
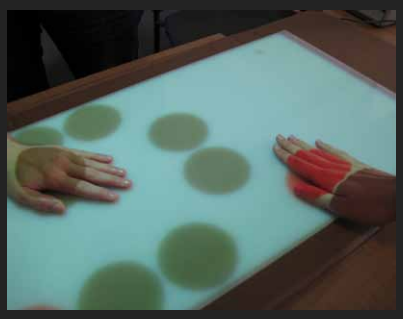
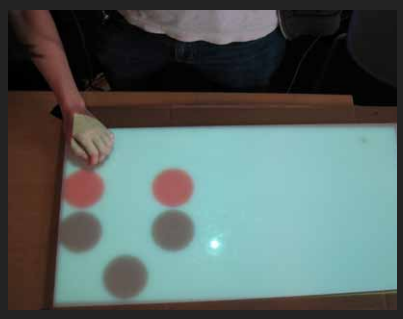

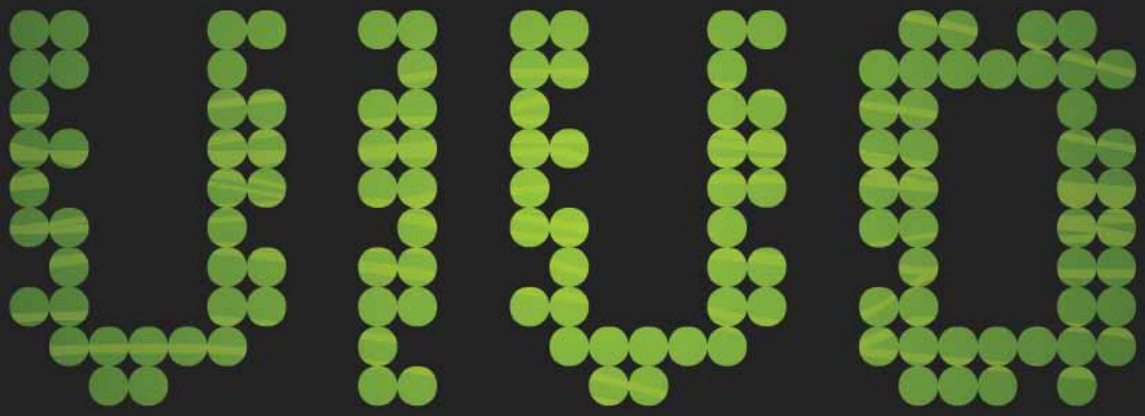

IAT 320 - D101

Final Project Documentation

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Abstract

Vivo is an interactive tabletop installation which simulates the growth and decay of an ecosystem based on Conway's 'Game of Life'. Through Vivo, users explore how organized structures evolve from instability and how interference can cause that organized structure to become unstable again. Using thirty two light sensors, Vivo tracks a user's gestures and objects placed on the table surface; these actions are catalysts for the virtual ecosystem, adding new 'cells' or ensuring the survival of a community of cells. This paper will describe the processes and implications involved in Vivo.

Introduction

Vivo takes inspiration from the 'Game of Life' which consists of a two-dimensional orthogonal grid of square cells, each of which is in one of two possible states, alive or dead. Every cell interacts with its eight neighbours, which are the cells that are horizontally, vertically, or diagonally adjacent. Environmental changes cause cells of the environment to react or adapt and either thrive, grow or fail to sustain themselves.

The 'Game of Life' is an example of emergence and self-organization. Many systems in nature, e.g. galaxies, compounds, cells, organisms and societies, have developed with 'design' despite the absence of a designer. It is difficult for people to view these systems as a whole without very specialized equipment. Vivo has therefore been designed with a time scale and magnitude that is appropriate for everyday users. A user can affect Vivo by touching or placing items on table surface. Fleeting gestures (i.e a quick brush), add new cells into the system while prolonged gestures (i.e placing an object on the surface), ensure the survival of a small ecosystem of existing cells. This evolution simulator then allows users to watch cells live, die and evolve based on their actions quickly and systematically (allowing for causal relationships to be formed within their mind). The system will eventually reach a point of stability, however, they system will immediately return to instability when a person interacts with the surface. Through Vivo we wanted to research if experiencing a self-organizing system will cause users to reflect before entering an environment or interacting with a certain entity because they know their actions will cause the system to react (i.e critically thinking about repercussions).

