Exploring the Techno-Somatic Dimension and Movements of an Interactive Ball Simulation

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1. Introduction & Related Works

Engaging with interactive applications by the use of bodily movements to control the interface, is something that we will increasingly experience in the future. In between the human movements and the virtual interface is a dimension in which we can "feel" or sense the virtual interface, even though we know that it is not physically present, it all depends on how well considered the design of the virtual interface are. The more well considered, a more material feel will be the result.

The background for this project is based on the paper "Designing the techno-somantic" by Garth Paine[1], where he proposes an alternative approach, when analysing and designing interaction in realtime performance systems, one he names the techno-somatic dimension. The dimension acts as the interconnection between the human and the interface, and where *materiality* take its substrate from the qualities of *somatics* and *functionality*. The qualities of somatics, are the engaging of the interface and how well the interface "fits" the human body. The functional qualities are the technical and aesthetics of the interface. These qualities produce a range of properties that gives the interaction a materiality. From the materiality, supplemental qualities emerges from the performative act, which includes, precision, gesturality, the nature of control, fluidity and viscosity. Materiality is manifold and can be considered dynamic and porous, and variates from individual to individual, only constrained by the somatic and functional qualities of the dimension.

In Paine's paper he keeps his focus primarily on musical interfaces and instruments talking of the feel of the instrument. In this project I will focus on an interactive virtual ball simulation developed in Processing, with the purpose of a better comprehension of the techno-somatic dimension and a further study into the materiality the simulation can afford. This project also includes a focus on what kind of movements the simulation encourages and a dicussion on why that is.

2. Design of the Ball Simulator

As a building block for analysis of the simulation I have used the Human-Artifact model [2], questioning why, what and how, between the artifact (Ball Simulation application) and the human (player) (see Figure 1). Starting from the top on the artifact side, the motivational aspect is to play with a virtual ball, while the motivational orientation is to have fun, train motor skills and to create a realistic feel of the virtual ball's physique. Next up is the artifacts instrumental aspect, which is a bouncing ball, as to the goal orientation for the human is simply to make the ball bounce. The operational aspects is done by moving a body part, the hand or the head to make the ball bounce, and for the human the operational orientation is the learning principles of the ball's physique. Last is the adaptive aspects, which is to take control of the ball. By playing around for a while, the human should comprehend that the best control of the ball is taken, with slow and precise movements to create the best possible effect in order to bounce the ball.

	ARTIFACT	HUMAN
Why?	To play with a virtual ball	Have fun Train motor skills Feel of ball
What?	Bouncing Ball	Make Ball Bounce Keep from touching "ground"
How?	Move hand/head to bounce ball	Ball physique principle
	Take control of ball with slow and clear movements and a wide moving surface	Going from fast to slow & clear movements to bounce ball

Figure 1. The Human – Artifact Model

3. Implementation

The interactive ball simulation was developed in Processing 3.1.2 on a PC with a built-in camera. To build the simulation two add-on libraries was utilized: OpenCV (Open Source Computer Vision) which is designed for real-time applications, and the Processing-Video library which captures video data from the camera. As the built-in camera only captures the resolution of 640x480 pixels, the interface for bouncing the ball around is quite small.

From the OpenCV library the function BackgroundSubstraction is used to detect moving objects in the scene. A tracking contour is drawn around the moving object and then combined with the seperate processing file Ball.pde, the ball physique, which reacts on the impact of movement from the player.

The application will work most optimal with the player placed in direct daylight or in a well-lit room in front of the camera. Also a non-disturbing solid color background behind the player, will assure the most clear capture of movements.

4. Testing

Before setting up the test environment, the methodology of Moving and Making Strange" by Loke and Robertson [3] was considered. It consists of three perspectives:The mover which investigates and invents movements. Secondly the observer, that describes, documents and makes visual analysis of the movements. Lastly the machine (the technology), which explores and maps human-machine interaction, and interprets the movements of the mover. These perspectives was considered while running the test.

The testing was done by having the code run on a PC laptop, which picked up movements through the built-in webcamera. There were five test participants, who one by one was put in front of a PC laptop with a built-in camera. They were seated and no longer than one meter from the camera. They where told to try and keep the ball in the air, without touching the ground. They played with the simulation for five minutes, underway I took observed and took notes, and afterwards they briefly told about their experience and asked how much they could feel the ball.

5. Findings

To provide insight into which movements the Ball Simulation afforded, I have applied the Laban Movement Analysis (LMA) onto my observations of the players. LMA is a method for understanding and describing human movements and is generally divided into four categories: body, effort, shape and space.

