Enabling participatory interactions at live music performances using digital technology

by

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Abstract

Technology has long been used to improve the presentational aspects of a live music performance, but less often is it employed to encourage participation from audience members. This thesis investigates how digital technologies might be used to make traditional pop and rock concerts more participatory. A literature review and survey of related projects were first conducted. Preliminary research was then carried out, including interviews with both concertgoers and performers. Multiple prototypes were developed and tested with users, and, after analyzing the results, a refined device was created and implemented at a live music performance. The paper concludes with a discussion on the significance of the device and possible future directions.

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Chapter 1

Introduction

At the 2011 Coachella Valley Music and Arts Festival, Monteal-based indie rock group Arcade Fire are about to play one of the final songs of their headlining set. The guitar riff from the band's hit song "Wake Up" is instantly recognized by the audience, who cheer loudly with excitement. The song reaches the first chorus, and, suddenly, one thousand white beach balls begin tumbling over the top of the stage and gently falling onto the crowd below. The cheers swell into a roar as the balls disperse over the mass of people. When the band hits the song's final chorus, to the spectators' surprise, the balls begin to light up – flashing different colours to the beat of the music. Arcade Fire finish their set, grins on the band members' faces, as they watch the glowing orbs bounce across the crowd. After the show, festivalgoers grab on to the beach balls; cars leaving the festival grounds are seen glowing with the light from what have now become souvenirs from an unforgettable live music experience.

This project was made possible by several teams that managed the logistics, developed the wireless LED devices, fabricated and tested hundreds of beach balls, and ultimately executed the launch (citation). The result was an awe-inspiring, albeit momentary, event that extended a live music performance into the audience. Large rock and pop concerts seem to be growing more technically complex and spectacular all the time. Powerful equipment makes shows louder, larger, and flashier. Only recently, however, have many mainstream artists begun investigating how technology can benefit not just the performance on stage, but the interactions within the audience as well. This thesis examines these sorts of technologies, asking how they might be used to make conventional rock and pop concerts more participatory.

1.1 Motivation

In his 2008 book *Music As Social Life*, musicologist and anthropologist Thomas Turino divides live music performances into two categories – presentational and participatory. In presentational performances, the artist prepares music and presents it to a separate group, the audience. An example of a presentational performance would be a typical rock concert; a band rehearses and plans a set list and then performs it for a generally attentive audience. Participatory performances, on the other hand, deal only with participants and potential participants, and there is no artist-audience distinction. Peruvian communities, for example, perform in large groups with each participant either dancing or playing a panpipe or flute. Contra dances in the midwestern United States can also be considered participatory performances, featuring musicians, pairs of dancers, and a "caller" that provides the dancers with instructions – each an integral part of the event.

Many technologies exist for creating enhanced presentational performances. In general, they are implemented to aid the artist in presenting their music to the audience. When The Beatles did their first tour in North America, for example, they had 100-watt amplifiers custom made to ensure their music could be heard over the incredibly loud cheers of the fans; ultimately, the equipment was not nearly loud enough to overpower the audience (citation). Today, a large arena rock show might implement sound systems demanding tens or hundreds of thousands of watts (citation), enough power to send strong vibrations through concertgoers' bodies or even, after enough exposure, cause hearing damage. Performers may take advantage of enormous screens that provide far-away fans with close-up views of the show. Complex lighting rigs, laser arrays, and flashy visualizations are also common methods of turning a regular performance into an awe-inspiring spectacle.

There has clearly been a lot of effort put into developing technologies for enhancing the presentational aspect of live music performances in Western culture. We can see an evident inequality between the presentational and the participatory here. As Turino points out, when it comes to presentational performances, profit making is usually the primary goal. Louder speakers and bigger screens mean artists can play larger venues with more seats to sell to fans. On the other hand, Turino admits that participatory performance does not fit well within capitalist societies: "Participatory traditions tend to be relegated to special cultural cohorts that stand in opposition to the broader cultural formation" (p. 36). Why, then, might we want consider technologies that enhance the participatory aspect of performances? As stated by Turino, and echoed by others (Levitin, 2008; Bateson, 19??; citation), disregarding its potential financial value, it is music's function as a social interaction that holds the most value for humans. Levitin states that the social nature of music may have been an important evolutionary adaptation that helped early humans thrive in groups: "Singing around the ancient campfire might have been a way to stay awake, to ward off predators" (p. 258). The connections formed with others through music making and dancing, Bateson argues, "is crucial for social and ecological survival" (p. ??; citation). Thus, while we may no longer depend on participatory performance to the degree that our ancestors did, it seems as though it is against human nature to continue widening the gap between audience and performer. Artists are placed on brightly lit stages with booming sound systems, allowing their voices to echo through stadiums; the voices of audience members, meanwhile, become meaningless noise as more and more people are packed into venues. How might technologies instead be used to embrace the social functions of music and let everyone – performer and audience – be a participant? This attitude is, fortunately, supported by recent trends in technology.

