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Tone Faithfulness and Identity in Duala Lullaby

Dikongue Rachael Dikongue

Department of theoretical Linguistics, Faculty of Arts, University of Buea

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***Corresponding author:** Dikongue Rachael Dikongue
Department of theoretical Linguistics, Faculty of Arts, University of Buea

Abstract

This article explores the relationship between spoken tone and sung tune in Duala lullabies, a soothing music genre within the Douala traditional or ethnic songs. Duala is a Bantu language spoken in the Littoral region of Cameroon. The research on the relationship between spoken tone and sung melody has been ongoing for decades now with results varying grossly across languages, within the same language (different song genres) and even depending on the preferred methodology. While some song genres like gambling songs have been said to have a higher level of correspondence between tone and tune (Herzog 1934), others like gospel songs have been proven to show a lower degree of correspondence between tone and melody (Rycroft 1979). One of the major questions often asked and which this paper attempts to answer is; how do the native speakers of a language understand the lyrics of the songs even after they have been altered to satisfy the needs of the song melody? The main results of this study show that, even though the words are forced to obey what we call "the obligatory melodic pattern" of the melodic line of the songs, what seems to be a sacrifice of the tonal identity of the words is rather only at the surface level. Underlyingly, those words always look for ways to recover their identity. Positional faithfulness proves evident in lullabies as words found in strong positions (final position of the melodic lines) maintain their tonal identities.

Keywords: *lullabies, positional faithfulness, obligatory melodic pattern, Duala songs*

1. Background to the study

The research and debate on the opposing nature of spoken tone and sung tune in tonal languages is still ongoing, with different languages having different levels of correspondence between the two. According to Schellenberg (2009), a culture may be presumed to have three basic choices when it comes to representing speech tones in music: linguistic tone can be slavishly followed; it can be abandoned completely; or a position somewhere in the middle can be taken. After an extensive analysis of the relationship between tone and melody in over 25 different languages, results and conclusions have found supporters in all three camps. Studies examining the interrelationship between linguistic tone and melodic tune have yielded seemingly inconsistent and even contradictory results with evidence. While a plurality of studies surveyed for this research (approximately 52%) report finding a high degree of tone and tune matching (Mendenhall 1975; Leben 1983; Chan 1987; Wong & Diehl 2002; Wee 2007; Schellenberg 2009; 2011; Morey 2010; 2014; Sollis 2010; Karlsson et al. 2014; Ketkaew & Pittayaporn 2014; Lissoir & Demolin 2015; Kirby & Ladd 2016; Proto 2016), others report a low degree of tone-tune correspondence in languages such as Northern Ewe (Agawu 1988), Cantonese (Ho 2006), Kalam Kohistani (Baart 2004), Dagaare (Bodomo & Mora 2000), and in Mandarin (Schellenberg 2012b). Furthermore, even within the same language, contrasted results are yielded depending on what genre was investigated and/or what approach was used (Gibbon, Ahoua & Kouamé 2011; Connell 2012; Herzog, 1934; Richards 1972; Rycroft, 1979).

According to Elliott (2020), one of the earliest studies to look at the relationship between linguistic tone and melodic tune was carried out by Herzog (1934), who discovered that different musical genres yielded divergent degrees of tone-tune correspondence. The differences in results were not only limited to folk songs, as even some popular or secular music have witnessed similar differences across languages. Interestingly, scientific investigations have seen a field of researchers whose aim was to

look into the validity of this finding and, after so many years, the results continue to differ according to languages, genres and even the preferred methodology. Authors like Ho (2006) and Schellenberg 2011, examined the popular music produced in Hong Kong ('Cantopop') and discovered that alignment of tonal and melodic transitions is both empirically robust and salient to listeners. The results of past researches have prompted a lot of researchers like Kirby (2016) to ask questions like "if pitch is being used to distinguish meaning, how can speakers of tone languages understand lyrics when they are set to music? In other words, how is (linguistic) tone reconciled with (musical) melody?". A lot of researchers like Saurman (1999) claimed that, the subjects' ability to understand the song could be attributed to native speakers' "familiarity", "association", and "prior experience" that enable them to associate meaning to the words regardless of the mismatches between linguistic tone and melodic tune. Ladd (2013) concluded that the use of voice pitch for musical purposes coexists with the phonological uses of pitch in a tone language in two main ways: in mostly residual phonetic detail, and in constraints on text-setting. The Linear Conventionality Scale continuum based on research by Gibbon et al. (2011) illustrated the different song genres and their levels of tone and tune correspondence across different languages of the world but even this cannot be said to be true for all the languages of the world as different languages still prove contrary when it concerns tone and tune correspondence.

