

HYPOTHESIS OF POLYMETRIC STRUCTURES IN AFRO-BRAZILIAN MUSIC

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Abstract

Due to Atlantic Trade, some “characteristic devices” (Pressing, 2002) would have been inherited from African music by Afro-Brazilian Music. One of these devices is the polymetric structure. While this concept is used by many musicologists, for Western and non-Western music, some authors argue against its existence (Agawu, 2003; London, 2012). Very few studies deal with this potential music property in the Afro-Brazilian repertoire. Thus, this paper presents a preliminary study about the verification of the hypothesis of the presence, in Afro-Brazilian music, of polymetric structures. Several concepts related to meter are evaluated for their application to this musical corpus. Some analyzes based on samples coming from a selection of Afro-Brazilian music (*samba*, *maracatu de baque virado* and *coco*) are presented. The studies on African and Afro-Brazilian dance, especially the concepts of “polycentrism” (Welsh-Ashante, 2001) and “polymetric lines” (Naveda & Leman, 2008) open promising perspectives for future investigation on a theoretical plan. Then, an experimental protocol such as Magill & Pressing (1997) will allow to test our hypothesis thru a psycho-cognitive approach.

Introduction

Brazil was involved in the Atlantic Trade. Nowadays, a very large amount of people is categorized as “Afro-Brazilian” or “Afro-descendent”. The analysis of performances pertaining to the corpus of Afro-Brazilian music reveals a musical organization generally composed by recurrent temporal patterns¹, which could reveal the influence of the *Bantu* (and Yoruba) cultures on Brazilian musical culture (e.g. Kubik, 1979 ; Mukuna, 1979 ; Sandroni, 1997; Capone, 2000; Fryer, 2000; Vatin, 2005)². Graeff (2014) explores the African rhythmic fundamentals in order to analyze the Afro-Brazilian music, especially the *samba de roda*. Her transcriptions of both musical events and dance movements include simultaneous isochronous and non-isochronous “rhythmic lines”, based on cycles of 8 and 16 “fast pulses”. Browning (1995) states that “samba is a polymeter, layered on a 2/4 structure. But the strong beat is suspended, the weak accentuated”. But neither evidence nor deep explanation is given to justify it³. Nevertheless, her stating enters in resonance with my own intuition. Is the concept of polymetry really applicable to model any Afro-Brazilian music?

¹ An increasing amount of literature seems to confirm that many forms of Afro-Diasporic music involve similar patterns in temporal organization that can be considered as fundamental traits or “characteristic devices” (Pressing, 2002).

² Despite a big valorization of the *yoruba* culture (Carvalho, 2006), the works of Mukuna (1979) and Kubik (1979) allow to reconsider the importance of influence of bantu culture, although discrete, on Afro-Brazilian music.

³ Browning is a very experienced *samba* teacher. Her knowledge about music seems to be a little too weak. Nevertheless, her explanations deals with both the subdivisions microtiming and the metric structure.

Our proper experience of Afro-Brazilian music (by both performing and teaching) let us give a positive answer to this question and put forth the following hypotheses:

- these recurrent patterns (fixed or varied) are emergent phenomena of latent isochronous and non-isochronous –metric– organizations,
- the co-presence of isochronous and non-isochronous patterns as respective spaces of attending, constitutes a polymetric structure.

In order to produce some evidence to verify these hypotheses, we'll examine some correlated concepts (rhythm, meter, time-line pattern, ...) and evaluate the relevance of their applicability for Afro-Brazilian music.

Non-isochronous meter in Afro-Brazilian music

Rhythm & meter

First, it seems important to recall that meter and rhythm are two very different, but interrelated concepts. Works from Justin London (2004)⁴ and David Huron (2006) are central.

As Clayton (1997:3) guesses, “for the Western musician or musicologist, meter seems to be only a concept [...] applicable to a vast number of music, all susceptible to be transcribed with the measure system of Western music” and is often reduced as the time signature mentioned at the beginning of the score. He enlarges the Western concept of meter, by proposing “a double model of meter, as the interaction of several levels of pulses [...] and as a background to the rhythmic pattern” (Clayton, 1997:13)⁵. The first idea is grounded in the TGMT of Lerdhal & Jackendoff (1983), the second one in Kolinski's idea of meter as a framework (1973), both approaches are inherited from the Gestalt psychology principles.

