

# "Aurora Borealis" - Gesture Controlled Light Installation

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## ABSTRACT

This paper describes a hand controlled interactive light installation, "Aurora Borealis". User can select a light color by performing a certain gesture with the control device and control its intensity by tilting the device. The selection of color is presented to the user with audiovisual indication.

## Author Keywords

Interactive art, light installation, human computer interaction, gesture control, user participation.

## ACM Classification Keywords

H5.2. Information interfaces and presentation: User Interfaces. Interaction styles.

## INTRODUCTION

The rapid development in mobile and wearable computing is providing users with new optional and complementary interaction solutions. One potential intuitive communication channel is gestures, which have not yet been fully utilized in human computer interaction. The role of this complementary interaction modality is expected to increase as the enabling technologies develop.

The present sensor-based gesture interaction methods are enabled by detecting the movement with inertial sensors, e.g., accelerometers. The sensors can be integrated into clothing, wristwatches, jewelry or mobile terminals, thereby providing means for anytime-anywhere-anything control of devices and applications with simple predefined or user definable movement.

This paper describes a light installation which uses human gestures as an interaction mode between the artwork and the audience. By performing gestures and tilting, a user can individually control a color intensity level of the light projector. With adaptive background music, the light controlling provides a multi-sensory experience to the audience. The gesture recognition in our installation is based on wireless sensor technique, which gives us the

possibility to recognize hand gestures in three dimensions.

## GESTURE-BASED INTERACTION MODES USED IN INTERACTIVE ART

In addition to the sensor-based recognition also cameras are widely used in gesture-based art installations. In the light and sound work "LivingRoom" [3] and PAGE (Painting by Aerial Gesture) [4] cameras are used to detect the movements of the audience to display different kind of color and figure presentations for the audience. One example of hybrid sensor-based and camera-based gesture recognition is the work "Unconscious Flow" [5] by Naoko Tosa. In that work a range sensor is used to calculate the distance between user's hand and the surveillance camera.

Another example of sensor-based gesture control is the work by Chris O'Shea [2] "Frequency Modulator", which uses infrared distance sensors to create different light density modes calculating the distance between user's hand and the tube shaped device. Infrared sensors are used also in the PAGE system.

## SENSOR-BASED GESTURE INTERACTION

Sensor-based gesture interaction methods can roughly be divided into two operating modes [1]. Measurement of tilt, rotation or amplitude can be used directly to provide control command. The other mode utilises discrete hand movement patterns, e.g., gestures.

Developed gesture interaction prototype is based on wireless handheld sensor box, SoapBox [6]. 3D acceleration sensors of the box measure static acceleration (i.e., tilt), as well as dynamic acceleration (i.e., movement). The measured signal values are wirelessly transmitted from the handheld controller device to the receiver that is connected to a windows PC with a serial connection. The measured signal values are processed on the PC. The start and the end of the gestures are marked by pushing the button on the box at the start of the gesture and releasing it at the end, which then activates the processing program on the PC. The processing results are mapped to different control commands and transmitted to the multicolor light projector.

The developed gesture interaction prototype has been utilized in two public space demonstrations. In the Heureka (The Finnish Science Center) demonstration, a DVD

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multimedia presentation and a tabletop could be controlled by gestures. The demonstration was presented at Heureka Science Center in Finland for a one year, 2004-2005. This demonstration is on display now in the Knowledge Pavilion - Centre of Live Science in Lisbon. The second demonstration was developed for Oulu Expo in 2004-2005. The Oulu Expo demonstration was quite similar to “Aurora Borealis” presented in this paper. The Oulu Expo demonstration is illustrated in Figure 1.



Figure 1. Oulu Expo demonstration.

#### “AURORA BOREALIS” INSTALLATION DESCRIPTION

In the “Aurora Borealis” installation, the control target is a tube shaped RGB light projector. By using gestures and tilting, a user can individually control Red, Green and Blue color intensity levels of light projector. In addition, each color is connected to the kindred ambient sounds. Thereby, controlling lights provides a user with a non-ordinary way to express themselves as well as a multi-sensory experience. An example of the gestures indicating the colors is illustrated in Figure 2.

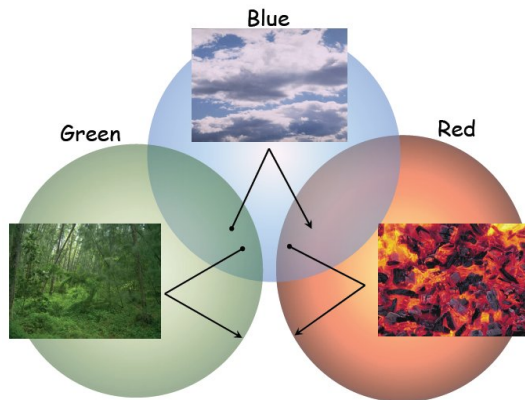


Figure 2. The gestures indicating the colors.

User can select a controllable color by gesturing the corresponding gesture symbol. When a gesture is performed, the recognition result is visualized to the user by

flashing the selected color and by playing a sound connected to the corresponding color. After selecting the color, the user can either increase or decrease light intensity by tilting the device. Selected color only flashes when it is recognized, otherwise the RGB light tube shows the combination i.e. sum of the three colors. For example, if the user had adjusted red and green to maximum and blue to minimum, the output color is yellow. While the RGB light tube shows mix of the colors, the last selected color is indicated by background music intending to create a mental picture the color.

#### CONCLUSION

We have presented an interactive light installation controlled by user’s hand gestures. The use of wireless sensor technology gives the interaction a new dimension of freedom. “Aurora Borealis” - light installation - light sculpture - demonstrates the breaking of the usual boundaries between an artwork and the audience.

#### ACKNOWLEDGMENTS

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