1.1 Lullabies in the Duala

According to Berliner (1949), the English word "lullaby" comes from Middle English "lullai, lulli", to which an ending "by" is added. "Lullai" is an interjection used in cradle songs and "by" later became "bye-bye", meaning "go to sleep". The synonyms of the verb "lull" are "sooth", "calm", "hush" and "rock". According to Gurak (2017), Lullabies are the first contact of a child with music. Hasanuddin and Zulfadhli (2020), further explain that, lullaby songs are functional folk songs whose texts or lyrics and songs play an equally important role, called to function because both the lyrics and songs are in accordance with the rhythm of special activities in human life. The further explain that lullabies are more similar to the genre of poetry than prose. As a poem, the text of the lullabies is divided into two formats: the physical format (line, stanza, sound, diction, imagery, and figurative language), and second, the inner format (theme, message, tone and atmosphere).

In Duala, recitals play the role of lullabies as most of the lullabies are usually short stories that carry warnings. In most cases, these warnings serve as lessons that parents implant in the minds of the children even as the children fall asleep. Duala lullabies are mostly performed by mothers and are often accompanied by rhythmic taps, usually on the child's back to enable them drift to sleep.

1.2 Positional faithfulness

In Optimality Theory (Prince & Smolensky 1993), the grammar of a language consists of a set of constraints and a ranking of those constraints. The constraint set is universal, so the only language-particular aspect of a grammar is its constraint ranking. As a result, constraint ranking plays a crucial role in many domains of language. There are many examples of OT analyses in which typological facts are used to refine the formulation of the constraints developed to account for some phonological phenomenon. One such proposal is the theory of positional faithfulness (Beckman 1995, 1998; Casali 1996). The theory of positional faithfulness (Beckman 1995, 1998; Casali 1996) is one approach that has been taken within the Optimality theory (OT), toward the problem of positional neutralization, a type of phonological process in which material that is contained in a 'strong' position is resistant to neutralization processes (generally featural) that affect material in the corresponding 'weak' position. According to OT, faithfulness constraints demand that the output be as close as possible to the input, along all the dimensions upon which structures may vary (Prince & Smolensky 1993), although perfect identity cannot always be attained (McCarthy and Prince 1995).

1.3 The Obligatory Melodic Principle (OMP)

There are many different definitions of melody. Kim et al. (2000), define melody as an auditory object that emerges from a series of transformations along the six dimensions: pitch, tempo, timbre, loudness, spatial location, and reverberant environment. While Solomon (1997) define it as a combination of a pitch series and a rhythm having a clearly defined shape. One certainty about the different definitions is that melody involves more than just lyrics of a song. While a lot of research has been carried out on the relationship between tone and melody have yielded different results, one thing they all have in common is that they all agree that the melodic structure of the music played a great part in the outcome of the results. The OMP states that the melodic demands of a contour line must be obeyed despite the demands on the internal tonal structure of the word. Each song has one, once the melody of any song has been set, it is now up to the language to fill in the melodic lines with words that correspond with the demands of these melodic lines. The impact of OMP can be seen when songs and even nursery rhymes are sung in a different language. A rhyme "twinkle, twinkle little star", will always maintain its melody even if the rhyme is sung in another language.

The lullaby that was investigated for this research always ended on a low note, regardless of the tonal identity of the words that were found in this position. It was observed that, OMP banned the presence of a high tone on the final two words of the melodic line, and so all the words that were found in that position had to carry a low note by default.