Based on a psycho-cognitive approach of the temporal perception, and particularly on the works of Jones concerning the “rhythmic attending” (Jones & Boltz, 1989), Huron (2006) considers as well the meter as a predictive pattern for the temporal events. He argues that a succeeding anticipation has two advantages: it allows minimizing the expended energy by optimizing the levels of arousal and has a facilitating effect on the attention. The “meter involves our initial perception as well as subsequent anticipation of a series of beats that we abstract from the rhythmic surface of the music as it unfolds in time” (London, 2012:4).

So, the meter is neither objective nor explicit. It's inferred by the listener/musician. Kvifte (2007:82) even states that two kinds of meter must be examined separately: “meter as produced and performed by a performer, and meter as perceived by a listener, dancer or performer”.

⁴ In this paper, we will refer to the 2012 (2nd) edition, but all the main ideas are already present in the primary edition of 2004.

⁵ Translation mine.

A meter has hierarchic dimension. For a given meter, several patterns can latently coexist at several levels. These patterns are called "metric levels", the highest the slowest.

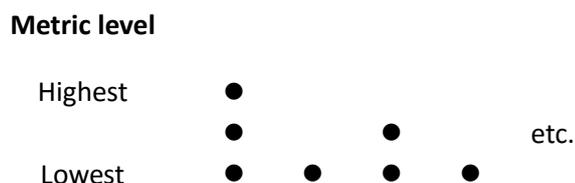


Figure 1: 4-beat metric organization showing 3 metric levels. 1 cycle is presented.

As a temporal space of attending (and so, of performance), the meter is potentially shared by all the actors of the musical ecosystem (composer, interpret, listener⁶). Determining if this sharing is really effective is another question, which is beyond the focus of this study.

Conversely, the concept of rhythm "involves patterns of duration that are phenomenally present in the music" (London, 2012:4). These patterns form the stimulus itself, the real sonic footprint.

A meter is not directly heard⁷: it is inferred from the rhythm, but it gives specific anchor points to structure the rhythm (Clayton, 1997). The latter is sometimes called "surface rhythm" (e.g. Holzapfel, 2015) or "figure" whereas meter is called "ground". Using this terminology, what is very interesting is indeed the "figure-ground relationship" (Pressing, 2002:289).

Timeline pattern & non-isochronous meter

NKetia (1961:78) coined the very important concept of "time-line pattern". Arom (1985:429) talks about the "rhythmic oddity" principle and its structuring role. Kubik (1999) proposes a generative model and states that "Timelines are so important structurally in those types of African music that we can call them the metric back-bone of these musics". Although this assertion is not agreed on by all Africanist scholars, numerous authors deal with the same idea.

The ethnomusicology of Afro-Brazilian music already uses the concept of time-line pattern (Kubik, 1979; De Oliveira 2006), or similar concept like *padrão rítmico*⁸ (Mukuna, 1979), *paradigma rítmico*⁹ (Sandroni, 1997), *linha-guia*¹⁰ (Fonseca, 2002), *linha-rítmica*¹¹ (Pinto & Tucci, 1992; Graeff, 2014),

⁶ This typology stays artificial and more describes a dynamic function than a permanent state. Moreover, the concept of composer is here to be understood in a general sense (Dahan & Laliberté, 2008), where the composition can be asynchronous (traditional composing task) or synchronous (improvising task). Composer and improviser are both incarnations of the same activity, which is easily verified in the Western history, with such very famous musicians as Bach or Mozart.

⁷ In specific cases, the meter is directly expressed by a constant pattern, like the Afro-Cuban *claves*.

⁸ "rhythmic pattern"

⁹ "rhythmic paradigm"

¹⁰ "guideline"

¹¹ "rhythmic line"

*formula-chave*¹² (Estival, 1997) to model their musical organization or, at least, to explain the strong relationship between this time-line and others musical parts.

For us, one of these patterns is the well known “characteristic syncope” or “American Syncope” (De Andrade, 1989), which is diversely declined in Afro-Brazilian music (Sandroni, 2001):

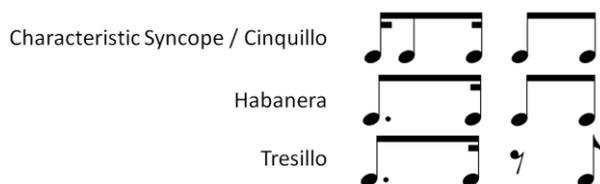


Figure 2: Declination of the “characteristic syncope” in Afro-Brazilian music of the early 20th century.

