syllable, maintaining a steady tonal height from onset to offset as illustrated in Figures 1-3.

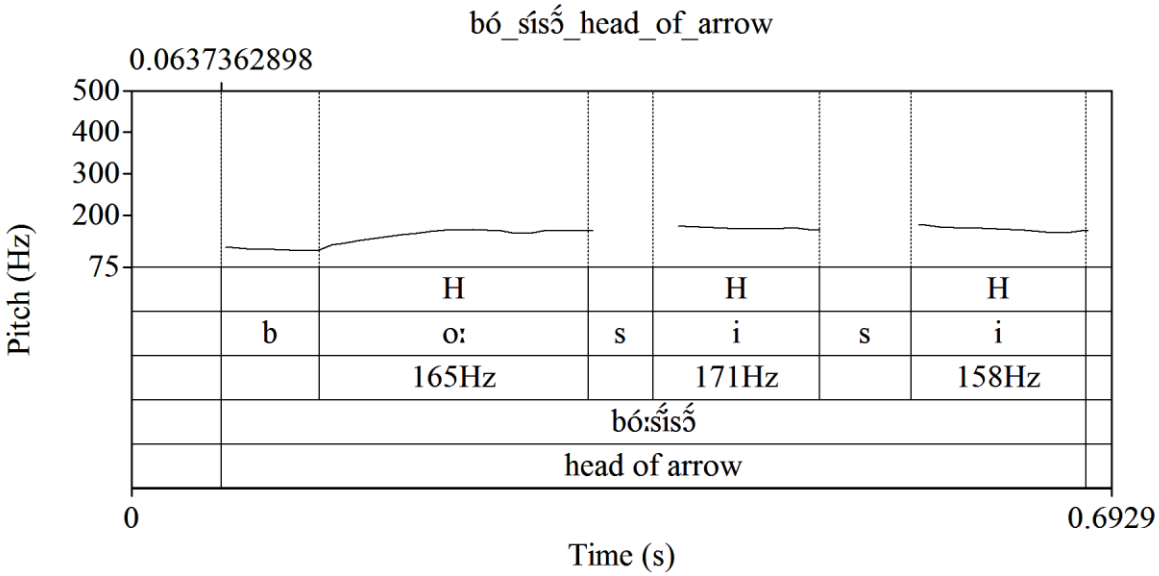

Fig 1: Pitch track for the word bó:sísɔ̰́'head of arrow'

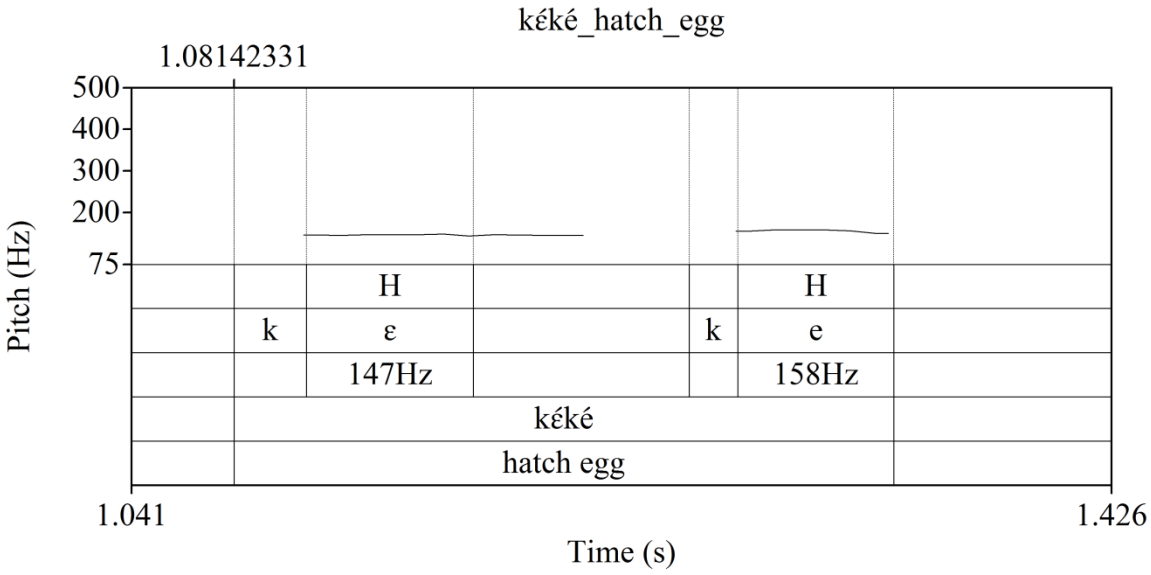

Fig 2: Pitch track for the word kɛ́ké 'hatch egg'

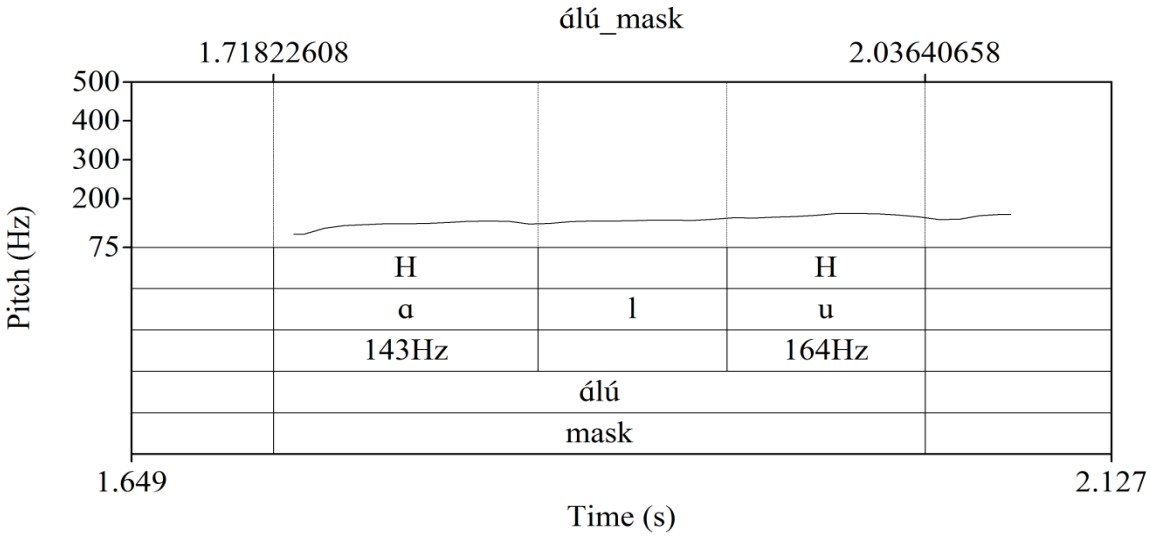

Fig 3: Pitch track for the word álú 'mask'

