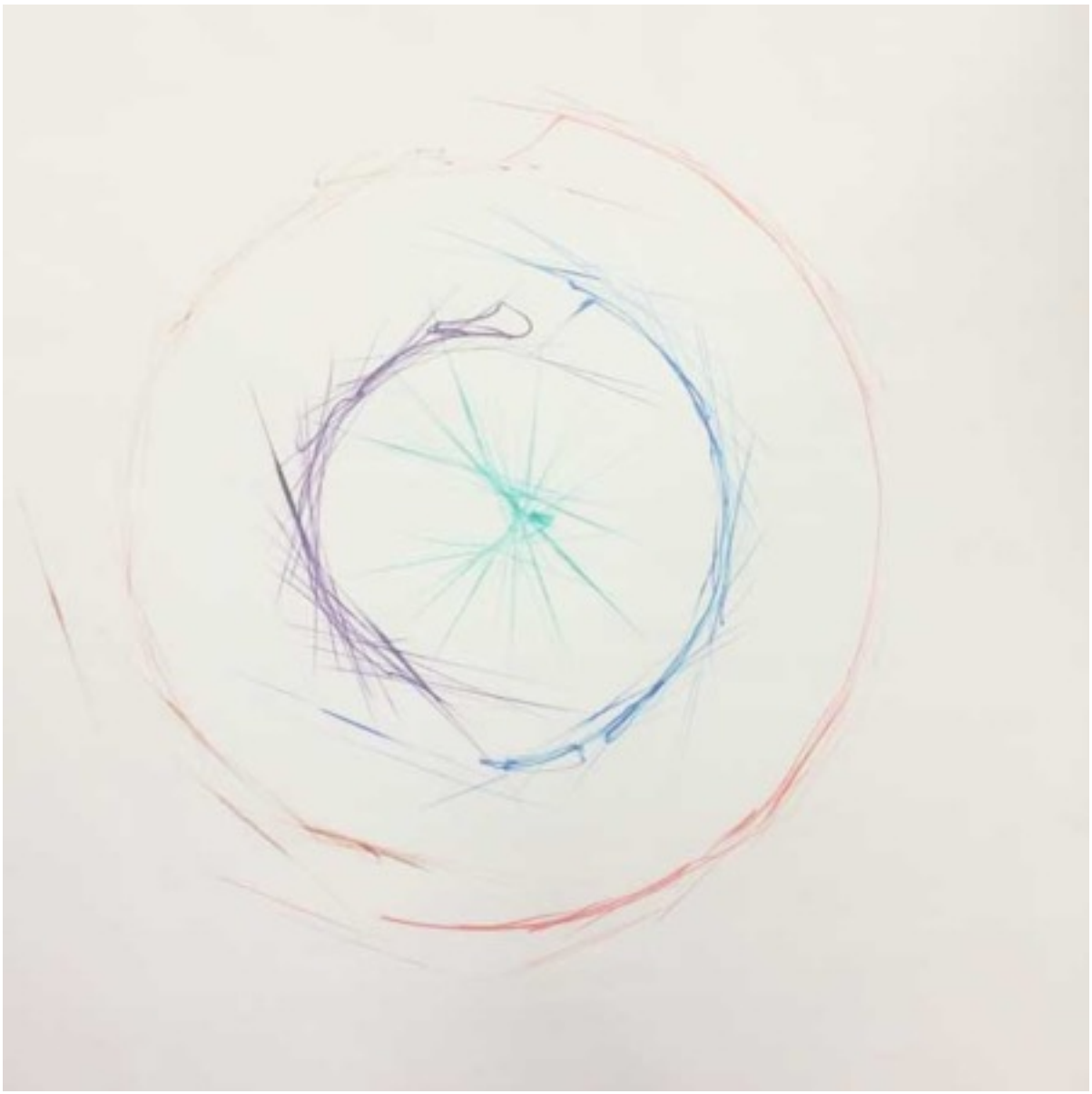
Colors of Time

White Paper



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Executive Summary

Ever since mankind developed the concept of time, we have found a variety of ways to both represent and manage time. Clocks, watches, calendars, to-do lists. While useful, these mechanisms are also often a key source of anxiety for most people. The goal of JARS Collective was to take this stressor and transform it into a unique and artistic experience.

