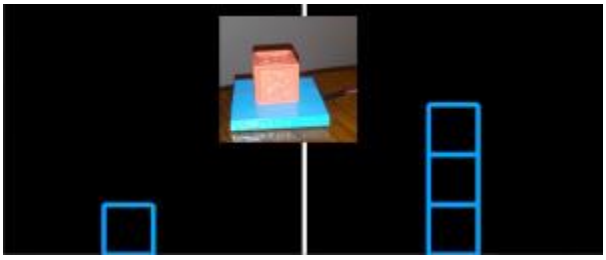
Lisa's Play Board

April 2015

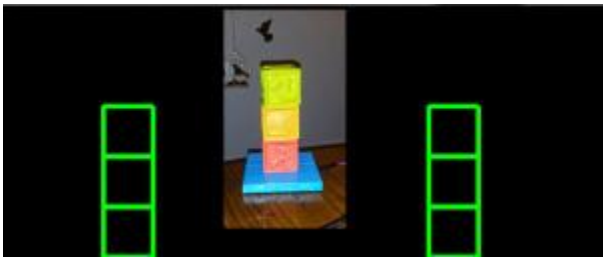
Lisa's Play Board is a platform to be used for children's games that promote growth in cognitive and motor skills. The bases of this interactive game board are the hardware pieces that consist of four quadrants that can be used for different games. The quadrants respond based on pressure, so the games need a physical piece such as tangible objects or force exerted by players stepping or pressing on each quadrant. Having to press, step or jump on the board allows more physical activity to occur during play which can help with motor development. The responsiveness of the board with the software games allow the child to have immediate feedback of what they are doing which can help with different cognitive tasks involved in games.

Current Use Cases:

Currently the board is set up with two types of games: a building blocks game and a Simon memory game. The block game is targeted for preschool aged children. Studies have shown that playing with blocks can improve spatial and motor skills. The block game on Lisa's Play Board gives an image of what the child is supposed to build on one half of the screen and displays their progress on the other half of the screen. This helps the child develop spatial skills by having to replicate a 2D image with 3D objects.



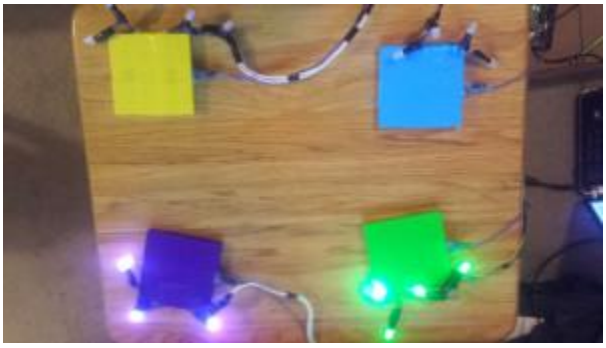
The left side shows what the child has built. The right side shows what the child is trying to build.



When the child has successfully built the image, both light up green.

The memory game is made like a Simon game. The board will play a sequence and the user must repeat the sequence. If the user is successful, the sequence adds one until the user makes an error. To show the user the sequence, the quadrant that is in the sequence will light up and play a specific beep. When the user goes to repeat the sequence, they must step on the quadrants which will light up and beep to provide feedback of which quadrant was played. Once the player has reached a sequence over five long, the board will sometimes choose two quadrants to be played at once. This makes the user have to jump on the two quadrants, adding difficulty and increasing activity. If the user makes an error, all the lights will turn red and a buzzer will sound.

A square will light up to show it is next in the sequence or when player steps on that square.

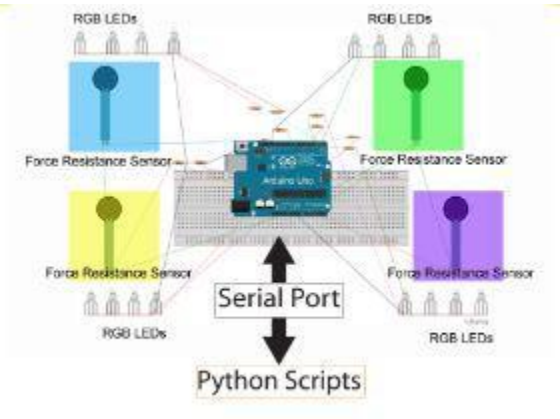


To increase difficulty, user must jump on two squares at once.

When player makes an error, all lights turn red.

Technical Information

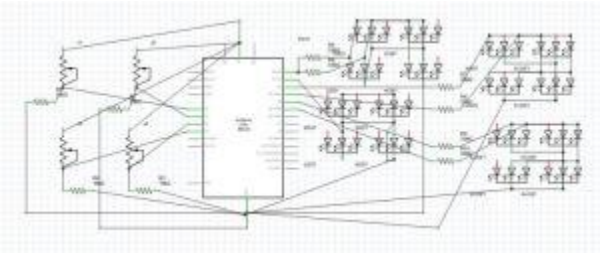
Lisa's Play Board is made with an Arduino Uno that talks to Python scripts over a serial port. Each quadrant is made of two wooden boards with a force resistance sensor in between them. Each quadrant also has four RGB LEDs that allow them to light up any color. For the block game I have one Python script and for the memory game I have two Python scripts that interact with the Arduino.



For the block game, my Python code reads in the values of the force sensors from the Arduino through the serial module and draws the GUI using the module pygame. When the script is started, it opens a window and draws three boxes on the right. Then based on the values of the force sensor it receives from the Arduino, the script interprets how many blocks must be on the board in that moment and draws that number of boxes on the left side of the window.

For the memory game, I have a Python script that communicates with the Ardunio and one script that handles the sequence. The Python code that works with the Arduino uses the serial module to read the values of each sensor and also write to the Arduino. The code on the Ardunio takes the value of each sensor and if that value is over a certain limit, it will light up. From the Python code, if the value of a sensor is over a certain limit, it will also play the sound associated with that quadrant. This should all occur when the player steps on the quadrant and therefore the Python code will add this sensor to the current sequence and compare it to the sequence the computer has randomly generated. If the sequences are the same, the Python script will add another step to the sequence. If it is incorrect the script will play the error buzzer sound and tell the Arduino to light up red. When the computer generates the sequence, it looks to see how long the sequence is. If the sequence is under five, it will only generate a value for a single quadrant to be played at once. However, if the sequence is longer, it will randomly generate a value for either a single

quadrant or two quadrants. The Python code will play the sequence by playing a certain sound file and by writing to the Arduino to light up certain LED circuit.



To build Lisa's Play Board I needed one Arduino Uno, four force resistance sensors, 16 RGB LEDs, 330 ohm resisters, 10K ohm resisters, and lots of wires. I built the circuit in a breadboard that I connected to the Arduino board. Each sensor was connected to an analog pin on the Arduino board and every series of LED pins was connected to a digital pin on the Arduino board. All components also needed to be connected to power (5V) and ground. I soldered all of the circuitry to make it more robust.

Future Development

I would like to improve the block game by having it work with all four quadrants to make more complex configurations.

I am working on developing multi player versions of the Simon memory game. One player will be able to make a sequence for the other player to follow. I also want to design a way for two players to compete at the Simon game.

Other future development will be to design more games, either multi player or single player for different age groups.

Resources

Demo video: https://www.youtube.com/watch?v=yBr6qT3EEgw