Bouncing Glow: Methods of Creating Content Elements for One-Pixel-Displays

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ABSTRACT
This paper describes novel methods of generating patterns as content for One-Pixel-Displays. These patterns of varying light intensity are created as content elements for One-Pixel-Displays or computer controllable light sources in general. The elements are intended as the language foundations for storytelling within a new medium. We argue that content creation in this field is running behind the hardware developments and therefore needs to be explored. One example presented is the time-based mapping of the vertical position of a simulated bouncing ball to light intensity variations of a light source, in this case a TFT and a DMX-controlled incandescent light bulb. The other example is the mapping of different sound recordings to light. These methods show promising first results for creating content elements.

Author Keywords
Design, Light, Mapping, One-Pixel-Display, Light Intensity Patterns, Simulation of Physics, Sound Recordings

ACM Classification Keywords
H.5.m Information Interfaces and Presentation: Miscellaneous

General Terms
Design, Experimentation

INTRODUCTION
With Bouncing Glow we describe our efforts to generate content for One-Pixel-Displays. The hardware of these One-Pixel-Displays might be based on incandescent, LED, electroluminescent, or OLED technologies coupled with control circuitry. The medium of film, for example, has been explored widely as narrative by filmmakers, artists and designers.

Little research and art creation has yet been done to animate these single glowing entities as novel media. How can we create meaningful content for these displays despite the obvious limitations?

BACKGROUND AND RELATED WORK
Controllable light sources have become very common e.g. as LED displays in the urban context. Recently there have been some attempts to focus on freely configurable displays. Libe-erated Pixels as Seitinger coins them in the title of her PhD Thesis Defense are represented in her research as the examples Urban Pixels [5] and Light Bodies [6]. In Urban Pixels the focus lays on freely reconfigurable, independent and wirelessly controllable light sources (resembling bigger display structures). In Light Bodies the responsive interaction in a performative context is highlighted. Pintus in her paper Tangible Lightscape[2] calls attention to the aspects of product communication through light. A well known commercial and patented example is Apples Breathing Status LED Indicator that mimicks the rhythm of breathing [1]. Here we build on our own research completed under the title Semiotic Foundations of Illuminants as Time-Based Medium in Space: Experiments and Artifacts [8].

Figure 1: Processing sketch mapping vertical position of a bouncing ball to light intensity

APPROACHES FOR ANIMATING ONE-PIXEL-DISPLAYS
Via this process, fundamentals research on how to animate One-Pixel-Displays, we discovered two main approaches of mapping sensor or simulation data on light intensity values. One is the mapping of natural forces e.g. gravity, the other the transformation of sound data to light intensity variations over time. Both directions showed promising first results and might be coupled with direct user interaction.
Physical Simulation and Motion Sensory Data Mapping

In order to see the results of mapping physical simulations to a light source, we mapped the vertical position of a simulated bouncing ball to light intensity (Figure 1). The relative height of the ball is discreetly mapped to the light intensity, where the ground line is either represented by full light or complete blackness. The luminance intensity changes incrementally from light to dark as the ball begins its fall to finally bouncing on the ground line repeatedly (ie. loosing kinetic energy). The experimental set up in physical space resulted in what we perceive and describe as *Bouncing Glow*. As the only light source, the controlled light in the dark room seemed to suggest the space itself to be bouncing. This was a similar effect to that on screen and is an effect to be evaluated further with other observers.

Mapping of Sound Recordings

The other approach was the direct mapping of amplitude data of several audio recordings, e.g. human heart beat, human breathing, sea shore, bird sounds to light. This showed that the synesthetic experience is somewhat transported through light too.

Reality based Simulation vs. Cartoon based Animation

An unanswered question is that of the user acceptance of realistic and exaggerated cartoon like animations on One-Pixel-Displays. We assume that the most realistic data mapping does not lead to the best user experience. Examples of this are rotoscoped video or film shots, which can create the feeling of odd motion, although based on real movements. An aspect to look into further is the relevance of the initial mental models the observer creates while exposed to the situation. This, so we assume, strongly influences the observers future perception.

Additionally the vertical positions of the ball have been mapped to a DMX dimmer controlled incandescent light bulb diffused by a yellow bucket. The processing patch hereby communicates through Pure Data over an DMX interface to the dimmer. For the sound to light conversion we built a patch (Figure 2) in Pure Data [4] allowing us to import sound samples and convert them to DMX signals. Another approach taken was the use of wav2c [7] in order to generate data arrays from sound files. Real-time based programming languages for sound and video processing have shown to be the more reliable choice.

CONCLUSION

This paper describes two paths for developing content elements for One-Pixel-Displays by mapping data directly to light intensity values. Initial experimental settings have been created and demonstrated. These also require further evaluation in the form of user studies. These experimental approaches also create space for further research in the field of content creation for One-Pixel-Displays to interact with each other and/or the user. Concurrently, artistic explorations of One-Pixel-Displays will be carried out, based on aesthetic intuition.

ACKNOWLEDGMENTS

I would like to thank my Ph.D. Advisors Prof. Dr. Ute Holl and Prof. Wolfgang Sattler, as well as my former mentor Prof. Ursula Damm. I also want to thank Jamie L. Ferguson for our ongoing dialogue on this matter, and the Bauhaus University Weimar Kreativfonds 2009 for financial support.

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7. Wav2c makes arrays out of sounds... http://github.com/olleolleolle/wav2c.