THE WALKING MACHINE

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ABSTRACT

The Walking Machine is a realtime controlled generative rhythm section, which has been developed for live performances in a free jazz context. The Walking Machine provides a stable rhythmic platform and basic swing as well as being dynamic enough in order to allow its player to interact with other musicians in a direct musical way. A Game pad is used as the controller, with realtime access to high-level parameters that controls probability distribution of intervals and durations, the performer controls the overall behaviour of the instrument. The instrument is allowed to sound and act "artificial" at the same time retaining the traditional role of a rhythm section. I suggest that The Walking Machine expresses some of my musical preferences. Development and evaluation relies on the author's experience as a practicing musician on saxophone for many years.

1. INTRODUCTION

The Walking Machine was designed to be a live instrument that was as expressive and dynamic as a traditional rhythm section. The main idea was a concept that featured real time control of high-level parameters that controls e.g. probability distribution of intervals and duration. The performer plays and controls the overall behaviour of the instrument; single musical events are generated by underlying stochastic processes. The instrument was designed with no constraints concerning meter, period and harmony to offer the soloist maximum freedom within the given musical style.

2. BACKGROUND

2.1. Probability distribution and interpolation

In the last two decades a vast number of programs that utilize transition probabilities based on Markov chains of various degrees for analysis or generation of musical events have been presented. Notable examples are Robert Rowe's Cypher (1) and George Lewis's Voyager (2). The majority of those programs were about creating virtual co-musicians whose musical outcome typically was derived from a musicians input and/or based on pre-programmed constraints. However, the Walking Machine was created with the aim to be a playable independent and dynamic live instrument in a free jazz group context.
In 2003 David Wessel and Ali Momeni presented *Space Master* (3), an application that featured mapping from low dimensional controllers, like knobs and joysticks, into multi dimensional spaces. Their software was built on realtime interpolation between stored lists of parameter values.

2.2. Musical inspiration

The musical inspiration is a free tonal walking style inspired by, for instance, *The Sorcerer* by Miles Davis Quintet (4), John Coltrane Quartet as heard in *One Down, One Up* (5), Wayne Shorter's *Super Nova* (6) as well as Ornette Coleman's *Science Fiction* (7).

2.3. Intervallic approach in jazz

One common practice in contemporary jazz is called "pattern playing", that is, creating and playing patterns or sequences, based on an intervallic approach, with inherent melodic interest. As a consequence, the rhythm section gains freedom with respect to the soloists. In 1961 John Coltrane expressed: "At first I wasn't sure, because I was delving into sequences, and I felt that I should have the rhythm play the sequences along with me, and we all go down this winding road. But after several tries and failures and failures at this, it seemed better to have them free to go – as free as possible. And then you superimpose whatever sequences you want to over them" (8). The well-known jazz educator Walter Bishop Jr. wrote in the preface in his practice book *A Study of Fourth*: "While listening to some of the younger innovators in jazz, I became aware of the possibilities inherent in using an intervallic approach to improvisation" (9). With this work Bishop summed up and formalized a common practice in contemporary jazz. In 2006 the British sax player Evan Parker was asked about his practicing habits and he mentioned the use of patterns based on intervals as central in his music: "Not really musical material, but more of a sort of proto material for what could become a study, mechanical exercise, or etude based on certain intervals or combination of intervals" (10).

2.4. Additive Rhythm

Hall states that (additive) "rhythm patterns are formed by combining underlying unit pulses into notes" (11). One composer that has explored additive rhythm is Olivier Messiaen. His *Mode de valeur et d'intensité* from 1948 is considered very important in this context.

3. THE INSTRUMENT

3.1. History of The Walking Machine

The first attempt in experimenting with a generative probabilistic approach concerning intervals and durations was undertaken by the author in the late

nineties. The goal was to create a modal jazz tune generator based on transition probabilities. The musical result was satisfying and the idea of creating a live instrument that retained the "sound" and "feeling" of this software was born. One predecessor of the Walking Machine was implemented in the *Space Master* software. Unfortunately it proved to be too demanding for computers available at that time which made the instrument unsuitable for live use on stage. With the introduction of the "Pattr" library in Max/MSP, finally a simple interpolator was at hand.

