Remote Control of Complex Interactive art installations

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ABSTRACT

Movement based interactive artworks are capable of instantly engaging audiences by reacting to physical motion consistently with real-world physics. Sustaining this engagement, however, requires a constant alteration of both the output and interaction aesthetics. Mobile devices (such as the iPad or iPhone) can be used to control the often-overwhelming plethora of parameters found in many interactive systems. The effect that mobile control of these parameters has on the inception, refinement and live performance of two separate art works is examined. An open-source dynamic remote control system is being developed to further facilitate the creative development and performance of interactive artwork as demonstrated by these case studies.

Author Keywords

Remote Control; Mobile Device; Interactive Artwork; Presets; OpenFrameworks; iPad; iPhone; TouchOSC;

ACM Classification Keywords

H.5.2. Information Interfaces and Presentation (e.g. HCI): Input devices and strategies

INTRODUCTION

Developing interactive artworks that are engaging to both participants and passive audience members is a difficult task. Interactivity can provide instantaneous engagement but a plethora of different visual states and interaction aesthetics are often needed to maintain engagement for extended periods. When designing visual states for artworks that involve interactive graphics, the iPad becomes an invaluable creative tool. The development of two separate interactive artworks with iPad controls are examined. Within these works, the mobile control allowed the artistic director more creative control, facilitated rapid content development and produced a more nuanced audience interaction.

Simulations of real-world physics can be used to transform real-time motion capture data into complex and engaging audio visual works[4]. These systems can sense physical movement of the participants to create reality-based interactions that are easily understandable to even the novice participant[3]. However, the continued use of a single motion mapping for extended period of time is likely to induce audience fatigue and engagement will subsequently decline over time. To combat this, Salter et al [7] postulate that dramatic or narrative arcs can be introduced to the system at a higher level to keep the interactions fresh and maintain interest in the piece. Chadabe[1] argues that it is preferable to have a system with a large number of parameters to alter the mapping from motion into the system, although with an increase in the number of parameters comes a decrease in the ability to coherently manipulate all of these parameters. The two artworks examined utilise real-world physics simulations and each had a large number of parameters that could alter the way the system responds to motion by introducing physical phenomena such as mass, viscosity and gravity effects. Combinations of these settings were stored as high level presets that allowed simple but meaningful manipulation of all parameters simultaneously. Choreographing these presets enabled a narrative arc to develop over time, helping to sustain audience engagement.

Control over these low-level parameters and high-level presets was added to a remote control device (iPad) to facilitate a rapid and more creative development. Mobile devices, such as iPads, iPhones and Android tablets, have been used to control many real time installations and musical instruments. They can offer the user a malleable interface that is specifically tailored to the needs of the job at hand. The first widely successful touch screen based mobile control was the JazzMutant Lemur [5]. It contained a range of user programmable virtual buttons and sliders with the sole purpose of controlling other equipment from a semi remote location. Since the introduction of the iPhone and iPad, software developers have been able to replicate the Lemur functionality at a significantly lower price. TouchOSC[1] is one of the more successful applications to mimic remote control in a fashion similar to the Lemur.

Although easy to use, TouchOSC requires the user to manually create layouts in order to interface with the target device. Recently, a number of apps have been developed to automatically generate these layouts with minimal manual effort. *Mira* is a remote app suite that auto generates layouts based on Max/Msp user interfaces[9]. *Control* is a similar technology which expands on the concept by allowing advanced script-

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[1] http://hexler.net/software/touchosc

ing on the device for complex interactions between the virtual sliders, knobs and buttons[6] .

The two artworks examined reveal that the creation and refinement of high level presets from a mobile device can enhance both the development and operation of interactive artworks. A prototype software solution capable of generating and manipulating high-level presets for OpenFrameworks applications is also presented[2].

CHOREOGRAPHED PHYSICAL THEATRE

Encoded[3] is a one hour interactive physical theatre show by *Stalker Theatre* including dance, aerial acrobatics, projection mapping and interactive graphics. The interactive graphics are generated in real-time by a complex particle system that uses optical motion tracking and fluid simulation to react naturally to the movement of the performers. The fluid simulation system was created using OpenFrameworks.

The first stage of the project development involved a series of physical workshops that focused on improvisation of both physical movement and interactive graphical states. The multitude of fluid simulation controls were manipulated to create a palette of interesting high-level presets that worked well with different types of physical movements. These presets were given semi-descriptive names such as 'strings', 'snowman' and 'water-wall' which enabled the artistic director to request certain reactive scenes which could then be choreographed, stating that "One of the challenges with this technology is that there is so many variables that being able to do the snapshot of the scene is the first big step".

