

Microtiming and anisochronous meters in Afro-Brazilian music: didactic issues induced by an alternate way to “think” time in music

Problem

The analysis of Afro-Brazilian music played by Westerners generally reveals rhythmic transformations. These transformations are so systematic that they are predictable. Why ?

Microtiming

By confirming the results of studies on the same topic (e.g. Gerisher, 2006; Lindsay & Nordquist, 2006 ; Wright & Berdhal, 2006 ; Gouyon, 2007), all Afro-Brazilian musical organizations on which we have done measurements (Guillot, 2011) show a stable anisochrony of the fast pulses (or basic pulses, subdivisions, ...). By using the profiles proposed by Polak (2010), one discovers a considerable variety in the characteristics of Afro-Brazilian fast pulses organization. The patterns of microtiming can be analyzed:

- **synchronically**: they involve gradual differences between local communities and regional styles.
- **diachronically**: some of them, found today, were already present at the beginning of 20th century.

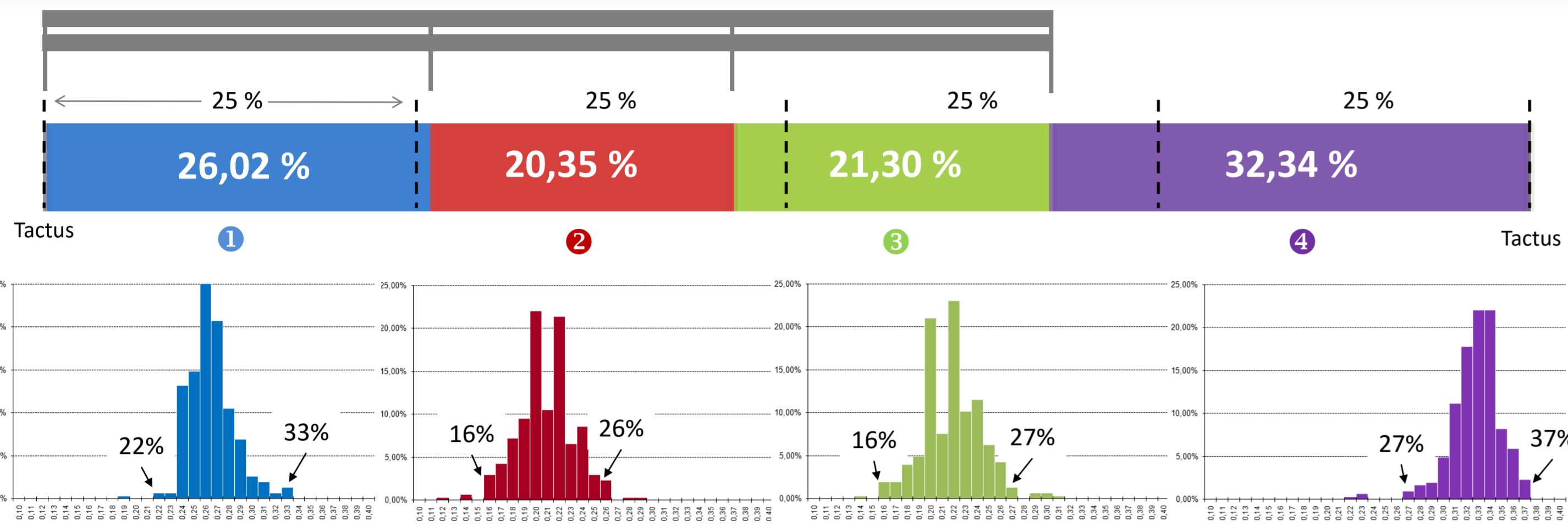


Fig. 1: Example of average microtiming values of a piece of *maracatu de baque virado* (Pernambuco) called "Roda bahiana" (Maracatu Nação Encanto da Alegria, 2004). The data (which are only averages) were obtained with Sonic Analyzer and a plug-in of onsets detection. From a Western view, the piece can be considered as binary. All instruments are mixed. Upper horizontal bar shows the respective durations of each of the 4 fast pulses. Histograms give an idea of data dispersion.

Anisochronous meters

Afro-Brazilian music analyses reveal a musical organization generally composed by recurrent temporal patterns, probably influenced by Bantu and Yoruba cultures (e.g. Kubik, 1979 ; Mukuna, 1979 ; Sandroni, 1997; Capone, 2000; Vatin, 2005). Graeff (2014) transcriptions of both musical events and dance movements of *samba de roda* (Rio de Janeiro) include simultaneous isochronous and non-isochronous “rhythmic lines”, based on cycles of 8 and 16 “fast pulses”. **Hypothesis**: these recurrent patterns (fixed or varied) are emergent phenomena of latent isochronous and anisochronous –metric– organizations.

