Sensory Board for Adam’s Adventure Playground

Danielle Napoli
Alyssa Smith
Christine Wakefield

Sponsor – Dr. John Enderle
TA – Sarah Brittain
Client - Brian Schwarz
schwarz@engr.uconn.edu
191 Auditorium Road U3187
Storrs, CT 06269
860-486-3245
Alternate Design 1

Panel 1: Tic-Tac-Toe

This game will consist of nine spinning cylinders, each with an X, an O, and a blank spot as in Figure 1. This design of tic-tac-toe will then be inserted into a sizable cut-out portion of the HDPE panel. The game would be attached to the panel securely. This will be a very simple design, as the tic-tac-toe game with spinners as described can be bought from a vendor. The cylinders would be approximately 6 inches in diameter and 9 inches tall, hence taking up a total of approximately 20 inches by 30 inches in the center of the panel.

![Figure 1 – Tic-tac-toe game with spinners on poles](image)

Panel 2: Cranking Game

This hand crank will have a shape as shown in Figure 2 where each segment itself has a small-diameter cylinder (approximately 2 inches). Overall, the crank will be 1-1.5 feet in total height, and 2.5-3 feet in width. Ideally, it will be similar, if not the same, as the one seen at Bodie’s Place in Milford, CT however this crank will have many more capabilities than the one seen at Bodie’s Place. It will be connected to some circuitry which will connect to a meter, or gauge, which will then light up and make a sound after a certain amount of cranking has been done. This meter will be long and in a horizontal direction, located on the panel above the crank and the meter would indicate how much energy is being generated. A piece slightly larger than the size of the crank will be cut out of the HDPE panel so that the crank can be attached inside that cut-out space and still be able to rotate. The electrical meter will be attached securely to the outside of the panel above the crank, with all electrical components inside the board and only the user interface that lights up on the outside.
Panel 3: Communication

In this design, the panel will have a braille alphabet to teach children how to read in braille. Along with the braille alphabet, there will be riddles for the children to solve. The questions for the riddles will be in both the standard alphabet and in braille. However the answer to the riddle will be only in braille so that these children can use their new skills. This will be a great panel for children to connect with each other and learn. A figure of what the alphabet will look like is shown below and the riddles will be placed right next to or below the alphabet.

This game is great for children who may be blind or even for children who are friends with or know someone who has a vision impairment. It is also great for children with autism because they typically enjoy solving riddles.
**Panel 4: Memory Game**

The memory game will start off with a child pressing start that will cause one button to light up. To continue the game the child must then press that same button and in return the game will then light up that same button and add another to the sequence. The game will repeat this until the sequence includes ten buttons or the child has made a mistake in repeating the pattern. A flowchart of this process is shown below.

![Flowchart of Memory Game](image)

**Figure 4** – Flow chart describing memory game for design 1

This game can be used by all children, especially those who may have autism, and the increased difficulty can give the children a feeling of accomplishment and pride once they have won the game.

**Panel 5: Musical Panel**

The musical panel will be comprised of a chimes component as well as an electrical piano. The chimes will be built into the panel so that they can make contact with the panel siding when touched, producing a sound which eliminates the need for a mallet. The piano will be comprised of buttons that are shaped like piano keys and when each button is pressed, the key will light up and the tone of the note will be produced using a programmed microprocessor. There will also be three buttons next to the piano that, when pressed, will prompt the user to play a programmed song such as “Mary Had a Little Lamb” or “Hot Cross Buns”. The user will be prompted using the lights on each key so they are aware of what button will need to be pressed next in order to play the song. This design will need a speaker to be built into the board in order for the piano sounds to be heard.
Panel 6: Create-a-picture Panel

This panel will be comprised of a 10x10 grid of pushable squares. Each square will be 2”x2” and made of an opaque plastic material. There will be 0.5 inches of HDPE between each square. There will also be a four position sliding switch to the right of the grid. The user will be able to slide the switch and choose one of four colors to make the square. Once a color is chosen, the user will be able to press in a square and the square will light up to the respective color. The square will lock into the pushed position by magnetic force and the internal cube that resides in the square will have a magnetic outline that will hold the polymer square in place. The internal cube will also have a pattern of four different colored LEDs. The color of LED that is lit up when the square is pressed in depends on which setting the sliding switch is in. Once the user is done creating their picture, they will be able to press a reset button, which will be located below the sliding color selector switch. When the reset button is pressed, a linear actuator stepper motor will extend, causing a flat panel to press against the engaged squares, returning them to their original position and allowing the user to create another picture.
**Figure 6a** – Pushed in and engaged square

