Sputnik

Project Report HCC Project Seminar 2011

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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

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[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

Only a few projects exist that go into a similar direction as sputnik. The *Virtual Xylophone*[Mäki-Patola et al., 2005] is a virtual reality system in which the users can place bars of different pitch in the scene and then struck them with a virtual mallet. By translating the configuration and mapping of the real instrument into the VR environment, new modes of play emerge. [Zappi et al., 2010] created a virtual controller for *Ableton Live* that allows users to create simple proxy objects in a VR environment, bind them to certain controls and use them effectively as virtual sliders. [Rodet et al., 2005] created a virtual environment for an exhibition setting. User interaction is limited but is done through a 6DOF motion tracker with tactile feedback.

More projects exist in the realm of Tangible user interfaces. With mixiTUI [Pedersen and Hornbæ k, 2009] created a table top tangible interface for a sequencer that aimed not only to be functional but also to visually enrich the artists performance. Interviews with musicians and an extensive user study have been performed. [Jordà et al., 2007] created the famous *reacTable*, also a table top tangible interface that allows the creation and manipulation of music by composing various objects on a surface.

[Kiefer et al., 2008] assess the general qualities of the Wiimote as a musical controller and [Miller, 2010] uses the Wiimote and sensor bar to create the *Wiiolin*, a virtual violin that mimics the real instrument and can be played either in an upright position like a cello or horizontally like a violin. It only uses audio feedback.

A bit farther away, [Miyama, 2010] uses an low resolution distance sensor array to control the many parameters of a synthesizer. A small gui application is merely used for monitoring the system state, and sound creation is done in pd.

The field of Tangible User Interfaces provides part of the theoretical background for this work. Work of [Fitzmaurice et al., 1995] and then later [Ishii and Ullmer, 1997] introduced this term. [Shaer, 2009] Gives a very good overview over this field as well as the history of TUI studies.

[Sharlin et al., 2004] introduced *spacial TUIs* that focuses on *I/O unification* by tightly coupling the action and perception spaces and embodying a clear state representation across all sensory modalities.

[Ullmer and Ishii, 2000] introduced *MCRpd*, a formal model for descibing and analysing TUIs that will be used in section **??**

Entering the musical realm [Fels and Lyons, 2011] give a good overview and general introduction into the field of NIMEs. [Cook, 2001] shares 13 general principles for designing computer music controllers that resulted from his yearlong experience in this field. [Dobrian and Koppelman, 2006] asks the question of virtuosity and expression by pointing at the elephant in the room, e.g. the lack thereof and also the lack of a comparable standard repertoire.

In contrary to that [Gurevich and Treviño, 2007] question the hegemonial *composer–interpret–listener* relation in favour of a more holistic *ecological* view of musical expression. Later work by [Gurevich et al., 2010] evaluated a hightly constrained, prototypical one-button instrument that spurred a wide variety of play styles.

Closing the loop back to design and HCI, [Magnusson, 2010] gives a good overview over the field of *affordance* and elaborates on *contraints* from different viewing angles and how they impact and support creativity. Finally, [Wanderley and Orio, 2002] goes in to depth about evaluating input devices for musical expression in the context of HCI.

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

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thank Esben, thank the participants,

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