The Internet has connected performer and audience in a new way. Social media allows for unique interactions between artists (big and small) and their fans. A small touring band, for example, might send out a message to their followers on Twitter (http://www.twitter.com) asking for restaurant suggestions in a town they are passing through. More well-known artists may have difficulty connecting to their growing fan base, but events like "Ask Me Anything" question-and-answer sessions on Reddit (http://www.reddit.com) allows them to directly answer questions from their supporters. Beyond these unprecedented social media interactions, the Internet is also continually supplying new ways for musicians and fans to collaborate. Crowdfunding platforms like Kickstarter (http://www.kickstarter.com) rewards fans for directly funding artists' projects by giving them special gifts; Feedbands (http://www.feedbands.com) lets users vote for their favourite musicians each month, and the winning artist gets their record pressed on vinyl as a limited-edition run; using Alive (http://www.alive.mu), promoters can ensure shows get good turnouts by having concert-goers commit to buying tickets before artists are booked to play. The Internet has afforded many new types of participatory experiences for musicians and fans. Recently, digital technologies are being used increasingly to enhance this connection during live performances themselves.

As the music industry continues attempting to find its footing in the digital age, ticket prices for concerts are steadily increasing (citation?). It seems then that, in order to ensure patrons are getting their money's worth, it is important for performers to deliver a truly unforgettable show. Stages, lighting, and visuals are certainly becoming more extravagant, creating a large spectacle. Some artists, however, are looking to more innovative solutions to wow their audiences. Arcade Fire and Coachella, as described earlier, succeeded in creating a memorable live music experience using hundreds of wirelessly controlled LEDs. Wham City Lights created a similar experience by using a smartphone application to turn audience members' personal devices into a synchronized light show (citation). Other instances allow for more direct interactions. At a special performance by R&B artist Usher, for example, fans could send tweets about the performance that would appear on the large screen onstage and then morph into abstract animations (citation). Plastikman, alter ego of Canadian DJ Richie Hawtin, produced a smartphone app to accompany his 2010/2011 world tour; fans with the app could view a live video stream of the performer's perspective, reorganize audio samples that Hawtin would use in his performances, and participate in a live chat with other users during the show (citation).

There are countless types of performance exhibited by the world's various cultures – some more presentational, some more participatory. In Western cultures, presentational performances draw the biggest crowds, and technologies are being developed to make them larger, louder, and more lucrative. We must remember, however, that music is an inherently social activity; by continuing to separate performer and audience, we are potentially reducing its impact as an event that brings people together. Thus, it is valuable to consider how we might use technology to enhance not the presentational aspect of a concert, but the participatory. The activity on the aforementioned internet services proves the public's desire for deeper interactions with artists, and recent experiments with interactive systems at live performances have produced impressive results. Lastly, participatory technologies at rock and pop music performances have yet to undergo an academic investigation. I believe, then, that it is worthwhile to survey this fledgling field and better understand its implications on the modern music performance.

- *I want to mention – somewhere – that phone use at shows has become an issue for some concertgoers and artists. This trend may be further contributing to the barrier between audience and performer at concerts.*
- *I want to point out that there has been little academic research in this specific area. How do I show this? Mention some of the few studies that HAVE been done?*

1.2 Objectives

The goal of this thesis is to explore how digital technologies can be used to make live music performances more participatory experiences. I have divided this task into three objectives. The first objective is to study relevant literature and perform case studies on existing projects. Literature reviews will pull from works in musicology – to examine the nature of music as a social activity – and human-computer interaction – to understand how interactive systems can be designed for large groups of people. Precedent projects will be analyzed, observing what was done right and what issues are outstanding. After reflecting on what I have learned, my next objective is to identify questions that remain unanswered and conduct my own primary research that addresses them. This will involve questionnaires and interviews with frequent concertgoers and performers themselves. The final objective is to determine the criteria for a successful participatory concert technology through multiple rounds of prototyping and user testing. A final version will be implemented at a live music performance, and its effectiveness will be evaluated.

Scope:

- I will be focusing on standard rock and pop performances. I am most familiar with this type of performance. Additionally, they provide an environment where audience members generally feel free to move around and be vocal (unlike classical music concerts, for example).
- No smartphone apps. I personally dislike phone use at concerts, and other concertgoers and artists agree. However, I will still analyze precedence that took advantage of smartphones. (Or do I need to include this...?)
- I will not be considering the financial aspects of mass-producing my final prototype
-

1.3 Overview

- **Chapter 2: Background**

  To begin, I will examine related academic and professional work. I will examine music as a social activity, outline research done on designing technology for crowds, and describe some relevant projects that have been implemented at real-world events.