Figures 1-3 present the pitch tracks of the high tone in Baan across seven vowels (/i, e, ɛ, a, ɔ, o, u/). The pitch height of the high tone remains relatively stable, with only

minimal variation in mean F_0 values. Slight variations are observed, with marginally higher F_0 values on high vowels (/i, u/) and slightly lower values on low vowels (/a, ɔ/), reflecting. These slight differences may be attributed to physiological or articulatory factors, such as vowel height and tongue position, rather than phonological contrast**.** In a sequence of high tones with an intervening low, the high tone after the low tone is realized on a different pitch level from the high before the intervening low tone as seen in the word **dʒógòmá:** 'pineapple' in figure 4.

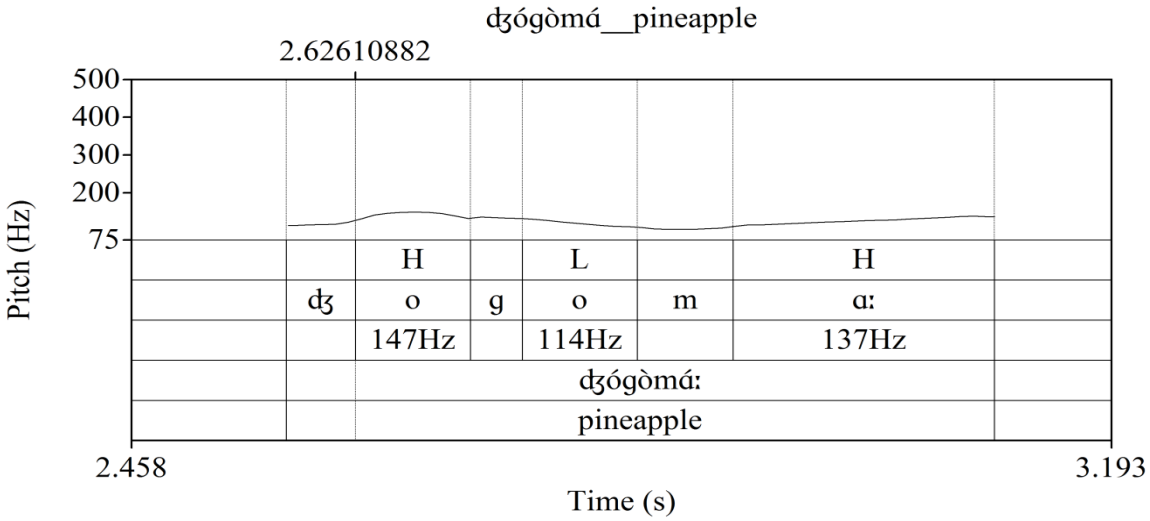

Fig 4: Pitch tract for the word dʒógòmá: 'pineapple'

The high tones in Figure 4 are phonologically identical but realized on two distinct pitch registers. The first high tone on **dʒó** is produced at a higher pitch (149Hz) than the second high tone on the final syllable **má:** (137Hz) due to the lowering effect of the preceding low tone, a phenomenon known as automatic downstep or downdrift. Overall, the analysis shows that the high tone in Baan maintains consistent acoustic properties across vowel contexts, preserving a stable pitch target that distinguishes it clearly from mid and low tones.

Mid Tone

In Baan, the mid tone has the highest frequency, occurring in every environment of a word: word-initially, word-medially and word-finally. It occupies the central pitch

range of the language's tonal system. The data in table 2 presents words that attest the mid tone in Baan.

Table 2: Mid tone distribution in lexical items

Noun	Gloss	Verb	Gloss
ɑlɑ̠	'name'	ɔgɛ̠	'cough (v)'
bɑ̠	'crocodile'	kpɔ̠	'vomit'
wo̠	'cotton'	gbɑ̠	'sew'
bi̠	'vagina'	dɛwɛ̠	'soak'
tɛbe̠	'master'	sɛlɛ̠	'put, place'
kube̠	'family'	kpɔrɑ̠	'roll'
tɔdolɛnu̠	'kitchen'	zɔwɛ̠	'follow'
bibenu̠	'abscess'	kpogɛ̠	'store up'

The mid tone in Baan is realized with a relatively stable F_0 level that occupies the mid-range of the pitch register. Unlike the high tone, which maintains a consistently elevated pitch, the mid tone shows minimal pitch excursion, suggesting a steady realization without significant rise or fall across the syllable duration. Figures 5-6 represent pitch tracts of the mid tone across six vowels /ɔ o e u ɑ ɛ/ in Baan.

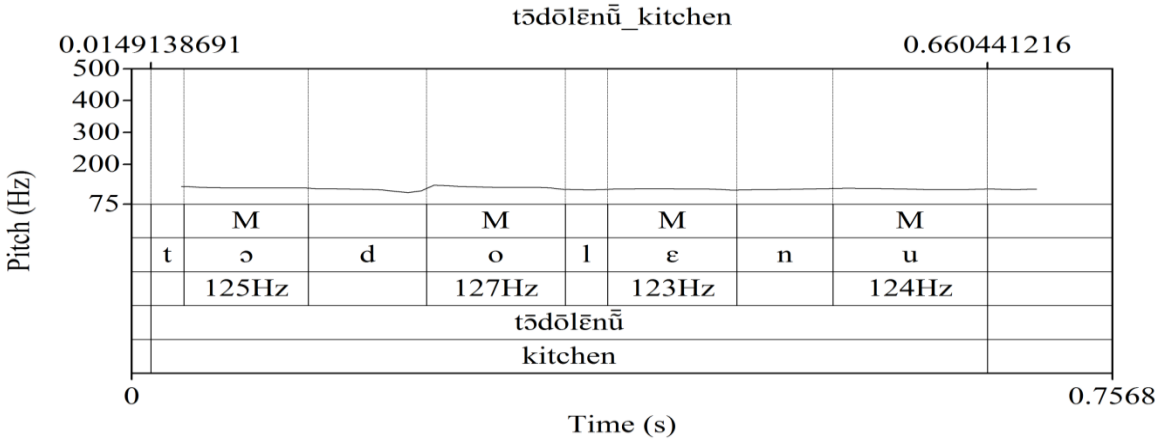

Fig 5: Pitch track for the word tɔ̄dōlɛ̄nū̄ 'kitchen'