Providing remote control of these named presets with the TouchOSC app running on an iPad (see figure 1) had a seemingly profound effect on the development of the show. The interactive system soon became a known and controllable entity in which desired states could be recalled at will. The artistic director of *Encoded* was given a copy of the TouchOSC layout on his own personal iPad so that he possessed simple but immediate control over the reactive fluid system via selection of these predefined presets. Despite some initial scepticism regarding the workflow, he quickly warmed to the remote control system stating that "It allowed for a much more responsive creative environment because it was immediate. It allowed for a refinement and subtlety of development process because everything was at your fingertips"

Giving the director control during rehearsals meant that he could easily see the available palette of predefined presets and quickly select which looks would match a given movement choreography. Before the introduction of the iPad to *Encoded's* development, any changes to the system were by way of a loud verbal command from the director on the stage to the interactive technician at the back of the theatre. The iPad control largely removed the need for these distracting interactions and enabled the director to pay more attention to the performers on stage. This direct control also freed up the digital projections operator to focus on other development

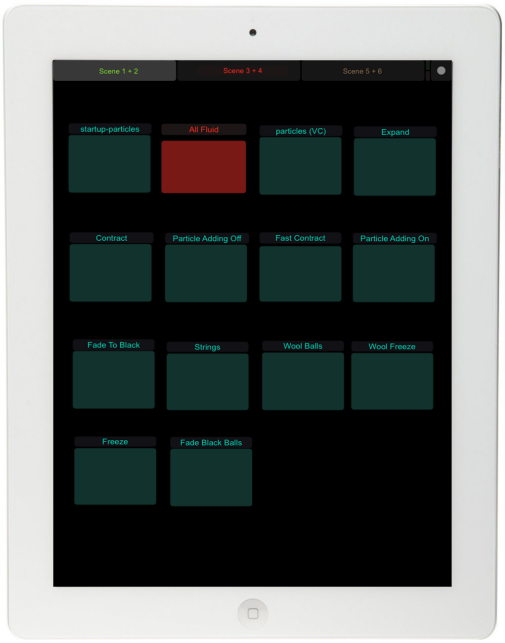

Figure 1. The TouchOSC layout used to operate the reactive graphics for the physical theatre performance, *Encoded*. Blue buttons operate presets in the fluid simulation graphics, while the red buttons control the VJ software and vision mixer

tasks like creating and refining traditional projection mapping graphics. The remote control of the fluid simulation was so successful that the vision mixing and pre-rendered video playback was also controlled by the TouchOSC layout.

INTERACTIVE INSTALLATIONS

Creature[4] is an interactive artwork inviting audience participation and was developed over a much shorter time frame than the two year *Encoded* project. The system borrowed considerable knowledge and technology from the *Encoded* project, but we opened up the system to the audience and expanded on the existing technology considerably. *Creature* was created for an outdoor art and science event exploring the theme of biodiversity. Local fauna was 3D modelled for the piece while local flora was photographed and texture-mapped onto simple geometric particle shapes. The interactive states found a balance between interactivity and narrative by morphing between abstract movement based particle graphics and simple 3d-modelled imagery. A considerable amount of new presets were created for the event to ensure that the interactive component remained a satisfying experience while the entire piece contained a diverse visual palette.

The TouchOSC solution used in the *Encoded* development provided an easy show operation environment and allowed the artistic director to build scenes by selecting from a palette of pre-defined presets. The solution was quite simplistic, however, and did not help with the initial development period of building presets, or allow any deviation or refinement from these predetermined presets.

[2] http://www.openframeworks.cc/
[3] https://vimeo.com/55150853
[4] https://vimeo.com/108033499

When designing creativity support tools, such as a remote control for interactive artworks, Shneiderman[8] suggests that it should be simple for novices to start using the device, while still allowing flexibility for advanced users to achieve all that they desire. The high-level preset functionality presents the users with an easy way to recall 'look's that are already known to work well, while the low-level parameter interface allows advanced users exact control over every single element of the system. To satisfy both the remote control requirement and the importance of preset creation and recall on creative development, a new software application (codenamed ioStorm) has been developed. This app will automatically generate control layouts from OpenFrameworks software and allows the user to access low level parameters and generate their own presets from the one remote mobile app.

ioStorm - Remote Control System Description

When opened for the first time, the remote ioStorm application will connect to the ioStorm enabled applications via UDP protocols over any available wireless network. The host app automatically respond to the presence of the remote app by sending all of the parameter names, types and acceptable values to the remote device. The ioStorm app generates a simple user interface for these parameters which mimics the user interface found in the host applications. By generating a user interface on the fly, the system alleviates the time associated with setting up the remote layout design in TouchOSC. As the system mimics the user interface of the desktop app, familiarity with the system is also ensured. Upon change to either of the desktop apps or the app running on the remote device, the values are immediately synchronised via OSC commands to ensure all user interfaces are always up to date.

Presets can be triggered, created and edited from the remote iOS application, enabling the user simple and easy control over the system. The control can be at a high level via pre made presets, such as with the TouchOSC *Encoded* setup, or at a low-level giving access to the entire system via the parameter slider interface. All communications use the OpenSoundControl format which allows external programs (such as TouchOSC, Max/Msp or Puredata) a simple interface for recalling presets or even manipulating specific parameter values.