- **Chapter 3: Research Question**

  In this chapter, I will further explain and justify my research question. I will then describe the approach I will be taking to answer this question.

- **Chapter 4: Preliminary Research**

  I will begin tackling my research question by examining the problem from both the audience's and the performer's point of view. This will be accomplished through observations of live music environments and interviews with concertgoers and artists.

- **Chapter 5: Development**

  This chapter will cover my prototyping process in detail. For each phase of development, I will first state my objective. Next, I will describe the steps I took to try to achieve that objective. Lastly, I will present the results of the user testing conducted with each prototype.

- **Chapter 6: Implementation.**

  Here I will describe the production of the final version of my device. The implementation of the device at a real-world event will be thoroughly examined, and I will reflect on its execution.

- **Chapter 7: Conclusion**

  To conclude, I will summarize the overall outcomes of my work and briefly discuss possible future directions for the project.

Chapter 2

Background

This chapter examines related research and projects. I will focus on music as a social activity and designing for crowds before discussing relevant projects that were successfully executed in real event settings.

2.1 Music as a Social Activity

Investigating music as a social activity will help us understand the roles of the performer and the audience and how they might be modified to enhance a live music performance.

2.1.1 Turino

- Why music matters
- Presentational performances
- Participatory performances

2.1.2 Kershaw

This article examines how the behaviour of London theatre audiences changed over the twentieth century. Kershaw begins by citing a newspaper article claiming that theatre audiences are much more prone to giving standing ovations than they once were. He asserts that investigating this particular trend could tell us more about modern theatre as a whole. It is pointed out that little research has been done on applause as a phenomenon, and Kershaw surmises that this is due to it being taken for granted as a straightforward element of a performance. So, just what is applause? The author proposes that it could be an attempt to extend a performance that one does not want to end, or perhaps it is more "a giving up of individual judgement" and an attempt at forming a momentary community (p. 135). Regardless, Kershaw maintains that this increasing acquiescence in audiences indicates disempowerment and the fall of the theatre as a political environment. The potential power of an audience is emphasized via a case study: in 1926, an Irish audience rioted during a performance of a controversial play, thereby ending its run and making known the audience's opinion on the play's political issue. This sort of defiant reaction empowers the audience, Kershaw claims, whereas applause seems to actively muffle dissent.

Kershaw proposes that, over the twentieth century, the role of the audience member changed from patron to customer. Pre-World War II spectators had no inhibitions about booing or yelling their approval. In the 50s, however, theatres were becoming increasingly regarded as indicators of status; they were decorated lavishly, and the audience was managed such that certain groups sat in predetermined places. Since the 80s and 90s, most theatres have been filled with advertisements, indulgent services, and merchandise sales. Thus, states Kershaw, "the standing ovation [became] an orgasm of self-congratulation for money so brilliantly spent," and"political significance, democratic exchange, and the power of community all but evaporated" (p. 144).

The paper closes by recommending that theatres look for ways to encourage conflicting viewpoints in their audiences. The author proposes some admittedly "desperate" strategies, such as booking audiences with contrasting interests in the show or placing opinionated "plants" in the crowd to inspire irregular reactions. Kershaw believes that the political potential of the theatre is in danger of being lost and, thus, that "[it] now, perhaps more than anything else, needs unruly audiences" (p. 151).

2.2 Designing for Crowds

Designing for large groups of people has only recently attracted notable interest in the field of human-computer interaction (HCI). As interactive systems become increasingly ubiquitous, HCI researchers are asking how the needs of multiple people in a public space differ from those of an independent user. The characteristics of live performance make it an especially useful venue for these investigations; thus, conveniently, much of the research done in this field focuses on concerts, theatre performances, and dance clubs.

2.2.1 Maynes-Aminzade, Pausch, and Seitz

In their 2002 paper, Maynes-Aminzade et al. describe three different computer vision systems that allow an audience to control an on-screen game; they also outline the lessons they learned about designing such systems. The first method tracks the audience as they lean to the left and right. The control mechanism was intuitive, but the system required frequent calibration. The second method tracked the shadow of a beach ball which acted as a cursor on the screen. This was also intuitive, but it only involved a few people in the audience at a time. The third method tracked multiple laser pointer dots on the screen, giving each audience member a cursor; this was a more chaotic system once the number of dots got overwhelming. Lastly, the authors presented some guidelines for designing systems for interactive audience participation. They recommend focusing on creating a compelling activity rather than an impressive technology; they state that every audience member does not necessarily need to be sensed as long as they feel like they are contributing; and they suggest that the control mechanism should be obvious or audience members will quickly lose interest. The authors also note that making the activity emotionally engaging and emphasizing cooperation between players will increase the audience's enjoyment.