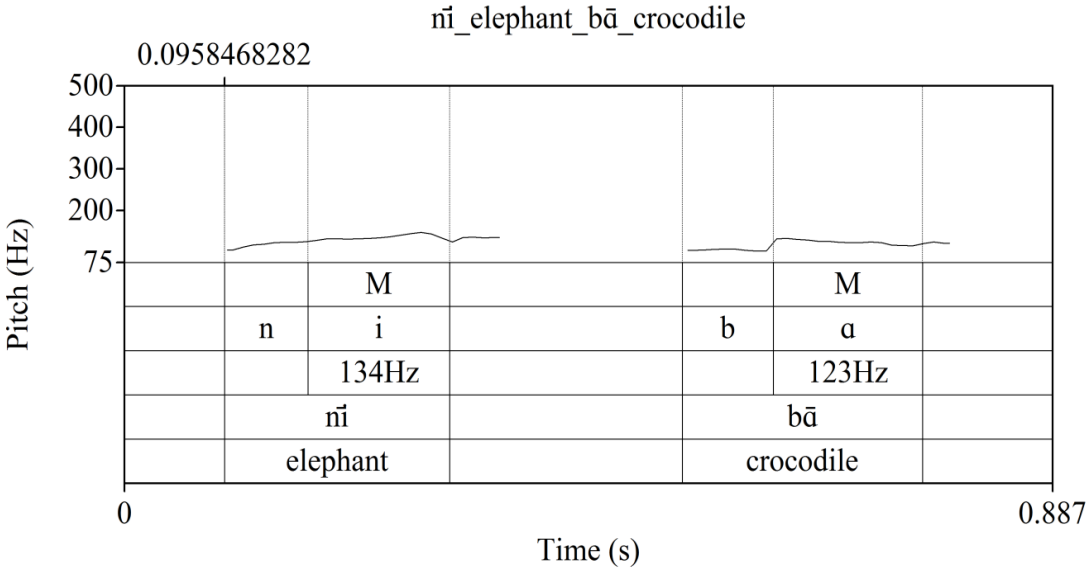

Fig 6: Pitch track for the words bā 'crocodile' and nī 'elephant'

As the figures show, the mean F_0 values of the mid tone as realized across the seven vowel phonemes of Baan indicate that the mid tone occupies the central pitch range of the language's tonal system, with average F_0 values ranging between 123–134 Hz. Across the vowels (/i, e, ɛ, a, ɔ, o, u/), the F_0 of the mid tone remains relatively stable, exhibiting minimal deviation from the overall mean. Slight variations are observed, with marginally higher F_0 values on high vowels (/i, u/) and slightly lower values on low vowels (/a, ɔ/), reflecting physiological effects of vowel height on pitch rather than tonal contrast.

Low tone

The Low tone is phonetically realized on a low pitch. The low tone in Baan can occur in every environment in all lexical categories, nouns, verbs, etc. Table 3 shows lexical items in which the Low tone occurs.

Table 3: Low tone distribution in lexical items

Noun	Gloss	Verb	Gloss
mɡ̀bɑ̀	'fence (n)'	ìrì	'look at'
ìrì	'examination'	ò:mɑ̰̀	'return'
nd̀uɑ̰̀	'life'	ɑ̀nɑ̰̀	'deny'
kɔ̀wɑ̀	'cripple (n)'	è: lɑ̀	'pour'
kòrɑɡ̀bɑ̀:	'side of body'	sɑɡ̀ɑ̀	'choose'
ɑlɑbɑ̀	'seven'	ɡɑ̀ʒ̀ìɡɑ̀	'forbid'
è: rɑɡ̀bɑ̀:	'diarrhoea'	sìnɑ̀sì:̰̀	'sneeze'

The low tone in Baan is characterized by a consistently low F_0 throughout the syllable. These values consistently fall below those of the mid tone, reflecting a distinct lower register realization. The pitch remains steady with no upward drift or terminal rise as shown in figures 7-9.

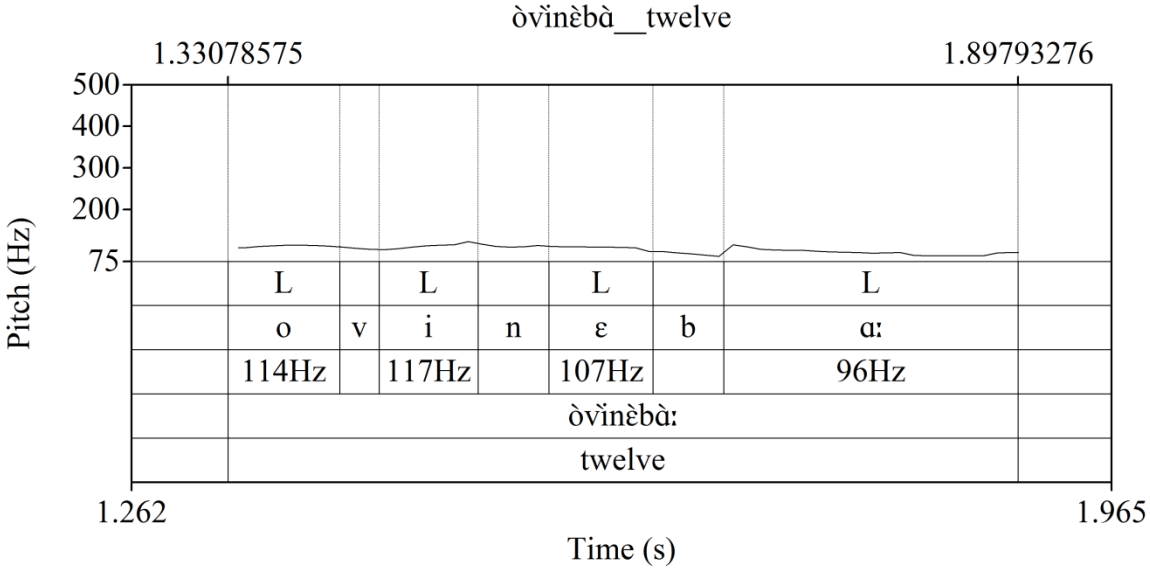

Fig 7: Pitch track for the word òvìnèbà: 'twelve'