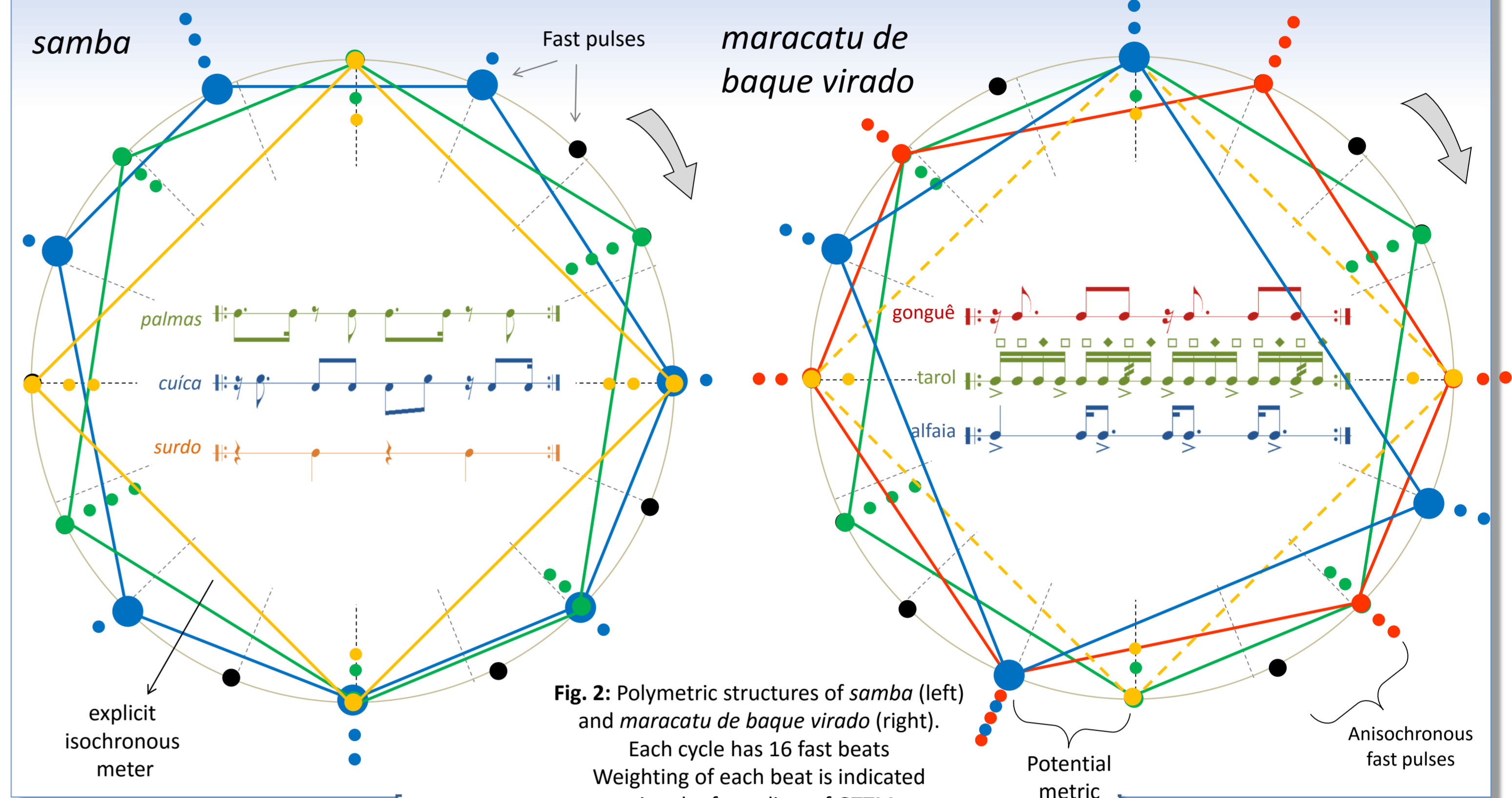


Fig. 2: Polymetric structures of *samba* (left) and *maracatu de baque virado* (right). Each cycle has 16 fast beats. Weighting of each beat is indicated using the formalism of GTTM.