Colors of Time is an art installation that brings schedules and pendulums together to create individualized pieces of art based on peoples' calendars. Five independently moving pendulums correspond to respective work days and move based on schedule data provided by guests. Brushes within these pendulums leave strokes on a rotating base, resulting in unique pieces that can be taken home or shared with other visitors of the installation. Through a three-month design process, we ideated, research, and developed Colors of Time.

Introduction

Colors of Time is an art installation that creates beautiful patterns to abstractly visualize one's weekly schedule. It consists five pendulums mounted on a frame, with each pendulum assigned to one day of the week, and an separately rotating base underneath the pendulums that hosts a sheets of paper. Colors of Time first reads the user's schedule information from Google Calendar and then uses the number of tasks in each work day to calculate the initial starting position the respective pendulum. The pendulums are then raised through a motorized mechanism to those calculated starting positions, after which they are released into free swing simultaneously. As the pendulums swing, colored brush-tip pens hidden in the bottom of the pendulums will hit the rotating paper base, allowing the stroke patterns to form. When hitting the paper, the brush tip also gives tapping and sweeping reminiscent to that of to the sound of a clock and it gives people a feeling of time passing by.

To construct the initial prototype for the installation, the materials we used include PVC pipes, air-dry clay, brush-tip pens, a stepper motor, an arduino-compatible kit, cardboard, large-format sheet paper, and a variety of adhesives. The motor, which the paper's base is attached to, is controlled by the adruino, while the pendulums are, for the purposes of this initial prototype, attached to the frame and unmechanized. The paper sheet is removable from the base.

Our primary motivation is we intend to use art to represent time. Typically, time and tools used to manage our allocation of it are designed with utility and pragmatism in mind; this is one of the largest sources of stress and tension for most people, particularly those with busier and active lifestyles. Anxiety-related disordered are often treated through clinical art therapy, which relies on the distracting, self-theraputic, and near-meditative nature of making art (Scott, 2014). The goal of the project is to use this approach to make time and time management a source for creativity, inspiration, and relaxation.

Colors of Time is designed to be deployed in public spaces, such as art galleries and office environments. The target buyers of the installation, therefore, are gallery curators and office managers, while the target users are patrons of the arts and people in working environments. The visualizations are intended to be taken back to one's own environment or to be displayed within proximity of the installation in a shared space. This is intended to impart a sense of ownership over one's visualization while also encouraging the sharing of the individualized patterns that the installation creates.

Colors of Time is the result of a three-month-long research and design process, the details of which will be provided in the rest of the report.

Research

In order to understand what people think of time as well as to observe how their calendar affects them, we set out to do in-depth interviews and observations.

Interviews and Observations

As described by Weiss R. in 'Learning from Strangers', a researcher expects concrete descriptions that the respondent has witnessed. These include both, the respondent's thoughts and feelings and scenes and events external to the respondent (Weiss 1994).

Moving ahead with this idea in mind, we created a set of questions for these interviews aimed at understanding how the interviewees use their calendars, how tangibility of physical objects make them feel, as well as what role calendars and schedules play in their lives. We interviewed 8 people, a pool that included between students, professors, working professionals. Interviews were conducted via phone, through Skype, or in-person. Following are some of the questions from the interview protocol that we used:

- What kind of calendars do you interact with in your life? Could you elaborate upon a particular interaction in each case
- Do you have a physical calendar? (If no, why don't you use a physical calendar? What has stopped you from using a physical calendar?)
- How do you feel about interacting with digital books when compared to physical books?
- What role does your calendar play in your daily life?
- How do you track the passage of time ? Is there is a particular method you like and could you elaborate on that?

"There are spatial relationships in a wall calendar that I can't get from Google Calendar"

While some people used Google calendars every now-and-then, there were few of the interviewees who used physical calendars, diaries and to-do lists heavily. These interviewees displayed a strong attachment to these physical entities that help them keep track of time. People who used online calendars expressed that these tools were often frustrating and stressful to use; one interviewee expressed a strong preference for physical calendars as the tactile nature of such allowed her the sensation of control over her time.

The most common sentiment among interviewees was "my calendar drives my life". Observations of interviewees' work environments were also conducted during in-person interviews. This allowed us to gather further relevant information in peoples' actual working environments, further driving insights that were derived from the interviews (Randall *et al*, 2007).

