SpaceBounce!: Improvisational 8-Bit Bouncing

Andria Poiarkoff
Sonic Arts Research Centre
Queen's University Belfast
Belfast, BT7 1NN
apoiarkoff01@qub.ac.uk

Abstract

We present *SpaceBounce!*, an interactive installation based on the properties of sensor use on tangible, strechable materials. The installation combines simple movements, bouncing and weight-shifting, with multiple sensor-laden rebounding surfaces.

Keywords: Interactive installations, tangible interfaces, musical spaces

1. Introduction

The idea behind *SpaceBounce!* began with the desire to create an installation that captured the feeling of an early video game. In early video games, such as could be played on the *Atari* or original *Nintendo*, one was provided with pixelated characters, a restricted set of motions, and mechanical 8-bit sounds that served to acknowledge the characters' movements, the destruction of the enemy, or the contact between surfaces. [1]

The focus of the overall installation came to revolve around the idea of bouncing. This came about from an observation of movements within early video games. Throughout these games there is a continuing trend of physical, visual, and aural bouncing and rebounding: the rebound and corresponding 'boop' of the ball in *Pong*, the laser strike and subsequent explosion of space ships in *Space Invaders* jumping, mushroom-squishing and box-hitting in *Mario*: "a player presses a button, and the character on the screen jumps and makes a 'bleep' noise; pressing the button again will cause a recurrence of this sound. The 'bleep' is an interactive sound effect." [2] These actions combined with sounds served to create an action-reaction feel that was unrealistic but amusingly gratifying. This is the experience that *SpaceBounce!* was intended to create.

2. Design Development

Developing *SpaceBounce!* required researching ways of utilizing simple physical motion to control a reactive sound. It was a matter of finding a way to create an alternative, interactive control that would bring a user into the experience. This is often the case with actual video game controllers, such as the dance mat for *Dance Dance Revolution*, or the plastic 'instrument' controllers that are a staple of games such as *Rock Band* and *Guitar Hero*. In the case of the *SpaceBounce!* installation, the interactive controller needed to become a source for cooperation between individuals, or as stated by Tina Blaine, "…the controller becomes a means of communication for developing community through gameplay." [3]

Solid surfaces were originally considered, it was determined that the interaction required physical feedback in order to make the user feel as if they were truly causing an action-reaction effect. At this point research shifted to the use of stretchable materials and membranes as interfaces, such as Zstretch [4], a music controller made out of fabric. As presented in the Zstretch abstract, "The musical controller takes advantage of the fabric's topological constraints to enable proportional control of musical parameters." This tangible effect is what needed to be achieved, only to support the entire weight of an adult, the material would have to be stretchable but retain an extreme tensile strength. This led to the idea of using an indoor rebounding trampoline. Not only would the flexible stretching of the trampoline material allow for sensor usage, it also created the physical reaction that had been missing with solid surfaces.

3. Implementation

The main considerations for the development of the SpaceBounce! were:

- utilizing simple, fun movements
- reactions directly resulting from movements
- instant gratification

3.1 Physical Design

The rebounding trampoline was wired with a sensor mounted to the underside of the material face, in the centre where a participant would be most likely to jump.

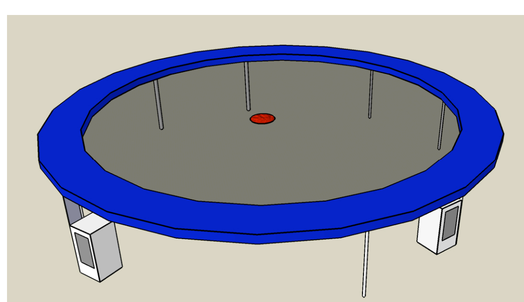

Figure 1. Example of Sensor and Speaker Placement.