The following example (Figure 3) illustrates how the voice rhythm is correlated to a 7-beat *agogô* (bell) pattern.

Figure 3 is a musical score for a song of *candomblé*. It features three systems of music. The first system is for the soloist, with the title 'Oba nixá' above the staff. The second system is for the agogô, with the title 'Mã inã' above the staff. The third system is for the soloist again. The lyrics are: 'O - ba - ni - xá ré lôô - quôô-dôô o - bê-ri ômã O - bá ni - xá ré lôô - quôô-dôô O - ba cô - ssô a - iô Mã i - nã i - nã má i - nã uá i - nã i - nã Obá cô - ssô Mã i - nã i - nã má i - nã uá i - nã i - nã Oba cô - ssô - uá i - nã i - nã - A - la cô - ssô a - ra... ra...'. The agogô part is a 9-beat pattern represented by 'x' marks on a staff.

Figure 3: This score shows how the soloist part and the agogô part (which plays the time-line pattern) are synchronized in a song of *candomblé* (Fonseca, 2002). The agogô part is the 9-beat described by Kubik (1979).

The concept of non-isochronous meter was coined by London in 2004 as an “accentless meter” where there is a “subjective sense of the downbeat and on-beat versus off-beat location” (London, 2012:137).

A similar idea is proposed by Danielsen:

“if a regular pattern of syncopation appears in the music for a long time, sooner or later it ceases to be heard as deviation from the main pulse; it ends

¹² “key formula”

forming an independent and equally relevant layer of pulses” (Danielsen, 2006:62 in Chor, 2010:21)

Except for Africa and Afro-diasporic countries, such non-isochronous meters (NI meter) would exist in numerous places in the world, such as the North of India (Clayton, 1997), or Turkey (Holzapfel, 2015). Soley and Hannon (2010) experimentation on young American and Turkish children showed that such non-isochronous meters seem to be integrated and preferred as early as some months after birth.

As far as we know, the concept of non-isochronous meter (London, 2004) is not yet used “as is” to model the Afro-Brazilian music. Indeed, a lot of work remains to be done in order to understand precisely how such a metric organization really works. A hypothesis on one of the main properties of such meters is that the accentuation differs from an instrument to the other, and can change in function of other parameters. This accentuation doesn’t correspond to “downbeats” but to some kind of cue-points. For example, in the 7-beat NI meter of *samba*, the main harmonic changes from *cavaquinho*¹³ (like tonic and dominant chords) occur at different locations than *cuíca’s* cue-points:

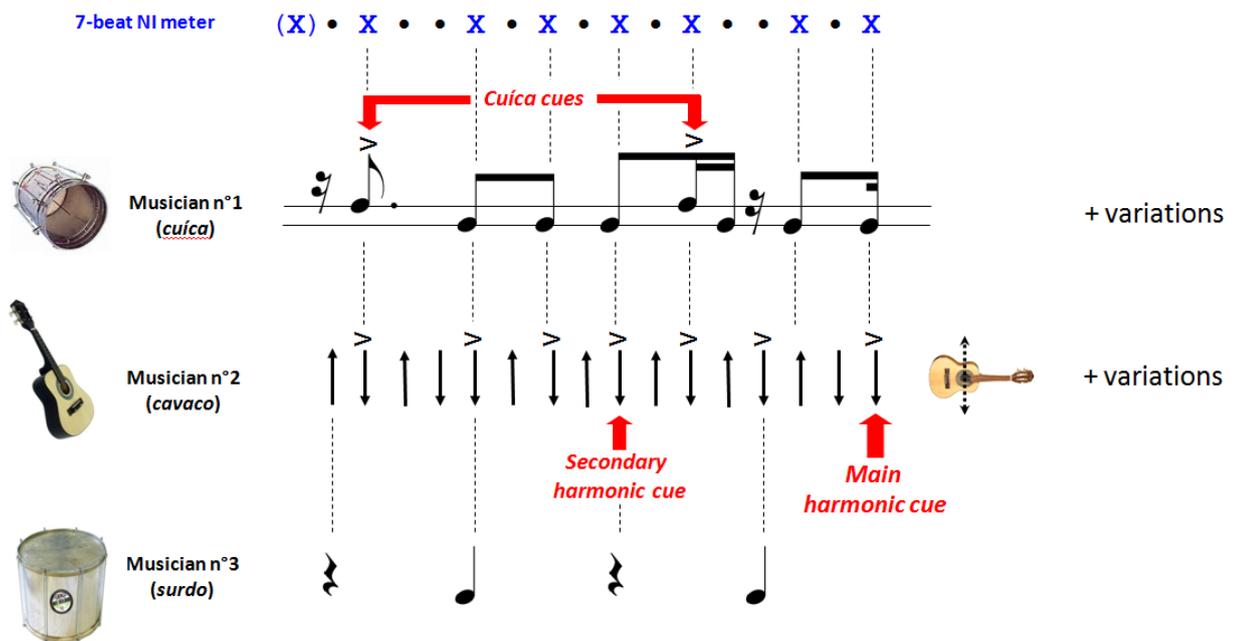


Figure 4: Comparison of cavaquinho and cuíca cue-points, both based on the same 7-beat NI meter in samba. The isochronous surdo part is showed for better understanding.

¹³ Small 4-cord guitar.

Concept of polymeter

Although numerous musicologists insist on its existence, the Grove hasn't any entry for the term "polymeter". Rundall (2011) recalls that the concept of polymeter has been used for a long time to describe some (part of) pieces of the Western music, from Guillaume de Machaut (polymetric Rondeaux) to Ligeti (ex: *Magyar Etüdök*, Movement III, "Vásár"), without forgetting Bach (ex: Sonata n°1 BWV 1001) or Mozart (ex: final of 1st Act I of Don Giovanni). Zappa or Meshuggah are examples of contemporary artists using polymeters in music. Works in ethnomusicology report other musical systems polymetrically organized, like the *purata*, a sung dance of young women in central Transylvania (Giurchescu, 1967, 2001) or Albanian music (Shetuni, 2011).

In the African musical corpus, Jones (1959) is probably the first to transcribe a song by the mean of a polymetric model. Agawu (2003) criticizes the usage of this concept as a way of "exotizing" the African music. We don't agree and think that the musical polymetry could be a specific emergence of a more general temporal thinking, like it seems to exist in Nuer community of East Africa (Gray, 1996). Nevertheless, his definition states a number of interesting concepts (underlined by us and discussed later in this paper):

"Polymeter is the simultaneous use of more than one meter in an ensemble composition. Each functional component of the texture, be it an instrument or a group, is said to expose a distinct rhythmic pattern within its own metric frame, apparently without any obvious regard for a larger coordinating mechanism. Constituent meters do not collapse into each other or into a larger meter, but persist into the background, creating a kind of metric dissonance or metric polyphony. Philosophically, polymeter indexes coexistence, not (necessarily) cooperation." (Agawu, 2003:79)

Based on studies in the psycho-cognitive domain, London, as well, argues against polymeter and admits that his statement "runs counter to various music-theoretic claims regarding metric dissonance and other instances in which one putatively hears two meters going on at once" (London, 2012:67). For him, a musician cannot entrain two meters at the same time.

Afro-Brazilian music and polymetry

Thanks to the analysis of musical performances of the beginning of the 20th century, Sandroni (1997) shows how the 3-beat (or 5-beat) pattern presented in Figure 2 is progressively replaced, in the middle of the 1930s, by a 9-beat (or 7-beat) pattern named by the author as the "Estácio paradigm", and considered today as well as a time-line pattern. The analysis of recent musical performances of *samba* shows that, despite this transformation, some instruments (or the footsteps, or hand-clapping) go on playing patterns and variations based on this "old" short pattern synchronically with the "new" long pattern. Moreover, the isochronous meter formalized by the *surdo de marcação* (low pitch drum) leads to formulate the hypothesis that several time frameworks are in co-presence. A similar phenomenon (but differently declined) is observed in *maracatu de baque virado*, *coco* and other bahianese forms of *samba*.