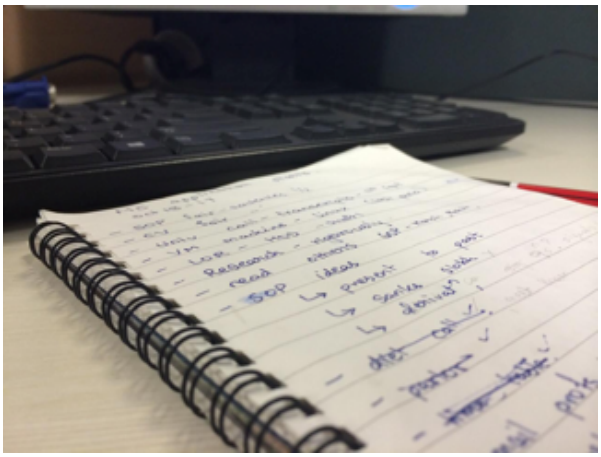

Fig. 1: Notebook-based to-do list of an interviewee

Fig. 2: Color-coded wall calendar of an interviewee

These findings about people's feelings and behavior with respect to calendars, schedule - essentially 'time' - are the key motivation behind our design decisions, as explained in the Design Process and Working Solution sections. To summarize, following are the highlights of the research findings,

- Tangibility gives control
- Everyday is driven by calendars
- Tight schedules bring anxiety and frustration
- Time seems uncontrollable in a busy life

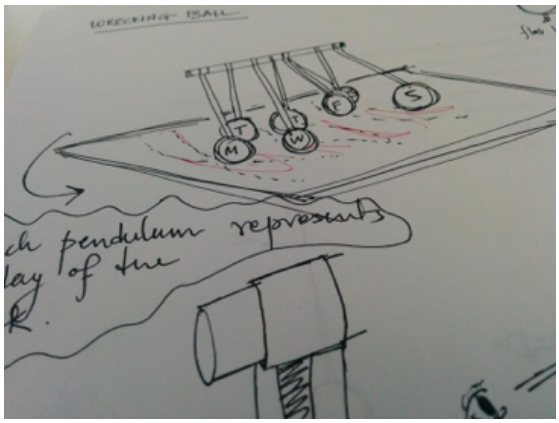

Fig. 3: Preliminary sketch of the Colors of Time installation

Design Process

Based on the findings from User Research and Observations, we realized that modern technologies like Google calendar itself, has taken away the 'tangible' aspect of physical things. The tick of clock is replaced by the static, digital clock on top-right corner of your smartphone or laptop. As we progressed in the design process, there were certain pivots that we had to take, considering project timeline and scope.

Problem definition

In the modern world, time has developed a negative connotation of frustration, anxiety and stress. Google calendars drive one's life and people feel they do not have control over time. As a result, time seems to have become more intangible.

Brainstorming

As a result of an initial brainstorming session, the original design that we intended to investigate during our research and observations was a physical calendar that was capable of synchronizing two ways with Google Calendar. Existing solutions are only able to send chances to the cloud but are unable to change to reflect these changes. As a result of the insights derived from the interviews, we realized that this project was not practical nor did it address any problems in a meaningful way, therefore forcing us to pivot.

So as to continue to work with our concept of time and our management of such, we began to list out different physical materials that are associated with time. These included sand, water, split-flaps, pendulums, and sundials. Because of the emphasis on anxiety derived from schedules, we decided to focus on how these materials could be used create an abstract art installation that would remove users from their click-whirr feelings of stress. Several sketches that made use of these ideas were made, which proved to not only be an effective means to explore alternative ideas but also was helpful in fostering discussions about the implications and practicality of these various ideas (Rohde, 2011).

One of the initial ideas that we began to work on was to create a split-flap based tower that would use audio and visual cues inherent to a split-flap display to impart a sense of accomplishment upon users once they clear items off their to-do lists and conclude an event listed on their calendars. Keeping in mind the importance of cost and its ability to become problematic during later stages of a project (Benzion, 2014), we ruled out this design due to the calculated chronological and monetary costs.

From here, we pivoted again, focusing still on time and, now, abstracted visualizations of such. We agreed that utilizing pendulums would be effective and meaningful for our ends.