These conclusions provide both guidance and new questions to consider for my own research. While I hope to work with some relatively advanced technologies, it will be important to remember that it is the actual interaction that will determine how engaging the experience is. User-centered design will need to be a major part of my development process. While this paper dealt with accurate control of a video game, my work will address interactions that are more passive and abstract. The authors stress the importance of an obvious control mechanism; considering how much their environment (a movie theatre) will likely differ from mine (a loud, dark music venue), I believe this will be especially crucial for my project. Audience members whose senses are already being overloaded will have even less patience for figuring out how something works. I will have to consider how this and other factors apply to my unique environment. How can I best tap into the emotional sensibilities of an audience at a concert? How might I create a cooperative environment in a situation that is not goal oriented? These are questions I will have to address in my primary research.

2.2.2 Ulyate and Bianciardi

In their paper, the authors describe their "Interactive Dance Club" – a venue that delivers audio and video feedback to inputs from multiple participants – and they present the "10 Commandments of Interactivity" that guided its creation. The goals of the project were to create coherent musical and visual feedback for individual and group interactions and to allow non-artistic people to feel artistic. Inputs included light sensors, infrared cameras, pressure-sensitive tiles, proximity sensors, and simple mechanical switches. By interacting with them, users could make notes sound out, manipulate projected video and computer graphics, modulate music loops, and control the position of cameras in the space.

This project's "10 Commandments of Interactivity" contain the following points:

- Movement is encouraged and rewarded.
- Feedback from interactions is immediate, obvious, and meaningful in the context of the space.
- No instructions, expertise, or thinking is required.
- A more responsive system is better than a more aesthetically pleasing system.
- Modularity is key.

Lastly, the authors share the lessons that they learned while running the Interactive

Dance Club. They observed that interactions involving full-body movements were most satisfying. The form of an object, they found, determined how users first attempted to interact with it. They emphasize the practicality of a system that is both distributed and scalable. Designing the interactions required finding a balance between freedom and constraint. They found that, no matter how elegant the system, some users would still find a way to create unpleasant noise. Lastly, they observed that instant gratification is important; feedback that is too delayed or interactions that require too much concentration are ineffective.

2.2.3 Bongers

In his 1999 paper, Bongers provides a theoretical HCI framework for physical interaction between performers, audience members, and electronic systems in a musical performance. He defines three types of interaction – "performer-system", "system-audience", and "performer-system-audience." Bongers models the interactions as control systems wherein actions are either a *control* or *feedback* process. Electronic sensors and actuators are discussed, followed by human senses and motor systems. Bongers states that a more convincing interaction is one that provides "multimodal" feedback – influencing more than one of the users' senses. Lastly, a few prototypes of novel interaction systems are described. Especially notable is the "Interaction Chair", which most easily fits in the performer-system-audience category. Here, the performer has the ability to send vibrations through each audience member's seat back, while the chairs contain sensors that allow audience members to influence visuals projected behind the performer. Other projects like this one can benefit from Bongers' theoretical framework; thinking in terms of control and feedback processes may provide new perspectives on a system's design.

2.2.4 Barkhuus and Jorgensen

Barkhuus and Jorgensen's paper investigated interactions between audiences and performers at a concert. The authors used observations from traditional rock and rap shows to inform the design of a simple ”interaction-facilitation technology” – a cheering meter. By tracking the applause patterns at several concerts, it was determined that the two most common reasons for cheering were to express anticipation and to reward the performers. This led to the creation of a cheering meter, an instrument for measuring the volume of an audience – in this case, to determine the winner of a rap battle. Microphones captured samples of the crowd's cheering, the signal was filtered, the peak volume was measured, and the rating on an arbitrary scale was displayed on large screens onstage.

The researchers reported no major issues while testing the system, and they express confidence that their technology helped to enhance the concert for the audience members. In their paper, they outline the main reasons for the cheering meter's success. First, the authors state that the usability of the system is due to the fact that it is based on an already-present behaviour; they recommend "designing technology that fits the situation and which utilize present activities rather than aiming to employ the latest cutting edge technology" (p. 2929). Next, they suggest that an event should not rely on the success of the technology; the rap battle, for example, could have easily continued if the cheering meter malfunctioned. Lastly, the authors emphasized the importance of immediate visual and/or aural feedback; seeing direct consequences of their actions gives the audience confidence in using the system. This research focused on a very specific type of event using an almost-gimmicky system, but the design principles it yielded are valuable.

2.2.5 Tseng et al.

This paper described the motivation and creative process behind a Taiwanese interactive theatre experience that let audience members connect with a dance performance. The project was realized using projection mapping, a Kinect, a local area network, and a custom iPhone app. Audience members downloaded the app before the show and entered a code corresponding to their seat number to connect to the local network. During the first part of the performance, each user was given control over one "light dot" projected onto the stage. The dot could be moved by moving the iPhone; users could also point their phone's camera at different light sources to influence the brightness of their dot. Later in the performance, audience members could use their phones to trigger sounds and projected images onstage. The dancer, tracked by the Kinect, interacted with the projections, improvising a dance with the light.