The concept of polymeter isn't used a lot for the analysis of Afro-Brazilian music. Generally, it is rapidly intuitively referred to but without any strong scientific reference (e.g. Browning, 1995;

Carvalho, 2006). Our proper knowledge (by playing and teaching) about several kinds of Afro-Brazilian music leads us to claim that each one can be considered as a polymeter, more precisely a “polyphonic polymeter” because of the simultaneous presence of several rhythmic streams (Rundall, 2011:41). In order to defend this hypothesis, the underlined concepts in the former quotation of Agawu (2003:79) and the London’s (2012) arguments will be confronted to the literature and our proposed models. First, we examine the concept of “polycentrism” in dance analysis.

Polycentrism

Some of these intuitions (Browning, 1995, Sodr , 1979) lead Naveda & Leman (2008) to formulate hypotheses on the relationships between music and dance in the *samba*. They use the expression “polymetric lines” from Africanist literature and suggest a “polymetric engagement” of the dancer. This idea could be strengthened by the promising concept of “polycentrism” (G nther, 1969; Welsh-Ashante, 2001), born in the field of African and Western contemporary dances. It has been defined in order to describe how some parts of the body can move independently from other parts, as there were different centers. Graeff (2014), which also uses this concept¹⁴, notes that the study of Naveda & Leman (2008)

“limits itself for the moment to the identification of periodic aspects of basic footsteps and gestures of the samba, leaving besides the aspects related to improvisation – aspects less relevant in the samba carioca than in the Samba de Roda” (Graeff, 2014:18)¹⁵

Kvifte (2007:82) underlines the ability of a dancer to subdivide his movements “in ways that are not easily described by simple division by integers is amply documented in the study of dance movements”, which fits with the idea that all Afro-Brazilian music reveals microtimed “subdivisions”.

“the various types of movement ground themselves on the same foundation than the percussion”¹⁶

and that

“the movements of the different parts of the body are able to represent simultaneously and alternately the elementary pulses, the beats, the time-line pattern and the improvisation” Graeff (2014:19)¹⁷.

Using well-known techniques to find “the” pulsation of a piece of music by observing dancers’ footsteps or hand-clapping could lead, in this case, to biased results.

¹⁴ *Policentrismo* in portuguese.

¹⁵ Translation mine.

¹⁶ Translation mine.

¹⁷ Translation mine.

Own metric frame

With regard for the psycho-cognitive definition of a meter as a space of attending, we consider that a musical piece has a polymetric structure if the listener can form distinct expectations based on, at least, two distinct patterns. These patterns cannot be the metric levels of a same meter. Naveda (2011:30) assumes the idea of a polymetric form for the *samba*: he describes it as structured by 3 types of metric layers, each one located in a specific zone of the audio spectrum: “bar and beats” (low-spectrum), “syncopated patterns” (mid-spectrum) and “*tatum*¹⁸ level” (high-spectrum). We don’t personally consider that this 3rd layer is really autonomous. Moreover, the *terceira surdo* sounds low but plays “syncopated” variations. Nevertheless, this “prototypical model”, as it is mentioned, defines that each instrumental/vocal pattern refers to its own metric frame. Of course, a metric frame can be shared by several instruments/voices.

We don’t think each hypothetical Afro-Brazilian polymeter has any “larger coordinating mechanism” (Agawu, 2003:79), but only a specific inter-positioning between all the meters, which characterizes each music style.

Metric dissonance, metric polyphony and coexistence/cooperation

The co-presence of distinct meters (formalized by recurrent patterns and their respective variations) can be analyzed as a kind of metric cohabitation.

Because each meter uses the same fast pulses flow to unfold, this metric cohabitation forms a “direct grouping dissonance” (Krebs, 1999). This metric dissonance is considered as “polyphonic” (Berger & Berger, 2004) because these dissonances belong to different auditory streams¹⁹ (Diamonte, 2014). We put forth the hypothesis that these metric dissonances produce metric tensions which result on a “kyneogenic”²⁰ influence on the musicians, the dancers and the public.

So, we consider that this cohabitation implies at the same time both concurrence (the metric tension) and collaboration (the kyneogenic influence), so what we could call a “collaborative concurrency”.