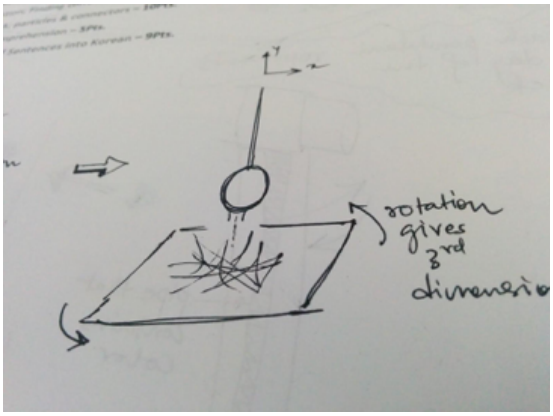

Fig. 4: Proposed solution to address what would otherwise become five parallel strokes of color.

Sketching

The fundamental concept was to use a pendulum for each day of the working week, and the duration of the pendulum's swing would depend on how many activities a person has assigned for each day of a week; "longer" days would have more strokes as a result of a higher initial starting point, and strokes would be formed on paper by brush tips at the bottom of each pendulum. Patterns would be created as the pendulums swing, and busier days would emerge more salient versus less-busy days. In order to prevent the visualization from being just give parallel strokes of ink, the base needed to be able to move since allowing pendulums to move in two axis could result in collisions; therefore we decided to have the base rotate, allowing more interesting and unique patterns to form. In order to

prevent friction from dampening the momentum of the pendulums and ending their motion more quickly than would be needed, the pendulums would need to be weighted in order to provided more force for swing. The paper on the base had to be removable in order that new users could have a fresh start rather than draw atop the creations of others.

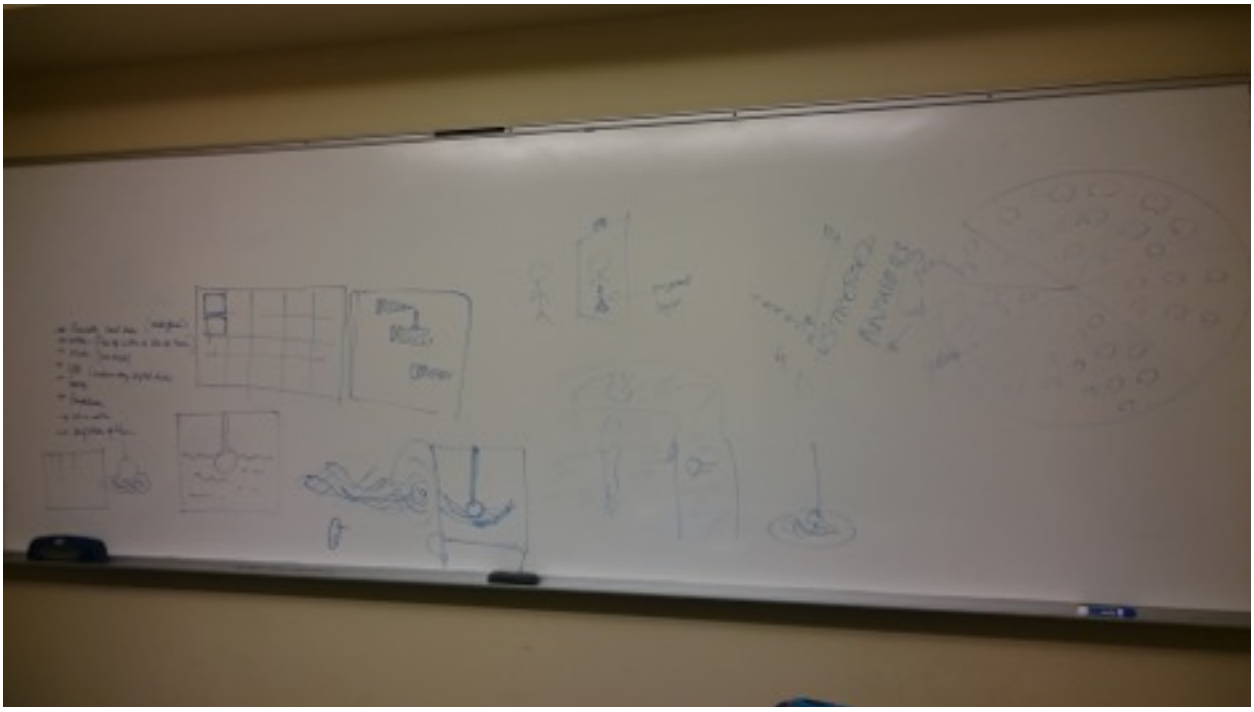

Fig. 5: Sketches produced during a brainstorming session oriented around how to make use of materials associated with time in an abstract manner.