This paper investigates how tones in a Duala lullaby maintain their tonal identity when put in song. we argue that although these words are altered at the surface level in order to satisfy OMP, these changes are only surface deep as the language always looks for ways to recover its identity underlyingly. We investigate the relationship between tone and melody using two different approaches: the tone-tune directionality (Ladd 2013 & Schellenberg 2009) and the experimental approach (Boersma & Weenink, 2010). In section 2, we are going to look at the methodology. Section 3 presents the results, while section 4 concludes the paper with discussions and conclusions.

2. Methodology

Two female consultants were interviewed for this work, both being in the early 50's. both women are mothers with the youngest being a mother of four kids and the later a mother of five. It was important that we consult only women, and with children, because lullabies are songs that are (mostly) sung when mothers try to rock children to sleep. Both women spent the majority of their lives in Douala where they lived and studied before travelling to other parts of the world for work and or business. The selected song was sung without the aid of any instruments, or rhythmic taps as is the culture while singing a lullaby to a baby.

Corresponding author: Dikongue Rachael Dikongue

The recordings took place on the 15th of April, 2022 at one of the consultants' residents in Tiko more than 500 meters from the tarred road, in and enclosed and quiet area of the house. The selected lullaby, is a folk song with origin as old as time, with their knowledge being passed from generation to generation. The song was sung for a total of three times, the lyrics of the song was written and the words were used as spoken data, which was recorded a number of five times per token. Both consultants took turns in singing the songs and speak the various words of the songs which were all recorded and later transcribed accordingly.

Two approaches were used to analyze this data. The first is the tone-tune directionality approach and the second, the experimental approach. The first approach was propounded by Ladd (2013) and Schellenberg (2009). The main aim of this approach is to be able to compare tonal patterns to musical transitions in songs. They propose the following pattern:

Table 1. Ideal musical sequence

Tone sequence	Ideal note sequence
L H	Up
H L	Down
H H	Level
L L	Level

Source: ***Elliot (2020, p. 142)***

The expectation is that when the tone sequence moves from a low (L) tone to a high (H) tone, there should be a concomitant rise in the musical score as well. Following Kirby and Ladd (2016), we distinguish among three types of alignment. First, alignment is parallel if a rising tone (LH) is mapped onto rising music, a falling tone (HL) onto falling music, or a flat tone (HH or LL) onto flat music. Second, alignment is contrary if a rise is mapped onto a fall, or vice versa. Otherwise (when a contour tone is mapped onto flat music, or a flat tone onto changing music), the alignment is said to be oblique.

The second approach used for this research is the experimental approach. The audio recordings of all sessions were transferred to PRAAT for acoustic analysis. The signals were segmented into syllables and the mean fundamental frequency was calculated for each syllable. Mean F0 was used to capture any changes in F0 over the duration of the syllable; if the singer modifies the song melody in some way to reflect the speech melody, mean F0 would be expected to capture the changes. Once the F0 measures were calculated, the transitions from one frequency to the next were examined. For any given syllable, there are three possible directions in which the fundamental frequency can move: up, down or remain the same. A sequence of transitions creates a melody. In this paper, melody is used to refer only to the transitions. In musicology, melody is usually considered to include both transitions and rhythm but, in this study, rhythm has been excluded.

All recordings were done using a Remax RP1 recorder connected to an Omni-directional condenser microphone with exceptional signal-to-noise. Speech data was recorded digitally at a sampling rate of 44.1khz. The recording format was in wav, with a recording quality of 512kbps-1536kbps.

Two variables were used in this research: the dependent variable which is the tone (spoken data) and an independent variable which is the melody (sung data). The consultants were first recorded singing the selected lullaby (sung data), the lyrics of the lullaby was then written out and used as the spoken data. The mean frequency of both the spoken and the sung data was later compared in order to investigate the relationship between the two. A comparative test was administered (ANOVA) in order to get the difference between both variables so as to be able to understand the significance of the differences. this was done by cross-referencing the mean frequency of the spoken sounds of the words against the sung ones. The P-values of both variables were analyzed, P-values below a 0.5 or less means that there is a significant difference between the two values compared while higher P-values means that there is not a significant difference.

