THE WOODBOT PILOTS: EXPLORING NO-HANDS INTERACTION FOR INTERACTIVE PUBLIC INSTALLATIONS

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ABSTRACT

We present and discuss the Woodbot Pilots, an interactive experience in the form of a gesture-based game that runs on a large-scale interactive installation designed to be placed in an airport terminal and used by the general public. The background of the project is described, as well as the installation itself and a scenario of its use. To end the paper, we discuss some of the issues it raises in relation to public installations as well as some of the lessons we have learnt in conceiving, designing, implementing, and studying its use.

Keywords: Installation, gestures, 3D camera

INTRODUCTION

Since the days of CD-ROM authoring, various kinds of interactive installations such as information kiosks and touch screen apparatuses have been working their way into public spaces, including museums, hotel lobbies, and art galleries and exhibitions. Some common forms of these installations have manifested with the use of mouse and keyboard interaction or touch screen kiosks. In the last few years, these traditional interaction styles for public installations have been challenged with the advance of new technologies such as multi-touch platforms, tangible user interfaces, mobile devices such as smartphones and tabled computers, and ubiquitous computing devices.

Consequentially, the creation of interactive experiences for public spaces and the assessment of the user experience of these installations has turned into a respected sub-community of research and design within the fields Human-Computer Interaction (HCI) and Interaction Design (Hornecker et al., 2006). Substantial effort has been directed at museums and galleries, in turning non-interactive installations into something with which visitors can interact and with which they take a more active part. Here, several novel systems have been designed and proposed to provide the user with for instance multimodal and context-sensitive information (Oppermann and Specht 1999), engaged the user in collecting things such as souvenirs and photos (Fleck et al, 2002), and new kinds of services such as treasure hunts (Fraser et al, 2003). More theoretically oriented research in this area has also explored the potential effects such multimodal, interactive exhibits may come to have on museum visitors, e.g. how people come to constitute the sense and significance of aesthetic objects through their interaction with others (Heath et al., 2002) and how interactive installations seem to facilitate improved and increased social interaction among museum visitors (Heath et al., 2005).

In this paper, we seek to relate to some of the lessons learned from previous work in and around interactive and multimodal public installations and take that knowledge to a different kind of public environment: an airport terminal. While an airport terminal just like a museum is a semi-public, somewhat shared environment, we believe the airport environment itself and how people is affected by the environment and the activities of traveling by air coalesce into a picture which one needs to take into consideration when researching, ideating, designing, and implementing interactive installations in this context. As a vehicle to discuss some of these considerations, we present the Woodbot Pilots, an interactive experience specifically designed to appear in an airport terminal. Our installation uses a combination of novel 3D camera technology and physical gesture

recognition to allow users to interact with a 3D game environment using nothing but their own posture and bodily gestures.

BACKGROUND

The Woodbot Pilots is a collaborative effort between a number of companies in northern Sweden: Interactive Institute Umeå, North Kingdom, and Adopticum/Optronic. The project was partly initiated with the intention of creating a public installation to showcase the capabilities of Adopticum/Optronic's new 3D camera (Figure 1), which had been expressly made for industrial environments. Here, we sought to employ it in a completely different circumstance: to recognize users and their gestures.

Figure 1. TOF 3D camera used in project.

Unlike ordinary digital cameras that use CCD or CMOS sensors that convert light into electrons, the camera we have used in this project belongs to a new generation of cameras that for each pixel also provide information about the distance to its target.

Hence, if each pixel in a two-dimensional picture frame (X, Y) is also given a depth value (Z), a computer connected to the camera can reconstruct a three-dimensional model (a height map) of what is in front of the camera (see Figure 2).

The depth value is acquired using a technique called Time-of-flight (TOF). TOF is a well known and proven technology for measuring distances and depths (Koechner, 1968) and for more than a decade, researchers have been looking into the possibilities of integrating TOF with CMOS chip technology (Lange, 2000). This solution has the potential to result in depth-sensing cameras that need no mechanical scanning and thus may be manufactured much cheaper than today. Such 3D cameras could be used in combination with an ordinary color camera to add the depth dimension to pictures and video.

