

## SUMMARY

Uruguayan Candombe drumming has deep African roots, and like other musics of the Afro-Atlantic world, its rhythm is timeline-based. The timeline pattern of Candombe, called *madera*, has many traits in common with similar patterns in Afro-American music, like the *son clave*. It presents, however, significant differences with the more common uses of timeline patterns in other musics of the same tradition. For instance, instead of a single timeline pattern as in other Afro-Latin-American musics, the *madera* pattern allows for different variants. In this paper, Music Information Retrieval techniques are applied to a dataset of Candombe recordings in order to analyse the characteristics of the *madera* pattern, and group and classify its most recurrent variations.

## URUGUAYAN CANDOMBE DRUMMING

### Llamada de tambores

- ▶ drum call parade
- ▶ groups of ca. 20 to 60 players
- ▶ three types of drum: *chico*, *repique*, *piano*



Fig. Group of Candombe drummers (*cuerda de tambores*) during a *llamada de tambores*.

### Rhythmic structure

- ▶ 4-beat cycle, 16 pulses
- ▶ *chico*: high pitch, timekeeper
- ▶ *repique*: medium pitch, improviser
- ▶ *piano*: low pitch, rhythmic cycle

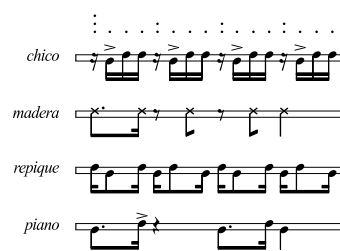


Fig. Simplified primary patterns of the three drums and *madera* with metric structure

## MADERA PATTERN

The *madera* (or *clave*) pattern is produced by hitting the wooden shell of the drum with the stick. Played by all the drums as an introduction to and preparation for the rhythm; during the *llamada* only by the *repique* drum in between phrases.

## DATASET

- ▶ 14 complete performances (45 mins)
- ▶ multitrack audio recordings in studio
- ▶ ensembles of three to five players
- ▶ five different renowned players
- ▶ rhythm cycles manually labeled (i.e. beat and downbeat annotations)
- ▶ ca. 500 cycles are *madera* patterns



## AUDIO FEATURE EXTRACTION

Spectral features used for both onset detection and *madera* sound classification.

### Spectral flux (SF)

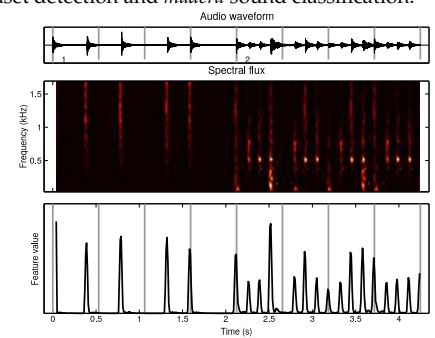
- ▶ Short-Time Fourier Transform
- ▶ mapped to MEL scale bands
- ▶ first-order difference
- ▶ half-wave rectified

### Onset detection

- ▶ SF summed along all sub-bands
- ▶ fixed and adaptive thresholds

### Sound classification

- ▶ first 40 MEL bands (< 1500 Hz)
- ▶ SVM trained on isolated sounds



## DETECTION OF MADERA PATTERN SECTIONS

- ▶ proportion of onsets classified as *madera* within each rhythm cycle
- ▶ threshold computed using Otsu's method for a two-state classification
- ▶ hysteresis post-processing to avoid some spurious transitions

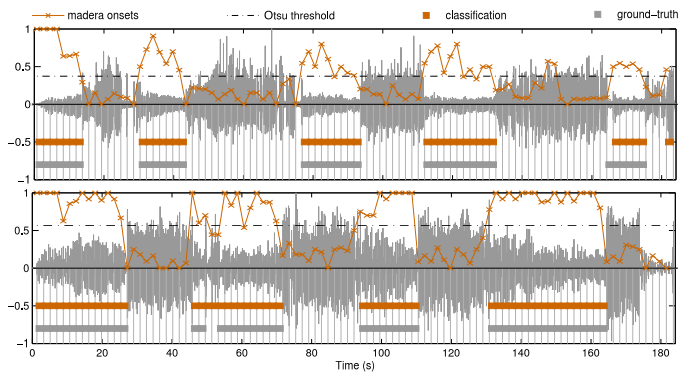


Fig. Detection of *madera* pattern sections for two *repiques* playing simultaneously

## ANALYSIS OF MADERA CYCLES IN A RECORDING

- ▶ feature signal is time quantized to the 16 rhythm subdivisions
- ▶ a map of the feature vectors of each rhythm cycle is computed
- ▶ the detected *madera* patterns are clustered and aurally checked

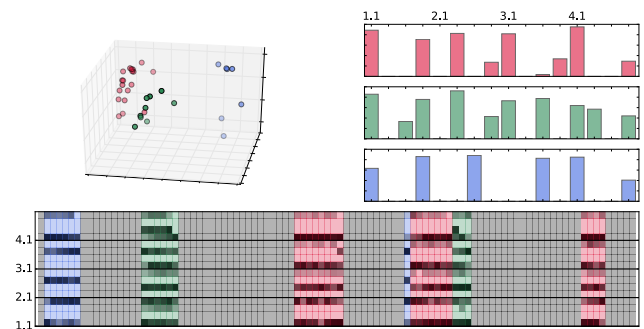


Fig. Analysis of *madera* patterns in a single recordings. The feature map of the recording (below), the centroid of each cluster (top-right) and a 3D Isomap representation of patterns (top-left).

## DATASET ANALYSIS

All the cycles with *madera* pattern in the dataset ordered by cluster, with transcription in music notation. There are four main groups, two of which can be subdivided in two variations.