**Figure 6b** – Pushed in and engaged transparent square to show the interaction between a square and the internal cube

**Figure 7** - Mechanics of the back of the square button system, showing the stabilization pole that allows for smooth sliding of the square button

**Figure 8** - Linear Actuator Stepper Motor, used to reset the squares
Board Layout: Connected

This design of the entire board makes it so that all three double-sided boards are connected together. The outer boards will be angled slightly so that they are easily accessible. The two outer panels will be specifically designed to be wheelchair accessible by having a larger space between the ground and the bottom of the panel. The wheelchair accessible boards will be 4’x2’ with 2.5 feet between the bottom of the board and the ground. The middle board will be 4’x3’ with 1.5 feet between the bottom of the board and the ground. Four metal poles with a radius of 2.5 inches will be used to anchor the panels to the ground and keep them raised.

Figure 9 – Layout of design 1 for the entire board
Panel 1: Tic-tac-toe Game

This design includes flat rectangles, each with an O, a blank, and an X in that order from top to bottom, which will be able to slide up and down. The letters would be raised so that a visually impaired child could play by feeling which letter is which. There will be a 3x3 grid of squares, in which each square will display either a letter or a blank. If a child slides the blank downward, the square will display an X; if he or she slides the blank upward, the square will display an O. Hence, there must be space between the squares for the symbols to be hidden behind when not on display. These pieces will be attached directly to the HDPE panel.

Figure 10 - The tic-tac-toe game with sliding pieces. (A) One tic-tac-toe piece. (B) A tic-tac-toe board displaying the placement of the pieces on the board, where the blocks outside of the dashed lines are not visible (they are slid underneath the board). The only letters visible at the moment are O in the top left, O in the middle, and X in the bottom right. This leaves the game at X’s turn to move.
Panel 2: Cranking Game

This game includes a hand crank, shaped like an L which will stick out of the panel and can be turned in either direction. The gauge will be round instead of horizontal, similar to the gas and speedometer gauges found on a car’s dashboard. As the child turns the crank clockwise, the gauge will begin to fill while at the same time making a sound as the gauge increases more and more. Conversely, turning the crank counterclockwise will cause the gauge to go down from its current position while making a different sound. The crank and the gauge will be securely attached to the outside of the panel, with any circuitry connecting the two securely hidden and protected on the inside.

Panel 3: Communication

This design will entail the children learning sign language. It will essentially be the same idea as the first design, however instead of braille there will be images of what hand gestures can be used for the standard alphabet. Along with the alphabet, there will be riddles in the standard alphabet with the answers in sign language. An image of what the sign language alphabet will look like is shown below.

This panel will work best for children who may be deaf and even children who may have mobility impairments because they will learn how to move their hands to make certain words and it can be a fun way to get their muscles moving.
Panel 4: Memory Game

The game will begin by a child pressing the start button and the game will light up five buttons in a certain order. The child must then repeat the sequence exactly to get to the next level. The game will repeat, using a five button long sequence every time until the child either makes a mistake or is able to correctly repeat the pattern ten times. A flowchart of this game is shown below.

Since all of the patterns will have five buttons in the sequence, the consistency will please children with autism and will give all children practice to be able to complete the whole game after a couple tries. This can teach the children what hard work and dedication can do.

Panel 5: Musical Panel

The chimes will still be incorporated into this design, however, they will hang loosely and not be restricted by an outer portion of the board. Therefore, a mallet will be necessary in order for the chimes to produce a sound. A mallet will be attached to the board using a steel wire in order to ensure that the mallet will not be taken from the playground site as well as being durable enough throughout the lifetime of the playground. The other musical instrument incorporated into the board will be a play guitar. The guitar will be shaped like an actual guitar and will have 5 elongated buttons that are in the shape of the guitar strings. The user will have the opportunity to play notes on their own or press one of the three buttons on the side of the panel that will prompt them with the right notes to play a song. Each of the strings will have
braille on them to identify the note that will be played by pressing that respective key. This design will also need to incorporate a speaker so that the guitar notes are able to be heard.