Cognitive filtering

Hypothesis: Considering that the human brain cannot process all the information coming from his senses, the inferences made by the music listener are driven by a **cognitive economy** principle (Lieuury et al., 2004). So, the processing mechanism make some **expectations** (Eerola, 2003; Huron, 2006) based on the subject's **enculturation** (Herskovits, 1960) which gives information about what is **relevant** (Sperber & Wilson, 1989) or not. The increasing knowledge in a particular domain leads the information processing of the listener to move from a **data-driven process** to a **schema-driven process** (Eerola, 2003).

These schema enhance preferences for what is already known (Desain & Honing, 2003; Soley & Hannon, 2010) but limit the abilities to face cross-cultural situations (McDermott & Varenne 1995; Ayari, 2003; Kalender *et al.*, 2013).

Fig. 3: An experiment was conducted with 25 French teachers of music, in order to evaluate their behavior in front of Afro-Brazilian microtiming. Several tasks were performed :

- **Declaration** : subject has to freely describe/analyze what he's listening
- **Reproduction** : subject has to reproduce a musical stimulus (with voice, hands, ...)
- **Transcription** : subject has to propose a written representation of a musical stimulus
- **Discrimination** : see fig. 4.

The behaviors can be grouped in 8 classes, or profiles.

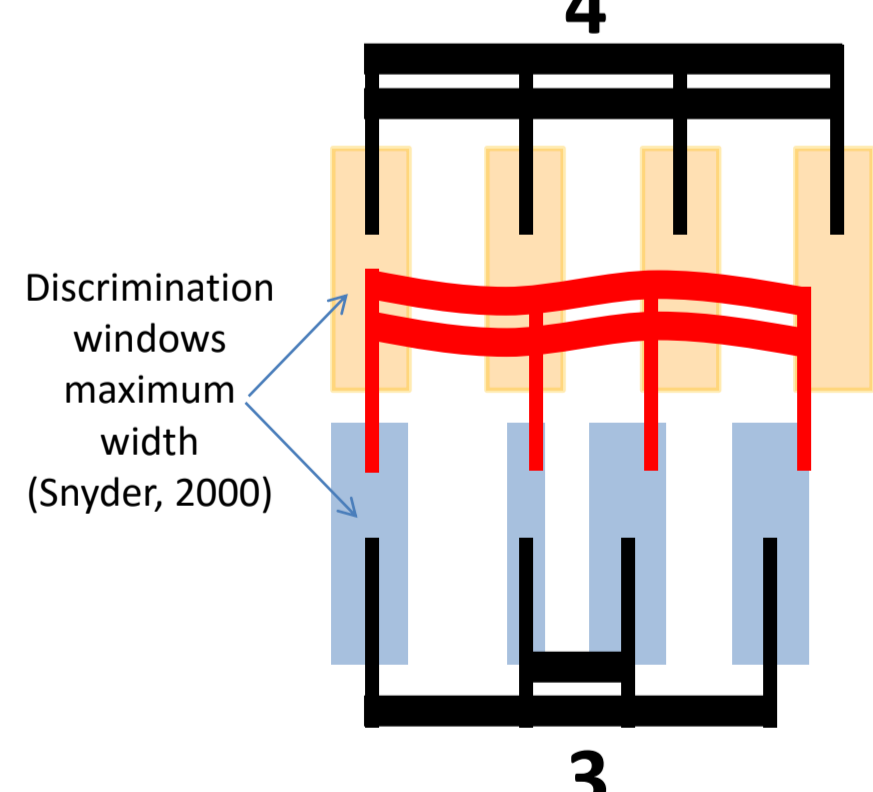


Fig. 4: In a quantization process of Afro-Brazilian microtiming, the width of discrimination windows doesn't allow to predict the result. In red color, stimulus. In black color: Western theoretical models

