Tangible Tube

Hilfi Alkaff
University of California, Berkeley
Berkeley, CA 94720 USA
hilfia@eecs.berkeley.edu

Albert Tjoeng
University of California, Berkeley
Berkeley, CA 94720 USA
albert_tjoeng@berkeley.edu

Victor Tjhia
University of California, Berkeley
Berkeley, CA 94720 USA
victor.tjhia@berkeley.edu

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Abstract
Tangible Tube is a device that invites users to play in a completely unprecedented form of interactions. Instead of utilizing traditional devices such as keyboards, mouse, joysticks and wii remote controls that challenges users on how swift and composed their fingers' movements are, Tangible Tube challenges users to play games using a tube that they will control through breathing and moving their mouth.

Keywords
Tangible Interfaces, Interaction Design, Children, Entertainment

ACM Classification Keywords
H.5.m [**Information interfaces and presentation (e.g., HCI)**]: User Interfaces, user centered design.

General Terms
Design, Experimentation

Introduction
TODO:
- Traditional entertainment software: PS, nintendo and newer game console: wii

Background

TODO:

- Related works that utilize breathing
- Research projects for entertainment that uses tangible UI

Implementation

The Tangible Tube system has two components; the tube itself and the screen. The tube is attached to an acrylic enclosure that houses a small Force-Sensing Resistor (FSR) and Inertial Measurement Units (IMU) that possesses 5 degree of freedom. The IMU captures the 3-dimensional motions of the tube and translate it into 2-dimensional movement in the screen. Additionally, it also records the angle in which the tube is rotated and how fast it is rotating. With the FSR integrated in the tube, how hard the user breathe into the tube is also captured. All of these informations will then be passed into arduino which will be read by a processing module.

We have developed two applications to demonstrate the interactivity of our Tangible Tube. The applications that we developed are written in processing since it provides a smooth interface with arduino while boasting numerous easy-to-use graphical functions. Making existing processing applications to work with our Tangible Tube require very minimal changes to the code base since we have made the interface to the hardware to be very simple and generic.

Our first application is a painting application program. In this application, the user will be able to paint by blowing into the tube and the harder the user blows, the thicker the color is. Changing the color of the paint is achieved by rotating the tube.

Our second application is a game in which the user is required to pass through a set of levels by shooting down balloons that randomly appear in the screen. This is done by moving the pointer to where the balloons are and blow into the tube. To make the game more interesting, the user will only be able to shoot down a particular balloon if the color of the pointer matches the color of that balloon. Similar to the previous application, changing the color of the pointer is done by rotating the tube.

How to put pictures:

Figure 1: Insert a caption below each figure.

How to cite: blablabla [1]

TODO:

- Pictures
- More details

Evaluation

In order to measure how interactive our Tangible Tube is, we developed our application to be able to take inputs from traditional input devices (*i.e.,*mouse and keyboard) and our Tangible Tube. For instance, in the shooting game applications the users will be able shoot down the balloons by clicking on the mouse and to match the color of the aballoons with the mouse pointer that the user is controlling, the user will need to press some keys in the keyboard.

After describing to our participants how our Tangible Tube works, the participants tried out the applications that we have developed both with and mouse and keyboard and with Tangible Tube as the input device.

TODO:
- Pictures
- Describe the experience of the testers.
- Evaluate how Tangible Tube is representative for games like balloon popping.

Discussions and Future Work

In the future, we would like to explore on how well Tangible Tube works in a collaborative setting. For instance, in the shooting game that we developed, we could extend the game so that two people will compete to get a higher score or collaborate to shoot down a number of balloons under limited time. We believe that our Tangible Tube will be much more interactive if this is implemented.

Following up our previous point, making Tangible Tube wireless is essential to maximize the user experience. In our current prototype, our Tangible Tube is wired to the laptop. In this case, the users will be constrained at how long the wire connecting the tube to the computer is and could not move as freely when using the applications. Under group setting, this problem is exacerbated since multiple users could now collided with each other due to space constraints and this will definitely detriment the user experience.

Instead of utilizing computer screen as the output of our Tangible Tube, we believe that it will be best if it is displayed on a standalone screen such as a television screen so that the Tangible Tube system will feel more natural to the user and not just "another computer application".

Last but not least, in the hardware side, we also need to smoothen the reading that we get from the accelerometers and gyroscopes in order to maximize user experience.

TODO:
- Put feedbacks from testers and incorporate it in this section.

Conclusion

In this paper, we have reported on the design and first testing of a tangible user interface that revolves around breathing actions instead of traditional entertainment that utilize pressing keyboard or joysticks. We believe that this invites our users into a realm of interactions that they have not experienced before. The amusement of people who tested our Tangible Tube, even in simple games that we developed, have confirmed our success and encouraged us to explore this further.

Acknowledgment

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References

[1] How to Classify Works Using ACM's Computing Classification System. http://www.acm.org/class/how_to_use.html.