Background -Research

Why a table?

Critical design challenges preconceptions and expectations thereby provoking new ways of thinking. Critical design objects are not instruments of utility, but try to move beyond what already exists. Vivo changes the expected functionality of a table by removing easy interpretation. This creates a void and people then create meaning based on the incompatible contexts. By using a interactive system a tool for critical reflection, the table now is an entity (rather than just an object); it has its own 'ideas' and is potentially hard to predict/control.

Early on in the project we wanted to explore the input of our work and discussed how users could interact with the interface, even though we had an idea that it would be a flat surface of some sort, we were were not sure if we wanted to explore placing the surface on the floor or placing it on an everyday surface such as a table or a desk. We looked at works such as United Visual Artists Contact as inspiration, as they utilized computer vision techniques and the floor. The floor represented an unattended space which we felt held a lot of potential, however we also chose to go with the table because it offered us a unique space that could give us even more control as to the response. Also the projectors were limited as to the scale in which visuals could be projected.

The game of life is capable of producing either stable figures or patterns that oscillate forever between two or more states. Through research we learned that humans have evolved brains that are pattern-recognition machines, adept at detecting signals that enhance or threaten survival amid a very noisy world. This capability is association learning, i.e associating the causal connections between A and B. To further Vivo's association learning even more we utilized the colour green to indicate cells that will live on into the next generation and red for cells that will die. These system attributes then cause users to anticipate the occurrence of important outcomes. Users can then strive to create or destroy ecosystems and make certain figures or patterns to see how they would affect the system.

We added colours to add life and metaphor to our piece. A transition and gradient of green and blue were added for when the cells were alive. Red represented the death of the cells. In the end, we found that this is an area that requires more development.

Background - Precedents

Slogan Bench

A simple wooden bench with a window in the back rest. The community was encouraged to submit slogans that woud be displayed. Slogans such as"Methadone is ok but not in front of children" were written by the elders of the community and would rotate inside the window using old bus sign technology. Social gatherings and discussions sprouted up around the new pieces, which became a manifestation of local culture and identity.

By changing the usual functionality of a bench, this everyday object now communicates a deeper message. We were inspired by this project to explore forms for Vivo that would cause users to have new interactions with an everyday object. We also wanted to change, but not block, the original functionality the piece could also be integrated into the 'real world' without disruption so it merges seamlessly with the original environment like the Slogan Bench.

A table surface as a result still retains its functionality but also attracts people's attention because of its unexpected display or response and creates a dialogue, with the body (through interaction), with the objects placed on VIVO and the people who experience it.

United Visual Artists - Contact

A responsive floor surface that uses the kinetic energy of people to generate audiovisual forms that react to the user, and communicate with each other. Contact was created in commemoration of an event called UK-Japan 2008.It involves the body of the people and utilizes a similar method of interaction that we were considering for our project and the visuals used in the installation we found were interesting.

However, the interaction was more of a novelty then a reflective work, which we felt would potentially be a shortfall of our project, although we do see potential in the floor as a surface and considered it for our project however, when we see stuff displayed on the floor it only catches our attention briefly and over time may be ignored.

Implementation: Process, and Development

We explored options for Vivo's output visuals, such as bottom-up projection in order to encapsulate as well as minimize environmental distractions. In the end, due to budget and time constraints, we designed a top-down projection system that still converged input and output in the same location. Although, we did not create a touch screen we took inspiration through our research of the material choices and techniques used to develop and create them, examples include the use of vellum paper and acrylic to diffuse the light to sense a user's hands and gestures. Although we did not end up with using vellum, we found an acrylic that met our needs without requiring us to do so.