The authors approached this project by asking, "How can the audience become an essential element in a performance?" (p. 561). They claim that, while new media has been incorporated into theatre for decades, mobile phones have not been used to their full potential. Feedback collected after the performance revealed overall positive reactions. Some users, however, were uncomfortable having their personal devices connected to an unfamiliar network. Another negative was that not every audience member owned an iPhone; one of these spectators, though, maintained that she enjoyed the show even while being excluded from the interaction.

2.2.6 Reeves, Sherwood, and Brown

This paper investigates the design of technology for crowds by observing and analyzing the behaviour of a group of football fans gathered at a pub. The authors note that most related work has focused on spectators at a performance or on exceptional circumstances like riots. This work instead looks at everyday crowd-based settings where there is no attention-grabbing "spectacle." To accomplish this, the researchers video recorded a crowd gathered at a pub during a football match and examined the group's behaviour for recurring themes. People were seen singing, jumping, and pumping their fists in the air in sync with each other. In general, these instances of collective participation were all visible or hearable from far away. Once a small group of people began the actions, they would quickly "snowball" and overtake the crowd. Researchers also noticed the importance of "shared objects;" an inflatable object bouncing between people, for example, connected individuals at a distance. It was also observed, of course, that not every person in the crowd cared to participate in these group activities.

After outlining these observations, the authors present a list of design lessons that they extrapolated. First, they suggest treating a crowd as a unit rather than a collection of individuals – for example, exploiting already-present crowd behaviours or allowing for only partial participation. The importance of "intra-crowd interaction" is also emphasized: allow for shared objects and space-dependent interactions, and take advantage of snowballing by encouraging highly visible/audible actions. Additionally, one should allow for interaction with people on the fringes of the crowd but be aware of problems that could be caused by latency. Lastly, the researchers note that every crowd is different and that each design should reflect the nature of the environment.

2.2.7 Gates, Subramanian, and Gutwin

This paper examines the complex interactions between DJs and audience members in nightclubs from an HCI perspective. The authors gathered their information by observing behaviours at nightclubs, surveying DJs, as well as conducting lengthy interviews with them. Most DJs had similar preferences and performance styles. For example, all of the interviewees said they preferred venues where audience and DJ are mutually visible; this allows them to adjust their performance based on visual cues from the audience. Using quick glances, DJs can observe audience members' facial expressions and body language and the flux of people on to and off of the dance floor. Many DJs stated that they will often exaggerate their movement or speak into a microphone to energize the crowd. Small, direct interactions can also occur between DJs and audience members, such as exchanges of facial expressions or gestures. DJs use the information they glean from their audience to shape their performance. Most DJs will craft a playlist before performing based on the venue, event type, and expected audience; during the performance, however, the energy of the crowd ultimately guides how the tracks are mixed. In general, the authors found that, as long as there is sufficient visibility, DJs are extremely competent at adjusting their performance based on the audience. Interviewees saw little need for technology to aid their performances; one of the few wishes the DJs expressed was for a method to discover the musical preferences of a given audience.

Based on the information collected, the authors present some design recommendations for those wishing to bring interactive technologies to nightclubs. For example, they state that, considering how skillful DJs are at observing audiences, any technology meant to gather information from the crowd must be more efficient than DJs themselves. Such technology, the authors suggest, would be most useful for gathering "invisible" information like musical preferences. They recommend against using biofeedback systems or systems where audiences have a direct influence on the performance; these methods do not help DJs do their job. The researchers state that gradual changes are more satisfying than immediate ones. Lastly, they emphasize the importance of respecting the DJ's art; technologies should allow them to stay in control of the music and should not add to their already-demanding cognitive load.

2.3 Notable Precedents

In the past few years alone, a number of large-scale projects have been realized that use technology to expand live performances into the audience. Some were implemented as experiments at one-time events, while others found commercial success and are being used by big-name companies.

2.3.1 Wham City Lights

Wham City Lights is a smartphone application that allows multiple devices to display light shows in sync during a concert. Audience members with an iOS or Android device can download the app before the show. Once the show has begun, an operator activates lighting cues by playing encoded, ultrasonic tones; devices with the app open "hear" these tones and perform the corresponding cues. This can be done at nearly any scale as long as every device is able to hear the tones. Users generally hold their devices up or wave them above their heads during the show. Light shows can be created live or programmed in advance using an online editor; cues include flashing colours, camera flashes, GIFs, text, and sound.

The concept was originally developed by US musician Dan Deacon. His intention was to prevent concertgoers from using their personal devices and disengaging during live performances. Deacon tested the app at his own shows and received a positive response. Today, Wham City Lights licenses their general-purpose app for different kinds of events; they also develop custom apps to include branding, tour dates, etc. Musicians and organizations like Brad Paisley, the Billboard Music Awards, and Intel have made use of this technology at their events.

