

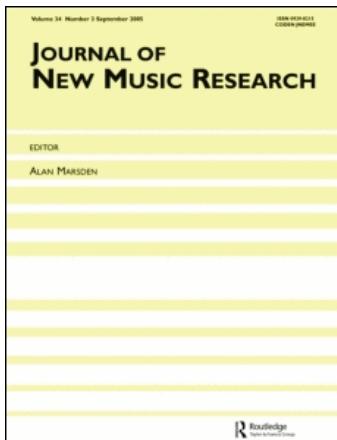
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A Cross-modal Heuristic for Periodic Pattern Analysis of Samba Music and Dance

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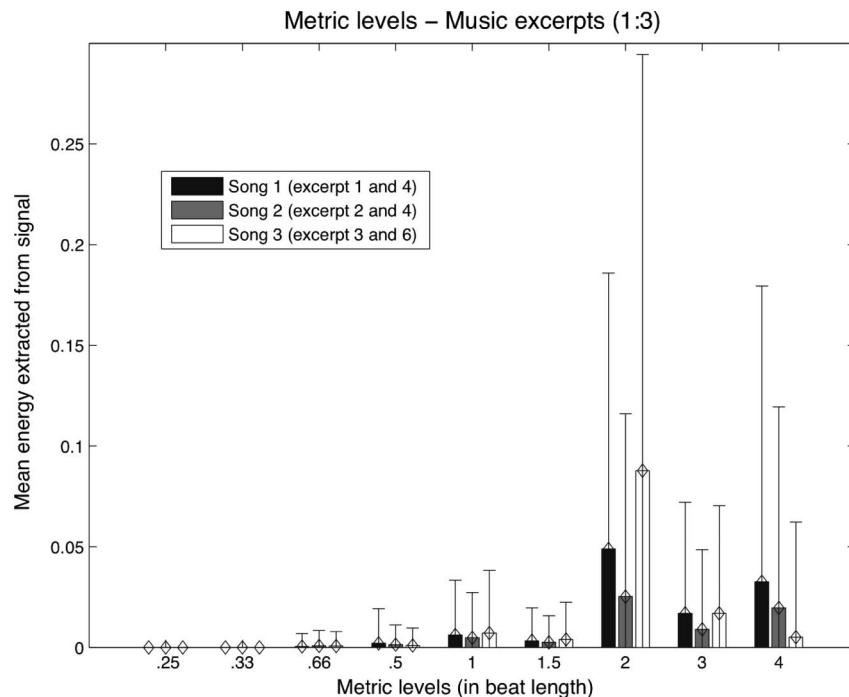


Fig. 24. Mean energy and standard deviation of periodicities found in all body parts, all excerpts, across different stimuli. The same songs were performed by both dancers (see description in Section 7.1.1).

and rotated around the heel in the half part of the gesture cycle. However, in the dances performed by the female dancer we observed that her feet movements involve shorter projections ahead and but a rotational gesture around the extremity of the feet. Although this explanation of differences is not properly described by our representations, the gesture grid of feet is able to capture relevance and metric and rhythmical engagement of overall movements.

9. General discussion

The goal of this paper was the presentation and illustration of a cross-modal method for the study of samba music and samba dance.

The core of this method is the use of musical metre as a lens to decompose body movement according to a proper periodic structure. The method is in agreement with an elaborate literature in which the samba culture is described as a form of human expression, in which music and dance are intricately related with each other (Sodré, 1979; Browning, 1995). Above all, our method is inspired by recent neurophysiological insights in the way in which humans handle periodicity when moving. Reference can be made to the hypothesis of a coupling between perception and action through a neuronal mirror-system (Rizzolatti & Craighero, 2004), and more specifically, evidence for strong ‘period-based entrainment mechanisms between motor and auditory systems,

similar to oscillators that become coupled in frequency to one another’ (Thaut, 2005, p. 43). This hypothesis is based on the possibility of a direct projection of rhythmic time information as auditory perceived into rhythmic motor responses. Hence, it can be conceived as a kind of resonance system.

However, the embodiment of music may rely on different degrees of resonance behaviour, which range from simple synchronization to attuning (or re-enactment) and empathic behaviour (Leman, 2007). In samba music and dance, there are indications that the human body is involved in a consequent re-enactment of the samba metre. Re-enactment assumes an active role of the subject that responds to music.

