spinCycle: a Color-Tracking Turntable Sequencer

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ABSTRACT

This report presents an interface for musical performance called the spinCycle. spinCycle enables performers to make visual patterns with brightly colored objects on a spinning turntable platter that get translated into musical arrangements in real-time. I will briefly describe the hardware implementation and the sound generation logic used, as well as provide a historical background for the project.

Keywords

Color-tracking, turntable, visualization, interactivity, synesthesia

1.INTRODUCTION

The original spinCycle consists of a turntable and video camera mounted to scan the radius of the platter and connected to a multimedia computer. Several variations of the interface have been implemented, each involving different audio content, but all consisting of the same hardware setup. Translucent plexiglass disks, with diameters of 2 or 3 inches, and tinted red, yellow or blue, are used as sound objects that can be arranged in visual patterns on the platter of the turntable. As the turntable spins, the video camera acts analogously to the needle and head cartridge of a traditional turntable, transducing sound from the colors it senses rather than from vibrations. A visual representation of what the camera sees is displayed, providing visual feedback to the audience, informing them of the correspondence between color and sound.

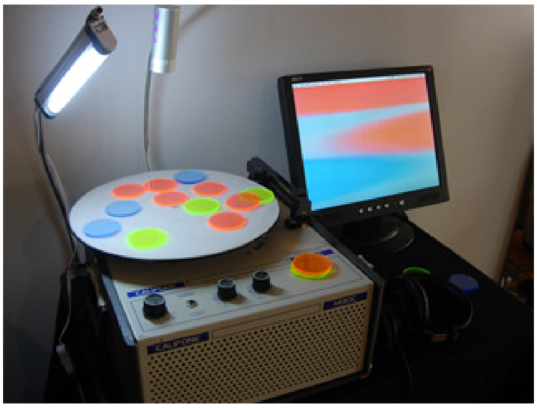

Figure 1. spinCycle, an early installation prototype

2.BACKGROUND

Recorded history of efforts to develop a relationship between color and sound dates back to the ancient Chinese and Persians. In the West, it was Sir Isaac Newton's system for mapping color to tones, laid out in his treatise "Opticks" (1704), that became the most prevalent scheme for connecting musical notes and colors. He arbitrarily divided the spectrum of visible light into seven colors (red, orange, yellow, green, blue, indigo and violet), and made a connection between their mathematical relationship to each other and the relationship between the notes of the musical scale.[1]

There are also many precedents of mapping color to sound in the design of musical instruments. Father Louis Bertrand Castel, a Jesuit monk, built an Ocular Harpsichord around 1730 that involved a six-foot frame above a regular harpsichord. A system of pulleys and rope would lift small curtains on the frame to reveal candles filtered by colored glass in time with the playing of the instrument. Each curtain corresponded to a key on the harpsichord. Development of the color organ continued, and several inventors have had measured success with the device. In the late nineteenth century Bainbridge Bishop outfitted an organ with stained glass windows that were lit based on the keys pressed, and Alexander Wallace Rimington requested that the audience wear white to enhance the effect of the lights projected from his color organ.[2]

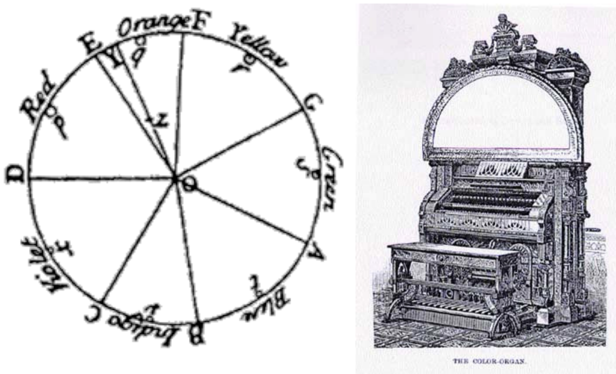

Figure 2. Sir Isaac Newton's Color Wheel (left) and Bainbridge Bishop's Color Organ (right)