3.2. The Bass, the Cymbal and The Drums

According to Robert Rowe's software classification system in *Interactive Music Systems* (12) the Walking Machine classifies in the *performance-driven, instrument, generative/transformative* paradigm.

The instrument consists of three parts: the bass, the cymbal and the drums that play in sync with each other.
The bass is based on probability distribution of intervals and durations that combines unit pulses additively into midi events played by a bass instrument on a synthesizer.
The cymbal durations are controlled in the same way as the bass and the sounds are randomly distributed samples of four recordings of a 1 m^2 steel plate played from a custom made sampler in Max/MSP.
The drum are based on another concept: The engine offer two fine tuned drum- or percussion loops of 1, 2 or 4 bars of arbitrary tempi, typically sliced in 8:ths or 16:th and played in sync with each other. The important feature is the possibility to rearrange the order of the slices arbitrarily in real time. In addition, it is also possible to arbitrarily control the length and pitch of each slice as well as trigging effects independently on the fly.

3.3. Sound Engines and Graphical Interface

The visual part of the software contains some windows needed for basic setting and visual feedback.

3.3.1. Intervals

The bass pitches are generated from probability distribution of intervals and controlled in two different ways:
1) The player controls continuous linear interpolation between pairs of lists over an array of five lists.

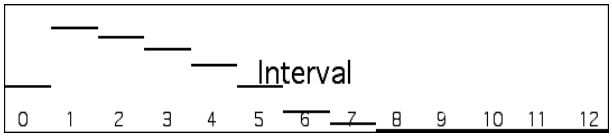

Figure 1. One stored probability distribution list of intervals

2) The player controls the centre position and skirt width of a bell-like peak of the probability list.

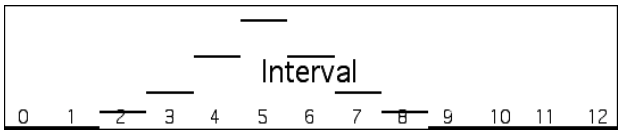

Figure 2. Group of intervals, here centred on the fourth

An attractor note is used as a playing parameter. New events will either "chase" a moving attractor enabling the player to create descending and ascending movements or jump around a fixed pitch if stable.
In order to keep the pitches inside the limits of the instrument – e. g. E on the bass - there is a controlling function that checks and, if necessary, changes the direction and inverts the interval if the next event is predicted to fall outside lower or upper limits.

3.3.2. Durations and accents

The control of duration on the bass and the cymbal is done, similar to interval generation, with interpolation between lists that contains five durations: sixteenth, eighth, quarter, half and whole notes. When the bass playing longer durations the cymbal goes into an offbeat mood with realtime control of the density.
Accents are generated such that between each one to each 16: s event a strong accent will be generated and the rest of the events will have a slight variation of softer accent values. Those accents are created independently of the generation of durations.

3.3.3. The Drums

The drum part shows a window of the position of the slices. A diagonal line from lower left to upper right plays the loop in its original version; control of the slope and position is mapped as playing parameters. In addition there is manual and random control of direction, order and tuning of single slices.

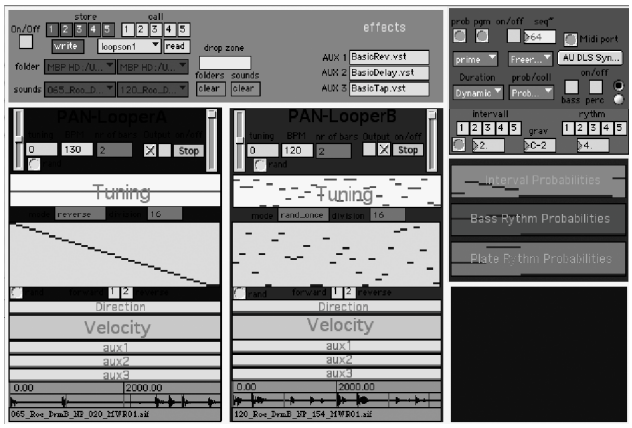

Figure 3. The graphical interface

3.4. Controller and Mappings

A Game Pad is used as a controller for pragmatic and musical reasons. It is cheap, easily replaceable and reliable. The controller offers the performer direct access to a great number of parameters simultaneously, a feature that makes it superior to knobs and faders in this particular application. There are 21 different controllers consisting of two joysticks for continuous controller plus a number triggers/toggles. The performer focuses on one particular sub instrument at a time where the others either continue to play with the actual settings, or are stopped.

