Text-to-Tune Alignment in the Music of *La Charanga Habanera*

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Abstract

Text-to-tune alignment (setting lyrics to music) involves the coordination of two distinct rhythmic structures: linguistic prominence (stress) and musical meter (rhythm). Prior scholarship suggests that these two rhythmic hierarchies tend to align themselves in the most straightforward way possible – stressed syllables will fall on musically strong beats – but my thesis shows that this generalization does not always hold. I transcribed the lyrics of the first four albums recorded by *La Charanga Habanera* (*CH*) a currently popular Cuban group. Because of its strong African influence, Cuban music exhibits a high degree of rhythmic complexity, and these rhythms interact with Spanish stress patterns in unexpected but systematic ways in *CH*'s music. In my analysis I show how inter-word vowel elision (synalepha), which is the typical pattern in spoken and poetic Spanish, is obligatory in lyrics except under very specific conditions. I also show how the text-to-tune alignment patterns established in the first three albums shifted in the fourth, when the group began to incorporate elements of rap into its music. Finally, I formulate some well-formedness constraints that govern the placement of stressed and unstressed syllables within the musical rhythmic hierarchy.

Introduction

The analysis of text-to-tune alignment (also called text setting) is hybrid by necessity, requiring expertise in both linguistics and music theory. Kiparsky (2006) describes text-to-tune alignment as the navigation of "*three* tiers of rhythmic structure: linguistic prominence, poetic meter, and musical rhythm" (7). Understanding and describing how the human mind comes to coordinate these normally distinct structures in a single whole is a difficult but fascinating problem. The results of studies of text setting bear on the cognition of both linguistic and musical structures, not only when they co-occur, but also separately.

Analyses of text setting must consider how weak and strong elements from each of the rhythmic structures align with such elements from the other structures. Are strong syllables always placed with strong beats? Can strong metric positions accept unstressed syllables? Does a weak rhythmic position ever take a stressed syllable? These are some of the questions that must be answered in a study of text-to-tune alignment.

Making a broad generalization about the alignment of lyrics and music, Chen (1983) writes that "musically strong beats normally fall on stressed syllables" (84). In the following paper I consider text-to-tune alignment in the music of a Cuban group called *La Charanga Habanera*, which (like most African-derived music) displays a high level of rhythmic complexity. I expected that, due to its complex rhythmic structure, this music would display some interesting and unusual properties in its text setting and show significant divergences from Chen's generalization. I was not disappointed.

For the purposes of this analysis, I considered only two of Kiparsky's three tiers of structure – linguistic prominence and musical rhythm – since I could not discern any evidence that the lyrics had a poetic meter distinct from the other two rhythmic structures. My analysis thus focuses on the alignment of the prominence hierarchies of lexical stress and musical meter. I considered this alignment from two different perspectives, firstly as statistical distributions and secondly as a system of formal constraints. Interesting findings result from both perspectives. Before I present these findings, I will briefly review some relevant background information of both Spanish phonology as well as Cuban music.

Linguistic Background

There are two properties of the phonology of Spanish that are worth reviewing here. First, regarding stress, Flores (2004) writes that:

> Nouns, adjectives, verbs, adverbs, disjunctive pronouns, numerals ... are always stressed regardless of whether they are pronounced in isolation or in connected speech. In contrast, definite articles, object/reflexive pronouns, monosyllabic possessive determiners, most prepositions, coordinators ... are usually not stressed in connected speech. The quantifier *un/una* when functioning as a determiner, it is usually unstressed in connected speech but it may be stressed for a contrastive effect. (13)

Despite this characterization of stress, as a preliminary analysis I assumed that all polysyllabic words have lexical stress on one syllable, even prepositions such as *como* ('like') and coordinators such as *pero* ('but'). This characterization of stress turned out to be the most appropriate one in terms of text setting; in no case did a stressed syllable from a function word appear in a rhythmic position that a stressed syllable from a content word did not.

Second, Espinosa (1924) explicates rules for inter-word vowel elision in modern Spanish. He explains that, in spoken Spanish, when one word ends with a vowel and the next word begins with a vowel, there are two options. It is possible for a speaker to elide the two vowels into a single syllable, e.g. *como* and *una* become *comuna* (he calls this 'synalepha'). It is also possible for consecutive vowels between words to be pronounced individually as two separate syllables, just as they would be written (he calls this 'hiatus'). He writes definitively that "in [spoken] Spanish synalepha is the rule and hiatus is rare" and furthermore that "in modern poetry the relation of synaphela to hiatus is the same proportion" (302, 308). Thus combining adjacent vowels into one syllable is overwhelmingly the pattern in both conversational and poetic Spanish.

Musical Background

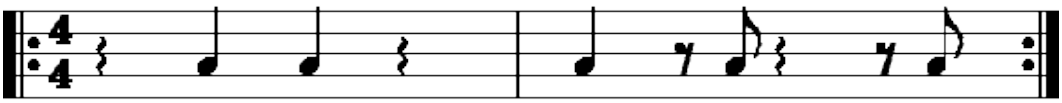
La Charanga Habanera (hereafter *CH*) was founded in Havana, Cuba in the late 1980s. The name of the group derives from an older style of Cuban popular music (called *charanga*),

which comprised the group's repertory in its first years of existence. In 1992 *CH* shifted its direction entirely and began to compose, perform, and record music in a more modern style (later dubbed *timba*). Soon after, *CH* became one of the most popular groups in Cuba, helping to define the genre of *timba*, and it continues to be a highly successful group today. Through the course of its 15-year history the group has undergone several changes in personnel, and so here I will focus only on its first four albums, on which the personnel remained relatively constant. These albums are *Me Sube La Fiebre* (1993), *Hey You, Loca!* (1994), *Pa' Que Se Entere La Habana* (1996), and *Tremendo Delirio* (1997). Some songs are in a ballad style or an older *son* style, but for my analysis I only considered the 34 songs in the *timba* style.

