

# **Prototyping Round 1 – 3/22/2013**

## **Prototyping Setup**

**Summary of exhibit** - Main processes of the exhibit to be used. No posters or written instructions. Setup is two pistons both using the compressor and an electromagnet hooked up to a light switch.

**Exhibit testing procedure** – The main concept of the exhibit is to pick up a bolt using the electro magnet and to ultimately place it on top of a notebook. Jerrod is the facilitator and will assist users in the use of the exhibit. This testing will mainly test the functionality of the arm and children’s ability to use it.

## **Testing results**

### **Successes**

- Magnet is working
- Multi user capable
- Long visit time

### **Shortcomings**

- Controls are extremely difficult
  - Pistons act too fast
  - On/off valve concept not easily understood by children
- Magnet is overpowering and makes arms function not as interesting
- Arm gets caught up on itself
- Magnet holds objects with residual magnetism

**Summary of testing** – The way Jerrod brought children to the exhibit was first by demonstrating the function of the magnet by having the children turn the switch on and off and seeing the results. Then he assisted the children in the operation of the arm and told them what to do in order to accomplish the task of moving the bolt. The magnet was a huge draw in for the children but the operation of the arms mechanical pistons was a complete failure and they would not be able to grasp the concept on their own.

### **Suggestions**

- Reduce piston speed to give greater control to the user
- Limit piston movement with manual stops to prevent “tangling” of the arm
- Cover magnet with some barrier to make objects drop more consistently
- +Try observing the users rather than facilitating to see the exhibits standalone success

# **Prototyping Round 2 – 3/28/2013**

## **Prototyping Setup**

### **Changes**

- Flow control valves
- Stop limits
- Smaller top piston
- Duct tape on magnet head
- Heat wraps on wires instead of wire nuts

**Summary of exhibit** - Same as prototyping round 1.

**Exhibit testing procedure** – The main concept of the exhibit is to pick up a bolt using the electro magnet and to ultimately place it on top of a notebook. Kate is the facilitator and will assist users in the use of the exhibit and attempt to initially draw their attention to the arm's motion. This testing will test the new flow control valves to see if their function makes the interface more accessible to users. The use of diagrams will also be periodically incorporated into the process.

## **Testing results**

### **Successes**

- Parents explained much more and assisted children in accomplishing task
- One child read and used diagrams successfully
- Task was accomplished due to new improved motion speed
- Desire to succeed evident

### **Shortcomings**

- Tended to move top arm and then bottom which resulted in minor misses
- Arm still tangles itself
- 1-2 year olds do not grasp the concept
- Turn radius was too much
- Not one to one movement, process is still a bit unclear
- Still reaching around

**Summary of testing** – All around improvement from first prototyping. The arm speed allowed the children to use it more accurately and actually accomplish the task. Also minorly explaining the process allowed for parents to be involved in the process and they found it just as interesting as the children. The main observation I made was that subjects line up the top arm to be directly above the bolt and when they lower the second piston the magnet misses the bolt. Also as Kate pointed out, most subjects when directly to the left valve first for whatever reason. The range of the unlimited piston also proved

to be too much as well. The diagrams Audrey drew up also helped and this was evident by the last subject directly saying outloud “stop” when pointing at the diagram.

### **Suggestions**

- Make troubling piston act as a vertical gain or loss
- Limit troubling arm
- Move onto other problems of the exhibit (i.e. games or gender bias)

# Prototyping Round 3 – 4/4/2013

## Prototyping Setup

### Changes

- Better gage signs
- New location (adjacent to the stairs in the main window area)
- Two games (tick tack toe and recycling)

**Summary of exhibit** – Prototype has displays for the two valves and also the games to be played. The recycling bin piece has a sign with the recycling symbol as well as recycling written out and tick tack toe is a wide yellow sheet cut into 9 squares. The setup is in a new location which is directly between the large window and the staircase and the museum is in disarray with large crates everywhere which could be a turn off to visitors.

**Exhibit testing procedure** – The main concept of the exhibit is to accomplish the tasks brought forth by both games. One game will be displayed at a time starting with tick tack toe and then we will switch about an hour into the prototyping process if we deem we have had enough trials. For tick tack toe, the users will play a game of tick tack toe, and for recycling the users will put tuna cans into a recycling box made by the group.. Audrey is the host of the exhibit this time. What we are testing to see is if they can use the arm's functions to accomplish a task.

