A Study of Distribution of Shona Tonal Categories in Disyllabic Nouns

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Abstract

This paper discusses the tonal contrasts of Manyika Shona, a Bantu language spoken in Zimbabwe. The distribution of tones through an acoustic study of F0 over time as well as the phonological aspect of specified tone vs unspecified is examined. The Privative H tone in Shona is linked at the offset of the vowel based on observations of F0 over time.

1 Introduction

Many Bantu languages including Shona have been categorized as a two-tonal contrast language of high tone and low tone (Doke, 1931). However, many have started to consider whether they can be described as having a presence vs absence contrast. Hyman (2000) suggests that all Bantu languages should be analyzed as having a privative feature of tone. This paper will consider the proposition made by Hyman while investigating whether the H and L are phonologically active or if only one is specified and which that is. The locus of the tone will also be considered. Shona is a Bantu language spoken in Zimbabwe that have often been described as having a register tone system with a H tone and a L tone contrast. Although Shona have many dialects this study have focused on Manyika. I propose that the L tone in Manyika Shona is phonological null (Ø) and that tone is linked to the offset of the vowel.

Hyman isn't the only person to have considered the tonal contrast of Bantu languages. Bantu languages are often referred to as "accentual" and not "tonal", this is because many languages only have a two-way phonetically high versus low but then phonologically it is often considered to be H tone versus no tone, in other words an absence of tone (Yip, 2002). Bantu languages have been researched extensively especially with focus on mobility due to its agglutinative morphology. However, in this study no morphemes such as prefixes were used in the elicitation of nouns and will therefore not be considered in the analysis.

Hyman illustrates using other languages to show the possibilities of contrast using an absence vs presence of high tone or low tone as well as mid tone contrast in (1) below.

Hyman - *Privative tone in Bantu* (2000)

(1) Phonetic Opposition	Phonological Opposition	Examples
a. [H] vs. [L]	/H/ vs. /Ø/	Slave, Navajo, Somali, Paici
b. [H] vs. [M] vs. [L]	/H/ vs. /Ø/ vs. /L/	Fasu, Yoruba

The examples in (1) shows how the opposition of tonal contrast can be represented in other languages.

The reasoning for suggesting the specified vs unspecified tonal contrast is that rules related to tone only allows for the specified tone to be manipulated. For example, spreading in specific Bantu languages only concerns the H tone or if the L tone is specified the opposite. As mentioned, there has been recognition of phonological asymmetry between surface H and L (Hyman, 2000). This means that an analysis of the tones would have its specified tone vs unspecified instead of a phonological H vs L tone. As a result, it is possible that the location of the specified tone is restricted while the so-called unspecified tone is freer. From here there are two hypotheses' that needs to be considered. One is that if the H tone in Shona is the only phonologically active tone then the pitch will target that H tone, either on the onset of the vowel or the offset. On the other hand, if the L tone is specified it should have the same target in the vowel.

2 Method

This acoustic study involved elicitation of 37 disyllabic nouns from a female Shona speaker of the

dialect Manyika. Out of those 37 nouns, three HH nouns, three LL nouns, three LH nouns and one HL were analyzed, out of a long list of elicited words there was a lack of HL combinations that will be discussed further below. The F0 was measured with the acoustic program Praat and with the use of the statistical program R the data was further analyzed. In this paper I report F0 results to show if the H tone in Shona is specified with a definite target or if it is a default tone without a tonal target along with the locus of the tone.

2.1 *Stimuli* The 37 nouns were elicited and recorded with a native speaker of Shona and they were repeated 5 times each. The nouns elicited were all without any connecting morpheme to avoid any influence from the morpheme onto the root noun. The words were selected using the Swadish list along with the use of a dictionary where tone was marked. All nouns were disyllabic and contained only the voiced consonants [b], [d], [g], [ɗ] and the nasal sounds, [m], [n], [ŋ] and [ɲ]. For the vowels the initial target was to find nouns containing the vowel [a]. However, this proved difficult and as a result, where [a] wasn't found vowels [o] and [e] were used. The consonants chosen were all voiced to make it easier to annotate and to keep the pitch movement as clear as possible. The words were elicited in citation form without any carrier phrase so there is a possibility that the tones in the nouns may shift to a sentence level accent or a list accent.

2.2 *Recording* The elicitation was conducted in a quiet room with Shona speaker SNA001. All targeted sounds were elicited in isolation using a TASCAM 100 recorder and a microphone. The Shona speaker was bilingual in Shona and English and therefore the words collected before the final recording were elicited in English.

3 Acoustic Analysis

3.1 *Data* All sound files were annotated and processed using several Praat scripts and 16 F0 points were collected in each repetition of each vowel and each targeted word. Each vowel was marked at the vowel onset and offset. After having extracted the F0 points to an Excel file, the analytical program R was used to create two charts depicting the F0 over time in both vowels.