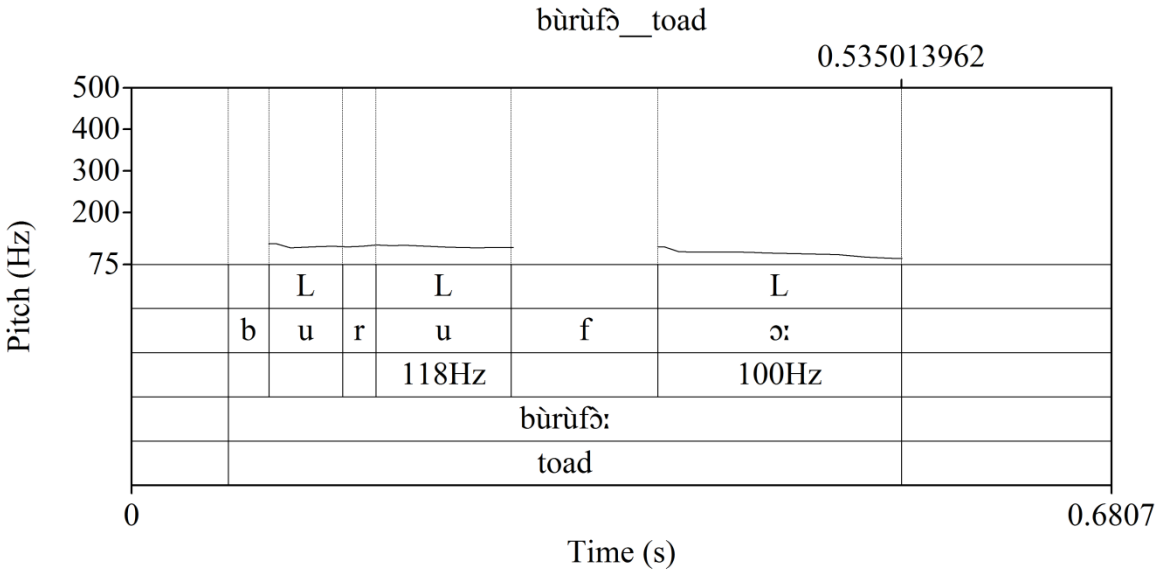

Fig 8: Pitch track for the word bùrùfɔː 'toad'

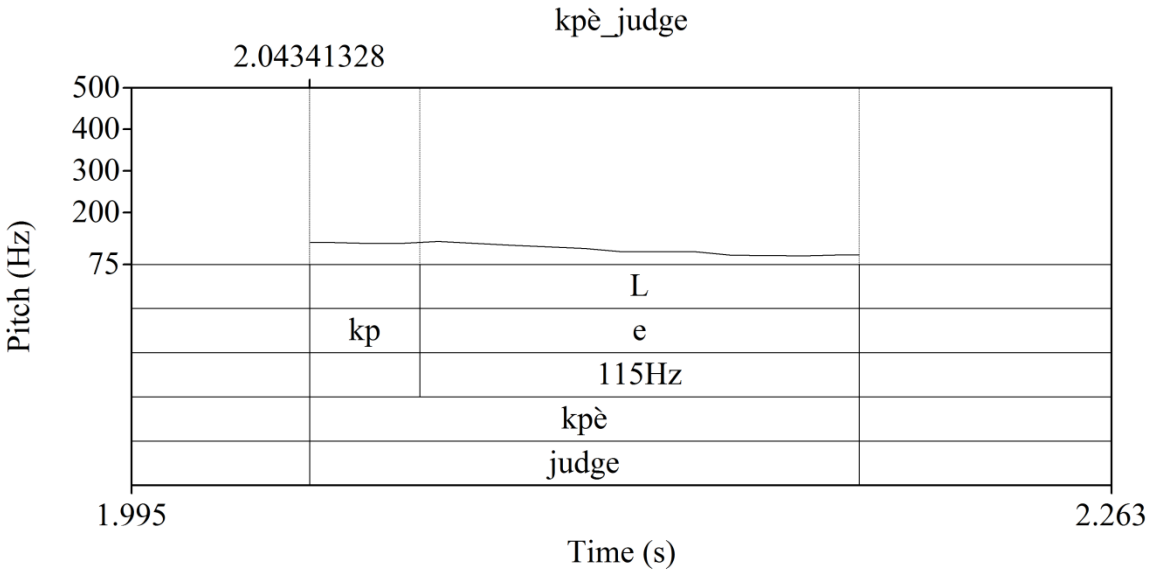

Fig 9: Pitch track for the word kpè 'judge'

The F_0 remains uniformly low across all vowels, though minor fluctuations are observed; typically a slight rise on high vowels and a slight lowering on low vowels.

These variations are phonetically conditioned rather than phonologically significant, reflecting normal articulatory effects on pitch production. The mean F_0 values of the low tone across the seven vowels indicate that the low tone consistently occupies the lower boundary of the pitch range, with mean F_0 values ranging between 96–118 Hz. The overall pattern confirms the low tone's stability and flat contour, with clear separation from the mid and high tones. This supports the classification of the low tone as a distinct level tone within the Baan tonal inventory.