## Testing results

### Successes

- Huge attraction
- Signage and colors very helpful
- Very long interactions
- Objectives were clear
- Parents explained theory behind the arm movement

### Shortcomings

- Too much pressure results in uncontrolled residual movement of the vertical piston
- Colors needed to be colorful
- Young children flipped switches
- Without parents, operation and concepts became difficult to grasp
- Children wouldn't read signs on their own

- Didn't bring it to "Stop" position usually
- Up and down as left and right were confusing
- Randomly turned off magnet/didn't have it on
- No signage for the magnet
- Tick Tack Toe
  - Knocked board off
  - Picked up multiple pieces
  - Magnet position on the piece made misses common
- Recycling
  - Large can was hard
  - Box moved around
  - Needed to get can from the top which was tricky
- Children get magnet to get thing and then stop as if task was accomplished

**Summary of testing** – The way in which Jerrod introduced children to the robot was first by explaining the interface and the task. If any problems arose Jerrod stepped in to assist but tried to let the exhibit stand by itself. This was limited by some parental involvement as well as the interest of children and their level of intellect.

For tick tack toe, Jerrod explained that the game could be won with a single placement. From there (based on parental input) he either sat back and let them work it out together or he gave the child the necessary guidance and assistance. The tick tack toe game worked well and gave children a great sense of accomplishment upon completion. It was however tricky to get the fine controls to pick up one piece and drop it exactly in the square. The best case all day regarding tick tack toe was one child who accomplished the initial placement task and then (with assistance from Jerrod and his mother) took every piece off the board. Also in another case, one parent described the arms motion by using his arm and talking of the active joints in the arm.

Recycling also went well. The task was easily recognized by the children and they had a general interest in the recycling concept. They could successfully move the arm and move the tuna can from its initial place to the recycling container. There was a taller can that was harder to pick up in all aspects which hindered some performance. Also the box would sometimes get knocked off the table.

### **Suggestions**

- Change front switches to vertical rather than mostly horizontal
- Insert springs which will push valve switch to the "stop" position
- Get uniform can size or at least smaller cans
- Better colors for valves
- Better adhering of diagrams to exhibit
- Let parents do the majority of the teaching, observe more next test phase

# Prototyping Round 4 – 4/6/2013

## Prototyping Setup

### Changes

- No angle for levels
- New location (adjacent to the stairs in the main window area)
- Two games (tick tack toe and recycling)

**Summary of exhibit** – Prototype has displays for the two valves and also the games to be played. The recycling bin piece has a sign with the recycling symbol as well as recycling written out and tick tack toe is a wide yellow sheet cut into 9 squares. The setup is in a new location which is directly between the large window and the staircase and the museum is in disarray with large crates everywhere which could have been a turn off to visitors.

**Exhibit testing procedure** – The main concept of the exhibit is to accomplish the tasks brought forth by both games again. One game will be displayed at a time starting with tick tack toe and then we will switch about an hour into the prototyping process if we deem we have had enough trials. For tick tack toe, the users will play a game of tick tack toe, and for recycling the users will put tuna cans into a recycling box made by the group. John is the host of the exhibit this time. What we are testing to see is if they can use the arm's functions to accomplish a task without large amounts of direction from the host.

## Testing results

### Successes

- Huge attraction
- Signage and colors very helpful
- Very long interactions
- Objectives were clear
- Parents explained:
  - theory behind the arm movement
  - how to move the levels and worked with child to do so

### Shortcomings

- Young children flipped switches
- Without parents, operation and concepts became difficult to grasp
- Children wouldn't read signs on their own
- Springs did not bring the levels all the way back to stop

- Up and down as back and forth confusion in signage
- Randomly turned off magnet/didn't have it on
- No signage for the magnet
- Tick Tack Toe
  - Pieces would slide when others moved in.
  - Picked up multiple pieces
- Recycling
  - Box moved around
  - Needed to get can from the top which was tricky
- Children get magnet to get thing and then stop as if task was accomplished

**Summary of testing** –John sat back and let the children play with the exhibit. The tick tack toe game worked well and gave children a great sense of accomplishment upon completion. It was however tricky to get the fine controls to pick up one piece and drop it exactly in the square. The best case all day regarding tick tack toe was one child who accomplished the initial placement task and put every other piece on the board. He then informed us that the right level was back and forth not up and down.

Recycling also went well. The task was easily recognized by the children and they had a general interest in the recycling concept. They could successfully move the arm and move the tuna can from its initial place to the recycling container. The box was taped to the table to prevent it from falling off the table.

### **Suggestions**

- Change front switches to back to mostly horizontal vs. vertical
- Insert springs which will help keep valve switch to the “stop” position
- Get plastic bottle that cannot be picked up by magnet
- Tic tac toe needs boundary cross-hatches and pieces to be flattened
- Switch to front and back instead of up and down

# **Prototyping Round 5 – 4/10/2013**

## **Prototyping Setup**

### **Changes**

- Spring design changes
- Valves in initial position

**Summary of exhibit** – Prototype has displays for the two valves and also the games to be played. The recycling bin piece has a sign with the recycling symbol as well as recycling written out and tick tack toe is a wide yellow sheet cut into 9 squares. The setup is in a new location which is directly between the large window and the staircase and the museum is in disarray with large crates everywhere which could be a turn off to visitors.