Development of Interactive States

When working in-situ at a venue the system is usually hidden away from the interaction zone so as to not break the immersive 'magic' of the installation with technological clutter. For *Creature*'s first outing the main computer system was awkwardly placed underneath a bank of make-shift scaffolding with the projector and infrared camera placed at the top of the scaffold tower. The physical distance and barrier between the technology and interaction zone made it very difficult to create and refine new interaction states.

With *Creature*, there were no designated performers or choreographed movements to build the interactive states around. Building this type of interaction suggested an iterative trial and error approach where neither graphics, interaction or

Figure 2. The ioStorm auto-generated layout for the *Creature* installation, displaying both low-level parameter control (left) and high-level preset control (right)

movement were predefined. This development of the interaction aesthetic was where the remote control became incredibly useful. The system could be altered, refined and tweaked, all whilst being up and close to the action. By physically participating in the interaction the digital artist could fully experience the system's shortcomings and strengths and instantly make adjustments as needed. Actually interacting with the system personally is the best way to make sure that the interaction aesthetic 'feels' right and that the piece is engaging to use. The preset system that is built into the ioStorm code makes it possible to then quickly store and test presets all whilst being immersed in the interactive installation. The ioStorm remote software made it possible to fine tune all of the interactive states in the *Creature* installation under a tight deadline (due to rain delays) and without any extra man power needed to constantly simulate the potential movements of the audience.

OPERATION OF INTERACTIVE WORKS

The installation was initially controlled from the tech box where the computers and projector were setup. It was possible to see that quite a number of the audience (around 30 at a time) were engaging with the system by waving their hands in the air to move the projections around. A selection of pre-made presets were sporadically selected and the crowd appeared to enjoy each change in both visual and interaction aesthetics.

Upon grabbing the mobile iPad controls and joining the crowd the true nature and breadth of interactions with the system became observable. From the control box, it appeared that the crowd was bunched closely up against one another and more or less just waving their hands. From the vantage point of the interaction zone, it became apparent that the crowd was not actually all bunched up but in groups of two or three coming back from the projection surface by up to 5-10 meters. Each group had positioned themselves with a decent amount of space in which to move about. It was very much a family event and many of the parents were standing back from the wall where they would occasionally wave their hands to interact with the system, all whilst still keeping a keen eye

on their children who were playing closer to the projection wall. Many of the children of all ages were not only jumping and waving to interact with projections, but were performing cart-wheels, hand stands and occasionally hopping to mimic the natural movement of the local animals like kangaroos and frogs. On a few occasions it would turn into a game whereby a group of children would compete to see how much of the image they could affect and what patterns they could create by scrambling up the vertical projection wall as high as possible. These different interactions were only observable from within the crowd and the remote control device allowed the system to be tweaked from this vantage point. This allowed a much more refined control over the artwork where the system could become highly tuned for the movement of individual members of the audience. The operator of the show was able to experience the interactions at the same time as controlling them. New presets were even created and refined whilst operating amongst the crowd as the operator was able to immediately see the affect of each parameter change on the interaction and ultimately engagement of the audience. It was very obvious to understand when an interaction state was not responding pleasingly from this vantage point. The influence of mobile operation was noticed by the director of the work, who stated that "when the operator is also part of the audience... that line between objective and subjective kind of blurs. It's a new creative environment that is emerging with this technology. It's less removed, more experiential".

CONCLUSION

During the development of both *Encoded* and *Creature* it became evident that the ability to quickly save the state of the system in a preset was a vital part of the creative process. Once these presets had been created the show could then be storyboarded in high-level chunks to create a narrative arc to the piece. Mobile remote control of the interactive system presented many benefits:-

- Promoted creative choreography of established presets
- Reduced operational needs during rehearsals
- Rapid development of interactive states
- Refined nuance of the interaction aesthetic
- Experiential operation tailored to specific audience interactions

Future work

The ioStorm remote control app was very successful in controlling the OpenFrameworks software behind the interactive *Creature* installation and facilitated the rapid development and refinement of interactive content. The software is still in early prototype and needs several improvements before releasing to the Opensource community. A zero-config network system, like Bonjour, should be added to allow automatic communication to any ioStorm compatible server running on the network. Recent work on the 'Storm' software suite has also seen the addition of preset morphing as a creative way to control the system. Adding a simple and intuitive method to morph between presets could add significant scope for improvisation and creative operation of interactive installations.

Given the success of the projects to date, addressing these outstanding issues to the ioStorm software suite should provide a streamlined solution to facilitate the development of future movement based artworks utilising the power or mobile devices. Ground Theory [2] methods can then be used to further evaluate the impact of using ioStorm to remote control interactive art installations.

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