The positioning of the harmony fulcrums in *samba* is a good example (see Figure 4). The Figure 5 shows a transcription of the melody and harmonic chords of the *samba* “*Onde está a honestidade ?*” already used by Sandroni (1997). This augmented score allows to understand how the melody is related to two distinct meters:

- The orange colored meter shows 2 metric levels of a kind of reverted Western meter in 2/4 (Lerdhal and Jackendoff, 1983). The “highest” metric level corresponds to the strong beats (second beat of each measure). Note: from a standard Western metric point of view, the main *surdo* (low pitch drum) plays on each weak beat. With regard to the 7-beat NI meter which unfolds on 16 semi-quavers, the 2/4 meter indication has a very limited relevance.

¹⁸ Fast pulses, subdivisions, ...

¹⁹ For Mirka (2009), such a metric dissonance pertains to the “split” category.

²⁰ Which induces motion.

- The green colored meter shows one of the possible forms (7-beat) of a non-isochronous meter modeled by Kubik (1983) and taking part of the “Estácio paradigm” coined by Sandroni (1997)²¹. 3 metric levels are displayed in order to illustrate the main and secondary cue-points of the harmonic structure.

Figure 5: This score of “Onde está a honestidade ?” shows how this melody fits with two different meters:

- the first one, in orange color below the score, is a kind of reverted (or phase-shifted) 2/4 Western meter.
- the second one, in green color over the score, is the 7-beat version meter (Kubik, 1979) taking part of the “Estácio paradigm” (Sandroni, 1997).

Cometricity/contrametricity

The idea of cometricity and contrametricity (Kolinski, 1973) has been used by a lot of authors, but their implicit reference is systematically an isochronous Western meter. But the idea of Kolinski is larger:

“With regard to the widely distributed pattern 3+3+2 it is important to determine in each situation whether we deal with a contrametric organization within a regular metric framework or with a cometric organization within an irregular metric framework” (Kolinski, 2013:500)

²¹ Sandroni (1997) explicitly quotes Kubik, mais never uses the term « meter ».

Indeed, in a polymetric musical structure, we propose to define a “degree of cometricity/contrametricity” of a specific event (strike/note) relatively to each meter. For example, the melody of Figure 5 is globally cometric with regard to the isochronous meter (orange color) but globally cometric with regard to 7-beat non isochronous meter. This degree can be simply calculated by counting the number of shared notes:

Number of notes of the melody: 27	shared notes number ²²	Degree of cometricity	not shared notes number	Degree of contrametricity
Melody vs isochronous meter	6	22,2 %	21	77,8 %
Melody vs non isochronous meter	24	88,9 %	3	11,1 %

Table 1: Evaluation of the degrees of cometricity/contrametricity

Models of the polymetric structure

The next figures show declined proposals of a polymetric modeling of 3 Afro-Brazilian music traditions (*coco*, *samba* and *maracatu de baque virado*). Only stereotypic patterns without any variation are presented. To simplify reading, we transcribed the patterns in the isochronous meter (4/4 or 2/4). Each pattern is typically related to one or more instruments, but an instrument playing mainly with a 2-beat cycle can produce variations by “borrowing” temporarily a 4-beat cycle (ex: *caixa* in *maracatu de baque virado*).

Coco

Figure 6 shows a 16-beat cycle to simplify the comparison with the other figures, but an 8-beat cycle is enough to model it. In a lot of declinations of *coco* tradition, only the *bombo* pattern is really varied.

²² Without any regard to the weight of each metric beat.