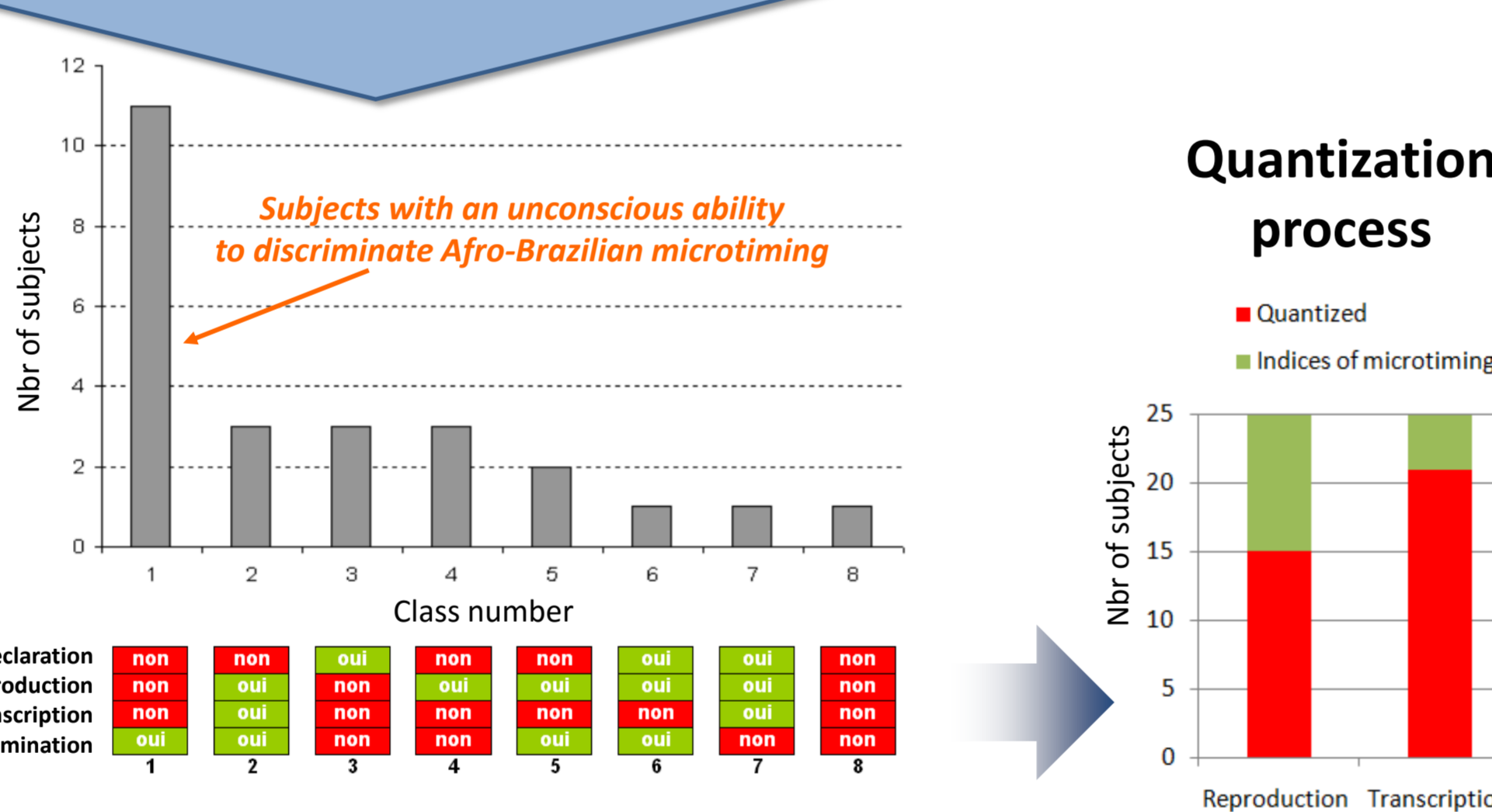