This work is work is focused on the melodic endings of the song, this is because the highest number of mismatches occurred between tone and melody occurred at the end of the melodic lines while the highest number of matches occurred at the beginning of the melodic lines

3. Results of lullaby: *múná wúbà*

3.1 Tone-tune directionality approach

The lullaby was made up of four lines and twenty-three words. All the lines started on a low note and ended on a low note. Each of the four lines had a maximum of six words for the first and the last line and five words for the second and the third line, however, only nouns, verbs and adjectives were analyzed for this research. The first line of the song was made up of six words; two nouns, two verbs and two lyric fillers. The second line was made up of six words; one noun, two verbs and three lyric fillers. The third line was made up of five words; one noun, two verbs and two lyric fillers. Finally, the fourth line was made up of five words; one verb, one adjective and three lyric fillers.

Table 2. *Directionality alignment for the lullaby (múnà wúbà)*

Melodic lines	Parallel	Contrary	Oblique	Total
1	2	1	1	4
2	1	1	1	3
3	1	1	1	3
4	0	1	1	2
Whole song	4	4	4	12

The words found within the first four words of the first line matched in tone and melody because the words were allowed to maintain their tone, however, the last word of the line originally carried a H and a falling tone but the position required just words with low notes, therefore causing a mismatch between tone and melody, same can be said for the second line since it is a repetition of the first line. The first word of the third line (*Mwěn)* was made up of a falling tone which caused a conflict because the melodic line required the position to be filled with a low tone word, to solve the conflict, the melody simplified the contour tone by selecting the tone which best fits its needs which in this case is the low tone. The second and the third positions of this melodic line, allowed for words with high tones to keep their tones and so all the words found within this environment matched in tone and melody, however, the fifth position of the line was occupied by a word which did not suit the requirements of the melodic line (*bwábè)* bringing about the second mismatch between tone and melody in

Corresponding author: Dikongue Rachael Dikongue

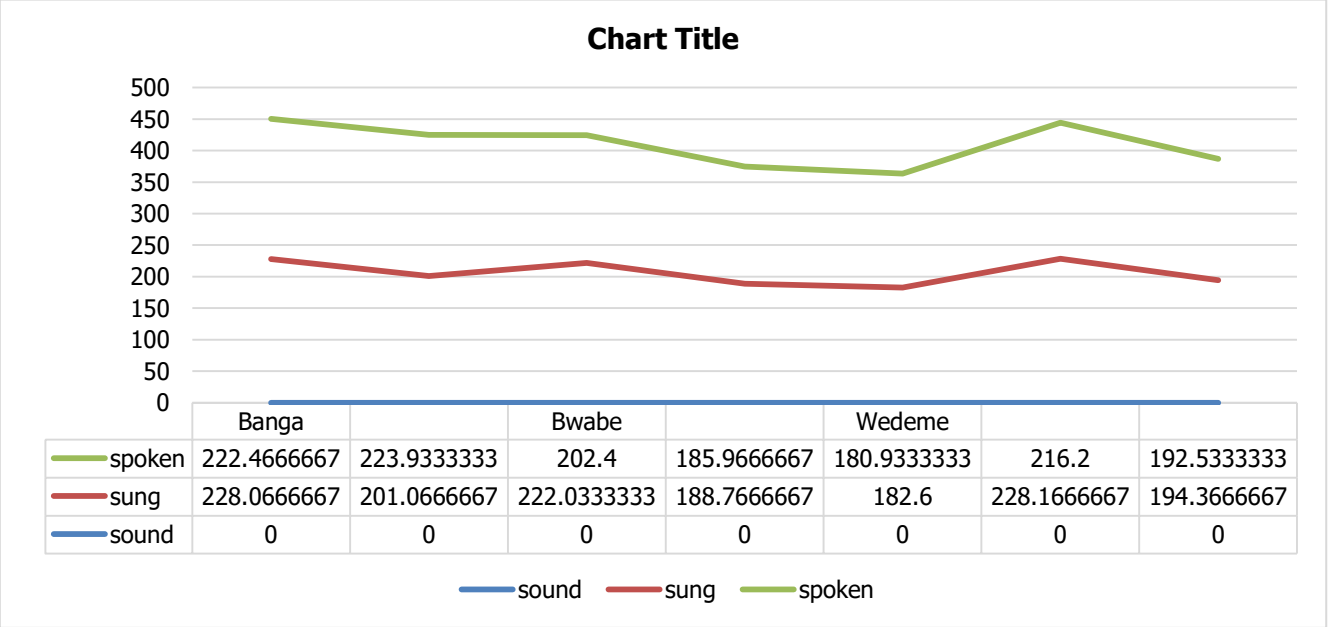
this song. The fourth melodic line demanded that the song ends on a low note and so demanded for all the words of the line to be of low notes and so words that carry high tones were not allowed on this line and when they did, the melody made sure that they were all pronounced with a low note which caused the mismatch of two other words *(Kwálâ, Wèdémè).* For the first word *(Kwálâ),* the melody changed the first high tone to a low tone and again, it simplified the low tone by selecting the tone that best fit its needs which is the low tone.