Nearly every *timba* song by *CH* (or by any other group) consists of two primary parts, and this is true in other styles of Cuban music as well. The first part, called the *cuerpo* (meaning 'body') is typically sung by a single lead singer, which tends to be more harmonically varied and relatively low energetically. The second part, sometimes called the *montuno*, is sung in a call-and-response fashion between a lead singer and another chorus of two or more singers, and tends to be harmonically repetitive and higher energetically. In this section, the lead singer sings improvised lines in between repeated refrains called *coros* sung by the entire chorus. For the purpose of this paper I will focus on the repetitive *coros*, which are composed and standard across performances, rather than the part of the lead singer, which is often improvised and so displays variation across performances.

In order to properly understand the rhythmic structure of *CH*'s music, it is necessary to understand a rhythm known as *clave* (meaning 'key' or 'clef') which is the basis of almost all Cuban popular and folkloric music. The word *clave* refers to the rhythm but also to the instrument that was originally used to play it (a pair of wooden sticks). *Clave* can be conceptualized in either 4/4 or 6/8 time, but the music of *CH* is exclusively in 4/4. *Clave* as a rhythm is a repetitive two-measure phrase (consisting of five notes), and is played more or less continuously throughout an entire song.

When played in 4/4 time, *clave* comes in two varieties, called *rumba clave* and *son clave*, which differ only in the placement of one of the five notes. *CH* always uses *rumba clave* in its music, which is notated here in traditional western musical notation:



In part due to the *clave*, it is best to conceptualize the underlying rhythmic framework of the music of *CH* as two measures of four-beats each, with each beat subdivided into two parts. These 16 total rhythmic positions might be depicted as follows:

	+	2	+	3	+	4	+	1	+	2	+	3	+	4	+

For the purposes of my analysis I found it convenient to adopt a binary distinction commonly used by musicians. I will refer to the numbered beats as downbeats (in red), and the subdivisions of the beats, notated with the symbol '+,' as upbeats (in green). Using this system of notation instead, a rendering of *rumba clave* would look like this (where an 'x' is a note):

		x		x				x			x				x
1	+	2	+	3	+	4	+	1	+	2	+	3	+	4	+

Here we can more clearly see that of the five notes of *rumba clave*, three are downbeats and two are upbeats.

Musicians often talk about the two different measures of *clave* as two different 'sides' – the 2-side and the 3-side. The name of the side comes from the number of notes of the rhythm that fall on that particular measure. Musically, it is possible to start playing the *clave* on either side, and this is another distinction that will be significant in my analysis. When the 2-side comes first (as above), musicians call the rhythm 2-3 *clave*. When the 3-side comes first, it is called 3-2 *clave*, which I notate as follows:

x			x				x			x		x			
1	+	2	+	3	+	4	+	1	+	2	+	3	+	4	+

Now that the reader has a basic understanding of the *clave* in itself, I should briefly explain its importance to the rest of the music. Although *clave* is repetitious and serves as a rhythmic constant, it does not simply mark a regular pulse. The *clave* does more than just keep time – it also serves as a rhythmic symbol, an abbreviation for the complexity and syncopation present in many of the other instruments (and voices). Washburne (1995) conceptualizes the relation between the *clave* and the rest of the music like this:

> All musical and dance components … are governed by the clave rhythm. In some way, they must correspond at all times to the clave rhythmic pattern.

While this may be somewhat of an exaggeration, it remains true that many of the rhythms played by other instruments only align with the *clave* in certain ways; some characteristic rhythms played on the 3-side never appear on the 2-side, and vice-versa. My analysis will show that the two sides of the *clave* (the 2-side and the 3-side) also exhibit contrastive properties when it

comes to text setting, and that the two orientations of *clave* (2-3 versus 3-2) show differing behavior in text setting as well.

A Note on Notation

I transcribed every *coro* (rhythmically, not melodically or harmonically) from every *timba* song on the first four *CH* albums. The result of this transcription is an Excel spreadsheet, which is included as an appendix. I distinguish between the two sides of *clave*, but I did not distinguish between 2-3 *clave* versus 3-2 *clave*, i.e. I transcribed the lyrics based on where they appeared relative to the *clave* rhythm, independent of which side appeared first.

I begin a new line every time a new *coro* starts. Some *coros* extend over multiple lines (when this happens I use the symbol ~ to indicate the *coro* continues onto the next line). I use **boldface** to indicate, within a polysyllabic word, which syllable carries the greater lexical stress. When two syllables fall onto a single rhythmic position (i.e., in instances of synalepha), I use a hyphen - between them.

Analysis I – Vowel Elision

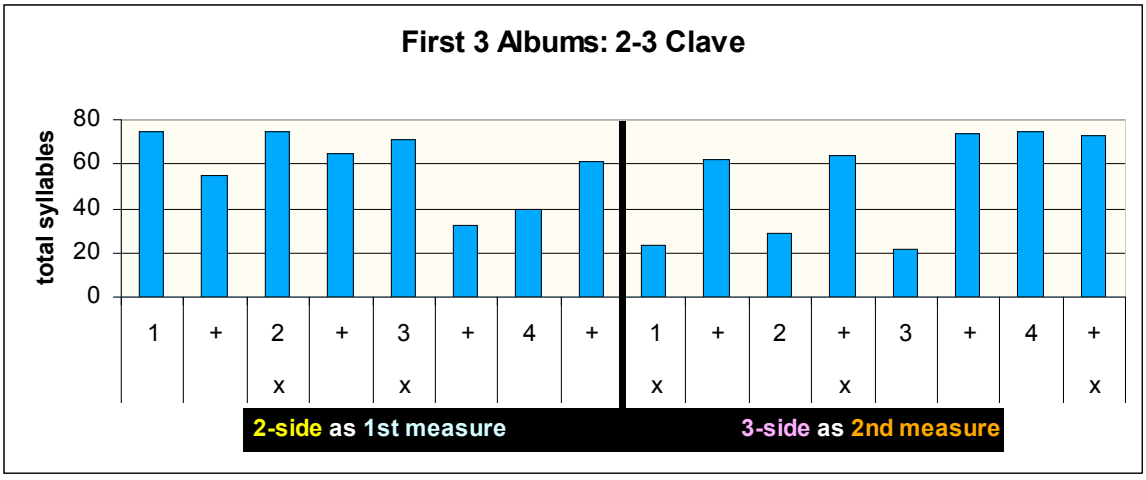
In the corpus, the relative rates of synalepha versus hiatus (i.e., inter-word adjacent vowel combination versus separation) were as Espinosa characterized. There are 138 instances of synalepha, the first of which appears in the first song (line 9 in the appendix): "*Me ha subido la fiebre*." The first and second vowels – the /e/ of *me* and the /a/ of *ha* (since in Spanish the character 'h' is not pronounced) – combine into one syllable and hence one rhythmic position. In contrast, there are only 13 instances of hiatus, one of which happens in the third song (line 27): "*ya tú no eres na'*." Here, even though *no* ends with a vowel and *eres* begins with a vowel, the syllables are kept separate and occupy distinct rhythmic positions.