The speakers were placed beneath the outer rim of the trampoline, as much for safety as for the sonic effect. Once the physical interaction had been tried and tested, along with the sonic reaction, it was decided that while the trampoline was gratifying, it was very restrictive. The effect was similar to Mario endlessly bumping the same coin box. At this point it became necessary to use additional trampolines, each with its own interaction and effect. The physical set up placed the trampolines in positions such that they appeared to be separate interactive devices. However, once one began interacting with one trampoline, it appeared that the logical next step was to bounce from one trampoline to the next. As this was an unpreventable development, it resulted in the need to place the trampolines close enough together to allow participants to safely bounce from one to the other.

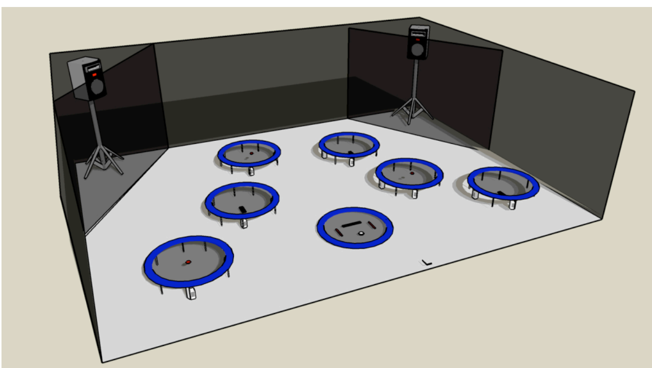

Figure 2. Model of Full *SpaceBounce!* Setup

Once the setup had been decided, it was felt that the overall sonic effect was unimpressive. The trampolines each had their own 8-bit sounds, which meant that the installation created a stream of individual sounds that weren't particularly connected. This resulted in the idea of a trampoline being used entirely for modulation, bringing the sounds together and feeding them back. For this purpose, a legless trampoline was placed on the floor at the centre of the installation, with multiple force sensors underneath to control modulation parameters. This trampoline was connected to stereo speakers outside of the physical installation.

3.2 Interactive Devices

The interactive system behind *SpaceBounce!* required a single sensor on each reactive trampoline. One half of the reactive trampolines had shock sensors mounted to the underside of the face, and the other had IR distance sensors mounted on the floor beneath the centre. The shock sensors allowed for an output based on physical force, while the IR sensors measured the depth and rebound of each jump via the distended surface.

The modulation trampoline involved a simple force sense resistor placed near where one's toes or heels would cause pressure, a flexiforce sensor opposite, and a bend sensor on either side. This trampoline had no legs, and was used by standing and shifting one's balance.

3.3 Mapping

The installation was controlled using two Arduino microcontrollers, one for the six reactive trampolines and a separate controller for the modulation trampoline. The data was processed and the audio controlled through Max/MSP.

The three reactive trampolines with shock sensors were mapped to adjust the gain of, and then trigger, the respective sounds. Two trampolines were programmed in such a way as to trigger sound upon impact, and the other programmed to trigger upon release.

The reactive trampolines with IR sensors were also configured in two ways. Two of the sensors used the measurement of the distended surface to control the start point within a three-minute sample of various 8-bit sound sequences and trigger its playback. The result of this was that each bounce resulted in a different sound, and if the participant could impact the surface and then balance in such a way as to keep the distention stable, the sounds would play out their sequence until interrupted. The third IR sensor was programmed to trigger a sound upon impact and subsequently modulate the pitch based on further movement.

The modulation trampoline was wired with four separate sensors. Unlike the others, this trampoline had no legs and required the input of the force between one's weight and the floor surface below. This trampoline was used to create unnatural sounding reverb, taking the audio generated by the other trampolines, adding its own effect, and feeding it back through the stereo speakers outside of the installation. The force sense resistor turned on the reverb, the flexiforce controlled the room size, and the bend sensors controlled the reverb delay and tail.

