# Algorithmic Cross-Mixing And Rhythmic Derangement

*Zlatko Baracskai*

University of the West of England
Coldharbour lane
BS16 1QY Bristol, UK
zlatko.baracskai@uwe.ac.uk

## ABSTRACT

This paper discusses the circumstances and the results in automating rhythmical derangement of popular music in order to render an odd-meter version of a tune. The resulting pieces will be performed in a late night concert of the International Computer Music Conference resembling a typical DJ performance setting. Created remixes often use two widely known tunes in parallel to bear the title of a cross-mix. The cross-mixes are made by firstly synchronising the tracks in their original time-flow by using audio stretching techniques. Secondly, the probabilistic splicing algorithms and further time-stretching are employed to render the tracks within a different metric structure. Finally, DJ production and performance techniques provide appropriate ways of mastering and presenting the pieces in a club-type environment.

The paper will further deal with the intentions behind using popular tunes, odd-meters and algorithms in the light of the motivation that yielded the currently presented system. The designed software plug-in will be briefly documented and made public as open-source development.

## 1. INTRODUCTION

The idea of rhythmical derangement was born from author's interest in odd meters and his general dissatisfaction with the widespread use of 4/4 timing. The construction of comprehensible yet admittedly more complex, asymmetric rhythms is the main artistic objective of the documented work and the resulting performance. The origins of these rhythms in dance music are believed to stem from Bulgaria and the surrounding Balkan countries [10] [14] [15].

The use of computer algorithms is meant to challenge the perception and stimulate creativity in order to synthesise a unique musical style rather than emulate an existing one, a distinction well defined by David Cope [5]. It is notable, that attempts to algorithmically synthesise popular music have gained stage in the recent years [4] [12]. The availability of a software framework aimed at dance music production, which can be easily expanded to utilize a variety of generative procedures [1] is likely to support an increase in application of these techniques. The current study explores one such specific technique developed to allow complex rhythmic manipulation of recorded music.



## 2. RHYTHMIC DERANGEMENT

Initially, the author used audio splicing to remix popular music as a way of investigating the easy to apprehend harmonic and melodic structures in a mutilated metric context. The familiarity of the musical flow aids its preservation within a distorted metric structure and thereby makes the comprehension easier for listeners not trained in folklore dance music that traditionally employs odd meters in fast tempi.

Mutation of the musical time-flow by displacing certain note onsets produces an alternative rhythmic arrangement that is referred to as derangement. This practice was first made possible by the recording technology that allowed studio-based manual operation on audio material – tape splicing. Software emulations of splicing and time stretching accelerated this process and allowed further development of derangement techniques. The basic splicing in this context may produce gaps in the audio as seen in Figure 1., where a displacement of a single percussive attack is displayed. Other than yielding a silent gap this transformation also erases an equally long portion of the audio creating two audible discontinuities.

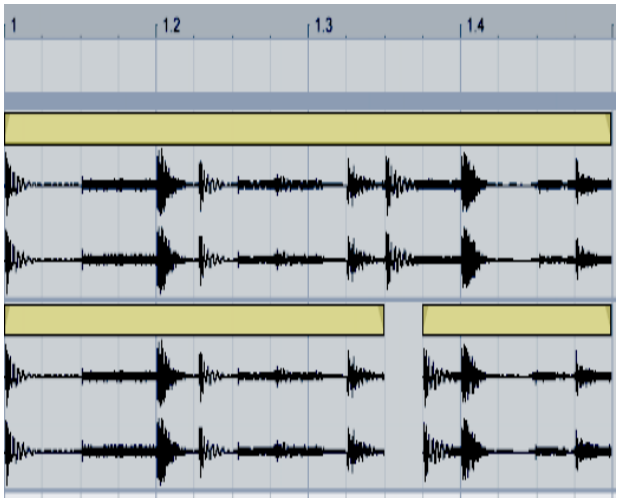


**Figure 1**. The waveform of a recorded drum sequence and the splicing based rhythmic derangement.

As the software based time-stretching techniques developed, they now support seamless displacement of the transients. This can be done by marking musical

moments and dragging them to a new metric position. The displaced transient will thereby induce a different time-stretching factor for the segments encompassed with the previous and with the next marked transient, as can be observed in Figure 2. Other than reducing the discontinuity, this allows for quicker and more flexible rhythmic derangement facilitated by the arbitrary metric grid imposed on the original sound file.