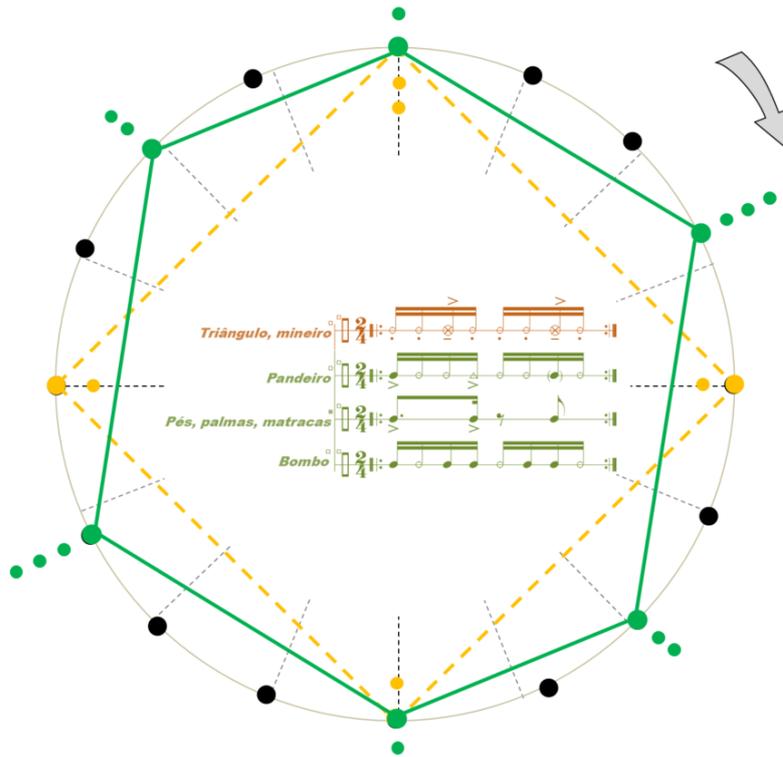


Figure 6: proposal for a polymetric model of coco
(state of Pernambuco, Brazil).

The circle shows a 16-beat cycle (arrow = time flow)

Green color: 2-beat cycle (all instruments and feet, except for mineiro²³ and triângulo²⁴)

Yellow color: 1-beat cycle (mainly inferred from dancers' footsteps)

Rhythmic patterns are given in their "stereotypical" state (i.e. variations are not shown)

Note : microtiming of fast pulses is shown

Samba

Samba is still notated as a 2-beat isochronous meter with 8 subdivisions (written in 2/4). But, in a polymetric perspective, what can justify that this meter is preeminent on the non-isochronous ones?

²³ rattle

²⁴ triangle

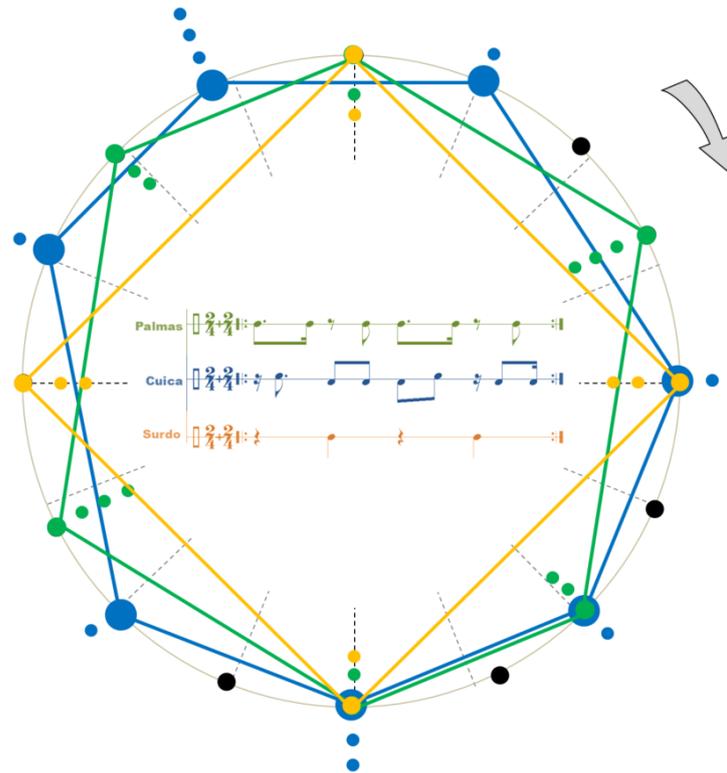


Figure 7: proposal for a polymetric model of samba
(state of Rio de Janeiro, Brazil).

The circle shows a 16-beat cycle (arrow = time flow)

Green color: 2-beat cycle (caixa, palmas)

Blue color: 4-beat cycle (cavaquinho, cuica, agogô, tamborim, ...)

Yellow color: 2-beat cycle of surdo

Rhythmic patterns are given in their "stereotypical" state (i.e. variations are not shown)

Note : microtiming of fast pulses is shown

Maracatu de baque virado

In this model, we put forth the hypothesis that both the 2-beat cycles pertain to the same meter cycle. Indeed, if we "sum" all the beats played, we obtain the characteristic syncopé sooner mentioned **X X • X X • X •** which could be the implicit model of both these 2-beat cycles. For an extensive study of a song of *maracatu de baque virado*, see Guillot (2008).