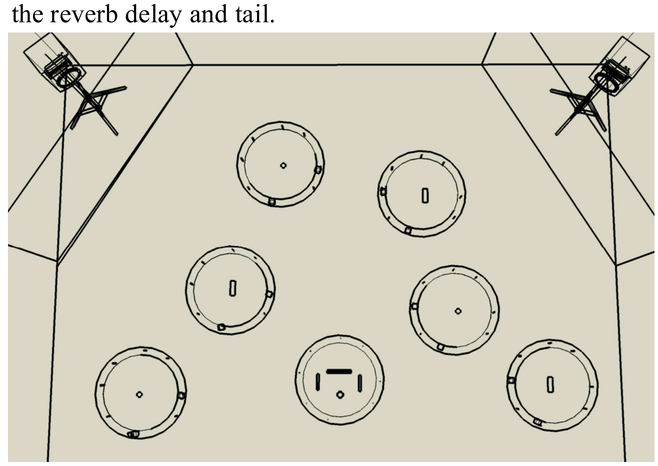

Figure 3. Diagram of Installation Sensor Placement

3.4 Aesthetics

The aesthetics of the actual presented installation were chosen to create a 1980's video arcade style atmosphere combined with a bit of outer-space surrealism. The outer walls of the installation were made with black fabric embellished with UV reactive pixel characters. The trampoline surfaces donned UV paint, and blacklights were suspended above the installation along with reactive fabrics.

4. Physical Interaction

Interacting with the *SpaceBounce!* installation was found to be extremely intuitive once participants were reassured that the trampolines were officially intended for bouncing upon.

4.1 Physical Dynamics

Bouncing was used to activate and trigger the sensors. While the shock sensors were actually much simpler to use than the IR sensors in terms of programming, the IR sensors proved easier to trigger in actually use. The installation was at its best when multiple users were bouncing simultaneously.

4.2 User Expression

Participants chose to interact with the installation in different ways. Some would approach a trampoline, step on gently, and then attempt to move slightly. Some participants would jump full-force onto a trampoline and off again. A few took a running start and proceeded to attempt to bounce from one trampoline to another around the entire installation. Most participants, upon gaining confidence in the hardware, eventually tried this last technique.

Once the general idea had been discovered, the participants would try to change the reaction by bouncing more or less forcefully or changing the direction of their motion.

Interacting with the modulation trampoline was rather different. Most users who attempted it stepped onto the surface and then attempted to bounce rather than trying different motions.

4.3 Difficulties

The majority of difficulties with the *SpaceBounce!* installation resulted from the trampolines standing freely on the floor rather than being mounted in place. This was not an issue when individuals were interacting with a single trampoline at a time, but when groups began participating and multiple people were jumping from trampoline to trampoline in different directions, they often becaume rather overzealous and forced the trampolines out of position, occasionally far enough to break the connections between components.

One specific difficulty, however, had little to do with mounting and more to do with participants being caught up in the larger interactions of the installation. The modulation trampoline was rendered out of commission not long after the opening of the installation. It had wrongly been assumed that participants would realize a legless trampoline with a surface an inch from the floor would not rebound. This proved incorrect, as participants continually bounced from trampoline to trampoline until approaching the end, at which time they would jump full-force from the reactive trampoline onto the modulation surface. This not only caused a moment of surprise in the participants through lack of rebound, it also quickly and effectively rendered the sensors beneath inoperable.

5. Conclusions

The *SpaceBounce!* installation was effective in creating a fun experience for the participants through both physical interaction and sonic reaction. The use of trampolines created an interesting use of mounted stretchable material, and the physical feedback through rebound added to the experience what a simple sonic reaction could have done on its own. The overall outcome was an installation fit ideally for a group of participants, resulting in the creation of a unique, playful sonic space.

[1] McDonald, G., "A History of Videogame Music," Available:http://uk.gamespot.com/features/6092391/index.html

[2] Collens, K., "In the Loop: Creativity and Constraint in 8-bit Video Game Audio," *Cambridge University Press*, 2008.

[3] Chang, A. and Ishii, H., "Zstretch, A Stretchy Fabric Music Controller," *Proc. Of the Conf. on New Interfaces for Musical Expression (NIME),* 2007

[4] Blaine, T., "The Convergence of Alternate Controllers and Musical Interfaces in Interactive Entertainment," *Proc. Of the Conf. on New Interfaces for Musical Expression (NIME),* 2005.