Contour tone

The falling tone in Baan is characterized by a progressive decline in fundamental frequency (F_0) from a relatively high onset to a lower pitch level toward the end of the syllable. This tonal movement gives it a distinctive falling contour, typically realized within a single syllabic duration. The fall often begins at an F_0 level comparable to that of the high tone and terminates around the mid or low pitch level, depending on the phonetic context. The contour may vary slightly among speakers, but the general downward slope of the F_0 trajectory remains a consistent acoustic feature. Consider figures 10 and 11.

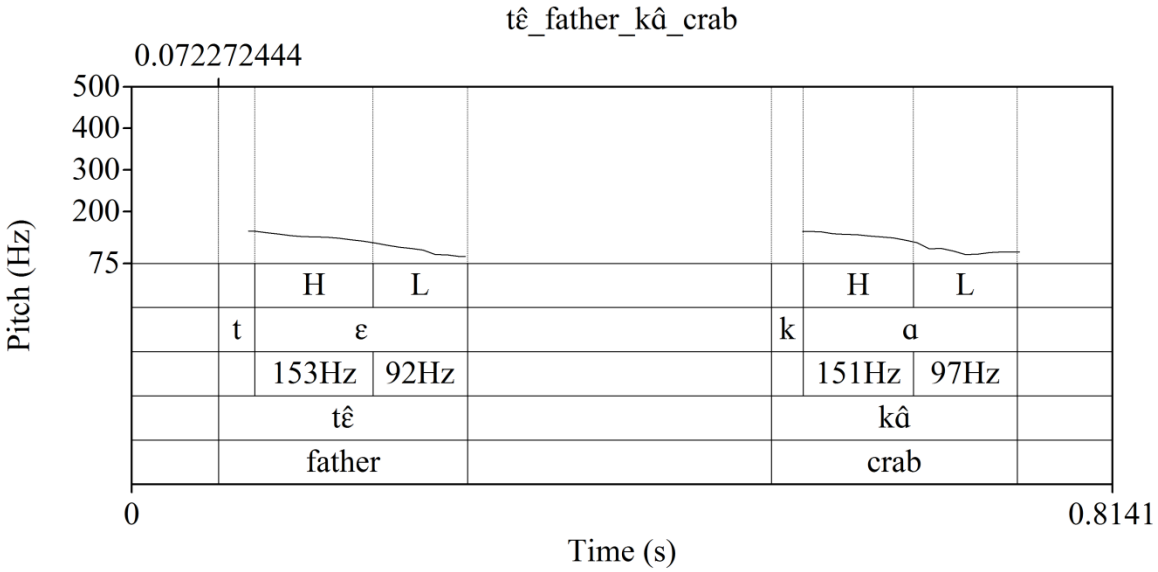

Fig 10: Pitch track for the words kâ 'crab' and tê 'father'

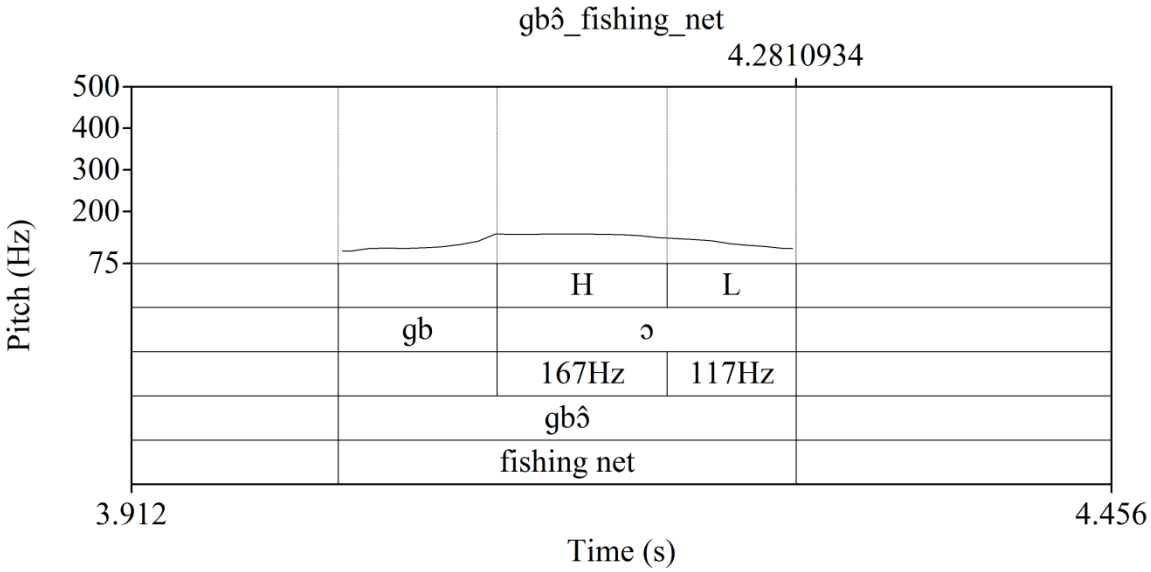

Fig 11: Pitch track for the word gbɔ̂ 'fishing net'

Contour tones are fundamentally a concatenation of two basic tones. Thus, vowels bearing contour tones are acoustically lengthier than a single tone bearing unit. In figures 10 and 11, we see a single vowel partitioned into two parts based on different pitch ranges. The pitch values in figure 10 clearly show that the vowels /ɑ, ɛ/ begin with a high tone (151Hz and 153Hz respectively) and drift into a low tone (97Hz and 93Hz respectively), while in figure 11, the vowel /ɔ/ begins with a high tone (167Hz) and drifts into a low tone (117Hz).

Tone Functions in Baan

In Baan, tone serves as a crucial linguistic feature that operates at both the lexical and grammatical levels to distinguish meaning. At the lexical level, tone differentiates words with identical segmental structures, while at the grammatical level, it marks contrasts in grammatical categories or functions. This section explores the various roles of tone in Baan, highlighting its significance in shaping the language's meaning.

Lexical Tone

At its core, Baan distinguishes three primary tonemes: High, Low, and Mid. These tones play a crucial role in the language's lexical and grammatical systems. Evidence from the dataset includes minimal pairs that highlight the distinctive function of tone in differentiating meanings. Examples (1-3) specifically illustrate how tone serves to distinguish identical words which differ only in their tone patterns.

