

Interactive Pong: Exploring Ways of User Inputs through Prototyping with Sensors

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ABSTRACT

This study aimed to explore ways of user inputs through designing interactive game controllers with different type of sensor. From building four experiential prototypes on Pong, we learned to drive design by focusing on interaction qualities, which determine the use of sensors. We found that the interaction qualities together as a set offer a way to design aesthetics of behavior in interaction.

Author Keywords Interactive Pong, Interaction Qualities.

ACM Classification Keywords H.5.2 [User Interfaces]: Prototyping

General Terms Design

INTRODUCTION

Designing an interactive product is about designing behavior in user product interaction [6]. In order to create aesthetically mature prototypes, six interaction qualities (instant, playful, expressive, collaborative, responsive and flexible) identified in our previous research [3], were mapped into the development. We focused on finding out if and how these qualities can be used to create expressive user inputs, especially with bodily components (sensors). The goal was to build experiential prototypes to explore ways of designing user inputs to optimize these qualities.

RESEARCH APPROACH

The classical computer game Pong was chosen as a vehicle to build interactive prototypes. It has a sufficiently simple required input, so broad explorations with sensors are possible. Pong is easy, robust and iconic, which helps both in attracting visitors and in explaining the setup and goal in seconds. We focused on designing interactive user inputs, instead of on screen interfaces.

We involved twenty MSc students on a design brief concerning interactive Pong. These students were mentored on design theory while gaining practical experience in the development of products, which utilize the potential of embedded ubiquitous technology in products in terms of

enriching user experience [1]. Max/MSP, Phidgets sensors and Arduino were selected [2,4,5] as development environments. These tools make it possible to build experiential prototypes, even with students who have few electrical and programming skills.

Design Brief

Each group had to focus on a pair of interaction qualities, to use Pong to create a specific scenario and to explore user inputs and qualities of sensors. To do so, they had to build experiential prototypes, going through several rounds of conceptualizing and improvement.

Iterations

A total of five iterations of concept and prototype development were made. The first two iterations focused on exploring sensor behaviors and finding out how each sensor can be used. The third iteration aimed to crack technological problems and further develop the concept to a mature level. The fourth iteration involved users to play Pong in multiple ways and to get comments. The last iteration aimed at finalizing the prototypes.

EXPLORING INTERACTION QUALITIES WITH SENSORS

Four experiential prototypes were built for exploring the six interaction qualities in pairs. Table 1 shows how the interaction qualities were distributed over the groups.

| Prototype | Interaction Quality | Sensor | User Input |
|----------------|--------------------------|---------------------------|-------------------------|
| Space Ship | Instant Collaborative | Force Proximity | Blow, Lean Thrust |
| Pada | Expressive Flexible | 2D Tracking Accelerometer | Intercept Tilt |
| Jump & Balance | Expressive Collaborative | Distance Light | Jump Weight |
| Pirate Ship | Playful Responsive | Infrared Motion | Pull, Dodge Pump, Steer |

Table 1. Distribution of interaction qualities, sensors and user interactions over the four groups.

Space Ship

Players fly two ships on a 2D map with obstacles (see Figure 1). The aim is to eliminate the opponent by taking the initiative to crash into him. A balancing board with

thrust control was designed and built to fly one ship. Leaning left on the board turns the ship left and vice versa. Pulling a rope thrusts it upward. There is also an option for multiple players to join this side. These players get respectively a flamethrower and a gravity gun to pick up and throw virtual objects. A Kinect is used to fly the other ship. The Kinect lets the player fly the ship around the map in a free style. (Note: This group crossed the boundary of using the classical Pong and created their own).



Figure 1. Storyboard and Design of Space Ship.

Pada

Pada is an audio game with bodily movement as input and music as output (see Figure 2). By using headphones and spatial sound, two players hear the music moving through the environment. In order to pass the music to each other and get the game going, they have to intercept the music before it has passed them. Players tilt their bodies and/or heads left and right to catch the position where music goes, in the mean time Pada measures their positions. These interactions involve whole body and convey guiding information.



Figure 2. Workflow of Pada.

Jump & Balance

The game is projected on the floor, which allows controlling the paddles to become a physical activity (see Figure 3). Four players are challenged to use special features in order to influence their opponents in a negative way. Controlling the paddles needs collaboration between two players as a team. One team controls the paddle by jumping on air pillows. The paddle reacts on the movements of the sensor by using air pressure. The other team controls the paddle by using a large balancing board. The paddle reacts on the height difference of the board.

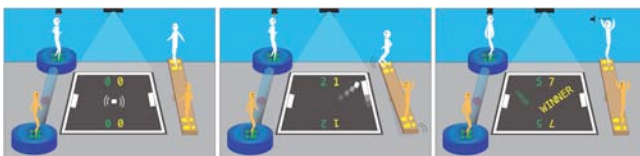


Figure 3. Storyboard of Jump & Balance.

Pirate Ship

Two pirate ships represent the two paddles in the Pong game (see Figure 4). There are four set of user inputs: 1) pull and release handle to attack the opponent, 2) dodge onto the platform to avoid cannonballs, 3) pump air to repair the shortened paddle (note: the paddle shortens when hit and also as time goes by), and 4) steer a steering wheel to move the paddle.



Figure 4. Design and Testing of Pirate Ship.

CONCLUSION

In this paper, we have presented our study on exploring expressive user inputs through interactive prototyping. Four prototypes on Pong were built. Each demonstrates a pair of interaction qualities. We used sensors to make user inputs more physical and interactive, e.g. blowing and steering. Each sensor has its main qualities. We have chosen to drive design by choosing an interaction quality as aim, and then explore the use of sensors to support the chosen quality. The sensors depend on the chosen quality, rather than the other way around. Interaction qualities together as a set offer a way to design the behavior in interaction. With the interaction qualities expressed and optimized, aesthetics of behavior in interaction can be designed. This result can be applied for designing expressive user inputs with technologies in other research domains and situations, such as the office, the home and the hospital. This result benefits designers and researchers in the UbiComp field who focus on understanding user product interaction by applying modern technologies.

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