Out of the 12 words analyzed, only four words corresponded in tone and melody. Judging from the results using this approach, we can conclude that contour tones are strongly prohibited from the melodic lines. This finding is in line with Medenhall's (1975), who notes that contour tones generally follow the direction of their tone. The author claims that, rising tones are sung as ascending and falling tones as descending. This is true for this lullaby, as we see the first word which carries a rising tone in isolation (mwěn), later changes to a low tone in order to fulfill OMP, which demands for the word to carry a low note (mwèn). However, the next word after (mwěn) carries a high tone which preserves the contour structure of the tone.

1.1 The Experimental Approach

According to the experimental approach, the high vowel in *báŋgâ* which measured at 222.4Hz when spoken in isolation measured at 228 when sung and same applies for the second vowel /â/, which measured at 223.9Hz in isolation and 201Hz even after the melody of the caused the word to be pronounced much lower than it is pronounced in isolation. The second word worth talking about is *bwábè,* which is made up of a high and a low tone. However, within the melodic line, it is pronounced on a very low note because of the position it finds itself, however, when we compare the frequency of the vowel when spoken and when sung we notice that very little changes occur underlyingly. In isolation, the first vowel /à/ has a frequency of 202.4Hz and when sung it has a frequency of 222 Hz. The second vowel /è/ has a frequency of 185.9Hz when spoken in isolation and a frequency of 195Hz. The third word (Wèdémè) also changes from a L H L in isolation to a L L L when sung, however, an analysis of the word proves that though it changes on the surface, it maintains its form underlyingly. The first vowel /è/ measures at a 180.9Hz in isolation and 182.6 Hz when sung. The second vowel /é/ which is pronounced at a frequency of 216.2Hz in isolation has a frequency of 228.1 Hz when sung although it changes from the H to a L on the surface. Finally, the last vowel/è/ has a frequency of 192.5Hz in isolation and a frequency of 197.2 Hz when sung. This can be better illustrated thus:

Figure 1: comparative analysis of the final words of the song



Drawing from the results of the data, the ANOVA test was administered to compare the spoken and sung forms. The results can be seen on the table below:

Table 3: Comparative Test Results

Word	Sound	Sung	Spoken	P-Value	Significance
Báŋgâ	/á/	228 Hz	222.4Hz	0.069722718	Insignificant
	/â/	201 Hz	223.9 Hz	0.003981919	Significant
bwábè	/á/	222 Hz	202.4 Hz	0.009381265	Significant
	/è/	188.7 Hz	185.9 Hz	0.00021245	Significant
Wèdémè	/è/	182.6 Hz	180.9 Hz	0.11117447	Insignificant
	/é/	228.1 Hz	216.2 Hz	0.052488731	Significant
	/è/	194.3 Hz	192.5 Hz	0.320099979	Insignificant

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According to the data, we can see that, the sung variable of the words experienced a significant rise in the F0 of the vowels except for the contour tone which experienced a reduction in its frequency. This rise was not limited to the high tone, as we can see even the words bearing low tones manifesting a similar pattern. However, the mean frequency of the high tone manifests a higher increase than the frequency of the low tone. While the mean frequency of the high tone saw an addition, which ranges from 5.6 to 19.6 Hz, the low tones only saw an addition which ranged from 1.7 to 2.8 Hz. This increase in the mean frequency of the vowels, is what accounts for the number of insignificances in the comparative analysis of the dependent and independent variables of the analysis.