Example 1:

a.	H	kɑ́	'forest'
b.	M	kɑ̄	'honour'
c.	L	kɑ̀	'mother'

Example 2

a.	H	nɑ́	'gun'
b.	M	nɑ̄	'do, act'
c.	L	nɑ̀	'ant-hill'

Example 3

a.	H	bɔ́	'market day (specific)
b.	M	bɔ̄	'city, town, village'
c.	L	bɔ̀	'beat (person)'

The data in examples 1-3 clearly demonstrate the lexical function of tone in Baan. Although the words are segmentally identical, they differ in meaning solely due to tonal variation. This indicates that tone in Baan is phonemic, as it serves to distinguish lexical items that are otherwise structurally the same.

Grammatical Tone

In addition to its lexical role, tone in Baan also performs crucial grammatical functions, such as word class conversion and temporal distinctions. In what follows, we show how tone is used in expressing conversion and aspectual contrasts.

Word Class Conversion

Tone can trigger word class changes without altering the segmental form. In Baan, this process involves deriving a verb from a noun by lowering either a high or mid tone on

the first syllable of the noun as demonstrated in example 4. This grammatical process is called denominalization.

Example 4:

a.	M	dʒeː	'dance (n)'	c.	H	tó	'act of crying (n)'
	L	dʒèː	'dance (v)'		L	tò	'cry (v)'
b.	M	kpɔ̰	'vomit (n)'	d.	H	bɔ́ːnṵ	'package (n)'
	L	kpɔ̀	'vomit (v)'		M	bɔːnṵ	'package (v)'

The examples in (4a–d) illustrate the conversion of nouns to verbs in Baan through tone lowering. In (4a) and (4b), the shift from noun to verb is marked by a change from a mid tone to a low tone. In (4c), the tonal change involves a shift from high tone to low tone, while in (4d), the high tone of the first syllable of the noun is lowered to a mid-tone in the verb form. These patterns demonstrate that tone plays a crucial role in marking word class distinctions in Baan, specifically in the derivation of verbs from nouns.

Aspectual Distinctions

Tone also plays a role in marking tense or aspectual contrasts on verbs. In the absence of overt tense/aspect morphology, tonal alternations may signal differences in time reference or action type (Welmers, 1973). In Baan, tone plays an important grammatical role in signaling aspectual distinctions, particularly in differentiating between progressive and perfective aspects. Rather than relying on segmental morphemes or auxiliary verbs, Baan uses tonal alternations on the verb to express tense and aspect contrasts, as example (5) shows.

Example 5:

a.	ɑ̀	é	**dú**	(LHH)		ɑ̀	é	**dù**	
		(LHL)							
	3SG	AUX	come			3SG	AUX	come	
	'He is coming'					'He has come'			

b.	ò	ó	**dú**	(LHH)		ò	ó	**dù**
		(LHL)						
	2SG	AUX	come			2SG	AUX	come
	'You are coming'					'You have come'		

The pair of sentences in examples in (5a–b) illustrates the distinction between progressive and perfective structures in Baan, marked by a tonal shift on the main verb. Progressive aspect is marked by a high tone on the main verb while perfective aspect is marked by a low tone on the verb.

Tonal Processes

This section explores the tonal processes in Baan. Tone plays a crucial role in distinguishing lexical and grammatical meanings in the language. The analysis examines how tonal patterns interact with segmental structures and investigates the processes that affect tonal behavior in the language.

Mid Tone Spreading

Mid tone spreading is a phonological process in which a mid-tone extends to an adjacent syllable, often across a morpheme boundary. In example (6) below, when a verb bearing a low tone follows a mid tone object noun, the mid tone on the object noun spreads leftward, delinking and replacing the preceding low tone. This tonal process ensures smooth transitions between words, reflecting the tonal assimilation within the language.

Example 6:

a.	/fɛ̀ + nɛ̄/	→	[fɛɲɛ̄]	'kill person'
	'kill' 'person'			
b.	/kpɔ̀ + dʒɑ̄/	→	[kpɔɗʒɑ̄]	'cut hair'
	'cut' 'hair'			
c.	/ŋʷɛ̀nɑ̰ + nu̱/	→	[ŋʷɛɲɑɲu̱]	'wear thing'
	'wear' 'thing'			
d.	/dè + nu̱/	→	[deɲu̱]	'eat thing' (food)
	'eat' 'thing'			

Mid tone spreading in Baan is a case of leftward tone spreading, where a following mid tone spreads to a preceding low tone syllable across morpheme boundary. The figure in (12) presents an autosegmental representation of mid tone spreading in Baan.

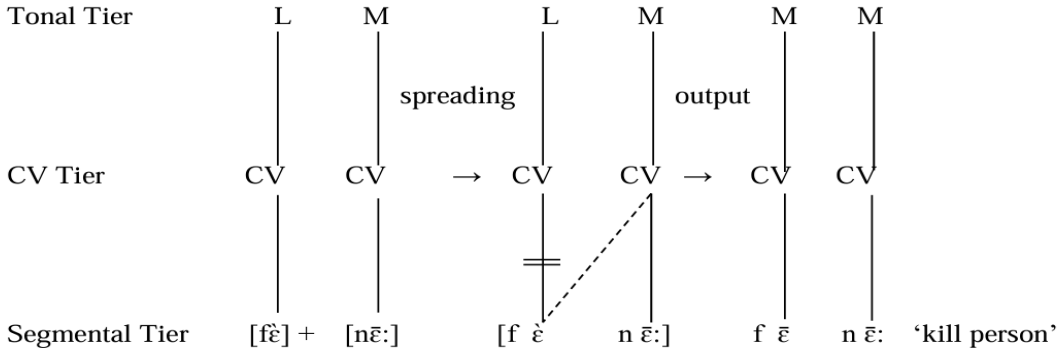

Fig. 12: Autosegmental representation of mid tone spreading

High Tone Spreading in Baan

High Tone Spreading (HTS) in Baan is a phonological process whereby a High (H) tone extends its domain rightward to adjacent tone-bearing units (TBUs), often neutralizing the underlying tonal specification of the affected syllables. This process occurs in two distinct environments: within relativized constructions and across morpheme boundaries.