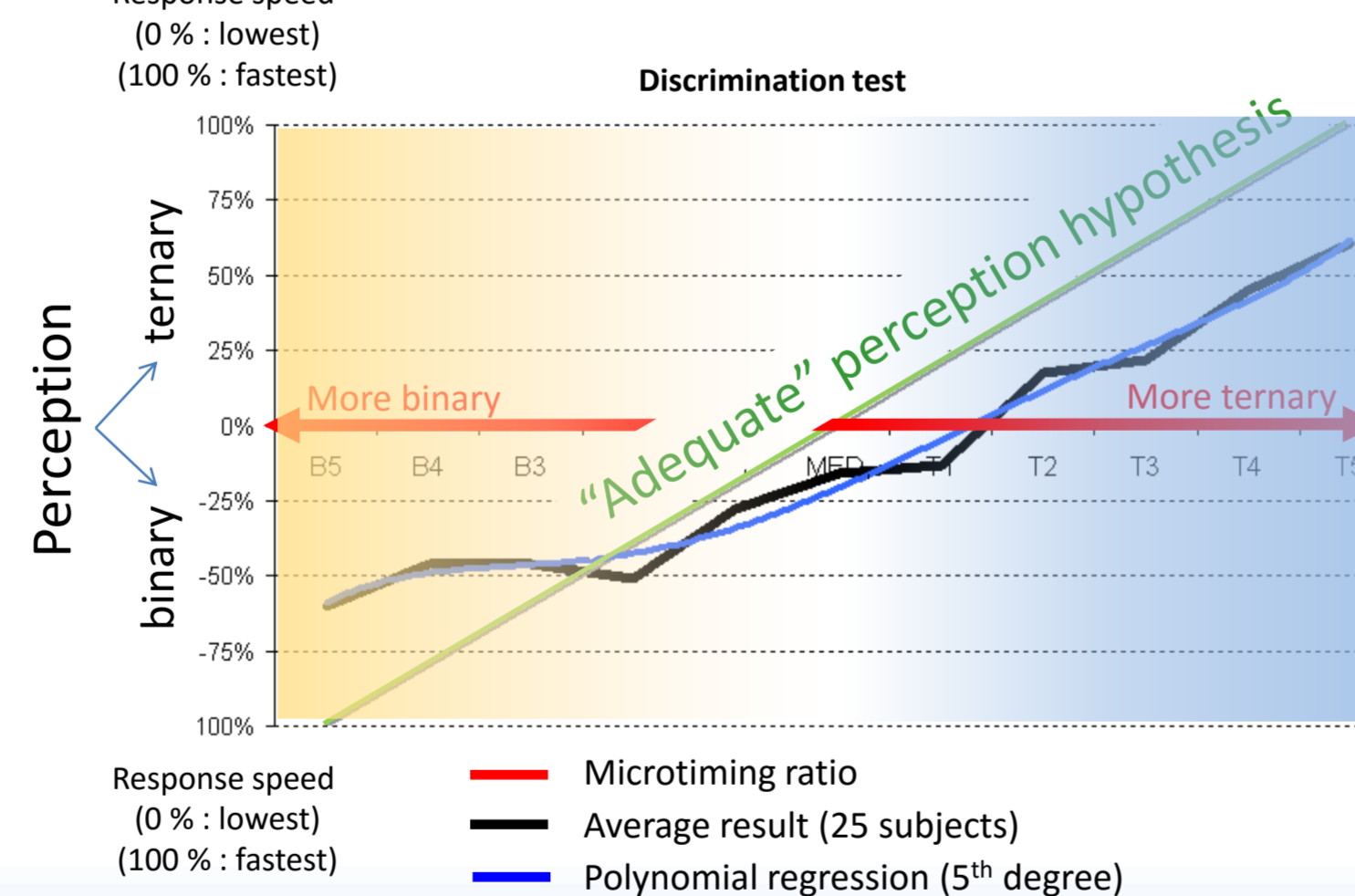