2.3.2 Xylobands

Xylobands are controllable LED wristbands designed to be worn by potentially thousands of users at entertainment events. They are controlled using a proprietary piece of software downloaded to a laptop; the laptop must then be connected to a radio transmitter. With the software, an operator can turn the Xylobands on or off, select which colours are illuminated, and control the speed of the LEDs' flashing. The transmitter has a range of around 300 meters. Each wristband contains a small printed circuit board that holds, among other components, an RF receiver and an 8-bit microcontroller. The electronics are powered by three 3 V coin cell batteries.

The technology was originally developed for the band Coldplay, and wristbands were handed out to all concertgoers during their 2012 world tour. Giving the wristbands to each audience member at every performance reportedly cost the band €490 000 (around $680 000 CAD) per night. UK-based toy development company RB Concepts Ltd. are the creators of the Xyloband. Their website advertises that Xylobands can be customized and used at concerts, festivals, sports stadiums, or corporate events.

2.3.3 PixMob

PixMob is a patented wireless technology that enables the control of multiple LED-embedded objects. By giving PixMob objects to spectators, concert producers can create a controllable LED light show within the audience. The objects are activated with signals from infrared transmitters. Like normal lighting fixtures, the transmitters' beams can be shaped with lenses and controlled via the DMX512 protocol. The objects light up when they are hit by a beam, so patterns of moving light can, in essence, be painted across the audience. Light shows are programmed, simulated, and controlled through a software package called LAVA; they can also be controlled in real time using a MIDI controller or the LAVA iPad app. Previous PixMob objects include balls, wristbands, pendants, and beads, and custom object creation is available as well. PixMob also offers "second life" customization: objects can be programmed to react to sounds, play an mp3 track, or communicate with the user's personal computer after the show is over. Past clients include Microsoft, Arcade Fire, Eurovision, and Heineken.

Chapter 3

Research Question

This chapter will provide an in-depth examination of my research question. Through referencing the existing research outlined in the previous section, I will justify the need for my work. I will then explain the steps I will be taking to address this question.

3.1 Research Question

How might technology be used to add participatory elements to traditionally presentational rock and pop concerts?

3.2 Approach

Chapter 4

Preliminary Research

One of my first goals was to get a sense of modern concertgoers' and performers' feelings about participatory performances and interactive technology. First, I sent out a brief online survey to music fans that helped me to understand how they generally responded to these topics. I then conducted followup interviews with a few of the participants and discussed their opinions in greater detail. Lastly, interviews were also conducted with multiple musicians to shed light on their perspectives.

4.1 Audiences

An online survey was created in order to obtain a sample of modern music fans' opinions on interactive performances. The survey was completed by 99 participants recruited via social media. The first few questions informed me of what type of concertgoer each participant was – asking their favourite genre, the size of the venues they frequent, and how often they attend live music performances. I also asked how often the participants communicate directly with musicians through their social media presences. Next, the survey focused on concert behaviours. Participants were asked in which actions they typically partake at live music performances; choices included applauding, headbanging, and holding up lighters. They were asked how they might like to interact with their favourite performer and what sort of message they would send them if they could. I asked for their thoughts on getting involved in performances, bringing new technologies into concert settings, and interacting with musicians using social media services.

The results were equally anticipated and surprising. Most participants favoured rock music or some variation ("indie," "alternative"); the majority attended multiple concerts per year – some even on a weekly basis; and most usually went to shows at small- to medium-sized venues. The majority of participants claimed to communicate with artists through social media either sometimes or regularly, though a notable amount indicated they never do this. The most popular concert actions were applauding, singing along with the performer, clapping or stomping to the beat, dancing, jumping up and down, and chanting words or phrases with the other audience members. When asked how they might want to interact with a performance, many said they would like to choose the songs that are played, while fewer expressed interest in manipulating visuals and contributing to the music; around one quarter of participants stated they did not have interest in directly influencing a live music performance. Given the opportunity to communicate with their favourite performer, most participants responded with praise or appreciation ("Thank you," "I love you!"). Other messages included song requests and suggestions like, "Don't bury the vocals," or "More rock, less talk!" The majority of participants indicated that they enjoy when performers ask them to participate in a performance – clapping or singing along or call and response, for example. Most also said they were excited by the idea of bringing new technologies into a live music setting.

Analyzing the responses further revealed some other trends...

4.2 Performers

Chapter 5

Development

This section describes the chronology of this project's various prototypes. The successes and failures are described, detailing the story of how I arrived at my final product.

5.1 First Phase

The goal of the first prototype was to simply demonstrate how multiple users might interact with a performance using handheld devices. To realize this, I used Wii video game controllers and the Max visual programming software. The final product was a system that allowed seven users to simultaneously manipulate a video loop by performing "audience-like" motions.