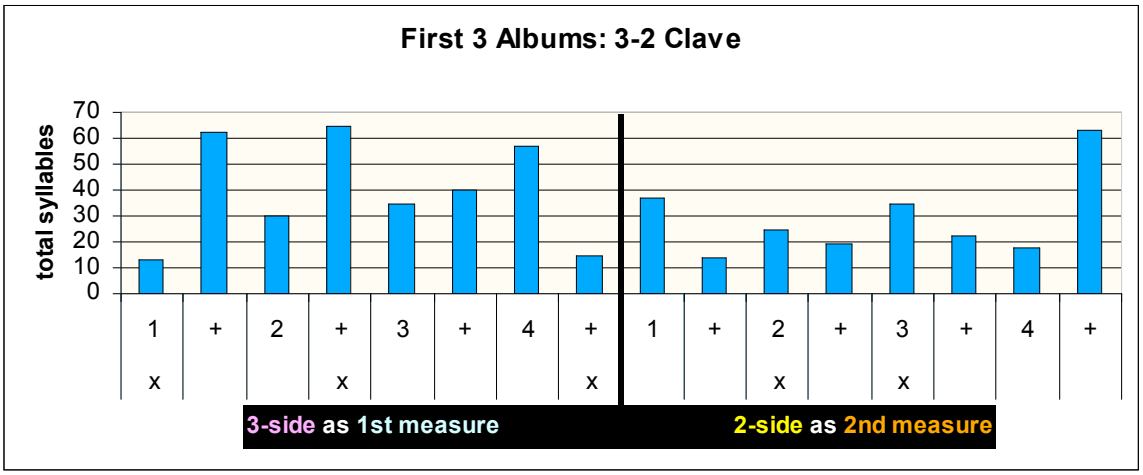
Synalepha appeared in all rhythmic positions and with all stress combinations, but hiatus interacted with both lexical stress and musical rhythm in significant ways. Specifically, in 11 of the 13 instances of hiatus, the second vowel (of the second word) carries lexical stress, and in the two exceptions ("*que es*," lines 26 and 292-3) the second vowel has phrasal stress (*es* as a monosyllabic word cannot have lexical stress by definition). Furthermore, in 12 of the 13 cases of hiatus, this second vowel falls on a downbeat (and in 10 cases this downbeat was a '1' – the strongest rhythmic position). Thus synalepha, the default pattern in spoken Spanish, can only be overridden in the music of *CH* in very specific circumstances, namely when the second vowel, which would normally be subject to elision, has prominence both linguistically (being stressed) and musically (appearing on a downbeat).

Analysis II – Distributions

One way that I analyzed the data was by strictly looking at statistical frequencies. For each album, I examined both the total number of syllables per rhythmic position as well as the ratio of stresses to syllables per position. On both counts, the first three albums display similar distributions, but the fourth album differs markedly. For both albums, with respect to syllables per position, I differentiated between the *coros* that appeared in 2-3 *clave* and the *coros* that appeared in 3-2 *clave*.

I will begin by discussing the first three albums and then move on to the fourth. Here is the sum total distribution of number of syllables per rhythmic position for the first 3 albums (the rhythmic position appears on the x-axis, with the notes of *clave* marked beneath):