Fig. 5: In a threshold detection task where the microtiming ratio is varied, subject has to decide if each stimulus tends to sound binary or ternary. Response time gives an information about (un)certainty. Listeners show a real ability (but not conscious) to discriminate stimuli.



Hypothesis: A majority of French music teachers unconsciously discriminate Afro-Brazilian fast pulses anisochrony, but they don't use consciously this ability to recognize or play such microtiming (Guillot, 2011).

Fast-pulses quantization

samba

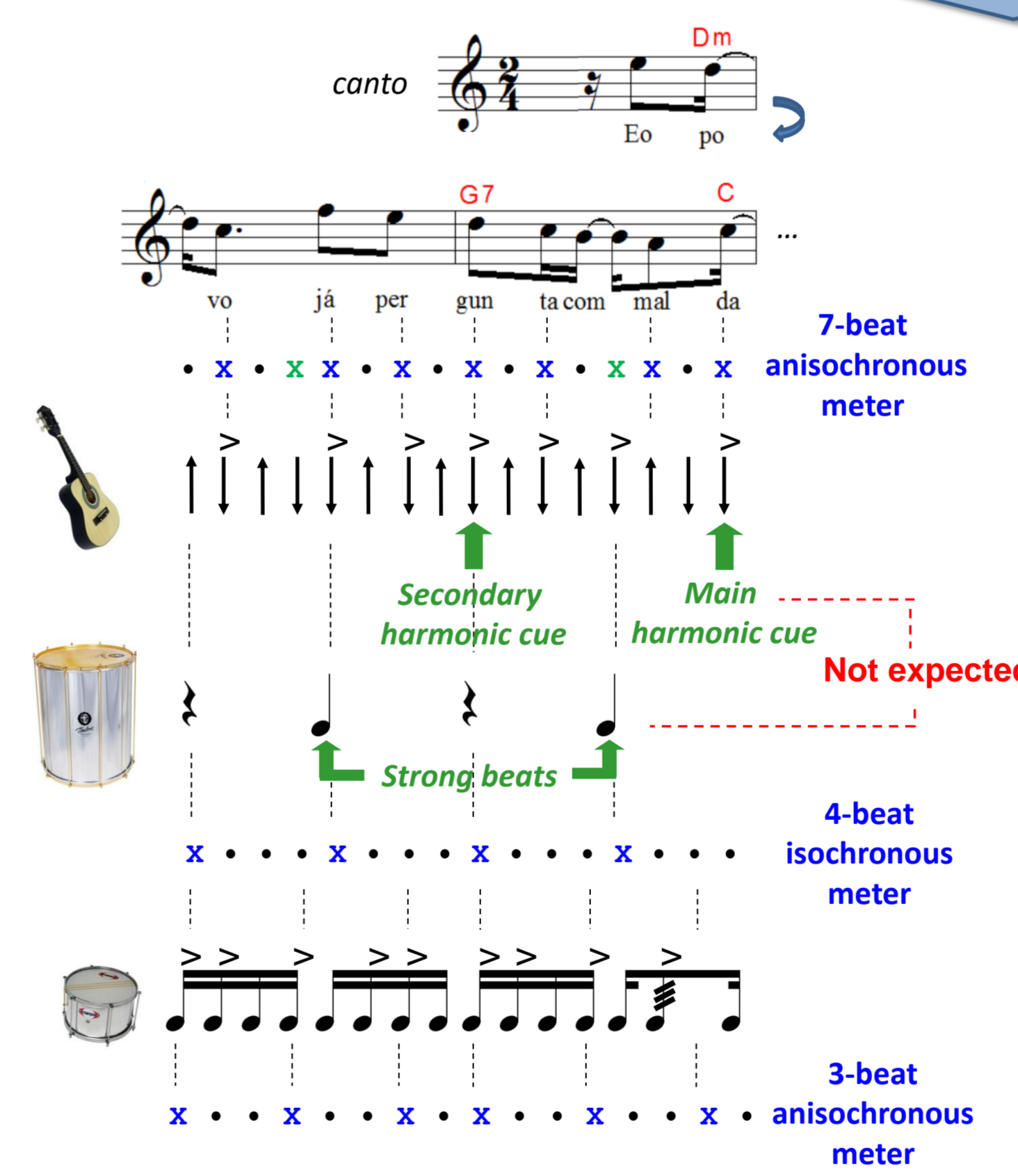


Fig. 5: Example of *samba* song (excerpt of "Onde esta a honestidade" from Sandroni, 1997) showing the nested isochronous and anisochronous meters. For a lot of Western listeners, main harmonic cue and strong beats are unexpected at their respective Afro-Brazilian positions.

Hypothesis : False metric inferences (due to metric dissonances between anisochronous meters and isochronous meter) lead to pattern transformations.