5.1.1 Prototyping

The first step in creating an initial prototype was deciding on the hardware and software that would be used. Wii video game controllers have an abundance of sensors: they contain eleven digital buttons, an infrared sensor, an accelerometer, and a gyroscope (in the newer "Wii Remote Plus" models), and all of this data can be sent wirelessly to a receiver via Bluetooth technology. In addition to these affordances, due to the console's popularity, the Wii controller is also something that many people are already comfortable moving with – shaking, waving, swinging. With these considerations, I decided that the Wii controller was

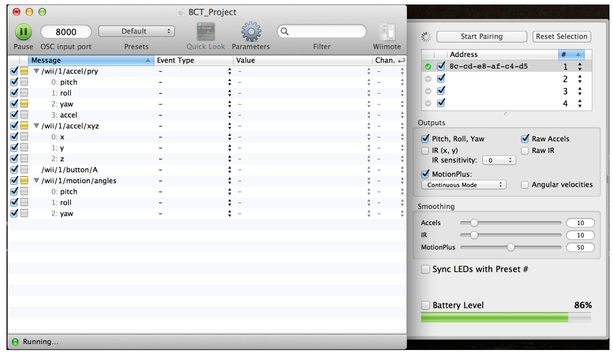


Figure 5.1: OSCulator software receiving data from one Wii controller

a suitable input device for my experiments. Next, I had to find software to process this data. After consulting multiple sources, it became evident that the best way to interface with Wii controllers was to use a combination of two software packages called OSCulator and Max. OSCulator is a program that receives data from devices like MIDI controllers and outputs it using the Open Sound Control (OSC) protocol. Fortunately, it is also preset to communicate with Wii controllers, conveniently displaying live data from each sensor. The OSC data can then be sent to Max, a visual programming environment that is especially useful for handling multimedia. Max is commonly used by musicians and video artists to create highly customized and interactive programs.

My first milestone for this prototype was having a single Wii controller communicate with my computer. Using a program called OSCulator, I was able to read movement and button-push data sent via Bluetooth (see Figure 5.1). From here, the data is sent to a simple Max program (called a "patcher") that I created. The patcher reads various movement data from the controller and visualizes them as different motions that a typical concertgoer might perform. The motions are: giving a "thumbs up" or "thumbs down", swaying arms from side to side, clapping, or doing "the wave," as shown in Figure 5.2. Visual feedback is provided in the form of illuminated LED objects and moving sliders.

My second notable achievement was testing the limit of how many Wii controllers would be able to connect to my computer using the current setup. Since my thesis aims to give every member of an audience a new way to communicate, this number would ideally be

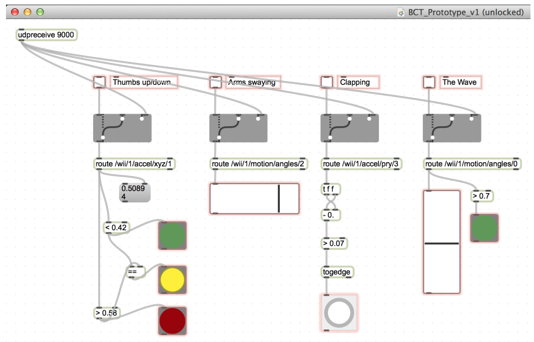
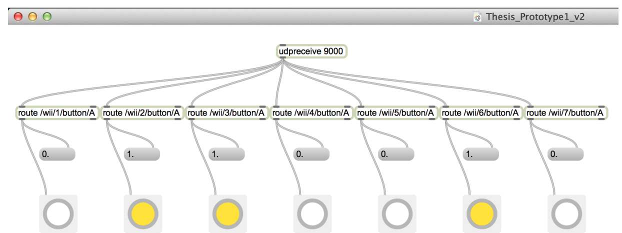