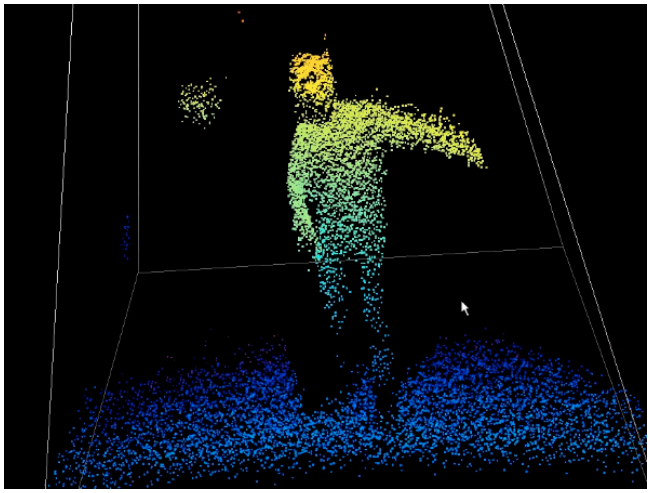

Figure 2. The depth values retrieved from the TOF 3D camera tracking a user in front of the camera

THE INSTALLATION

Imagine that your flight lands at the airport. As you disembark your flight and enter the reception hall in the airport terminal, you see before you a large installation wall. You then step in front of the installation, seemingly containing nothing less than a huge 82-inch-screen, on which a shadowy landscape is slowly drifting by. When you appear in front of the installation, the system recognizes that you are there and invites you to select one of the Woodbot pilot characters (see Figure 3) that you would like to select to fly with as your avatar.

Figure 3. The Woodbot Characters.

Then you just relax, take a deep breath, spread your arms and fly like a bird, traversing a virtual landscape as you reach the finish line—without

having to touch the installation or wear any sensors or other equipment. How quickly can you reach the goal?

The 3D camera is used both to first recognize and the track the user in front of the installation's screen. Using specific tracking algorithms designed especially for this project, we are able to capture the position and movement of the user's arms and upper body. By holding both arms straight out from the body (in the same way as how a bird would fly) and by leaning forward, backward, left, and right in this 'flying' position, the user is able to control the avatar and fly in a virtual world. The virtual world (see figure X) consists of a suggested track with various forms of obstacles that need to be passed and a number of different paths to choose between. Each session in timed and at the end of the flight session, which lasts between 30 seconds and a minute depending on the skill of the player, an arcade-style high score table is presented to the user to allow different users to compare their finishing time and their top speed to that of others.

PACKAGING FOR USE

The placement of the installation itself was a primary concern for us, as it needed to be in an area of the airport that could easily catch attention from potential users at a distance. We managed to attain a central space in the arrivals area at Skellefteå Airport, Sweden. As soon as passengers enter the terminal building from their flights, they can see the installation and its signage and as they collect their luggage and proceed to walk toward the exit. The central placement of the installation meant that they were obliged to pass the installation on their way out. Such a key location was crucial in getting the installation noticed by everyone in the terminal.

INSTALLATION HOUSING

The game itself is displayed in an 82 inch touch screen mounted vertically and housed in a floor-to-ceiling purpose-built casing. Packaging the installation in such a way allowed us to cleanly hide from the public the numerous wires and connections, computer and camera, speaker system, etc. that were required to drive the setup. There was also particular attention paid to user placement in front of the installation as a custom carpet was designed with a bounding box area to communicate where the player should stand to best have our 3D camera pick up the gestures for the game.

PASSIVE VS ACTIVE MODE

Skellefteå Airport not the busiest airport in Sweden. At times during the day but especially during the night, the terminal building is more or less deserted. As the installation is always on we needed to find a

Figure 4. Woodbot Pilots Installation.

suitable aesthetical approach for it to be on and alive even though there might be no or very few people in the vicinity. At other times, for instance in the afternoon when several airplanes tend to land simultaneously, the space is crawling with people busy to get their bags and exit the building.
To tackle these challenges and to make the installation blend in with the environment, the design team decided that when not in use, the installation should revert to a low-key, somewhat dimmed down 'screensaver mode' of previous flight patterns from players while still subtly be beckoning people to approach and try the game for themselves. When the 3D camera recognizes that someone has approached the screen, the installation lights up to much brighter and stronger colors (as a comparison, imagine the difference between evening and zenith lighting conditions).