Also, the DIY touch screens which we explored often utilized IR (infrared) sensors or a camera. Because of our research on touch screens we decided on using photo sensors instead of IR (infrared) sensors or an IR camera because we felt that it would be easier to calibrate on/off sensor versus relying on computer vision that is known to be temperamental and in our time frame would have been difficult to incorporate. Collaboration is incredibly important and we felt that it would be important to reduce the amount of garbage data we would have to deal with as best as possible.

After settling on a top down projection system we were going to embed the sensors in a soft textile similar to a table cloth. Vivo would then be able to be compressed and be easily transported, however, the resistance of the conductive thread proved to be problematic. There was also a greater chance of short circuits within this system, therefore, the decision was made to embed the sensors and wires on a stiff board. This allowed us to organize the system much more efficiently and when problems arose (such as accidentally using 250 ohm resistors instead of 10k) the circuit could be easily repaired.

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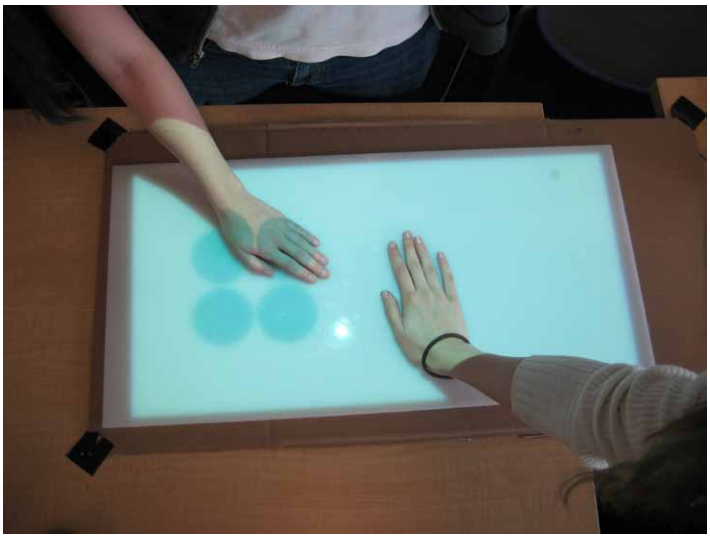
For better functionality as a table surface we also explored the types of material we could use to protect the sensor inlaid surface while retaining its functionality. We ended up choosing two pieces of plastics, acrylic that had two different finishes. One was a more clear acrylic with a frosted side that would allow more light through and a more semi-transparent plastic that that would block out the sensors from the user, creating a more encapsulating experience. Through experimentation we found that we liked the semi-transparent white acrylic more as it diffused the light to the sensors better when the user interacted with the surface as well as created an aesthetically pleasing glow when projected on. Also, the plastic allowed for the visuals to still appear even in a fairly well lit room.