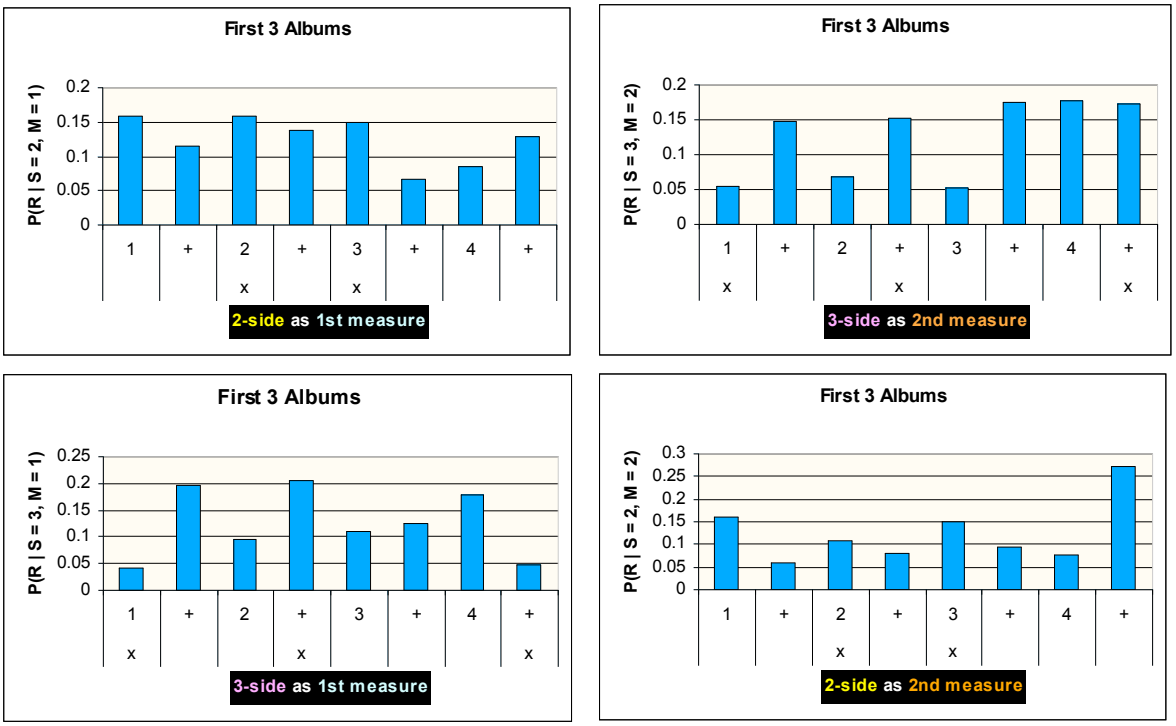




Notice that there seems to be a strong similarity between the different sides of the clave, independent of whether it appears as the 1st measure or as the 2nd measure. If we compare the 3-sides (in pink), we notice that the distributions appear to have a similar shape. Likewise, if we

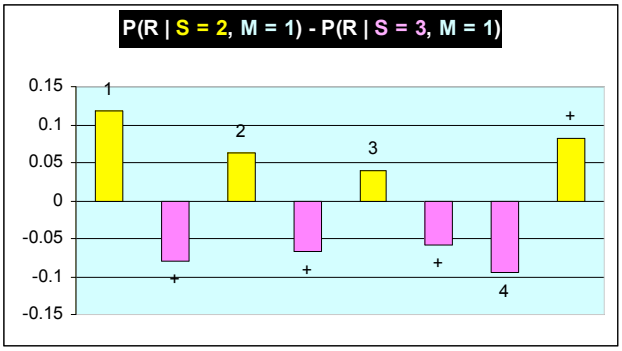
compare the 2-sides (in yellow), we notice that these distributions also have a similar shape (though a different shape from that of the 3-side).

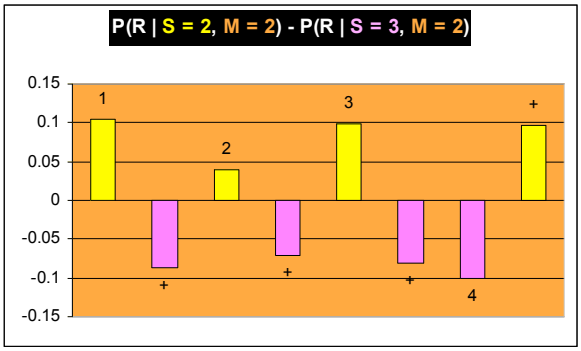
To formalize this visual intuition, due to the existence of 2-3 *clave* versus 3-2 *clave*, we have a cross-cutting distinction, which is the result of two different binary distinctions; each measure can be either a 2-side or a 3-side, and can be either a 1st measure or a 2nd measure. We can conceptualize these distinctions as two random variables (S for side of *clave* and M for measure number), each of which may take on two values (S = 2 or S = 3 for the 2-side and the 3-side, and M = 1 or M = 2 for the 1st measure and the 2nd measure). We can cut each of the above distributions in half at the measure lines, yielding four total frequency distributions. If we then divide each distribution by its total syllables, we get a series of four conditional probability distributions, each of which sum to one. (We assign the rhythmic positions to a third random variable R, which can take on any of the 8 possible positions in any measure.) These distributions tell us, for example, what is the probability that a syllable falls on the 1, given that it falls on the 2-side of the *clave* and the 1st measure. The distributions appear below (with the same shapes as above):



With the distributions conceptualized as conditional probabilities, we can determine which, if any, of the random variables have an effect on the rhythmic position – it is a simple test of statistical independence. If the distribution of rhythmic positions (R) is independent of the side of the *clave* (S), we would expect that the 2-side as the 1st measure would have the same distribution as the 3-side as the 1st measure, i.e. P(R | S = 2, M = 1) = P(R | S = 3, M = 1), and

similarly for the different sides as they appear as the second measure. If the two distributions are equal, their difference should be zero, and so to test for independence I subtracted one distribution from the other. The resulting graphs appear below:



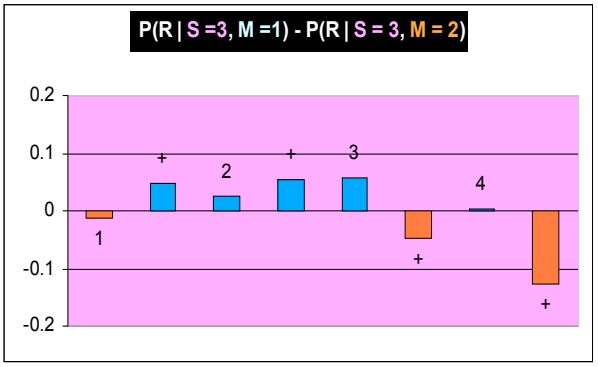


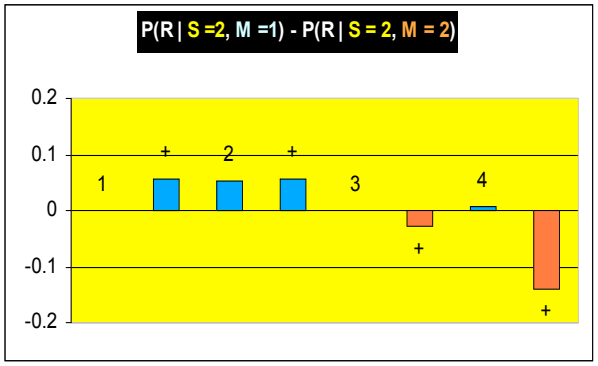
Not only are the subtracted distributions not equal to zero (or close to zero), but they are very similar across the two measures. The size and consistency of the difference across the two measures suggests that there is a very significant effect of *clave* on the syllabic distributions; text alignment follows the underlying rhythmic complexity in a very consistent way. This is a very nice result.