Figure 5.2: First Max patcher

(a) Wii controllers

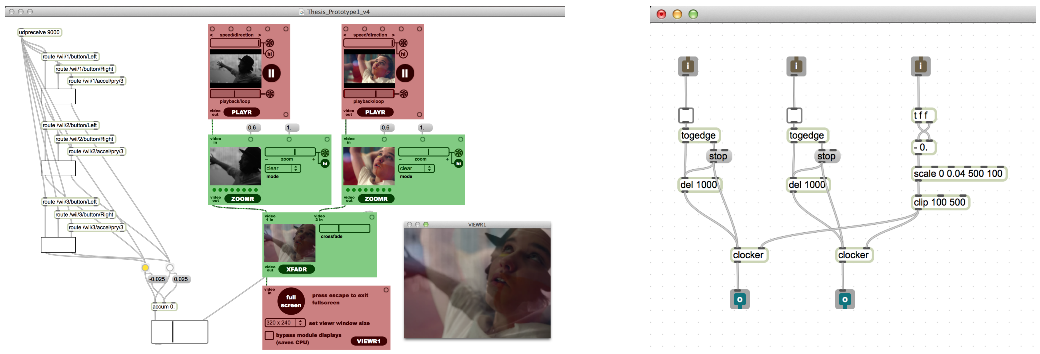


(b) Max patcher

Figure 5.3: Testing simultaneous input from seven Wii controllers

limitless. The OSCulator software, unfortunately, could only connect to a maximum of seven controllers. However, for the purposes of this prototype, this number is acceptable. To test this, I created a Max patcher to display data from seven Wii controllers. I synced all seven controllers with OSCulator with no issues, and the program worked as expected (see Figure 5.3).

The next goal was to have multiple Wii controllers collaboratively manipulating a video in some way. I decided to create a patcher where users could “vote” for how to control the video. In this case, I fed two video loops – one monochrome clip of one person dancing and one colourful clip of multiple people dancing – into a crossfader object. By pressing and holding the Left or Right buttons on their controllers, users can vote on which clip dominates



(a) Main patcher (b) Sub-patcher

Figure 5.4: Video effect voting system with three users

the screen. In an effort to experiment with multiple motion data, I also incorporated a mechanism that lets users make their votes count double by shaking their controllers. Lastly, I packaged all of these programming objects into a "sub-patcher," making the program more modular and readable. Figure 5.4 shows the patcher running with three users.

My next task was to create the VJ program for the performer in my scenario. I spent a lot of time experimenting with video effects in Max. I selected four effects objects that would allow the performer to rotate the image, control pixelation, enable a motion blur effect, and crossfade between two video loops. These are controlled by rotating the Wii controller, increasing the incline of the controller, pressing and holding the A button, and pressing the Left and Right buttons, respectively. An important part of programming this patcher was mapping the data from the controller to the effects controls. Values had to be carefully scaled and clipped in order for the user's movements to translate naturally to the effect they control. The patcher is pictured in Figure 5.5.

The results of the last two victories were finally combined to create my audience-performer interaction system (see Figure 5.6). Here, one user has the VJ controls described in the previous section. The audience voting system, however, is also implemented, allowing the other users to collaboratively control the crossfading of the two clips. Thus, as the performer simultaneously manipulates the two loops, the audience can decide which of them dominates the screen. Additionally, using the controller's B button, the performer has

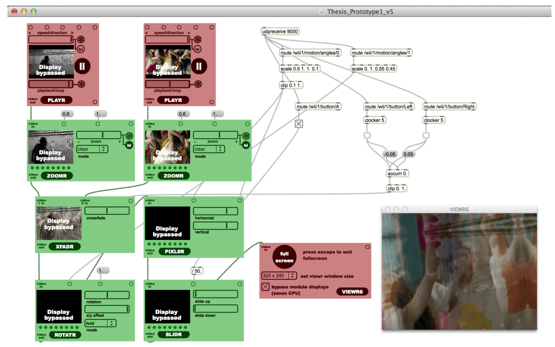


Figure 5.5: Wii controller VJ system

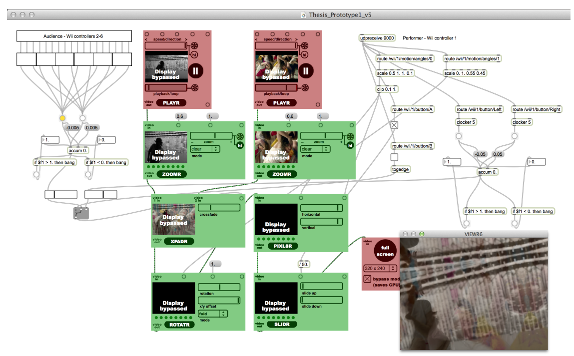


Figure 5.6: Audience-performer interaction system

the ability to "mute" the audience if their input is no longer desired. This stage required development of more sub-patchers to condense and modularize the program.

- I updated the look of the patcher, adding a dark background with light text.
- I added an auto-play function. This automatically flips through every round, playing each for a set amount of time.
- Added Lighters and Dance modes.
- Integrated video crossfade voting system within each mode.
- Added sub-patcher to lighten the processing load
- Polished off presentation mode.

5.1.2 User Testing

The first user testing was run at eLeo – an interactive exhibit hosted by OCAD University. My prototype was set up in a room with a wall-sized projection. Here, my goal was to observe how users approached the technology and how they performed the various inputs

5.2 Second Phase

5.2.1 Prototyping

5.2.2 User Testing

Chapter 6

Implementation

6.1 Production

6.2 Event

6.3 Reflection

Chapter 7

Conclusion

7.1 Discussion

7.2 Future Directions

7.3 Conclusion

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