

The Urban Musical Game: Using Sport Balls as Musical Interfaces

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Abstract

We present Urban Musical Game, an installation using augmented sports balls to manipulate and transform an interactive music environment. The interaction is based on playing techniques, a concept borrowed from traditional music instruments and applied here to non musical objects.

Keywords

Digital Arts, Music, Game, Expressive, Collaborative, Instruments.

ACM Classification Keywords

H.5.5 Sound and Music Computing.

General Terms

Performance, Design.

Introduction

The expressive control of digital sound and audio processing has been the focus of important research over the last ten years. Gestural and tangible interfaces are actually seen as one of the most promising approach to control abstract, disembodied digital sounds, as found in numerous examples [6]. By trying to recreate essential links akin a musician with his/her instrument, we believe musical interaction can provide

some interesting ground to the CHI community, as it inherently resonates with current trends on embodied interaction, expressive interfaces and aesthetic interactions [9].

Until recently, most of music gestural controllers were designed to fit idiosyncratic needs, as part of an artistic endeavor, and were inextricably bound to their creators [11].

Nevertheless, some recent works aimed at designing musical systems to be embraced by a larger community [5,8]. For example, The ReactTable [5] is a musical instrument based on a tabletop interface, where users can collectively interact with digital music through the manipulation of specifically designed physical objects placed on the table. Most of these works are based on original interfaces. In this paper, we propose an approach where users can reuse prior knowledge thanks to common objects augmented with sensors. We believe this approach can favor user appropriation as it resonates with natural user interfaces [3].

Urban Musical Game (UMG) is an example of such approach using sport balls. Playing the ball actually plays sounds based on instrumental behaviors, known as *playing techniques*. Such playing techniques can be modeled with physical dynamics such as [7]. Such modeling permits to base interaction on *movement qualities* [4], where the goal is not to achieve a movement but rather a manner of performing it (e.g. "shaky" or "impulsive"). We believe such motion description can favor musical expressivity. We also present this framework, taken from traditional instruments and extended here to non-musical objects.

Prior Works

Using a ball as a musical interface has been proposed earlier. For example, the MidiBall [2] was designed as a massive collaborative musical interaction. A 1.5m diameter ball was bounced between audience members in a concert venue; their actions triggered sampled sounds and visual effects that became part of an interactive concert experience. Nevertheless, we believe that our implementation remains original in its use of "playing techniques" or "movement qualities" as described below.

Urban Musical Game: Implementation

Participants in UMG can play and transform music through the use of foam balls augmented with wireless inertial measurement units (IMU) [13] (see Figure 1). The inertial unit is composed of 3D accelerometer and 3-axis gyroscope, sampled at 100Hz. The data are transmitted wirelessly from the emitter to receptors using the IEEE 802.15.4 protocol. Data are transmitted from the receptors to a central computer using an ethernet network and the OpenSoundControl protocol.

The use of playing techniques was implemented thanks to gesture recognition algorithms [1] connected to real time audio rendering processes [9]. Real-time data analysis and sound processing is implemented using Max/MSP.

Music materials were pre-composed so as to always ensure a consistent aesthetic overall, and maximize users' rewarding feeling. They were based on 6-tracks loops, which could be transformed independently thanks to the real time audio rendering processes.



Figure 1. Foam ball augmented with a wireless inertial measurement unit. The sensors and emitter are inserted inside the ball. The receptor is connected to the computer.

Game Scenarios

Several game scenarios were created using the following movement qualities:

- Continuous (C): sustained, continuous movement
- Impulse (I): stroke for initiation of movement, ballistic movements
- Periodic (P): repetitive periodic movement
- Free (F): free motions, complex motions

Each motion type, (C, I, P, F), is associated to a specific musical behavior, defining a set musical interactions that can be easily identified. Based on this movement description, we defined: "Roll" (C), "Dribble"(I), "Hit" (I), "Throw" (I), "Shake" (P), "Spin" (P) and "Dance" (F) (see Figure 2). Note that each ball action can be associated with different movement qualities, which allows for design flexibility.

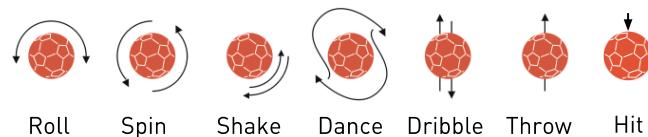


Figure 2. Playing techniques for UMG.

UMG the Band

TheBand (Figure 3) focuses on collective music creation and performance. It involves three sports balls, each being a different instrument: drums, bass and lead sections. While playing, participants can recreate paradigms found in music performance: soloing, accompanying, and duets.

UMG-Basket

This game (Figure 3) consisted in a battle between two musical worlds. The more points a team scores, the more they can hear their music. Besides, the music follows the game evolution: rhythm, tempo and music density are directly linked to the ball motion.

UMG-Volleyball

In this game, players need to keep up the beat. Each pass is transformed into sounds that come and add rhythm to the game.

UMG-TheBomb

This game was designed for children. Players need to throw the ball to their neighbor before it virtually explodes "sonically". Spinning the ball can cool down the bomb.

For all scenarios, users only had audio feedback so that they could focus on the relationships between their movements and sounds. The only visual feedback was the movement of the ball itself.

Discussion and Conclusion

Urban Musical Game was first presented in an open public space at the festival *Futur En seine* in 2011 in Paris. More than 500 users participated during the 10 days run. While no quantitative assessment has been

formally carried on, interviews indicated that the installation and the interaction were generally highly appreciated. In particular, people tended to stay more than 20 minutes in the installation and sometimes came back in the space.



Figure 3. (top) UMG BasketBall. (bottom) UMG The Band. Presented at the Futur en Seine festival.

We believe UMG illustrates the potential of musical interaction based on playing techniques, a high-level behavior that embeds physical and metaphorical meaning. This concept could be applied to other non musical objects, e.g. cookware¹.

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¹ http://www.youtube.com/watch?v=v7_cHlsQaGw

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