"Wrong" metric inferences

maracatu de baque virado

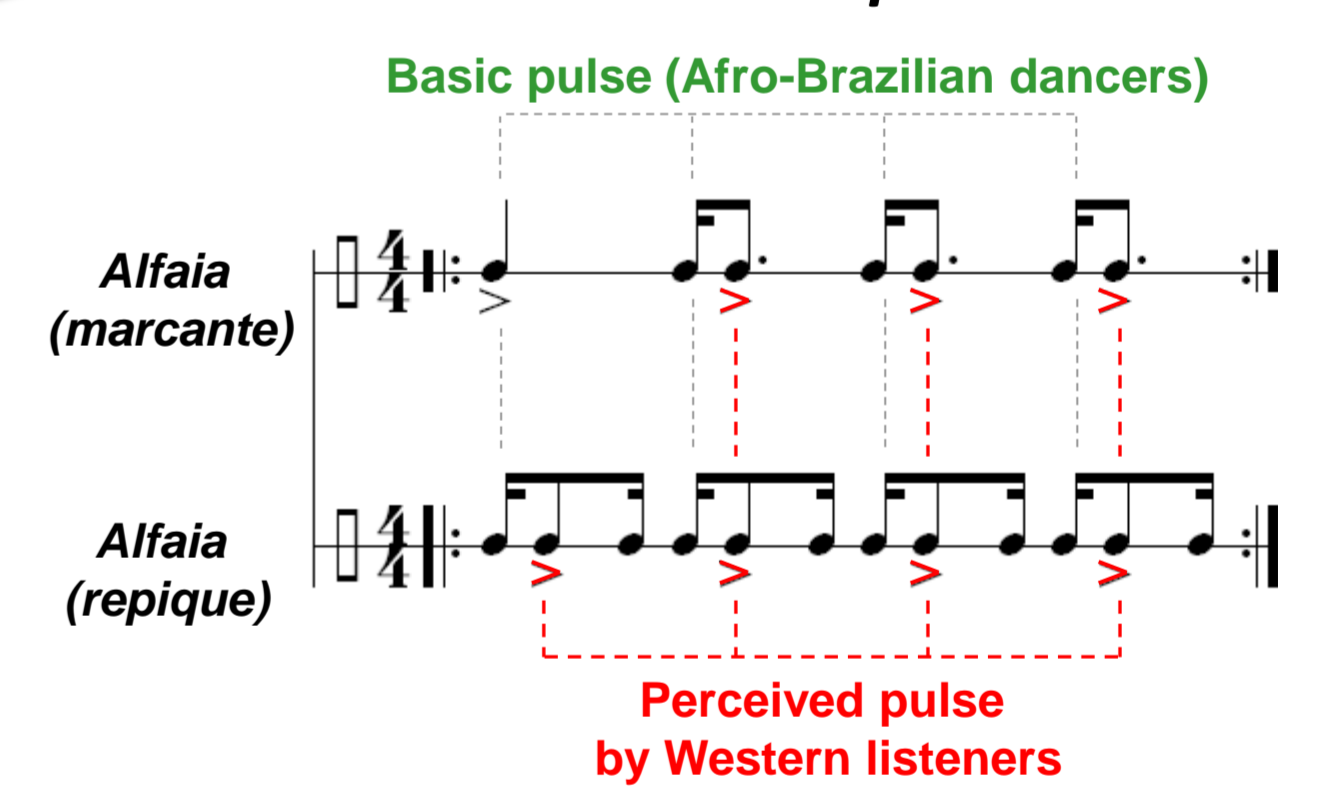


Fig. 6: In the "arrasto" pattern of *maracatu de baque virado*, a lot of Western listeners generally dance on a wrong basic pulse.

capoeira

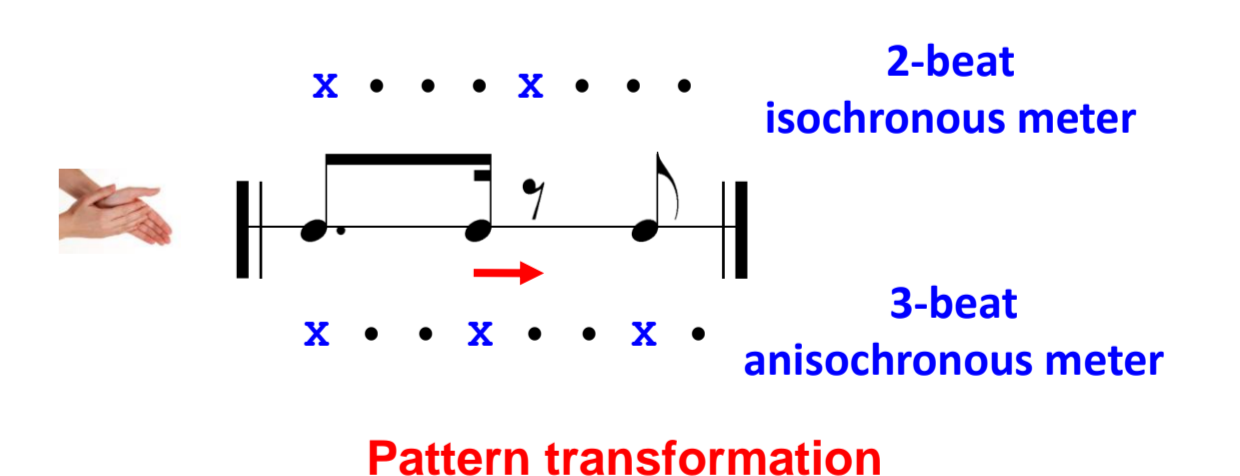


Fig. 7: In capoeira, a lot of Western listeners tend to move the « contrametric » note on a cometric position.

Conclusions

Although there's no evidence that Afro-Brazilian musicians “think” the music differently than Western musicians, the analysis of a lot of pieces pertaining to Afro-Brazilian repertoire shows that at least two ways of organizing time are structural. An increasing number of studies show that intercultural perception of these temporal organizations is “altered” by a mechanism of cognitive filtering.

Didactic implications

Some questions arise from this study:

- If structuring characteristics not taught, what is really taught?
- How to teach structuring characteristics ?
- The influences of both student enculturation and cognitive filtering mechanism are largely underestimated in Western courses of Afro-Brazilian music (and perhaps, in all cross-cultural music pedagogy)

Further steps

- **On cognitive side**: the main challenge remains to design experiments to demonstrate that the co-presence of microtiming and anisochronous meters are evidences of a specific way to “think” music.

