
Shadows no. 4: Belly Dance and Interactive Electroacoustic Musical Performance

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Abstract

Shadows no. 4 is a piece for a tribal-fusion belly dancer, wireless sensor network, and electronics. The movement vocabulary is derivative of *Raqs al-Sharqi*, commonly known as *danse orientale* (Middle Eastern dance). This dance form involves slow and languid movement and controlled isolations. The piece experiments with notions of gesture (dance and musical) in the performance of electroacoustic music. During the performance, sensors translate the dancer's movements into subtle and salient variations of the sonic texture.

Keywords

Music performance, music technology, dance, sensors, wireless

ACM Classification Keywords

J.5. [Arts and Humanities]: Performing arts (e.g. music, dance). H.5.5. [Information Interfaces and Presentation (e.g. HCI)]: Sound and Music Computing—Systems.

General Terms

Experimentation, Human Factors

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Introduction

Shadows no. 4 is part of an ongoing collaboration that focuses on intersections between physical and musical gesture. In performance, wearable sensors capture the dancer's movements, producing a range of salient and subtle variations of the music. The *Shadows* pieces feature movement vocabulary rooted in tribal style belly dance, a derivation of *danse orientale* (Middle Eastern dance), originating in the United States.

Background

There has been extensive research and development of interactive systems incorporating movement and music. Some systems focus on controller technology, which can include research on the connection between gesture and sound production [1, 2]. Other systems are developed specifically for interactive dance performance [3]. *Shadows no. 4* adds to this body of work through a multi-dimensional composition process that equally balances music, technology, and movement. This piece presents the movement vocabulary of belly dance as a promising partner to electroacoustic music performance.

Aesthetics

The dancer's background includes *Raqs al-Sharqi* (Middle Eastern dance) and derivative belly dance forms (American Tribal Style (ATS) and tribal-fusion). Sinuous undulations, controlled isolations, and layered movements are just a few characteristics of this dance form. In the performance of *Shadows no. 4*, sensors translate these movements into data, which are mapped to musical parameters. The rhythmic sections reference the drum solo, a genre of fast tempo, virtuosic improvisation featuring a dancer and drummer where the lines between leader and follower become

indistinguishable. In *Shadows no. 4*, the sensor network enables a solo performer to create this illusion.

Technical Specifications

We designed our system to minimize the amount of interference with the dancer's movement. To that aim, our system is constructed using the LilyPad Arduino, based on the ATmega328V microcontroller [4]. The LilyPad is small, light (a 2" diameter disc), and designed to be sewn to fabric with conductive thread. Through early experiments we discovered this type of thread too delicate for our purposes, as movement in the fabric caused the threads to break or make contact and short out. High gauge insulated stranded wire proved to be a better option for the project.

The LilyPad contains 6 analog inputs that we connect to a variety of sensors including flex, vibration, FSR, and triple axis LilyPad accelerometers (based on Analog Device's ADXL335). Additionally, the LilyPad comes with 14 digital I/O pins, 2 of which are used for serial communication and the rest for digital input from switches, buttons, etc. Our system is modular, and we use different sensors depending on the movement vocabulary involved.

The LilyPad is programmed to receive incoming sensor data and pass it to the computer as serial data. As a hardwired connection to the computer would limit the dancer, we transmit the data wirelessly using Digi's Xbee modules, which use the ZigBee specification. In initial experiments, we encountered problems with both connectivity and range using Bluetooth. We have found the 1mW Xbee modules extremely reliable and more cost effective than other wireless options.

Incoming serial data is processed in the visual programming environment Max [5]. Data is mapped to audio processing control parameters including filters, delay, playback speed, harmonization, and degradation of sound through reduction of bit depth. Additionally, sensor data is used to trigger sample playback.

Conclusion

Shadows no. 4 presents a working paradigm that integrates belly dance with interactive electroacoustic music performance. The wireless sensor interface is designed to emphasize the specific movement vocabulary of this dance form. Future design goals include refinement of the sensor network and incorporation of biosensors and motion capture to enhance the interaction between physical and musical gesture.

References

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