At first the participants tried out different sort of movements to get acquainted with the simulation, but after a short while they started to get a grasp of how to control the ball. This was a pattern that was recurring from all the participants. It seemed as if they were having fun, as they laughed and were intrigued, some even amazed by the virtual ball they could control. When the intriguement began to decrease, they started to get more concentrated and focused on controlling the ball.

In the beginning of the experience, according to Laban's effort actions[4], some of the participants used alot of thrust, like *punching* or *slashing*, to make the ball move, but all of the participants quickly adapted to the control of the ball and their effort actions became slower and more lighter, but still with some force. These effort actions can be characterized as *wring* and f*loat*, which are indirect in space, fast/slow in time and light/strong in weight.

To provide further insight to the LMA according to flow, weight, time and space[5], I would mostly place the efforts as follows:

- **Flow:** *Bound Flow*: Contained, controlled, keeping the inside in and the outside out, can be stopped at any moment, rigid, boundaries, clarity, etc.
- **Weight:** *Weight Sensing*: (can be on the Light or Strong end): Between active and passive weight. You relax and release into your weight to sense it. Mostly *Light* (Active Weight): Delicate, fragile, overcoming one's weight, buoyant, lifted up, etc.
- **Time:** Sudden or Quick: Instantaneous, staccato, quick, hurried, condenses the moment, spark-like.
- **Space:** Indirect as the randomness in tossing the ball around.

Most of the movements were directional arc-like shapes [5], which represents a relationship where the body is directed toward some part of the environment, in this case where the virtual ball goes.

Most of the participants described the experience as fun and interesting. One mentioned that it would be fun to play with another. Several mentioned that a bigger screen with more freedom of movement would have been optimal. One said that it was hard to control of the ball and keep it off the ground, but nonetheless it was still interesting.

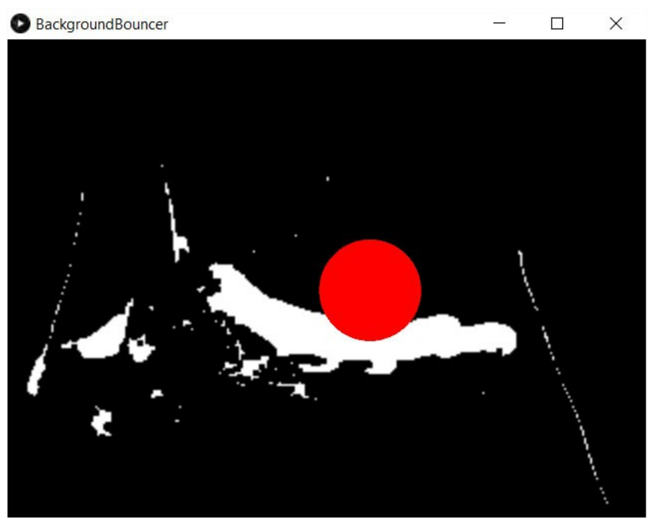

Figure 2. Participants hand in Ball Simulation

When I asked the participants to describe how much they felt the ball, one them answered that the ball felt like a balloon, since he used light and slow movements to bounce the ball. Another participant said that she could almost sense the ball being in her hand, even though she knew it was not. She also mentioned that she unconsciously formed her hand after the shape of the ball (see Figure 2).

6. Discussion

The most interesting to this project was the participant who mentioned that she unconsciously formed her hand after the shape of the ball. When putting this in the light of the techno-somatic dimension, it is showing that the engagement of the human imagination of sensing the materialism of a real ball, is somewhat achieved in this simulation. Though it was only mentioned by one participant, I observed that all of the participants almost had the same gestures, of forming their hand in a half-moon shape, mimicking the ball (Figure 2).

It was also interesting to see how playful and intrigued the participants were with the simulation, even with the small interface they were entertained and concentrated on controlling the ball. As one mentioned that it would have been fun to play against an opponent, it would have been interesting to make the interface wider, maybe on a projector, and make additional rules such as a volley simulation.

Another thing was how quick the participants actually adapted into take control of the ball. As all adult people more or less know the principles of a ball's physique, so it seems easy to adapt to a simulation of a ball. When looking at the weight effort, the participant were weight sensing in attempting to test and feel the ball's physique. It seemed as if they quickly developed a cognitive map on how the interface responded and how to use it.

7. Conclusion

Through observations of the participants interaction with the ball simulation, new insight was gained into the materiality that emerges from the techno-somatic dimension and what kind of movements it affords. The testing showed that movements of indirect space, fast/slow in time and light/strong in weight were predominant and that the participants quickly adapted to take control of the simulation. The most interesting insight was that the partcipants unconsciously formed their hands mimicking the ball's shape, which truly underlines the materiality quality of the techno-somatic.

8. References

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