Figure 5. Engaged in the flight experience

AVATAR SELECTION

As will be discussed below, we consciously decided to keep the complexity of the gestures to a minimum. So, in order to, first, afford people to walk up to the screen, and, second, to provide some simple inputs for selection and typing in user's name for the high score feature, the screen was equipped with touch screen capabilities.

Before starting flying, the player can select from a number of different woodbots using the touchscreen. When selecting between these different woodbots, they become responsive to some simple gestures that subtly informs the user that the system is in fact responsive to the movements of the user.

DISCUSSION

We argue that some aspects of the approach we have chosen and the lessons we have learnt in this project might be of interest to others that are involved in conceiving, designing, and implementing large-scale installations for public environments where people would not normally expect to find such interactive artifacts. The kind of interaction we have chosen is thought to be appropriate for the kind of environment in which the installation is placed. Large groups of people are passing through the airport terminal space, some of them are hurried, and some have time to spend. Airport terminals, often designed to appear calm and almost sterile, are generally far from cozy environments.

Figure 6. Choosing the Avatar that you'd like to fly with

Figure 7. A scene from the game landscape, created in Unity

If an interactive installation would have been designed an environment that required the user to frequently hold and touch a joystick, keyboard or

other device, or even wear some sensory equipment, users might start to worry about dirt and the potential risk of viruses and bacteria from all the people passing through the space, and might because of this opt not to engage in the interaction. The no-hands approach we have chosen seems appropriate from this perspective. It also seems to have aesthetic benefits in that as the player's body becomes the controller (thus reducing the use of any auxiliary controllers in the setup), the installation setup is kept very clean and self-contained. Every aspect of the installation can be housed within a single box, which makes it much less fragile and less prone to failing. This appears to be an important requirement and an archetypal design goal when designing interactive installations for public, largely uncontrolled environments and 24-hours-per-day-use without staff at the scene to assist and reboot.

An interaction style-related challenge when it comes to gesture-based interaction systems in general is such systems' lack of 'interaction affordances'. That is, a gesture-driven system does not communicate its own functionality in the same way as a typical graphical user interface does through menus and buttons. Hence, in a gesture-driven interface, how does the user know what functionality and what capacity the system holds and what the user needs to do to evoke this functionality? In our installation, there was a need for having potential users quickly understand how to operate the system and easily learn the gestures required. Users would need to quickly and effortlessly learn to control the avatar to be able to use the system, as we speculated that few potential users would have neither time nor patience to learn and practice advanced gestures. They would then quickly loose interest in the system and leave, we thought. At the same time, we agued, the controls need to be advanced enough to allow for improvement and 'virtuosity' to develop over time when playing the game. Ideally, the user should be getting better and better over time with practice. Finding this balance keeps users engaged and it also comes to enhance the interaction between groups of people, such as families or groups of friends competing with each other. This issue led to two key design decisions. First, we reduced the number of gestures the system recognizes to a minimum. Basically, the system only recognizes the 'fly like a bird' gesture. Yet, the user is able to control his or her avatar of choice using this gesture in a multitude of ways by leaning forward, backward, left and right to different degrees. Hence, these come together to form a simple yet powerful interaction style that allows the user to quickly pick up the concept yet improve substantially over time. Second, with the use of some very simple instructional animations showed briefly on the screen just before the start of the race, we noticed that users quickly responded to the interactions and were almost immediately able to understand the logic of the game and the metaphorical 'flying' gesture.

CONCLUSION

In this paper, we have presented the Woodbot Pilots, an interactive experience in the form of a large-scale, gesture-driven interactive installation designed to appear in an airport terminal and used by the general public. We have described the background of the project, the installation itself, and a scenario of its use. We have also discussed some of the issues it raises in relation to public installations as well as some of the lessons we have learnt from conceiving, designing, implementing, and studying it in use.

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