The above graphs give a measure of which positions are more likely to be filled on the 2-side (positive, in yellow) versus the 3-side (negative, in pink). Interestingly, the set of positions that are more likely to be filled on the 2-side (the first 3 downbeats and the final upbeat) is the exact inverse of the set of positions that are more liked to be filled on the 3-side (the first three upbeats and the final downbeat). Such an inverse pattern need not have been found, even if the effect of the side of *clave* had been consistent across measures. The fact that the two different sides of *clave* emphasize the exact opposite rhythmic positions recalls a description by Amira and Cornelius (1992):

> Clave is a two measure pattern in which each measure is diametrically opposed. The two measures are not at odds, but rather, they are balanced opposites, like positive and negative, expansive and contractive, or the poles of a magnet. (quoted in Washburne 1995)

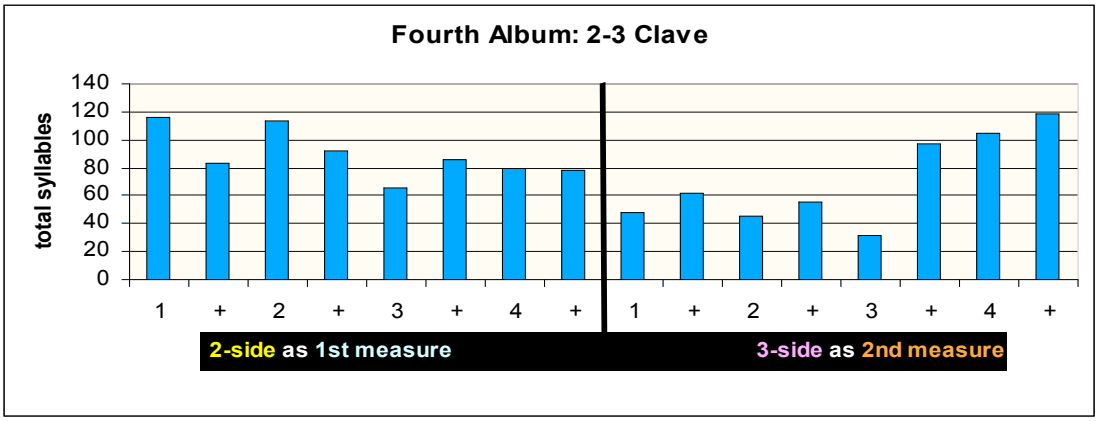
Having established the statistical dependence of syllabic placement on the *clave* rhythm, we can ask if the rhythmic position (R) is similarly dependent on the other random variable, measure number (M). We can perform a similar subtraction, taking the probability distribution of the 1st measure as the 2-side minus the 2nd measure as the 2-side, i.e. P(R | S =3, M =1) - P(R | S = 3, M = 2), and similarly for the 3-side. These subtractions appear below:

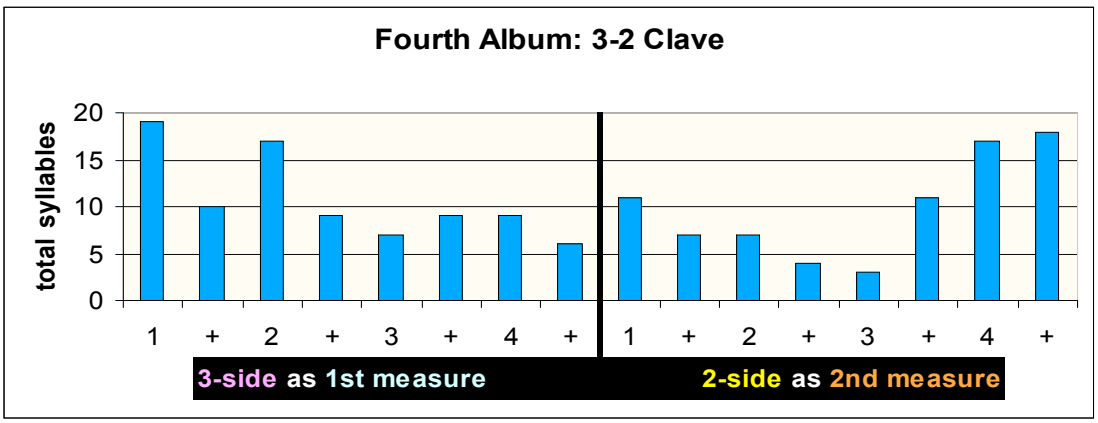




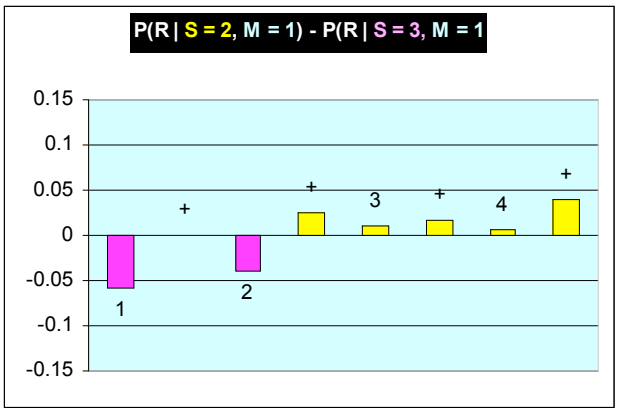
These graphs give a measure of which positions are more likely to appear on the 1st measure (positive, in blue) versus the second measure (negative, in orange). Again, as the two graphs are quite similar, we can see that there is a significant and consistent effect on syllable placement due to measure number. Thus, the text alignment in the first 3 albums of *CH* is dependent on both of these two different variables, the one purely rhythmic (from *clave*) and the other more melodic and harmonic (which measure is the 1st in a phrase).

