

# Mechanisms of Groove and their Applications

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## What makes us tap our feet, rock our head and get up and dance?

Groove is often described as the experience of music that makes people tap their feet and want to dance. The ShakeIt project looks into systematic patterns of signal properties (timing, metrical, dynamic, etc.) and relates them to the experience of groove. To that end, an analysis/synthesis process is followed.

Audio samples were automatically analyzed and examined against human judgments in empirical experiments to reveal the particular features that contribute to the experience of groove. Various rhythmic properties were found to be related to groove, some of which were genre-specific and some of which were general across genres.

## Analysis of Music Performances

**expressive micro-timing deviations**

Performers tend to systematically deviate (**swing**) from the metronomic time positions that correspond to the music score. The small timing deviations contribute to the expressiveness of the performance.

Music Score

beats 1 'n 2 'n 3 'n 4 'n 1 ...

"ON-sets" taken from a performance

hi hat

snare

kick

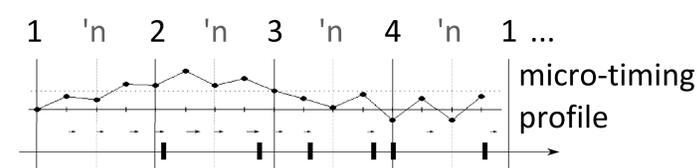
e.g. the Funky Drummer by James Brown

... **syncopation**

In several music styles, such as popular dance music, it is very common for rhythmic patterns to contradict the characteristic alternation of strong and weak events of the musical meter. Accented sound events often occur in unexpected metrical positions, such as **off the beat** 16th notes.

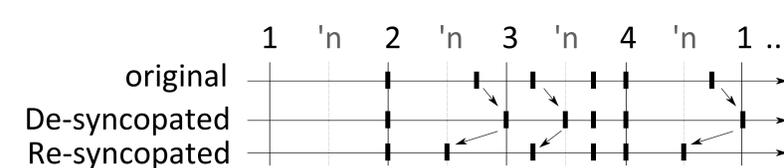
## micro-timing deviation VS metrical positions

Micro-timing deviations were studied in different musical styles. Three micro-timing profiles were created based on analysis of the funk, jazz and samba music styles.



## Algorithmic Generation of Music Examples

## Syncopation and De-syncopation of rhythmic patterns

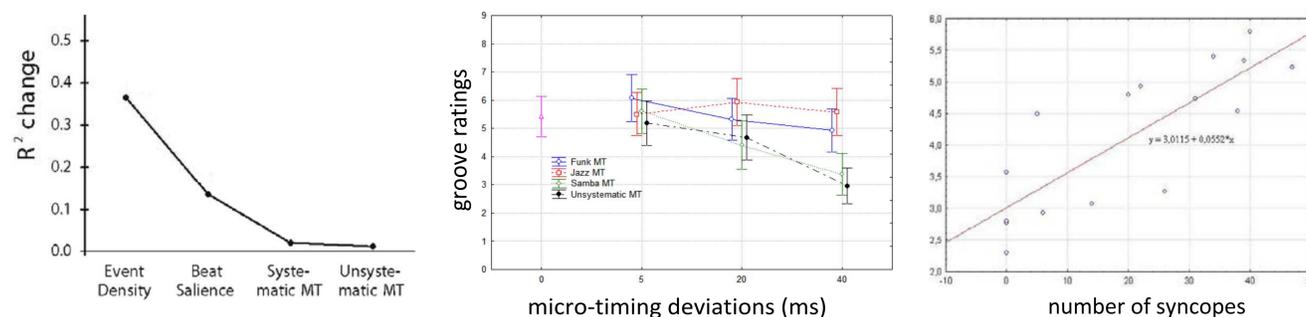


The syncopation of several songs was manipulated by "shifting" the events in rhythmic patterns

**Micro-timing deviations** were systematically and gradually applied to rhythmic patterns.

**Syncopation** was introduced in various degrees by varying the number of "shifted" events.

## Listening Experiments



Ratings on groove were collected from music experts and non-experts. Several low level descriptors were found to correlate with the groove ratings.

**Contrary to common wisdom we discovered that micro-timing did not increase groove in the context of our experiments. But, syncopation proved to greatly affect the groove feel.**

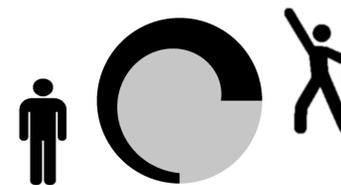
Don't Groove			Groove
Systematic and Unsystematic Micro-Timing		Syncopation, Event Density, Beat Salience	

## Creative Applications

The knowledge gained from the research drives the development of our music algorithms and software applications designed specifically for the effective manipulation of groove in rhythmic sequences.



## The Groove Dial



Additionally and as part of this project, datasets of audio samples were compiled, as well as tools for their annotation. All software and datasets are made freely available for other researchers or musicians through the project's web site.

## Selected Publications

G. Madison, G. Sioros, M. Davies, M. Miron, D. Cocharro, F. Gouyon, "Adding syncopation to simple melodies increases the perception of groove", Poster presented at the Conference of the Society for Music Perception and Cognition, 2013

M. Davies, G. Madison, P. Silva, F. Gouyon, "The effect of microtiming deviations on the perception of groove in percussive music", (inpress), Music Perception, 2013.G.

Sioros, A. Holzapfel, C. Guedes. "On measuring syncopation to drive an interactive music system". In Proc of ISMIR 2012, Porto, Portugalpp. 283-288, October, 2012

G. Madison, F. Gouyon, F. Ullén and K. Hörnström, "Modeling the tendency for music to induce movement in humans: First correlations with low-level audio descriptors across music genres" Journal of Experimental Psychology: Human Perception and Performance, 37 (5), pp.1578-1594, 2011.