Establishing a Musical Channel of Communication between Dancers and Musicians in Computer-Mediated Collaborations in Dance Performance

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ABSTRACT

In this demonstration, I exemplify how a musical channel of communication can be established in computer-mediated interaction between musicians and dancers in real time. This channel of communication uses a software library implemented as a library of external objects for Max/MSP[1], that processes data from an object or library that performs frame-differencing analysis of a video stream in real time in this programming environment.

Keywords

Interactive dance, interactive performance, interactive performance systems, interaction between music and dance, musical rhythm and rhythm in dance.

1. INTRODUCTION

1.1 The m-objects

The m-objects are small library of Max/MSP externals designed for interactive dance performance. These objects allow the creation of a *musical channel of communication* between dancers and musicians in computer-mediated collaborations in real time. The m-objects perform certain types of analysis and processing of dance movement as captured by a video camera, and extract what I call *musical cues* from dance movement in real time. *Musical cues* are rhythms produced by movement in dance that bear qualities akin to musical rhythms in their durational and articulatory nature.

The library contains six objects: **m.bandit, m.clock**, **m.weights**, **m.peak**, **m.sample**, and **m.lp** (Max/MSP objects appear in bold typeface in the text.). These objects can be

combined in several ways to perform the temporal domain analysis of dance movement, and can be grouped into objects that do analysis (**m.bandit**, **m.peak**, **m.weights**), processing (**m.clock** and **m.lp**), and extras (**m.sample**). **m.bandit** and **m.clock** are the core of the library since they are responsible for doing the frequency domain representation of the frame-differencing signal and musical tempo control respectively. Except for **m.lp** that is a subpatch, all objects were coded in C by following the published guidelines for writing external objects for Max/MSP. In [3] I do a presentation of the whole library. In [1] I explain the how the extraction of the musical rhythmic elements form dance movement is done in real time. For more detailed information about the overall study, including a tutorial introduction to the library, see [2].

1.2 A Possible Framework for Computer-Mediated Interaction in Dance Performance

This software library intends to promote certain ways of computer-mediated interaction in real time between a dancer/choreographer and a composer/musician. It is designed to be operated by specialists from the fields of dance and computer music. The main goal is to allow the composer of electronic music certain types of control over the temporal articulation of the electronic music score during performance, otherwise impossible to achieve with pre-recorded music. This control ranges from tempo adaptation of the score to the dancer's movement — thereby enabling the dancer to slightly accelerate or slow down the music being played — to the generation of musical rhythmic structures extracted from certain types of rhythms in the dancer's movement.

A camera connected to the computer observes the dancer and the computer produces movement analysis data that is interpreted musically at the temporal level. The musician/composer who operates the computer receives a musical temporal-level interpretation of the movement analysis data in real-time. It is up to the musician to decide what type of controls/parameters for interaction are given to the dancer over the musical content.

The computer thus acts as a mediator in the process and is responsible for providing the musical elements extracted from movement that can be used for interaction. It acts as a sort of a filter that can extrapolate musical elements from a dance,

thereby opening a channel for musical communication/interaction between dancers and electronically-generated music in real time. This type of interaction framework thus calls for a more intense participation of the composer/musician in the performance of dance with electronic music. It also opens interesting possibilities for improvisation or for the performance of open-form music/dance structures. The musician operating the computer can always change the parameters for interaction during performance and feed back different musical content to the dancer, or map the musical elements extracted from the dance to different parameters in the electronic score.

2. SOFTWARE APPLICATIONS AND DEMONSTRATION

2.1 Software Applications

The m-objects are to be used within the framework for computer-mediated performance proposed here. This opens a possible musical channel of communication between (electronic) musicians and dancers in interactive dance performance. Like any other software that maps movement qualities to musical parameters, the performances utilizing the m-objects show a strong relationship between movement and musical output. However, since the relation between movement and music is established at the temporal level, the performances utilizing this software show in general a "human feel" in the music being generated as the dancer's movement is articulating the musical rhythm. This opens interesting possibilities for shared musical improvisation between musicians and dancers.

In the performances utilizing the m-objects, I use generative algorithms in which the pitches are articulated by the computer's rhythmic interpretation of the dancer's movement. During a performance, one can give or take away the rhythmic control of the music to the dancer as well as modify the output of the algorithms according to the musical result being produced.

I used this library in four artistic collaborations so far: *Etude for Unstable Time* (2003-2005), *Olivia* (2004), *Will.0.w1sp* (2005), and *With Drooping Wings* (2007).

Etude for Unstable Time was the first piece for interactive dance created using the m-objects in 2003 in collaboration with choreographer/dancer Maxime Iannarelli and was premiered publicly in Pisa at the PLAY! concert of the *Computer Music Modeling and Retrieval 2005* conference on September 26. This short piece consists of a structured improvisation in two parts. In the first part, the rhythm of music is generated solely by the computer's rhythmic interpretation of dancer's movement. In the second part there is a game played between the dancer and me over the control of the tempo of sequence of samples being played.

The m-objects had their first public presentation in *Olivia,* a dance solo for children based on the cartoon character created by Ian Falconer. This solo was choreographed and danced by Isabel Barros, with music composed by me, and was premiered at Teatro Rivoli, in Porto, Portugal, on May 6, 2004. In this

piece, I used the m-objects to create two *magical moments* in the show. The first was when Olivia went to the museum and pictured herself in a ballet class. When the dancer started dancing, a piano solo was generated utilizing the rhythms produced by her movement, thereby giving the impression that the character Olivia was controlling the piano music. The second *magical moment* happened when Olivia was having insomnia at night and started rolling in bed until eventually began to dance, generating all of the rhythm being played by her movement.

Will.0.w1sp is an interactive installation conceived by Kirk Woolford in which a visual particle system is generated from captured sequences of dance movement, premiered at The Waag Society in Amsterdam on March 16, 2005. In this installation, the m-objects interpret the movement of the visual particles in order to generate the rhythms that control the sonic grains of the soundscape. This is the only piece in which all the behavior of the system is pre-programmed and no algorithms are manipulated during runtime.

In *With Drooping Wings*, a choreography by Né Barros for the Balleteatro of Porto (Portugal) utilizing Henry Purcell's music from *Dido and Aeneas,* I used the m-objects with more than one dancer moving at the same time. In this piece, I created this *schizophrenic harpsichord* that plays on top of Purcell's music activated by the dancers' movement on stage. Although the result is (purposefully) chaotic, there is this *strange* connection established by the overall movement of the dancers and the rhythms being played by the harpsichord.

2.2 Demonstration

In the conference, a dancer and I will do a live demonstration of how this software library potentiates the musical communication between dancers and musicians in computer-mediated collaborations, as well as showing how the m-objects can be used to make a dancer generate musical rhythmic structures in real time and/or control the tempo of an electronically-generated score.

The patches that are utilized in this demo are available at http://homepage.mac.com/carlosguedes

3. REFERENCES

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[2] Guedes, C. *Mapping Movement to Musical Rhythm: A Study in Interactive Dance.* Ph.D. Thesis, New York University, New York, NY, 2005.

[3] Guedes, C. The m-objects: A Small Library for Musical Rhythm Generation and Musical Tempo Control from Dance Movement in Real Time. In *Proceedings of the International Computer Music Conference* (ICMC '05) (Barcelona, Spain, September 5-9, 2005), 794-797

[4] http://www.cycling74.com/downloads/maxmsp

INSTALLATIONS