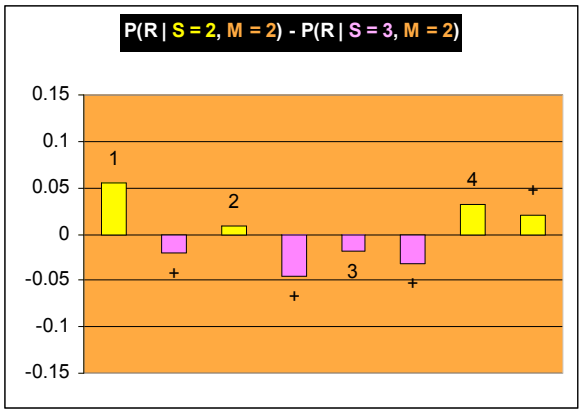
We have now seen that the syllabic distributions of the first three albums behave in a very orderly and consistent manner with respect to both *clave* and measure number. Surprisingly, the fourth album differed markedly from the first three albums. Here are the raw frequency distributions for the fourth album, both 2-3 *clave* and 3-2 *clave*:





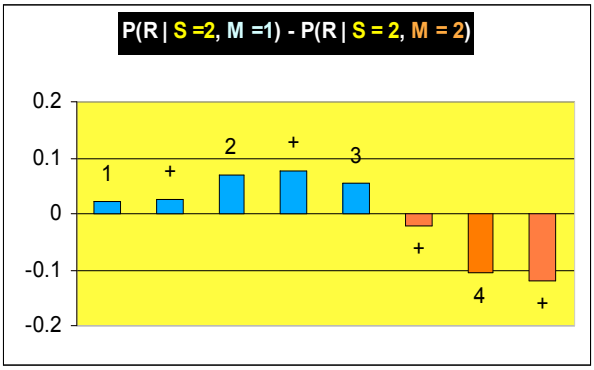
Here, unlike the first three albums, we do not see any similarities reflected in the distributions due to the different sides of the *clave*. The noticeable similarity comes not from comparing the sides of *clave* diagonally, but rather from comparing the measure numbers vertically (i.e., the 1st measures in blue and the 2nd measures in orange). We can form the same conditional distributions and perform the same subtractions (as above) in order to test for statistical independence here. Let's begin by subtracting the different sides of *clave* for each of the two measures:

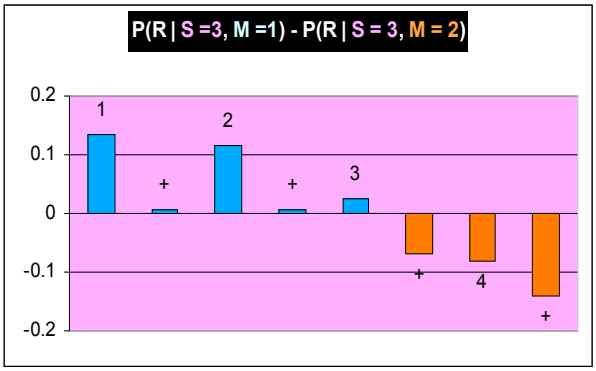




In contrast to the first three albums, the differences in the sides of clave are neither consistent across measures nor particularly large. This suggests that the syllabic distributions for the fourth album are in fact independent of the *clave* structure and therefore that text setting for this album has made a remarkable shift.

Just as above, we can test the statistical dependence of syllabic distribution on measure number for the fourth album. Here are some graphical representations of the differences between the first and second measures, first on the 2-side of the clave and second on the 3-side:

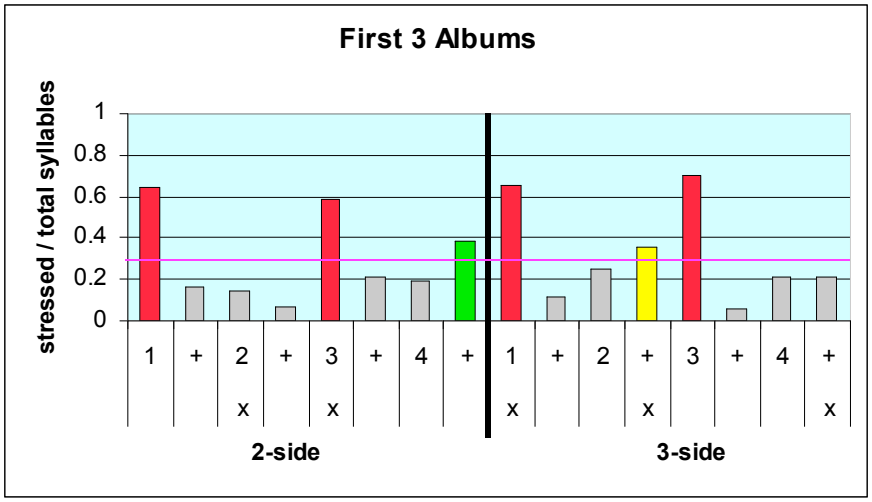


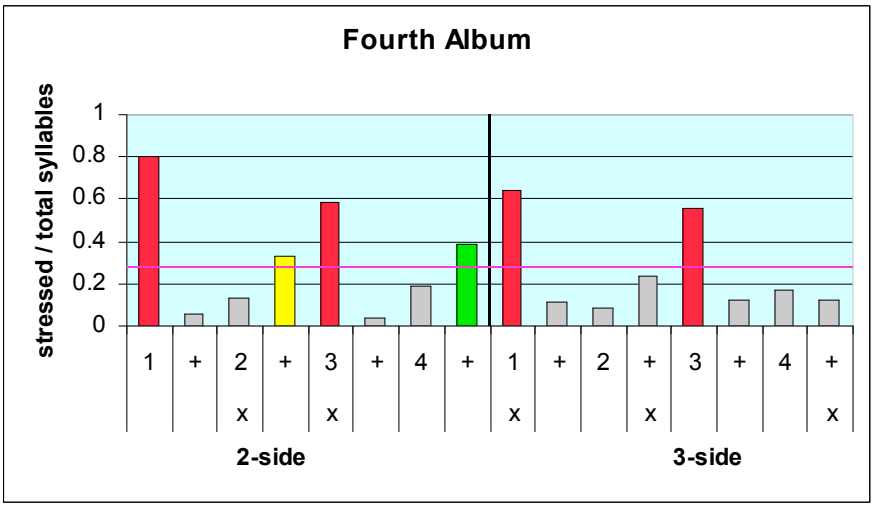


These differences, while not identical, have the same signs in every position, and many of the magnitudes are similar as well. This suggests that, while the syllabic distributions in the fourth album are seemingly independent of the underlying *clave* rhythms, they nonetheless maintain a distinction between the 1st and 2nd measures.

One complicating factor in this statistical analysis was that the vast majority of *coros* appeared in 2-3 *clave* – there were relatively few examples of 3-2 *clave* in the fourth album (see the scale on the y-axis of the graph above), and there could have been some sampling errors as a result. I would hypothesize that such sampling errors are the reason that, for the fourth album, the subtractions of the two sides of *clave* above are not closer to zero and the subtractions of the 1st and 2nd measures are not totally identical.

Having established how the first three albums differ from the fourth with respect to pure syllabic distributions, we should now briefly examine how they differ from one another in terms of statistical stress attraction. I took the total number of lexical stresses per position and divided by the number of syllables that appeared in that position, which yields a measure of how often, when a syllable appears in a particular position, that syllable is stressed. I did not differentiate between 2-3 *clave* and 3-2 *clave* in this regard because the levels of stress attraction were nearly identical across the two orientations. Compare the first three albums to the fourth (the pink horizontal line depicts the average stress/syllable ratio):





Here we can see that all four albums are quite similar in terms of how often the rhythmic positions of both sides of the clave attract stress. The 1 and the 3 of both sides of the clave attract stress the most frequently in all cases. This is not surprising, and supports Chen's generalization about strong beats aligning with stressed syllables. However, contradicting Chen's generalization, for each album there are two *upbeats* (the weakest musical beats) that have an above-average level of stress attraction. An explanation for this will be given in the following section, but for now it suffices to note that there is a difference between the first three albums and the fourth with respect to two of these upbeats (the upbeats following beat 2 on both sides of the *clave*, shown in yellow).

What might be the cause of the fourth album's divergence from the patterns set in the first three, both with respect to syllabic distribution as well as for stress attraction? One explanation that immediately presents itself is that, in the fourth album, *CH* began to incorporate rap into its music. Instead of singing their *coros* as they did in the first three albums (with a few exceptions in the third), in the fourth album almost half of the *coros* are rapped, i.e. chanted without a clear melody. (In the appendix, rapped *coros* are *italicized* while the sung *coros* are not.) I investigated whether perhaps the sung *coros* on the fourth album maintained the distributions from the first three, while only the rapped *coros* differed. For the fourth album, I separated the *coros* by style of presentation (rapped versus sung), but surprisingly they displayed similar distributions to each other, and both still diverged significantly from the first three albums. This would mean that, if the influence of rap was the cause of the shift, then that influence was quite pervasive. Not being an expert in rap, I am not in a position to state definitively whether or not rap was the cause of this shift in text-to-tune alignment, but this does seem a promising direction for future research.

This concludes the statistical analysis of the transcriptions. While there are several interesting patterns that result from this perspective, it is unlikely that the musicians and composers of *CH* were using probabilistic distributions when setting their lyrics to music. I will thus now look at the system of formal constraints that seem to be the source of some of the statistical patterns above.

Analysis III – Constraints

In describing a system of metrical constraints, it is necessary to determine which element(s) of which structure(s) is/are the most selective. Do strong rhythmic positions only accept stressed syllables, or must stressed syllables fall on strong rhythmic positions? These are very different alternatives – if we answer in the affirmative to the former question, stressed syllables might still occur on weak rhythmic positions, but if we answer in the affirmative to the later, unstressed syllables might still occur on strong rhythmic positions. Interestingly, the music

of *CH* is selective with respect to the same element as iambic pentameter in English – the stressed syllable. In both these systems, unstressed syllables may occur in any metric/rhythmic position (weak or strong); it is the placement of stressed syllables that is subject to constraints.

In the proceeding analysis, it will be useful to refer to the following hierarchical diagram of musical beats, which results from the simple rule that exactly one of two adjacent positions at one level must be present at the next higher level:

```
x
x                   x
x       x           x       x
x   x   x   x   x   x   x   x
1   +   2   +   3   +   4   +
```

Thus, while previously I have been referring to a binary distinction between downbeats and upbeats when referring to musical rhythm, more levels of structure are present (and useful at this level of analysis).

The following five rules describe the placement of 800 of the 806 lexical stresses in the corpus of *coros* that I transcribed; these rules are followed more than 99% of the time. I will first present the rules, then provide some explanation of them, and finally discuss the few exceptions. After each rule statement, I present a brief example of what the rule allows, followed by and an example of what it would not allow (marked with a star). Again, downbeats appear in red and upbeats in green. Lexical stress is marked with both **boldface** and underlining:

1) A lexically stressed syllable may be placed on any downbeat.

1	+	2	+	3	+	4	+	1	+	2	+	3	+	4	+
						tú	no	e	res	whit	ney	hou	ston		

2) If a stressed syllable is placed on an upbeat, the following downbeat must be unoccupied.

1	+	2	+	3	+	4	+	1	+	2	+	3	+	4	+
				quie	ro	te	ner			te-a	quí				
			*	quie	ro	te	ner	te-a		quí					

3) If a lexically stressed syllable is placed on the upbeat following 1 or 3, the preceding downbeat must be unoccupied.