(2) Shona stimuli

Tone marker	Shona	meaning	V1	V2
HH	góɗő	bone	o	o
HH	gwámbá	freeze	a	a
HH	kámbá	tortoise	a	a
HL	ɾɛ́ ŋgà	sky	e	a
LH	ɓàɓá	father	a	a
LH	ɲàŋgá	horn	a	a
LH	mùɲú	salt	u	u
LL	ɲàmà	meat	a	a
LL	ŋgànò	fable	a	o
LL	màŋà	chap	a	a

The list in (2) shows the targeted disyllabic nouns used to analyze the tone patterns, HH, HL, LH and LL. Most of the targeted vowels are [a].

3.2 *Result* The F0 traces were used to create a graph of the F0 movement over time in each vowel seen in figure 1 and 2 and were further normalized over time using R.

Since the F0 traces collected resulted in a list of 1585 columns. This data set will not be presented in its whole in this paper. However along with the F0 traces of each vowel and each repetition, other

measurements were also collected but due to space restriction, is not represented here.

(3) Sample measurements

File	Vowel	Absolute time	Relative Time	Vocalic Duration	F0	Tstep
Bone1	1	138.7	10.9	200	199.7	12.5
Bone1	1	151.2	23.4	200	205.2	12.5
Bone1	1	163.7	35.9	200	205.2	12.5
Bone1	1	176.2	48.4	200	204.8	12.5

Sample measurements in (3) shows an extracted example of the F0 points collected through Praat. The second to last column represents the F0 traces collected from the recordings using a Praat script. The following two figures were created using R and represents the F0 over time in each word and in each vowel, the F0 was normalized for each recording. The figures below represent the normalized F0 traces.

Figure 1.