**Exhibit testing procedure** – The main concept of the exhibit is to accomplish the tasks brought forth by both games. One game will be displayed at a time starting with tick tack toe and then we will switch about an hour into the prototyping process if we deem we have had enough trials. For tic tac toe, the users will play a game of tic tac toe, and for recycling the users will put tuna cans into a recycling box made by the group. Jerrod is the host of the exhibit this time. What we are testing is to see if the task can be accomplished and to test the effectiveness of the springs.

## **Testing results**

### **Successes**

- Function control improves over time
- Group teaching and collaboration
- Springs work as advertised
- Separating tic tac toe as well as playing it

### **Shortcomings**

- Tic tac toe board ripped
- One kid without guidance could not figure out controls
- Lightswitch overlooked

**Summary of testing** – Today's testing crowd was primarily tour groups so we did not get the parental involvement we were hoping for. The first group that came by seemed to be of middle school age. They showed an extreme interest as well as control mastery of the arm and accomplished the task with ease and visible interest. The other tour groups throughout the day were not as old and experience some troubles. The tic tac toe board ripped at one point causing a child to stop his engagement since he thought he had completely broken it.



Overall it was a successful test day and the springs worked as we thought they would. This caused for an increase in movement understanding and overall performance of the arm.

### **Suggestions**

- Better spring mounting to handle
- Wooden tic tac toe board

# Prototyping Round 6 – 4/12/2013

## Prototyping Setup

### Changes

- Fixed springs on handles more securely
- Wooden tic tac toe board

**Summary of exhibit** – Prototype has displays for the two valves and also the game to be played. The tic tac toe is a wooden square with wooden squares made. The setup is directly between the large window and the staircase and the museum is in disarray with large crates everywhere which could be a turn off to visitors.

**Exhibit testing procedure** – The main concept of the exhibit is to accomplish the tasks brought forth by both games. One game will be displayed at a time starting with tick tack toe and then we will switch about an hour into the prototyping process if we deem we have had enough trials. For tic tac toe, the users will play a game of tic tac toe, and for recycling the users will put tuna cans into a recycling box made by the group. Jerrod is the host of the exhibit this time. What we are testing is to see if the task can be accomplished and to see if it can be done without a host.

## Testing results

### Successes

- Board is very durable
- Handle fixture are very proper and used well

### Shortcomings

- Not initially drawing children in, once operation is seen then the draw occurs
- Not grasping scientific concepts, just problem solving

**Summary of testing** – Today's testing crowd was extremely unusual. An interest was shown in the arm and it was used properly but our age demographic was more than double what we designed our exhibit for. The new wooden board proved to be durable enough to withstand the blunt force of the swinging magnet which was a very good sign for us. Overall however this testing session did not prove us much new information and we are not sure if it was due to the strange age variation or the success of the exhibit overall.

### Suggestions

- better displays
- more color coordination
- sit back and observe testing style

# **Prototyping Round 7 – 4/15/2013**

## **Prototyping Setup**

### **Changes**

- CMTM location
- Fixed loose handles

**Summary of exhibit** – Prototype has displays for the two valves and tic-tac-toe will be played. We tested at the CMTM in three separate locations which were downstairs in a secluded room, upstairs in an open area widely trafficked, and around other air exhibits in a crowded room.

**Exhibit testing procedure** – This evaluation method generally consisted of explaining the exhibit and allowing for parents to guide their child through. Chris assisted by engaging the parents with a questionnaire while Jerrod assumed the parental role during this phase.

## **Testing results**

### **Successes**

- Long interactions
- Kids taught kids
- Rapid improvement of controls over time in many cases
- Parental guidance encouraged
- Multiple user engagement more successful than single

### **Shortcomings**

- Controls hard without parental guidance
- Magnet sometime overlooked
- Intimidating to parents
- Angle problem with arms
- Learning outcome problem

**Summary of testing** – Chris was impressed with the arm's progress and performance. Most parents assisted their child in the process but some were reluctant to try due to their intimidation of the arm. Most parents when asked about the arm said they were unsure if their child would be able to operate it and they were a bit unsure of themselves.

The children's use of the arm from the start was dicey but they improved quickly and by about 5 minutes of use were able to use the arm successfully. Some were unable to grasp the concept and asked for help on how to use it.

The magnet also was inconsistent in its performance. It was overlooked and often the process of it was misunderstood or not used. The learning outcome of the exhibit was also brought up by Chris. Yes it works and can be a standalone exhibit but what is being taught is unclear. Three options were specified: air properties, electricity applications, or problem solving. As of right now the main concept being taught is mainly problem solving which could be better balanced with others as well.

### **Suggestions**

- Paint/color tubes leading to pistons with an adaption made to the handles to signify where air is being pushed
- New light switch that is more noticeable to the user or a paint scheme which highlights the magnets position and function as a magnet
- Better color coordination between valve handles and pistons
- Visible magnetic pieces