1	+	2	+	3	+	4	+	1	+	2	+	3	+	4	+
			y		ser		fe		liz						
		*	y		ser			fe	liz						

4) A lexically stressed syllable is always allowed after a syntactic break.

1	+	2	+	3	+	4	+	1	+	2	+	3	+	4	+
									e	cha	pa	llá			
							*	tú	e	cha	pa	llá			

5) Lexically stressed syllables in words that are subject to synalepha may fall on any rhythmic position.

1	+	2	+	3	+	4	+	1	+	2	+	3	+	4	+
			ten		go-u	na		cri		sis		de-a		mor	
		*	hay		u	na		cri		sis		de-a		mor	

There are several points worth making about these rules. Rule 1 is to be expected given Chen's generalization, and Rule 2 also fits, but Rule 3 is a bit more interesting. In the standard rhythmic hierarchy shown above, all upbeats are equal, but Rule 3 differentiates between two sets of upbeats. As a result of this third rule, the upbeats that fall after 1 and 3 are subject to more constraints than those that fall after 2 and 4. Rules 2 and 3 combined allow the configuration of U-S-E (unstressed-stressed-empty) to occur starting on beats 2 and 4 examples of this are found above under Rule 2) but not starting on beats 1 or 3 (an example of a malformed setting appears under Rule 3).

How are we to understand these two rules, and why is the configuration U-S-E allowed to begin on some rhythmic positions but not others? There are two possible explanations. Since beats 1 and 3 on the rhythmic hierarchy above are more prominent than beats 2 and 4, it is possible that it is more rhythmically dissonant to have a U-S starting on these odd-numbered beats than it is on the even-numbered beats. Alternatively, we could conceptualize the upbeat after 2 as being an anticipation of 3 and the upbeat after 4 as being an anticipation of 1. By 'anticipation,' I mean a displacement of the prominence of a strong beat to the weak beat immediately preceding it. (This phenomenon seems to be present in a number of musical traditions, including jazz.) We might say that, due to the prominence of beats 1 and 3 in the hierarchy, it is only permissible to anticipate these beats (and that having U-S-E starting on 1 or 3 would illegally anticipate beat 2 or 4). This latter explanation also nicely explains why the positions following the upbeats must be unoccupied rather than being occupied by stressed syllables – it would no longer be a true anticipation if the anticipated beat were filled.

There is a remarkable similarity between Rule 4 and the inversion rule in English iambic pentameter. In both of these cases, a syntactic break enables a stressed syllable to occur in an

otherwise weak metric position. It is surprising that such disparate traditions follow similar structural patterns, suggesting that distinction between syntax and phonology is not as clear as is sometimes supposed. Rule 5 is also noteworthy, as it seems to suggest that when two words are subject to elision, both lose their lexical stress. It would be interesting to determine if this has any phonetic parallels in spoken Spanish.

Having reviewed the rules that determine the vast majority of stress placements in the corpus, we can now briefly examine the exceptions. Only two occur on the first three albums (lines 126 and 199), but interestingly they have exactly the same form – a stressed syllable on the upbeat following beat 2 of the 3-side of the *clave*, with unstressed syllables on the downbeats on either side (2 and 3). This is a violation of Rule 2 – there is an occupied downbeat following an upbeat with a stressed syllable. The position where this seemingly illegal stress falls is a note of the *clave*, and is often emphasized by other instruments as well. I considered formulating another Rule allowing these stress placements, but it seemed unjustified to make an entire rule to account for just two cases. This seems to be the only point at which it is useful to invoke the *clave* when describing stress placement from the perspective of well-formedness constraints.

The other four exceptions occur on the fourth album, which we have already seen was more experimental in its text setting than the first three albums. One of these appears on line 351 and is similar in form to the two exceptions above – it has a stress on the upbeat following beat 2 (with unstressed syllables on the downbeats before and after) – but in this case it is on the 2-side and not on the 3-side of the *clave.* Another exception is transcribed on line 283, where a violation of Rule 3 occurs; there is an unstressed syllable on beat 1 and a stressed syllable on the following upbeat. This violation can be explained by the fact that it occurs in a song originally written and performed by a Spanish *flamenco* group. The offending lyric is a direct quote of the original, and we might hypothesize that the Spanish group (*Ketama*) follows different constraints in its text setting, but this awaits confirmation from a different study. The final two exceptions appear on lines 389 and 470, where there is a stressed syllable on the upbeat following beat 3 (with beats 3 and 4 occupied) –violations of Rules 2 and 3. These exceptions can perhaps be thought of as the results of a changing vocal style on the fourth album, seen clearly in the distributions in the above section, but in nearly all cases the rules for stress placement remained constant across all four albums.

Conclusion

I have shown in this paper that lexical stress interacts with rhythmic prominence in systematic but previously unanticipated ways in the music of *La Charanga Habanera*. Chen's generalization does not apply totally to their text-to-tune alignment – stressed syllables may oftentimes appear on weak musical beats. Also, inter-word vowel separation (the opposite of

elision) displayed significant interactions with both rhythmic structures. Interestingly, the influence of the underlying *clave* rhythm seemed to play more of a role in *CH*'s text setting when viewed as statistical distributions than when formulated as a system of constraints. We also saw how vocal styling seemed to shift rather dramatically on the fourth album.

There are several areas that future research might focus on. It would be informative to transcribe the remaining recordings of *CH* to see the development of the distributions and the constraints beyond the fourth album. Similar text-to-tune analyses of *CH*'s peer groups in Cuba might reveal some constraints common to *timba* as a genre and not simply particular to a single group. It would also be profitable to examine text setting in an earlier Cuban music group to see how text-to-tune setting with *clave* has changed in the progression from older styles to modern *timba*. Finally, it would be useful to discover the origin of the rapped *coros* that seemed to change vocal styling to such a great extent, perhaps doing studies of text setting from American artists as well.

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