Goudeseune proposes that the feeling of an instrument is a consequence of the mapping decisions. And he also states: "If the performer can comprehend the mappings embedded in an instrument, obviously a more refined performance can result. This argues for static mappings over dynamic, and simple over complex" (13). The mapping strategy in The Walking Machine is basically a static *one-to-one mapping* (14) where the control of the probability distribution is considered an *implicit* (15) mapping where the generation of events takes place in a black box.

4. CONCLUSION

Various versions of The Walking Machine have been used and tested in concerts and on recordings for several years and it has proven to function very well. The feeling in performing with The Walking Machine is as much conceptualizing as playing with respect to traditional instruments and might be described as remote[1] (16). This remoteness, in my opinion, makes it possible for the player to be more aware of the music as a whole because it is easier to maintain a distant attitude, but on the other hand, it might hinder the performer to be totally engaged and absorbed in his instrument. The Walking Machine provides a jazz group with a stable rhythmic platform and basic swing as well as being dynamic enough in order to allow its player to interact with the other musicians in a musical direct way.

Lewis agues that "Musical computer programs, like any texts, are not 'objective' or 'universal', but instead represent the particular ideas of their creators" (17). Accordingly, I suggest that The Walking Machine, with its built in stylistic and esthetical properties, expresses some of my musical preferences. The process of creating this kind of instruments is a feedback process of ideas-tests-judgment over and over again until it behaves as desired. In this context I will emphasize that a very important factor in the development of the instrument has to do with my long experience as an improvising musician. During the course of the years I have learned the skills, the codes and the vocabulary of free jazz, which is a necessary knowledge base in order to be able to make proper judgments about the output of this particular instrument. With respect to my musical experience, taste and preferences, I know when it sounds "right".

[1] I will here refer to Denis Smalley's classification of the perceived connection between a sound and its physical cause.

5. REFERENCES

[1] Lewis, George, "Too Many Notes: Computers, Complexity and Culture in Voyager", Leonardo Music Journal, Vol. 10, 33, (2000)

[2] Rowe, Robert, *Interactive Music Systems* (MIT Press, Cambridge, Mass. 1993) p 39.

[3] Momeni, Ali and Wessel, *David Characterizing and Controlling Musical Material Intuitively with Geometric Models.* New Interface for Musical Epression, McGill University, Montreal Canada. (2003).

[4] Davis, Miles, *The Sorcerer* (Columbia Records1967) Col 474369 2

[5] Coltrane, John, *One Down One Up* (Impulse Records 2005) 0602498621431.

[6] Shorter, Wayne, *Super Nova* (Blue Note Records 1969) BST 84332.

[7] Coleman, Ornette, *Science Fiction* (Columbia Records 1971) C 31061.

[8] Porter, Lewis, *John Coltrane : his life and music* (Ann Arbor, Mich. University Presses Marketing 1999) p. 166.

[9] Bishop Jr, Walter, *A study in fourths* (Caldon Publishing Company, New York 1976). Preface.

[10] Huitti, Frances-Marie, "Evan Parker", Contemporary Music Review Vol. 25, 511 (2006).

[11] Hall, Ruth. *Math for Poets and Drummers*, The Mathematics of Rhythm Vol 20 (2004).

[12] Rowe, Robert, *Interactive Music Systems* (MIT Press, Cambridge, Mass. 1993) p 9-11

[13] Goudeseune, Camille, "Interpolated mappings for musical instruments", Organised sound, Vol. 7, No. 2, 85 (2002).

[14] Hunt, Andy and Wanderley, Marcello, "Mapping performer parameters to synthesis engines", Organised sound, Vol. 7, No. 2, 99 (2002).

[15] See Goudeseune (13)

[16] Smalley, Denis, "Spectromorphology : explaining sound-shapes", Organised Sound, Vol. 2, No. 2, 112 (1997).

[17] Lewis, George, "Too Many Notes: Computers, Complexity and Culture in Voyager", Leonardo Music Journal, Vol. 10, 33, (2000)