Evidence for the re-enactment hypothesis is revealed by our cross-modal analysis, in particular by the finding that the metre in samba dance is not exactly the same as the metre in samba music (Figures 15(a) and (b)). Indeed, metre in samba music is characterized by periodicities that extrapolate the binary musical bar, showing quaternary and ternary metre tendencies (Figure 17). One may also point out an inherent rhythmical ambiguity, which further contributes to the overall confused and ambiguous metric character of samba music. In contrast with the music, metre in samba dances seems to suggest a different profile in which the binary beat layer gets a more prominent role (Figure 19). Our initial observations suggest that counter phase oscillations between mirrored body parts may reaffirm these symmetrical 2-beat movements. Spatial gestures not only

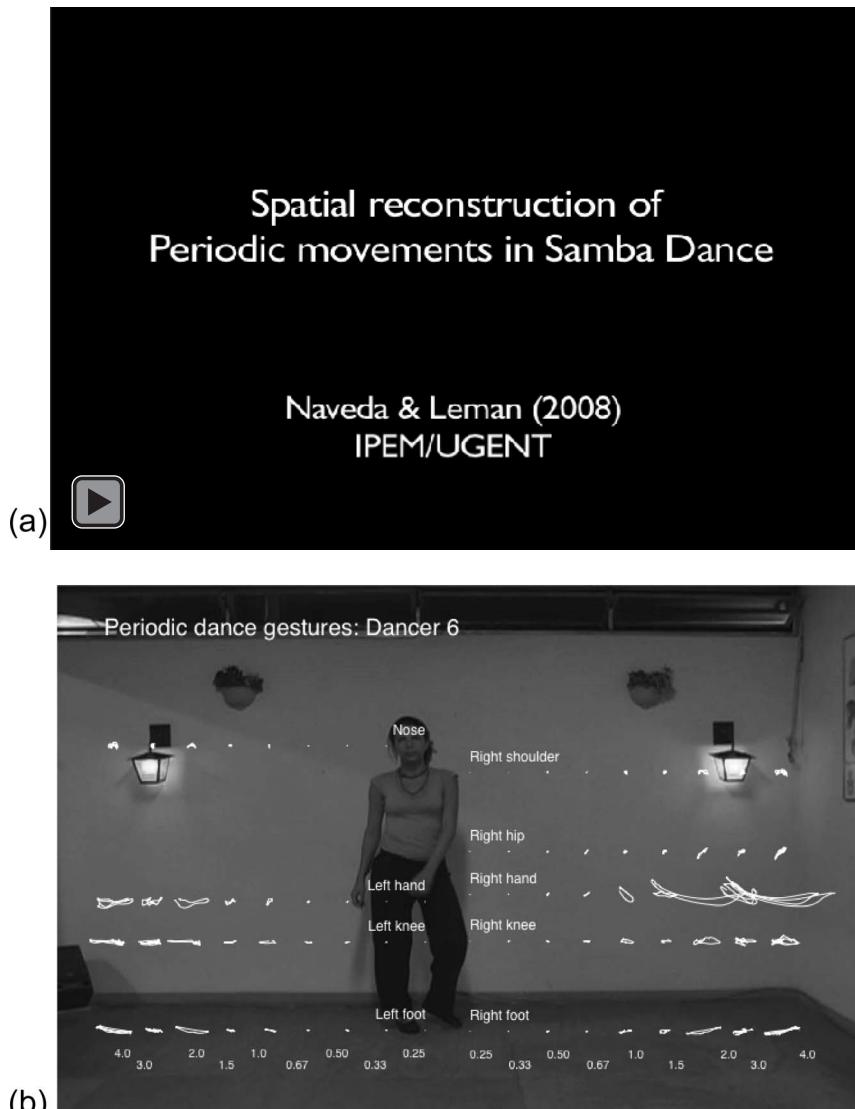


Fig. 25. (a) and (b) complete set of metrical gestures in two dances. Metrical layers expand from the centre to the extremities of the figure.

are better defined in 2-beat layers, but gestures are more precise and strong in the affirmation of beat and 2-beat marks (Figures 22 and 23). Further study is needed to figure out the precise nature of the rhythmic figures and interactions between body parts. It is likely that they may reveal interesting metrical constituents that reinforce oscillations in bar, beat and *tatum* levels.

Obviously, the cross-modal method is a starting point for further development in several directions. Our re-enactment hypothesis implies that the samba dance in turn contributes to perception through a disambiguation of the inherent ambiguity of the samba music metre. Disambiguation may well be the effect of the biomechanics of the human body, which imposes a certain motor structure onto an ambiguous auditory stimulus. The role of the body in this process may be a determining factor in meaning formation and subjective experience.

There are several ways in which the present study may be further developed.

A first direction is an improved motion capturing technology. While significant results can be obtained with video capturing, other methods, such as 3D-motion tracking systems (based on infra-red cameras) may provide finer details of the movement. Furthermore, we believe that our method can be easily extended to 3D motion.

A second direction is concerned with the study of a larger dataset for samba music and dance. We believe that our method can be applied in a straightforward way to an extended database of samba music and dance, and other styles as well, which is needed to test the re-enactment hypothesis more thoroughly.

A third direction is concerned with a refinement of the cross-modal method and its associated heuristics itself. This method consists of a periodicity analysis and a