Current Working Solution

Hardware

The hardware of the Colors of Time prototype created within the timeframe allotted consists of five pendulums, a frame to hold the pendulums, arduino board, a motor and a paper base. The five pendulums are comprised PVC pipes, clay and brush-tip pens. The brush-tip pens are buried within clay balls at the bottom end of the PVC pipe, which is mounted to the frame via an oversized cross-joint.

Considerations that led to the adoption of PVC over other materials include its cost, weight, and flexibility relative to other considered alternatives, which included wood, metal, and plexiglass. Clay was chosen for its malleability, portability, and cost; however it was proven to be an imprecise and unreliable material to work with.

The air-dry clay that was chosen (for convenience) shrinks sufficiently when it dries to result in chronic cracking. Creating discs that could join together did not work due to consistence shrinkage tolerances, and mounting the balls directly to the PVC was also ineffective due to the reduction in volume resulting in stress fractures in the materials.

Brush-tip pens were chosen due to their relative simplicity: we opted to table designing a mechanism for delivering ink into the installation and through the pendulums due to the mechanical complexities involved, and brush-tip pens proved to be a solution that was effective for prototyping purposes; while the tips of these pens are less flexible than actual brushes may be, this is not intended to be reflective of the final design for ink delivery.

We were provided with a Seeeduino kit, which included an Arduino-compatible board as well as an accoutrement of programmable hardware parts. After coming to an understanding of the actual capabilities of the Arduino and the hardware parts that were included in that kit (Banzi, 2011), we decided that, for this prototype, we would focus on using the provided stepper motor to rotate the base. Code was developed to activate and control the motor and then was burned onto the board for portability. The motor is attached to a cardboard base that holds a sheet of paper. The base needed to be wide enough in order for all of the pendulums of the frame to leave ink marks on the paper, and this proved to be a challenge. The size of the motor and its housing (the bottom side of a retail packaging box used for a 7” tablet) was too small to balance the base, and the contours of the motor itself made aligning the height a challenge. Initial attempts at mounting the base to the motor resulted in severe imbalances that affect the ability of the pendulums to draw effectively and evenly. We attempted to address this by creating a frame using sticks that then adhering this frame to the base; this turned out to be ineffective and may have exacerbated the situation. Our next solution was to extend the motor housing while also via stabilizers that went beyond the housing’s edge while trying

Fig. 6: An early working prototype for the Colors of Time installation.

to match the height of the motor's shaft; this proved to be effective enough to remain implemented.

Software

The hardware mechanism described in the previous section is controlled in part by two different software systems that work in combination with each other to ensure that the system runs smoothly. As mentioned in the above sections, the system utilizes a user's calendar events and to-do items in order to calculate the starting height position of the corresponding pendulum. This is done in order to ensure that each pendulum's resulting momentum corresponds to their respective days of the week and also ensures variance between each pendulum, allowing for varied and unique visualizations.

Google Calendar (Java Code)

In order for the system to be able to utilize the number of tasks that the user has, the system relies on a standalone Java program that uses Google's Calendar API in order to gain access to calendar items and to-do lists.
So as to visualize there upcoming work week, the Java code is able to derive the current date, i.e the date and time when the user is using the system, ensuring that the program is able to refuse events that have already passed or are more than a week ahead of the current date. While scoping the installation down to one's work week was partially a creative decision (it was assumed the weekends would not provide sufficient data for any worthwhile amount of momentum), this decision was also made in response to a technical limitation where the Arduino was only able to control five pendulums.

Motor Code (Arduino)

For the system to be able to produce some of the amazing curved patterns seen before in the report the system had to be able to rotate the base containing the sheet of paper upon which the visualization was getting drawn. To be able to do this, as explained before in the hardware section, a circular section of a cardboard sheet was cut and attached to a stepper motor. The stepper motor was then attached to a arduino, which was powered using a laptop.
The code running on the arduino is simple and is responsible for making the circular base rotate that allows for the creation of the beautiful circular patterns. The code runs in two different modes. The first mode is a semi-automatic mode, in which the arduino does not drive the motor until and unless it gets a single from the potentiometer attached to the arduino. This setup allows for the user to be able to control the base in order to be able to create patterns on his own rather than have one created for him. It was the vision of the team that this interactive element would help in more active engagement from the user than passive engagement. The second mode allows for the system to be sent into a more automatic mode, where the circular base is in total control of the arduino. This allows the arduino to rotate the base a slow enough rate in order to achieve the patterns shown before. This mode is engaged by pressing on the push button that is attached to the arduino.