- **On didactic side**: cross-cultural music pedagogy has big intrinsic value in terms of “musical mind” opening, but it needs to take in account the cultural background of the learners.

Bibliography

Capone, S. (2000). Entre Yoruba et Bantou. L'influence des stéréotypes raciaux dans les études afro-américaines, *Cahiers d'études africaines*, Numéro 157, pp. 55-78.

Desain, P. & Honing, H. (2003). The formation of rhythmic categories and metric priming, *Perception*, 32(3), 341-365.

Eerola, T. (2003). *The dynamics of musical expectancy - Crosscultural and statistical approaches*. Jyväskylä : Jyväskylä University Printing House.

Fonseca, E. J. de M. (2002). O toque da campânula: tipologia preliminar das linhas-guia do Candomblé Ketu-Nagô no Rio de Janeiro. *Cadernos do Colôquio*, Programa de Pós-Graduação em Artes/Unirio, v. 1, n. 5.

Gerisher, C. (2006). O Suingue Baiano : Rhythmic Feeling and Microrhythmic Phenomena in Brazilian Percussion, *Ethnomusicology*, Numéro 50.

Graeff, N. (2014). Fundamentos rítmicos africanos para a pesquisa da música afrobrasileira : o exemplo do Samba de Roda. *Música e cultura : revista da ABET*, vol.9.

Gouyon, F. (2007). Microtiming in 'Samba de Roda' - Preliminary experiments with polyphonic audio », *SBCM Proceedings*.

Guillot, G. (2008). Analyse des variations de gonguê d'une toada de maracatu nação (Brésil) - Cycle et variation, *Musimédiane*.

Günther, H. (1969). *Grundphänomene und Grundbegriffe des afrikanischen und afro-amerikanischen Tanzes*. Graz: Universal Edition.

Kalender, B., Trehub, S.E., Schellenberg, E.G. (2013). Cross-cultural differences in meter perception. *Psychological Research*, v. 77, 196-203

Kolinski, M. (1973). A Cross-Cultural Approach to Metro-Rhythmic Patterns. *Ethnomusicology*, vol. 17, pp 494-506.

Krebs, H. (1999). *Fantasy Pieces: Metrical Dissonance in the Music of Robert Schumann*. Oxford University Press.

Kubik, G. (1979). *Angolan Traits in Black Music, Games and Dances of Brazil. A Study of African Cultural Extensions Overseas* (Estudos de Antropologia Cultural 10). Lisboa: Junta de Investigações Científicas do Ultramar.

Kubik, G. (1999). *Africa and the blues*. Jackson, Miss : University Press of Mississippi.

Kvifte, T. (2007). Categories and Timing. On the Perception of Meter. *Ethnomusicology*, 51, no. 1: 64-84.

Lindsay, K. A. (2006). *Rhythm Analyzer - A Technical Look at Swing Rhythm in Music*, Thesis, Ashland University, Oregon.

London, J. [2004] 2012. *Hearing in Time: Psychological Aspects of Musical Meter*, 2nd ed. Oxford: Oxford Univ. Press.

Magill, J. M., & Pressing, J. L. (1997). Asymmetric cognitive clock structures in West African rhythms. *Music Perception*, 15, 189-221.

McDermott, R., Varenne H. (1995). Culture as disability. *Anthropology & Education quarterly*, 26(3), pp. 324-348.

Mukuna, K. W. (1979). *Contribuição bantu na música popular brasileira*. São Paulo : Global.

Polak, R. (2010). Rhythmic Feel as Meter. Non-Ischronous Beat Subdivision in Jembe Music from Mali. *Music Theory Online*, 16, n°4.

Sandroni, C. (1997). *O feitiço decente - Transformações do samba no Rio de Janeiro (1917-1933)*, Brazilian version of PhD thesis.

Soley, G., Hannon E. E. (2010). Infants Prefer the Musical Meter of Their Own Culture: A Cross-Cultural Comparison. *Developmental Psychology*, Vol. 46, No. 1, 286-292

Sperber, D., Wilson, D. (1989). *La Pertinence : Communication Et Cognition*. Paris: Les Editions de Minuit.

Vatin, X. (2005). *Rites et musiques de possession à Bahia*. Recherches Amériques latines, Paris, L'Harmattan.

Write B., Berdhal, E. (2006). Towards Machine Learning of Expressive Microtiming in Brazilian Drumming, *Proceedings of the 2006 ICMC*, Ed. ICMA, San Francisco, CA, pp. 572-575