HTS in Relativized Constructions

In relativized constructions, the relativizer **é** inherently bears a high tone, which spreads rightward to the following constituents. As a result, syllables that would otherwise surface with low or mid tones are raised to high. Consider the example (7):

Example 7:

a. /faː mˋ dʒaɹ̀ì-aˀ/ → [faː é mˊ dʒaɹ́í-a] 'car that I bought'
car 1SG buy-RES car REL 1SG buy-RES

b. /tɔ̠ dʒɔ́ɲ tóò-aˀ/ → [tɔ̠ é dʒɔ́ɲ tóó-a] 'house that John built'
house PN build-RES house REL PN build-RES

In these cases, the relativizer triggers a domain-wide tonal shift, ensuring tonal harmony across the relativized phrase.

HTS across Morpheme Boundaries

HTS also applies at morpheme boundaries, particularly when the second morpheme begins with a syllabic nasal of the N.CV structure. The syllabic nasal, which normally bears a low tone, assimilates the high tone from the preceding syllable. The spreading effect often cascades onto the following vowel as exemplified in (8).

Example 8:

a. /kpógó + mbiɔ̀/ → [kpógómbiɔ̀] 'bridge of nose'

b. /kpɑ́ + nd̀é/ → [kpɑńd́é] 'animal skin'

c. /ɲd̀ʒɑ̀ː + nd̀é/ → [ɲd̀ʒɑ̀ːnd́é] 'animal food'

d. /nɛːkóró + mfɑ́/ → [nɛ́ːkórómfɑ] 'barren woman'

Here, the high tone of the first morpheme spreads onto the syllabic nasal, overriding its inherent low tone. This process is consistent with assimilation-based tone spreading rules observed in many Niger-Congo languages (cf. Hyman, 2011). The figure in (13) presents an autosegmental representation of high tone spreading in Baan.

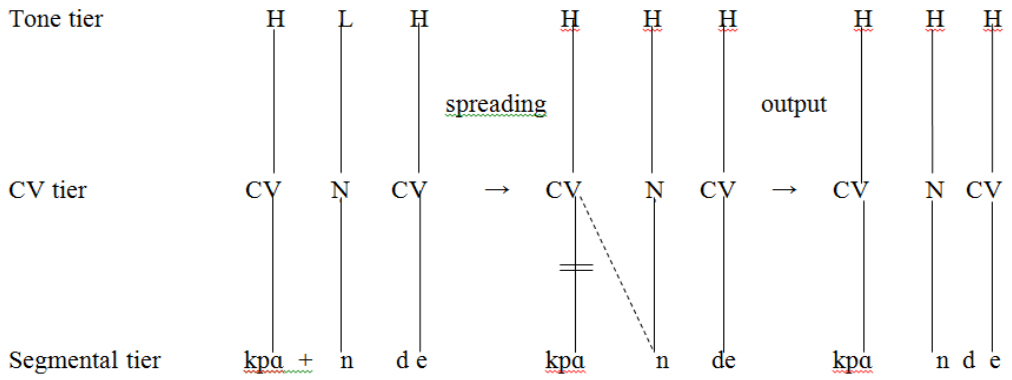

Fig 13: Autosegmental representation of high tone spreading.

Tone Elision

Tone elision is a process whereby a tone bearing unit (TBU) is deleted in speech, and its associated tone is lost along with it. In Baan, tone elision affects syllabic nasals. This happens when a syllabic nasal (N), which typically bears tone, is deleted in fast speech. Consider the examples in (9).

Example 9:

a.	/kùbà:bà:nsì/	→	[kùbà:bà:sì]	'pharisees'
b.	/ndɛ̀dɛlɛ̀/	→	[dɛ́dɛlɛ]	'orange'
c.	/mpìgiḿpi/	→	[pigiḿpì]	'sweet potato
d.	/ŋkùkʷè/	→	[kùkʷé]	'shadow'
e.	/mfífɛ/	→	[fífɛ]	'mosquito'

The data in example (9) illustrate tone deletion affecting syllabic nasals in Baan. Observe that even though the syllabic nasal is deleted, its tone does not relink to the adjacent syllables but gets deleted. The figure in (14) presents an autosegmental representation of tone deletion in Baan.

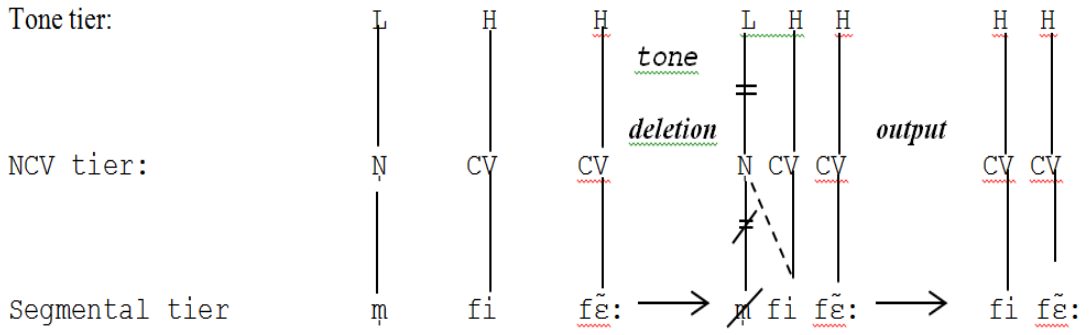

Fig. 14: Autosegmental representation of tone deletion

Tone Copying in Baan

Tone copying is a phonological process in which a toneless morpheme acquires its surface tone from an adjacent tone-bearing unit, usually the lexical root. In Baan, this

process is most clearly observed in the behavior of the nominal prefix **ku-**. Morphologically, **ku-** functions as a class marker or nominal prefix used in the formation of collective or plural nouns. It is a productive derivational morpheme that appears in several noun types, including agentive and abstract formations. Phonologically, the prefix **ku-** is underlyingly toneless, and it derives its surface tone from the tone of the initial syllable of the root it precedes. The following data in (10) illustrate this phenomenon.