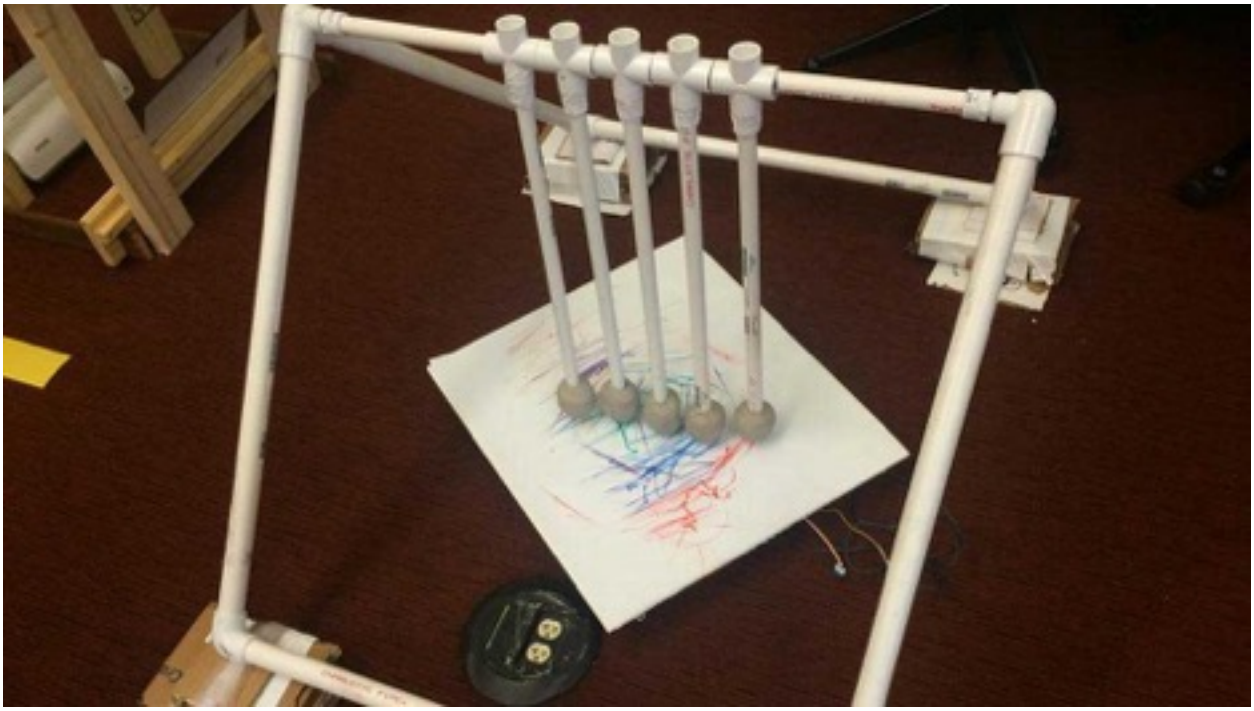

Fig. 7: The final working prototype for the Colors of Time installation.

Future Plans

While the final working prototype created in the span of this project is sufficient for demonstrating the basic underlying concept, it still has a ways to go before it able to completely achieve the originally intended goal. Additional funding is needed to secure the resources necessary to complete the project as designed.

First and foremost, higher-precision parts are necessary. As noted in this report, many of the materials selected were chosen for cost and flexibility. Sized and weighted pendulums are necessary to reduce unintended variance between the pendulums, and it is difficult to ensure that the brush-ink pens are all aligned to the same height. We would also need to develop a better form of delivering ink, as brush-ink pens are neither sustainable nor reliable.

Second, complete motorization of the installation needs to be implemented. We developed solutions for implementing this; ideally, we would use brushless motors, however the power draw of these motors, when engaged, is high and therefore will require extended design and testing. Our current "manually raise the pendulums" approach does not align with the intentions of the project.

Lastly, we hope to be able to bring a completed version of this installation to art galleries and other public spaces before we begin to market this as a produced project.

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