There is a rich history of performers and composers using turntables in novel ways to create and perform new arrangements of prerecorded music. John Cage was one of the first to use the turntable as an instrument in Imaginary Landscape No. 1, which called for records to be played on a variable-speed record player.[3] Nikita Pashenkov also provides an excellent history of optical turntables in his paper presented in NIME 2003, where he mentions the Piano Optophonique created by Vladimir Baranoff-Rossine, which "generated sounds and projected revolving patterns onto a wall or ceiling by directing a bright light through a series of revolving painted glass disks, filters, mirrors and lenses."[4] Gideon D'Arcangelo points out that truly interactive uses of the turntable as an instrument came in the 1970's when the advent of hip-hop coincided with art experiments being done by Christian Marclay.[5]

More current contributions to the field of optical turntables includes Jacques Dudon's Photosonic Instrument,[6] which involves light shining through optical disks and filter onto a photocell, and Miyakodub's Video Turntable, which employs color detection to trigger sounds, events and other musical parameters (delay, pan, on/off).[7]

Other recently developed interfaces worth noting that involve using tangible objects on a surface to arrange and create music are the reacTable*, developed by the Music Technology Group at the Universitat Pompeu Fabra[8], and the Music Table from ATR Media Information Science Laboratories.[9]

3.IMPLEMENTATION

3.1 Hardware

The current prototype consists of a traditional turntable capable of 16 rpm, white slipmat, firewire web cam on an adjustable gooseneck mount, small fluorescent lamp with adjustable mount and multimedia capable computer. The disks are made of fluorescent tinted plexiglass (red, yellow and blue), which provide vivid colors to ease color recognition by the computer.

In development at the moment is a custom turntable with a wider platter and continuously adjustable speed. The new platter has raised edges to prevent the disks from sliding off while spinning, which only happens when many are stacked on top of each other. The web camera is permanently affixed to the base of the turntable. The new version also provides a knob to adjust speed of the turntable and a series of buttons that can be used to select and assign the colors to be sensed. There are also plans to provide hardware controls that adjust parameters related to video sensing, such as white balance, focus and saturation; these parameters are adjusted in a software interface in the current prototype.

3.2 Software

The application was developed in Max/MSP/Jitter. Basic functions of the application include video sensing calibration (white balance, focus, saturation), selection of colors to be sensed, assignment of desired sound to color, and volume control for each sound channel.

The original performance prototype was developed for Gideon D'Arcangelo's NIME class at ITP in Spring 2005. The theme for the class was "Tools for the Remix", and accordingly, the prototype was designed to use sound coming from one channel of a two-channel turntable mixer as a source. Samples were selected on the fly and then remixed with the original record. The sensing algorithm uses edge detection of the colored disks to determine when a sound should be triggered, and granular synthesis is employed to play samples associated to disks located closer to the center faster than, but at the same pitch as those closer to the edge. A representation of the image that the camera sees at any given time is projected on to a screen behind the performer, which provides the audience with a connection between the colors and the sounds being emitted, and evokes a hypnotic synesthetic experience.

The installation prototype has two forms: drum machine and sine wave generator. The drum machine version has bass drum, snare and hi-hat color-sound assignment; users arrange drum patterns in real time and can make interesting syncopated patterns by shifting the disks slightly as the platter turns.

The sine wave generator installation prototype allows users to experiment with more colors and sounds by stacking and thereby combining the colors to make green, orange and violet. Each color is hard coded to sine waves at frequencies that make up a chord to insure harmonious results. The video sensing algorithm maps the area of a given color to the amplitude of the corresponding sound, thereby altering the envelope.

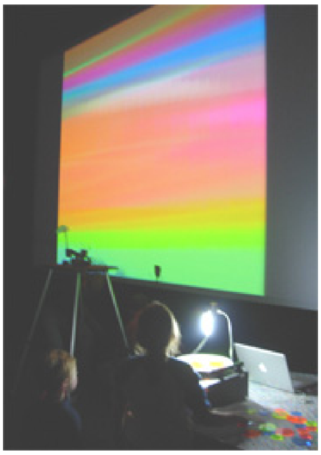

Figure 3. spinCycle sine wave generator installation

4.CONCLUSION

Using the turntable as the basis for an interface for musical expression is not a new idea. The familiarity of the turntable and its constant circular motion provide a good basis upon which to build creative devices for sequencing and looping music. What makes spinCycle distinctive is the simplicity of its interface that invites novices to arrange music and experiment effortlessly, but also provides a challenging experience for performers that can be perfected over time. The synesthetic nature also makes it well-suited for multimedia installations intended for children and adults alike, as well as provides a dazzling visual component for performance.

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