Judging from the presented data, some generalizations can be made; firstly, there is an obligatory melodic principle that must be followed in order for the songs to retain their musicality and the words within the melodic lines are forced to follow these patterns whether it affects the original structure or not. For example, we notice that in lullabies, all the melodic lines must end with a word that carries a high tone irrespective of the melodic demands of the melodic lines except for the fourth and the fifth melodic line which may end in a low tone. In the case of the second song, the tone sacrifices its identity on the surface level to satisfy the demands of the melodic line but it however, uses others means to recover from its loss which in this case is sung stress or accent. This sung was written using a tetratonic scale which means that it consists of four notes per octave, that is, stress or accent is assigned to the first and the last word of the melodic line. every word that is found at the prescribed positions will be pronounced with and extra force which in turn serve as a balance between the loss of the tonal values and helping the words to maintain their tonal identity.

The results of this data prove that the maintaining tonal identity is of utmost importance in this language. The theory of positional faithfulness explains a phonological process in which material that is contained in a 'strong' position is resistant to neutralization processes (generally featural) that affect material in the corresponding 'weak' position. According to Beckman (1995, 1998), initial syllables are strong positions while non-initial syllables are the weak positions that are easily neutralized. According to the results of this research, we can extend the positional faithfulness theory by saying that, the ends of the melodic lines are the strong positions which are resistant to change. The following constraints better explains the data as follows:

*contour: no contour tones may appear on the ultimate tone bearing unit of the melodic line

IDENT I-O (F): the input and the output must have identical underlying tonal features

*H (R, MeL): no high tones are allowed on the right edge of the melodic line

* Max: every segment in the input must have a correspondent in the output

The following constraints can be ranked as:

IDENT I-O (F) >>*H (R, MeL)>> * Max

The above ranking can be demonstrated on a tableau below as:

Input: Wèdémè	IDENT I-O (F)	*H (R, MeL)	* Max
Wédémè	*!	**	*
Wèdémè	*!	**	*
➡ Wèdèmè			*

It is worth mentioning that the melody of the sung affects contour tones differently. A total of three words (*mwěn, báŋgâ* and *Kwálâ*) carried contour tones and they were all affected differently depending on their position in the melodic line. While the rising tone on *mwěn* was located at the initial position of the melodic line, *báŋgâ* was located at the final position of the melodic line and *Kwálâ* was located at the third position of a five-word melodic line. all changed to low toneall of the words were all changed to low, however, while *mwěn, and báŋgâ* all experienced a reduction in the mean frequency of the F0 of the vowel; *mwěn* changed from 235.2Hz to 196.1Hz, while *báŋgâ* changed from 223.9Hz to 201 Hz. However, the F0 of the falling tone on *Kwálâ* increased from 198.8Hz to 225 Hz.

4. Conclusion

This research, answers the question of how native speakers are able to understand the lyrics of a song, even when the tones of the words are altered in order to satisfy the melodic demands of the song. The results disagree with Saurman's (1999) claim that, the reason native speakers are able to still understand the lyrics of the song even when the tones have been altered, is because of the native speakers' prior knowledge of the language. This research however proves that, the changes on the forms of the tones of the words are only surface deep, as underlyingly, the words remain the same. The results of this research prove that, while melody does play an important role in the outcome of the pitch of a lyrical composition, the tones in a tonal language will always sought out means to stay relevant, even if it means a modification of its identity.

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Corresponding author: Dikongue Rachael Dikongue