**Panel 6: Create-a-picture Panel**

This panel will be composed of a 10x10 grid of 2”x2” squares. In this design, there will again be 0.5 inches of HDPE between each square. To lock the squares in place, there will be a spring loaded lock system. This spring loaded lock will extend into a slot in the square when the square is pressed by the user to the specified distance. The same reset system will be used with the linear actuator stepper motor, however in this design there will be four different buttons to choose which color the square will light up with. The buttons will be programmed so that the user is only allowed to select one color at a time.

**Board Layout: Separated**

An alternative design for the layout of the boards is to have them separated. Each set of panels will be held up by two poles. The dimensions of the panels and boards remain the same.
Alternate Design 3

Panel 1: Tic-tac-toe Game

This design includes a tic-tac-toe game in which the squares with the symbols flip instead of slide. The game will begin with a blank grid then, in order to place an O, a child will flip down the block just above where they want to place the O. In order to place an X, a child will flip down the block above the desired spot two times. Thus, it is similar to turning the pages in a notebook with a spiral binding. The grid squares will be large enough to fit two squares, one on top of the other, since there will be the symbol in use, and possibly the other blocks for the other symbols above it. The back of the symbols will be blank, so as not to confuse the user.

Figure 16 - (A) The game starts with all blank squares. (B) Then to place an O, flip the square up once. (C) To place and X, flip it up once again. To restart a game, flip the squares back down again. (D) The tic-tac-toe game with flip squares as demonstrated in (A)-(C).
Panel 2: Cranking Game

Instead of using a hand crank, this will use foot pedals. To accommodate this, a seat could be attached to the panel, and foot pedals would be attached to the seat. The energy from the foot pedals will go to a grid of lights towards the top of the panel via electrical connections. As a child pedals a certain amount, the light in the top left will light up and make a sound. As the child continues to pedal the light directly to its right will light up and make a sound and so on and so forth. This process will continue as long as the child continues pedaling or until all the lights in the grid are lit. The circuitry will all be securely protected inside the panel, and the only parts visible to the children are the seat, pedals and lights.

![Figure 17 – Foot pedals for cranking game](image)

Panel 3: Communication

Instead of using an alphabet and letters to communicate, we will instead use images. There will be common sayings or sentences and instead of writing them out using words, we will use pictures that could describe most of if not all of the sentence, similar to the Rebus puzzles. Some examples are shown below.

![Figure 18 – Examples of Rebus puzzles](image)

1. PLEASE BRING ME A DRINK.
2. LET’S STAR PLAYING THE GAME.
3. HE IS WEARING A NEW KEY.
4. A BIRD IS SOMETHING LIKE A WASP.
5. IS HE THE PAIR OF THE SHIP?
6. THE JET SANG AN ANTHEM.
The Rebus puzzles are great for children who enjoy riddles and will use all parts of the brain, allowing any child (even those with mental handicaps) to participate.

**Panel 4: Memory Game**

This will be more of a matching game. There will be an even number of buttons and the child will start by pressing one of the buttons and a unique noise will be emitted. The child will then have to match this sound with the same sound on another button. Once all the pairs of sounds have been found the child will have won and the game will be over. A flow chart of this game is shown below.

![Flowchart of memory game for design 3](image)

This game is aimed to help children who may be deaf since the goal will be to match sounds. It could allow children who are deaf or blind to connect with each other by helping the other play the game so that a child can be the others eyes or ears.
Panel 5: Musical Panel

The only instrument featured on this design is a large multicolored electric piano. These keys will be larger and will have braille on each, describing the note that will be played by pressing each key. Below the keyboard will be a series of scores that show how to play a number of different songs. All of the scores will be raised so that visually impaired users are able to tell what notes are to be played for a particular song. A speaker will need to be incorporated in order to produce the sounds from the keyboard.

![Figure 20 - Example of the visual appearance of the keyboard](image)

Panel 6 – Create-a-picture Panel

The final design for this panel again uses the 10x10 grid system, however in this design there is no HDPE between the squares. The squares will be locked in place using the magnetic system described in the first design. When resetting, the squares will also flash to indicate that the user should not press any of the buttons.
Board Layout – Combined

For the layout of the board, the third design is one elongated board. Instead of separating the panels into different boards, there will be one long straight board that extends 12 feet long. The entire board will be 2.5 feet above the ground so that it is wheelchair accessible. There will be a support pole beneath the board at the center to ensure that it is stable and will not collapse.