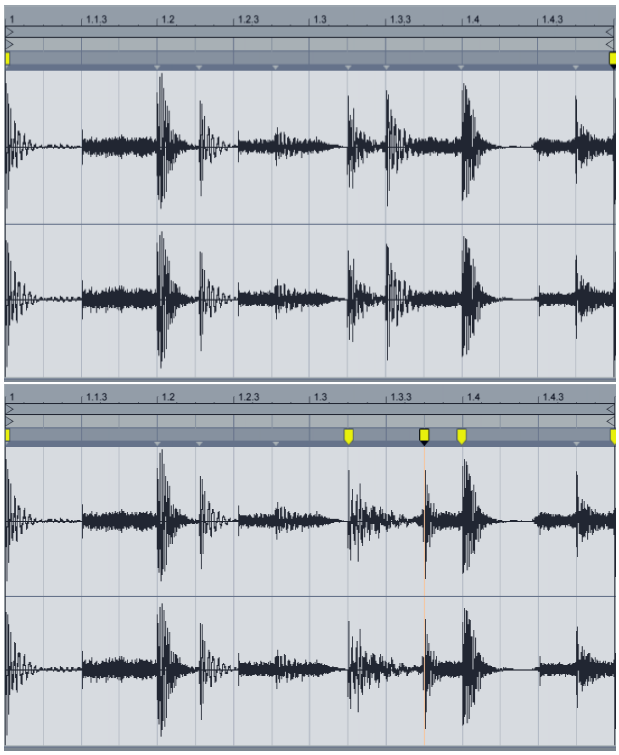


**Figure 2**. The waveform of a drum-beat and the displacement of a transient using markers.

The employed software framework [1] that enables easy rhythmic displacement within audio files can be furthered to allow algorithmic derangement by building custom API and audio processing effects. This study deals with an implementation of an audio effect that uses probabilistic generative techniques for rhythmical derangement. Having such applications at hand allows the composer to easily investigate rhythmical manipulation and challenge his own understanding of articulation within an odd time signature.

## 3. ASSYMETRICAL TIME SIGNATURES

The objective of preserving musical flow in transformations targeting complex metric structures is greatly determined by the admiration of folk music from the Balkan Peninsula. In this tradition the musical phrases are combined in sequence regardless of binary duration subdivision. Such rhythmic patterns are repeated to define a staggered musical flow.

In literature these rhythms are mainly referred to by their Turkish name *aksak*, meaning lame, stumbling or limping [8]. Often their fast pace allows the dancers to embody the flow, as the subdivision of fast asymmetric rhythms cannot be perceived [2]. Instead, it is a sequence of shorter and longer pulses with a clearly repeating pattern that stands out from texturally complex rhythmical background. Research into perceptual and performative aspects of these rhythms shows the great timing irregularities inherent in this tradition [13]. In the beginning of the previous century, analytical musicology has managed to approximate these timing peculiarities thereby standardizing and classifying the repertoire [10].

The resulting repetitive sequence of weak and strong beats was initially referred to in asymmetric rhythmical traditions by the name of the accompanying dance [15]. By assuring reliable recursion of the strong beats the complexity of the rhythm is reduced. In fusing these influences with contemporary dance genres, the produced music is fully quantized to the temporal grid. A listener should sense the recurring period but might not understand the subdivision if one lacks attention or acquaintance with such rhythms.

This strategy, hereby produces a steady yet complex pulsation that can act as the rhythmically innovative basis for a new musical sub-genre called *folk step*.

## 4. CROSS-MIXING

Although Egnes [7] argues that the remix has a larger significance than a phenomenon uniquely placed at this period in our history, the remixing of music could also be considered remote from true authorship. However, a majority of musical elements that create any musical piece, in general, have their precedents in the past thereby highlighting a considerable difficulty in producing a truly original work. Almost every musical piece is based on certain developments prior to the composition, be it the development of an instrument, rhythmic pattern, musical scale or an electro-acoustic component. A standpoint can be maintained that the borderline between authorship and artistic recycling is rather blurred due to the exponential growth of cultural artefacts [11].

In this exploring of asymmetrical rhythms the steadily recurring, bar-marking pulse is crucial to maintain. This strategy distances the music from the often pattern-phasing, floating character of these meters in contemporary music. Successful anticipation of major accents in music has a facilitating effect on attention [9].

It is proposed that this type of metric transformation yields best results when separate musical stems undergo the processing with different parameters tuned to preserve the musical flow of each stem in a distinct fashion. Hereby, having the discontinuities within different stems occur at different metric positions, superior preservation of musical flow is achieved compared to the previously described splicing operations.

## 5. METRIC STUMBLING

The current generative system employs solely design algorithms [16], the criticism and selection is left to the composer, making this a tool, rather than an autonomous musical machine. The introduced rhythmic derangement audio effect – zb.*metricStumble* [20] - operates by increasing the delay time in sync with the original, often quantized tempo. Allowing the composer to interact with the parameters of this probabilistic process, yields an active instrument [3] for transmutation of musical recordings.

