Sputnik

Project Report HCC Project Seminar 2011

Simon Wallner*

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This paper evaluates *sputnik* a 3D environment with which the user can freely interact through an elastic *arc of light/fishing rod* metaphor, to explore, create and interact with virtual *sound objects*. These sound objects are placed in the scene and react to the user's input by sending MIDI commands to an external audio program thus creating or manipulating the sound.

1 Reading Guide

Appendices Code Prerequisitions Video CD etc...

2 Introduction

Computer music is around us for some time now and through the use of the computer musicians have sheer endless possibilities of musical expression. With this plethora of possibilities comes the need for constraints and control to harness this expressive potential. Over the recent years many standard and non-standard interface have been developed, ranging from the ordinary button-fader-nob MIDI interface to more elaborate interfaces and systems like the *reactable*[Jordà et al., 2007], *mixiTUI*[Pedersen and Hornbæ k, 2009] or commercial solutions like the *Novation Launchpad*[1] or *Native Instruments Maschine*[2] to name but a few.

With the advent of motion based controllers in consumer entertainment systems, marked by the release of the *Wii*[3] console in late 2006, motion controllers became

*me@simonwallner.at

[1] http://www.novationmusic.com/products/midi_controllers/launchpad

[2] http://www.native-instruments.com/#/en/products/producer/maschine/

[3] http://de.wikipedia.org/wiki/Wii

widely and cheaply available. This and their interface capabilities make them the ideal tools to explore the realm of *new interfaces for musical expression.*

A common problem of computer music interfaces is that often the process of sound creation is not readily comprehensible. Seeing a performer on stage behind their laptop twisting knobs and adjusting faders might be ambiguous to an uninformed observer. It can be hard to relate the artist's action to the resulting sounds. This can hinder the experience and might go as far as to the point where the audience suspects that an artist just pressed play, as interviews conducted by [Pedersen and Hornbæ k, 2009] show.

This paper introduces *sputnik*, a system that uses a *Wiimote* controller to interact with a dynamic 3D scene. In the scene, a variety of sound creating objects are placed that send MIDI signals to an external audio program upon the user's interaction.

Users can freely navigate the 3D scene and interact with it through an elastic *arc of light/fishing rod* metaphor. It seems as if the *arc of light* was coming out of the Wiimote and reaches into the scene, acting as an extension of the user's body into the virtual space. With this bodily extension users can *grab* and *drag* objects around the 3D scene.

In this paper I evaluate the qualities of the *arc or light* metaphor and how the design decisions/constraints of the system influence its expressive potential both visually and musically. This evaluation is grounded in a user study of XXX users.

Based on these findings and the theoretical framework of [Ullmer and Ishii, 2000] the similarities and differences between *sputnik* and tangible user interfaces are discussed.

3 Paper Outline

The following section gives an overview over related work in the field of *New Interfaces for Musical Expression* and tangible user interfaces. Section 5 goes into detail about sputnik, both on a conceptual and a technical level. Section 6 describes the performed user study and the paper is finally concluded in section 7 where the findings are discussed.

4 Related Work

[Magnusson, 2010] gives a good overview over the field of *affordance* and elaborates on *constraints* from different viewing anlges and how constraints impact and support creativity.

[Ullmer and Ishii, 2000] introduces a formal model for tangible user interfaces and compares it to the prevalent MVC (Model View Controller) model. Different qualities of TUIs are stated and a few existing applications are assessed with it.

[Ishii and Ullmer, 1997] Introduced the term *Tangible User Interface* (*TUI*

[Kiefer et al., 2008] Assessing the potential of the wiimote as an musical interface and comparing it to a common interface. user study, only very simple mapping + perceptron shape recognition

[Wanderley and Orio, 2002] discusses the problems of how to assess interfaces for musical expression and searches the depths of HCI studies for a possible answer. no answer given

[Dobrian and Koppelman, 2006] dives tries to answer what constitutes an expressive musical interface, and how does the lack of virtuoso performers impacts the whole discussion. It highlights the role of a repertoire and the role of the performer. This is a bit contradicting to what [Magnusson, 2010] writes.

[Cook, 2001] provides a few (empiric) design principles for digital musical instruments and richly illustrates them with example projects.

[Fels and Lyons, 2011] General introduction and overview to/of the field of NIMEs given as a SIGGRAPH course. The definitive introduction to NIMEs.

[Gurevich and Treviño, 2007] introduce an *ecological* view of musical expression that goes against the conservative view of a uni-linear composer–interpret–listener relation.

[Gurevich et al., 2010] evaluate a highly constrainted one-button instrument in terms of the style and variations these constraints induce.

[Mäki-Patola et al., 2005] built four virtual reality instruments for a cave like environment, one of them being a virtual mallet, where users can hit the pads with virtual mallets. This comes closest to sputnik and also a few general thought on virtual scenes and the possible impact on the performance are given.

5 Results

‘7-10 pages

Description of the Implementation according to the learning goals:

1. Create a system that allows the user to interact with an virtual world through the Wiimote. This system should be intuitive even for untrained users, and have a very low barrier of entry.
2. Explore the technical capabilities of the Wiimote and Nunchuck controller and put it to good use.
3. Create a meaningful mapping form the virtual world to the sound generation system.
4. Create a sound generation system that allows nuanced and rich musical expression.

5. Develop an architecture that streamlines the three stages input - processing - output.

6 Evaluation

3-5 pages

Describe the evaluation according to the research questions. Describe the process and the observed results.

7 Discussion

3-5 pages

Discuss the results form the evaluation and answer the research questions.

1. How can the arc of light/fishing rod metaphor be used for intuitive interaction. How does lag impact the system?
2. What meaningful mappings can be derived from the interaction with and the visualisation of the virtual scene.

8 Future Work

9 Conclusion

0.5 pages

10 Acknowledgements

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