Example 10:

a.	ku + bé	'war'	→	kúbé	'army'
b.	ku + lɔ́kpìrì	'tax collector'	→	kúlɔ́kpìrì	'tax collectors'
c.	ku + tɔgɛnu̲	'teacher'	→	kutɔgɛnu̲	'teachers'
d.	ku + sìpɔ́rɔ́	'sinner'	→	kùsìpɔ́rɔ́	'sinners'
e.	ku + bà:bà:si̲	'pharisee'	→	kùbà:bà:si̲	'pharisees'

As shown in the examples, the prefix **ku-** consistently copies the tone of the initial syllable of the following word. When the word begins with a high tone, the prefix surfaces with a high tone (10a & b). Similarly, when the root begins with a mid-tone, the prefix surfaces with a mid-tone (10c), and when the root begins with a low tone, the prefix surfaces with a low tone (10d & e). This pattern confirms that the prefix **ku-** lacks inherent tonal specification and instead acquires its tone through right-to-left tonal assimilation from the root. Formally, the process may be represented as follows:

$$\emptyset \rightarrow T / \_\_ T.$$

Discussion of Findings

The study examined the tonal system of Baan with three main objectives: to identify the different pitch levels attested in the language, to investigate the functions of tone, and to explore the tonal processes evident in the language. The acoustic analysis revealed four distinct phonetic tones: three level tones (High, Mid, and Low) and one contour tone (Falling). These tones are realized as discrete pitch categories. The high tone displays a relatively stable pitch contour throughout the duration of the syllable. The mean F_0 values across the seven vowel qualities range between 172 Hz and 143 Hz, with the highest values occurring on the high vowels /i/ (172 Hz) and /u/ (165 Hz),

while the low vowels /a/ and /ɔ/ exhibit lower mean F_0 values. The mid tone is acoustically realized with mean F_0 values ranging between 123–134 Hz, positioning it clearly between the high and low tones. The narrow pitch range and steady contour observed for the mid tone indicate tonal stability and show that Baan maintains distinct pitch levels without overlap between tonal categories.

The low tone exhibits the lowest F_0 values, typically between 93–118 Hz. The tone is phonetically marked by a consistently low pitch contour across vowel qualities, confirming its perceptual distinctness from both the mid and high tones. The low tone also serves as a tonal anchor in sequences, often influencing the pitch height of following tones, as seen in cases of downdrift.

The falling tone displays a contour pattern characterized by a high pitch onset followed by a gradual decline toward the end of the syllable. Acoustic evidence shows that this tone occupies the largest pitch range among the four tones, with an average fall of about 50–70 Hz from onset to offset. The shape and timing of this fall vary slightly across vowels, with longer syllables allowing a more perceptible pitch glide.

Ngulube (2001) described Baan as exhibiting a discrete tone system, implying that in Baan, each tone level is realized at a fixed, distinct pitch height and that tones do not gradually drift downward over the course of a syllable (as in downdrift systems). The pitch levels of tones are relatively stable and consistent, so each tone can be measured and recognized as belonging to a discrete category rather than as part of a continuous pitch decline. The present study largely supports this claim in that the four tones (High, Mid, Low, and Falling) are acoustically distinct and realized at a fixed, distinct pitch height and that tones do not gradually drift downward over the course of a syllable. However, contrary to what obtains in Eleme and Kana (Ngulube, 2013; Ikoro, 1996), this study observes automatic downstep (downdrift) where a slight pitch lowering in High–Low–High sequences occurs. The analysis showed that in a sequence of high tones with an intervening low tone, the high tone after the low tone is realized on a pitch level lowered than the first high tone in the sequence, indicating that automatic downstep may occur in specific tonal contexts in Baan. This subtle lowering effect suggests that while Baan maintains a discrete tonal register system, contextual tonal interactions are not entirely absent.

The findings of this study reveal that tone in Baan performs both lexical and grammatical functions, aligning with patterns widely attested in other Ogonoid

languages (Williamson, 1985; Ikoro, 1996; Ngulube, 2013). Lexically, tone distinguishes meaning among nouns and verbs. The analysis further establishes that the falling tone in Baan is phonetic rather than phonemic, exhibiting a restricted distribution—occurring only in medial and final positions. This suggests that the falling contour results from the coalescence of two tone-bearing units rather than constituting a distinct tonal category.

Grammatically, tone in Baan plays a crucial role in facilitating word-class derivation, such as the conversion of nouns into verbs and adjectives. This multifunctional role of tone is consistent with what Hyman (2011) describes as the "morphotonemic versatility" of tone in African tone systems. Tone also functions grammatically in Baan by signaling aspectual distinctions, particularly differentiating between progressive and perfective aspects. This pattern is consistent with many Niger-Congo languages, where tone functions not only lexically but also grammatically, marking distinctions such as tense, aspect, mood, and polarity (Nurse, 2008; Nurse, Hewson & Rose, 2016). Such patterns underscore the importance of tone as both a morphosyntactic marker and a prosodic regulator within Baan's clause structure.

Furthermore, the study identifies several tonal processes that enrich Baan's phonological system, including mid-tone spreading**,** tone raising**,** tone deletion involving syllabic nasals, and tone copying. These processes reveal a high degree of interaction between segmental and suprasegmental features, affirming Goldsmith's (1990) and Yip's (2002) observations that tone operates on a separate autosegmental tier but interact dynamically with segmental structures.

Conclusion

This study set out to examine the tonal system of the Baan language through an acoustic investigation of its pitch levels, tonal functions, and tonal processes. The findings revealed four phonetic pitch levels: high, mid, low, and falling. Only three of these (high, mid, and low) function as distinctive phonological tones. The study further established that in addition to distinguishing between lexical meanings, tone performs grammatical functions that include word class conversion and aspectual distinctions in Baan. Several tonal processes were identified, including mid-tone spreading, tone deletion, and tone copying, among others. These findings provide a clearer understanding of the tonal system of Baan and make an important contribution to the

linguistic description of the language. They also provide a valuable foundation for on-going efforts to develop a practical orthography and writing system for Baan. The study recommends that further studies be conducted on the morphosyntax, pragmatics, and sociolinguistics of Baan to support comprehensive language description, documentation, and revitalization.

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