This audio effect operates on a time-grid specified by the *grid* parameter as in Figure 3. The *tabSize* setting fixes the duration of a metric cycle and thereby the amount of vertical sliders representing the stumbling probability. During each cycle there will occur a fixed number of 'stumblings' – sudden delay time jumps - specified by the *cuts* parameter. As the cycle progresses each grid point is represented by the next slider, which determines the likelihood of stumbling at that point time. Each 'stumble' cumulatively increases the delay time by the *cut back* duration, specifed using rhythmical duration units. If the *cut back* duration equals the *grid* and the original time signature relates to the *tabSize* – *cuts* difference, then the audio effect will repeatedly transform the rhythm into a meter related to the tab size. Using two delay lines, the stumbling can be made seamless using the *attack* and *decay* parameters to control the cross-fade between the cuts. The *transport latency* control allows offsetting the splices back in time to assure a cleaner transient response.

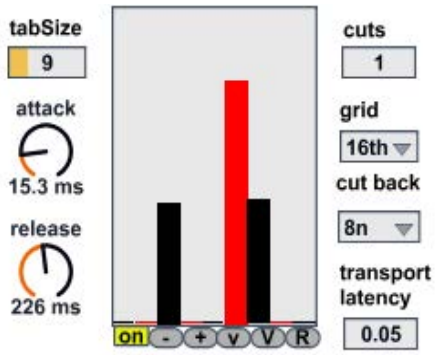


**Figure 3**. User interface of the *zb.metricStumble* Max For Live audio effect.

## 6. SUMMARY

In this paper a musical tool has been documented aimed at achieving a unique purpose of enabling automatic fusion of two remote genres. Many references have been cited to provide overview of the research that can shed light on the origins and properties of this fusion. The resulting music is to be performed live in an improvised DJ performance. Rendered pieces are freely available online through author's website [19].

The interest found in this approach is based on the derangement of familiar music. The expectations of the listener are being constantly addressed as each bar of known music is rhythmically transformed. This erratic process appears inconclusive but reveals its regularities soon after. As the metric recurrence becomes apparent it only takes focus and determination to catch up with the beat.

## 7. REFERENCES

[1] Ableton Max for Live, accessed 15/07/2014, http://www.ableton.com/maxforlive

[2] Bartók, B. "Some Problems of Folk Music Research in East Europe" In B. Suchoff (Ed.), *Béla Bartók Essays*. Faber and Faber, London, UK, 1940/1976.

[3] Chapel, R. *Realtime Algorithmic Music Systems From Fractals and Chaotic Functions: Toward an Active Musical Instrument,* PhD Thesis, Universitat Pompeu Fabra, Barcelona, Spain, 2003.

[4] Collins, N. "Algorithmic Composition Methods for Breakbeat Science" *Proceedings of Music Without Walls*, 2001.

[5] Cope, D. *Virtual Music: Computer Synthesis of Musical Style,* The MIT Press, Cambridge, Massachusetts, USA, 2001.

[6] Creston, P. *Principles of Rhythm,* Belwin Mills, Melville, New Yorkm USA, 1961.

[7] Egenes, J. "The remix culture: How the folk process works in the 21st century", *PRism 7(3)*, Wellington, New Zealand, 2010.

[8] Fracile, N. "The Aksak Rhythm, a Distinctive Feature of the Balkan Folklore", *Proceedings of the Studia Musicologica Academiae Scientiarum Hungaricae 44/1-2,* Budapest, Hungary, 2003.

[9] Huron, D. *Sweet Anticipation – Music and the Psychology of Expectation*. The MIT Press Cambridge, Massachusetts, USA, 2006.

[10] Krader, B. "Bulgarian Folk Music Research", *Ethnomusicology, Vol. 13, No. 2,* New York USA, 1969.

[11] Manovich, L. "Remixing and Remixability", accessed 20/02/2012, www.manovich.net/DOCS/Remixability_2.doc , 2005.

[12] Maurer, P. *Generating a Genre: An Algorithmic Approach to Creating Popular Music*, MMus Thesis, New York University, USA, 2009.

[13] Moelants, D. "Een model voor ritmeperceptie toegepast op de muziek van de 20ste eeuw" *PhD Thesis*, Universiteit Gent, Belgium, 2002.

[14] Proca-Ciortea, V. "On Rhythm in Rumanian Folk Dance" *Yearbook of the International Folk Music Council, Vol. 1,* 1969.

[15] Singer, A. "The Metrical Structure of Macedonian Dance" *Ethnomusicology, Vol. 18, No. 3,* University of Illinois Press, USA, 1974.

[16] Stiny, G. & Gips, J. *Algorithmic Aesthetics,* University of California Press, Ltd. London, England, 1978.

[17] Temperly, D. *Music and Probability,* The MIT Press Cambridge, Massachusetts, USA, 2007.

[18] Wateny, S. "Cover story - music remixes" *Artforum International Magazine*, New York, USA, 1994.

[19] www.zlatko.hu, accessed 15/07/2014.

[20] zb.metricStumble, accessed 15/07/2014, http://www.maxforlive.com/library/device/2427/zb-metricstumble