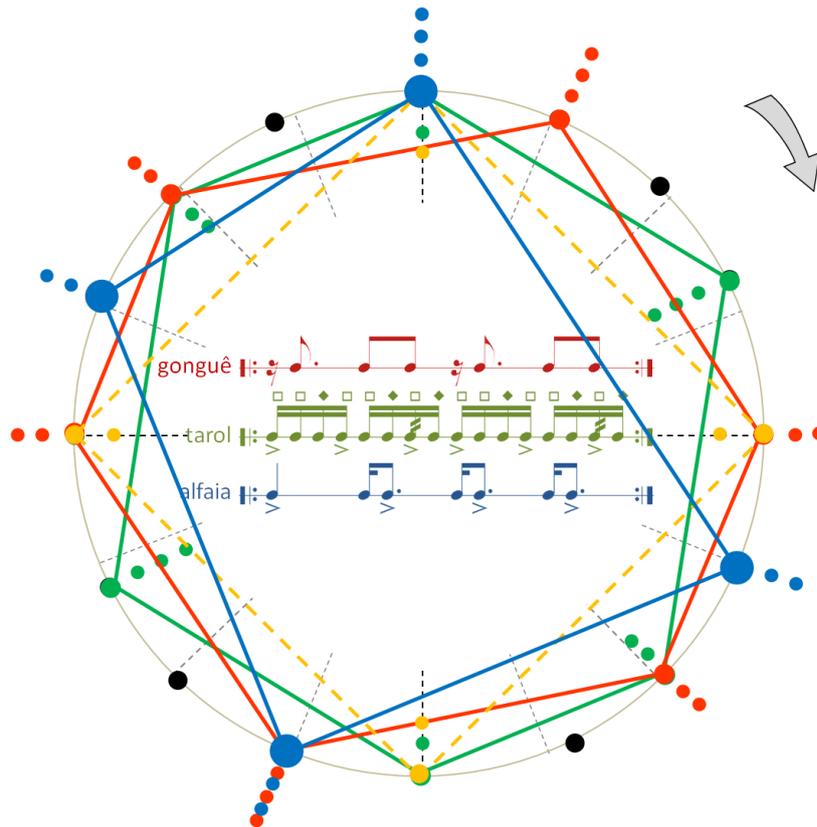


Figure 8: proposal for a polymetric model of baque de arrasto (maracatu de baque virado, state of Pernambuco, Brazil).

The circle shows a 16-beat cycle (arrow = time flow)

Red color: 2-beat cycle of gonguê (bell)

Green color: 2-beat cycle of caixa (snare drum)

Blue color: 4-beat cycle of alfaia (bass drum)

Yellow color: 1-beat cycle inferred from dancers' feet

Rhythmic patterns are given in their "stereotypical" state (i.e. variations are not shown)

Note : microtiming of fast pulses is shown

Conclusion

We discussed some concepts related to polymetry in Afro-Brazilian music. Although some authors claim its existence, no one gave any evidence to this hypothesis. With regard to the relevant literature, we gave some clues to help verifying this hypothesis:

- Several (probably all) Afro-Brazilian musical traditions reveal the co-presence of recurrent (fixed and varied) patterns,
- These patterns can be considered as isochronous and non isochronous time-lines,
- The co-presence of these time-lines forms a polymeter, an idea supported both by footsteps/hand-clapping analyses and by the choreology, which brings the concept of polycentrism,
- The metric dissonance induces metric tensions which produce entrainment of the musicians, the dancers and the public.

All of these sub-hypotheses will need further study to be completely verified.

Openings

Now, a big challenge remains: the polymetric hypothesis and the related sub-hypotheses must be verified on a phenomenological plan with every actor²⁵ of the musical ecosystem. Although it is very tricky, some methods have already been developed in order to answer this kind of question (*e.g.* Magill and Pressing, 1997). One of the questions will be about the dynamic attending: London (2004) states that a musician can dynamically switch his/her focus on a specific layer of a polymetric system. By keeping in mind the concept of polycentrism, we put forth the hypothesis that the musician can do it on a mix of “weighted” meters.

²⁵ Kvifte (2007)

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