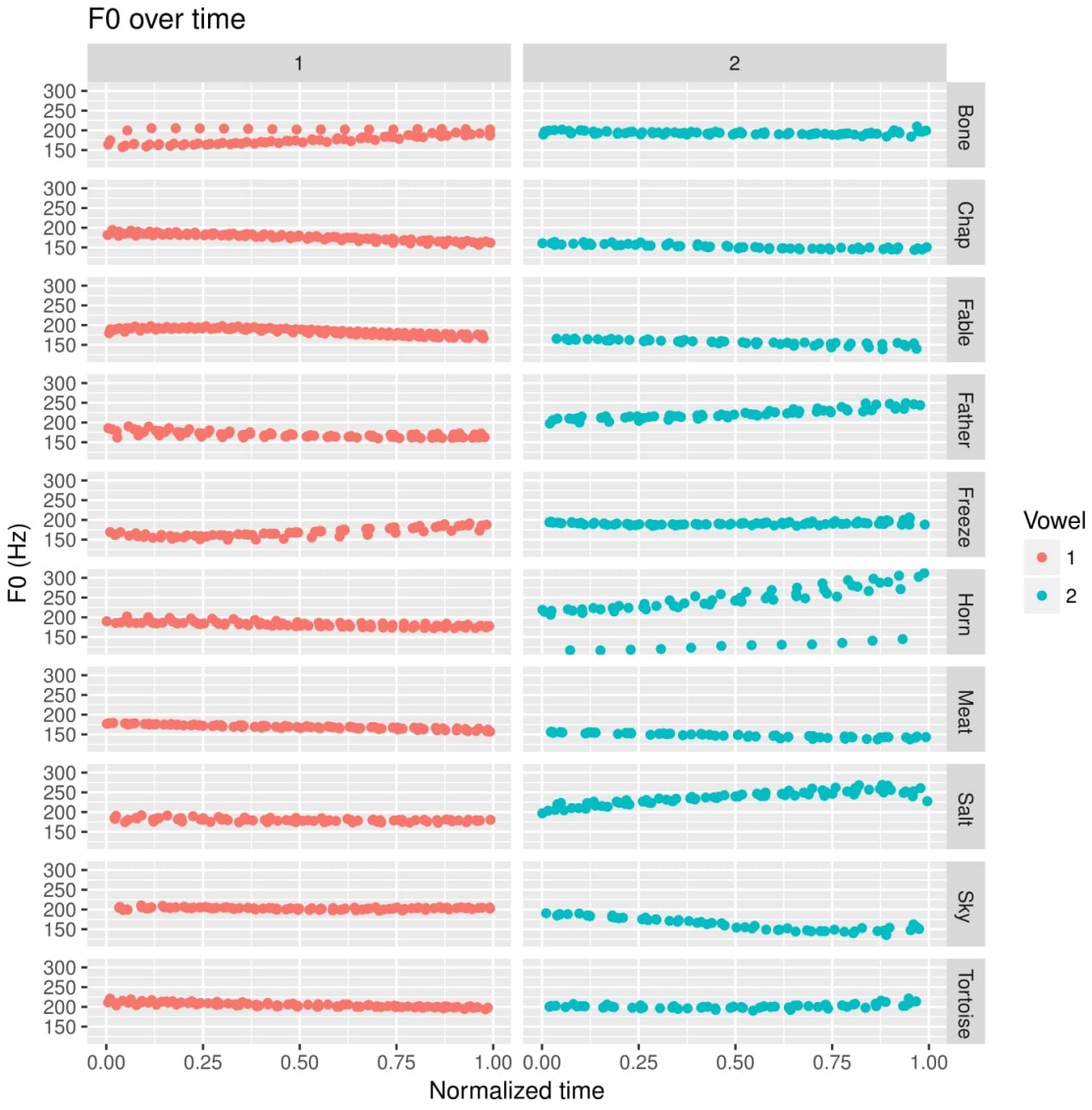
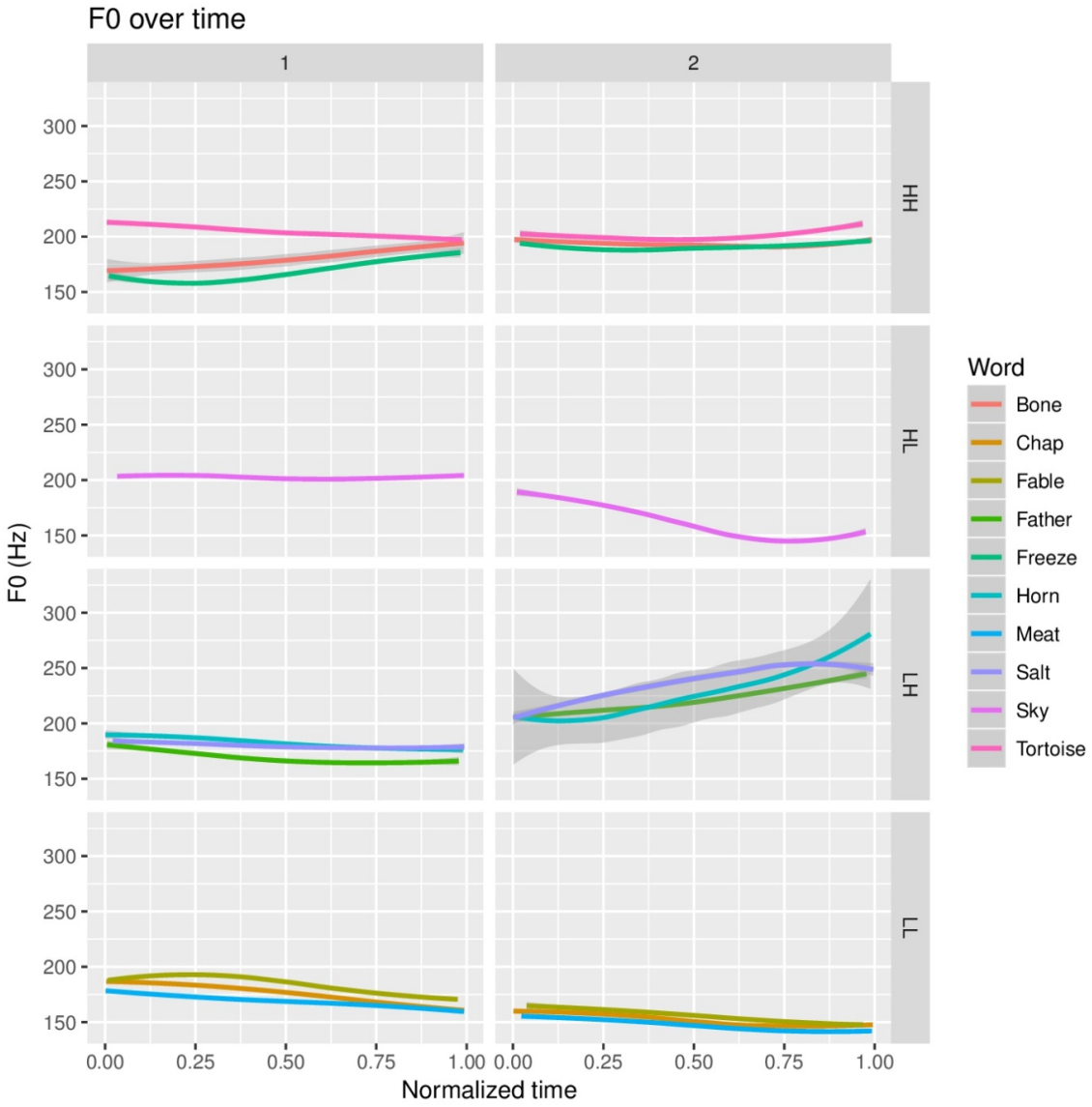


Figure 2.



By considering the graphs above, the offset of the vowel is the most likely candidate for the tonal target. This can be seen in the examples of the words grouped in the HH category. The onset of a H tone word could have an F0 value as low as a L tone word but they all gather at the same offset point of the first vowel. On the other hand, the so-called L tone doesn't seem to offer up much information as to whether it has a clear target as the L tone is less consistent in its gathered F0 and seems to just continue at a lower F0. Further HL combination nouns are needed to investigate this thoroughly. It is also important to point out that the offset at the final vowel shows some discrepancy, this is most likely due to word ending intonation. The initial voicing of the vowel shows a variation of Hz values while the offset shows a clear point of localization.

4 Phonological Analysis

Looking at the phonological aspect we need to consider if the locus of the tone can help decide whether the tonal contrast is [H] vs [L] or [H] vs [Ø] or [L] vs [Ø]. As mentioned above, the lack of HL contrast is problematic as it would help to see more data from this to determine the locus more clearly. However, I propose that the contrast is H vs Ø as the H tone has a clear target on the offset while the so-called

L tone doesn't have a clear target based on pure observation. It seems like the L tone must be lower that the H tone to be considered non-high, and that this is the distinction for tones in Manyika Shona.

4.1 *Limited Presence of HL Tone* The recordings only included one HL sequence out of all 37 nouns that were elicited. I hypothesize that there must be some phonological constraints that keeps the HL pattern from occurring too often. Cross-linguistically, constraints like these do exist and most commonly the pattern of HH, HL and LH are all acceptable, but the *LL sequence would not be produced. Technically, the production of HL sequences is possible in Shona and are used unlike the example above. If we assume that the tone is anchored to either the onset of the vowel or the offset, we can hypothesis that the pitch pattern would have a rise or a dip on the vowel onset point or the offset point. By looking at the data presented in figure 1, we can propose that the tone is linked to the offset of the vowel. This is especially notable in the LH and HL sequence. With the HL sequence there is only one word elicited but as we can see at the offset of vowel 1, the H tone stays consistent from the onset to the offset, making it clear that the tone must be linked to the offset as if the opposite was true then the offset wouldn't need to be that level. We should see a raising or lowering affect at the offset point. It is possible that if the tone is linked to the offset, it will reach its intended point at the very end of the vowel, therefore when you produce a HL sequence in Shona, reaching the H tone at the very end of the first vowel you must immediately start to lower the tone to reach the intended point for the L tone and it must happen quickly. This may be uncomfortable or difficult for native speakers of Shona making this tonal combination less frequent.

5 Discussion

Having looked at the acoustic signals and the phonological realization of tones in Shona, we must first consider how the tonal representation of the acoustic study is realized. Consider the pitch movement of HH in figure 2. If the tones are anchored to the onset of the vowel then they should appear to have H target. However, some of the classified H tones have the same pitch realization as a L tone. To the offset of the vowel the H tones of the HH examples all seem to have a definite target. Take the word "tortoise", it has the highest F0 point at the onset but is lowered at the offset to reach the same point as the other HH words. The second vowel of the HH pattern has the same realization of height as the offset of vowel 1. The LL segments are realized as a gradual lowering from vowel 1 to vowel 2. Seeing as there is only one example of HL the level of description and definite arguments we can make are limited, but the H tone clearly seems to have a target, the L tone doesn't reach its target until after the onset of the vowel. This could be postulated as the L tone being the undetermined tone, also referred to as /Ø/. Further, the LH examples prove that the tone must be anchored to the onset as the offset gives the LH tone too many variable movements. For the LL pattern, the second L tone is lower than the first vowel; this could be assigned to downdrift. Another possibility is that the L tone is specified by suggesting that the HL sequence is deemed "difficult" for a speaker, if it is, it may suggest that there is indeed a L tone target, or a slight lowering could have been sufficient to distinguish the H vs /Ø/ contrast.

6 Conclusion

This paper has focused on the phonetic and phonological realization of tones and its distribution in Manyika Shona. Acoustic studies of tone based on elicitation are particularly difficult as there are many variables to consider. It is likely that the tones in Shona are linked to the offset of the vowel as presented through the F0 plots. This makes the sequence of HL hard to produce as you must quickly reach a new target as soon as you have realized the first tonal target. Future study of Shona tones would be needed to make a definite conclusion to where the tones are linked as well as more research into the HL sequence. The contrastive tones cannot be fully determined without further analysis and a larger collection of data, but the data collected so far suggests a H vs /Ø/ contrast for Manyika Shona.

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