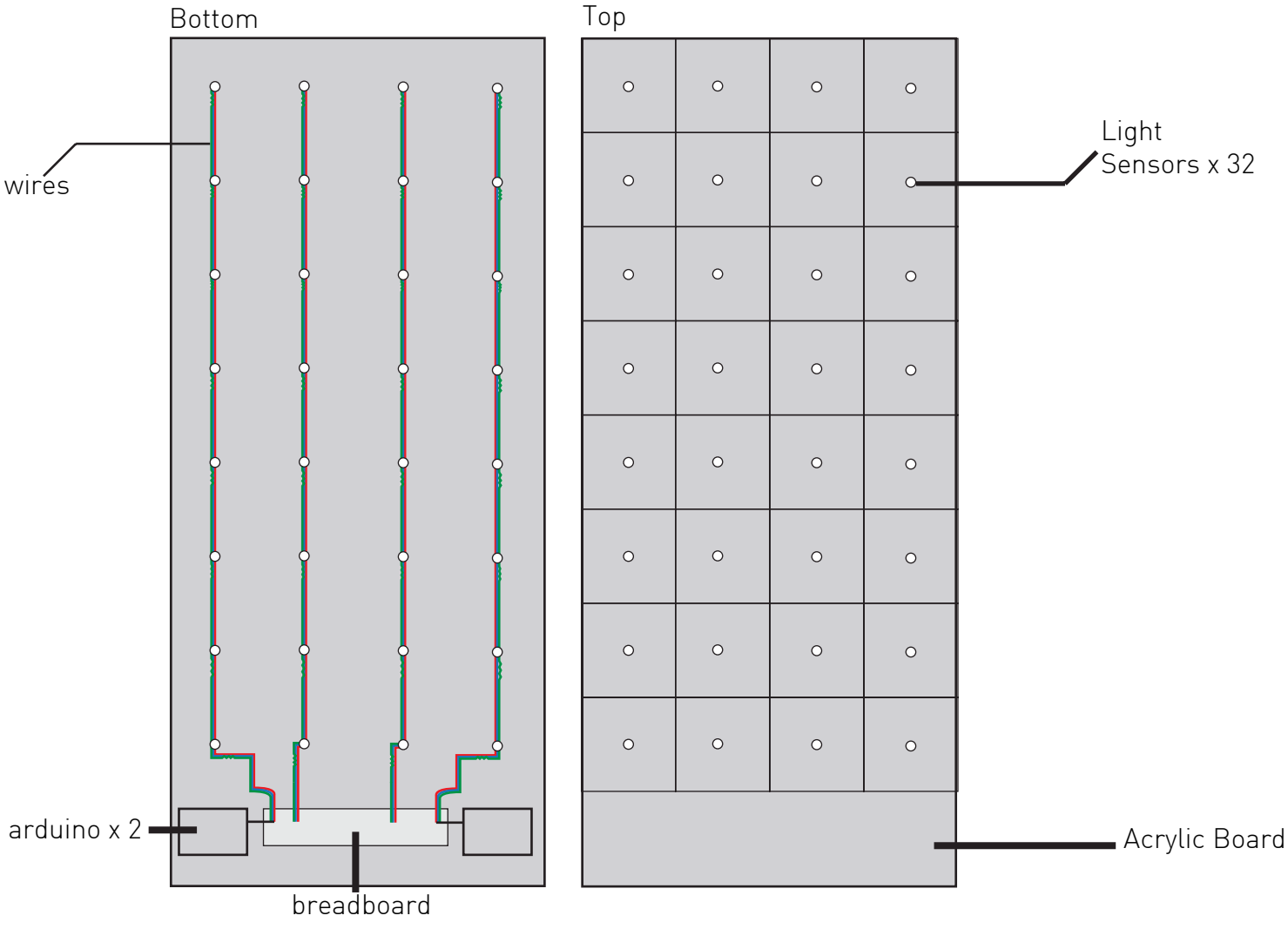
Technical details

A single Arduino did not have enough pins to facilitate the number of light sensors needed, therefore, we used two Arduinos communicating via different serial ports. Sometimes the communication would overlap resulting in garbage input. A series of 'try/catch' codes were implemented in the Processing code to prevent errors, though this still left the occasional delay in response until the next read instance.

All thirty two light sensors were wired in parallel connecting to the two Arduino boards by digital pins. The sensors and wires were embedded into a board using one hundred and thirty two segments of wire and thirty two 10k resistors.

A board of acrylic was overlayed on top of the board with the embedded light sensors. This was done so that the sensors would be protected while still being accessible in case they needed to be repaired or replaced. The acrylic also added to the aesthetics of Vivo, giving a glowy, eternal feel to the virtual ecosystem.





Technical details continued...

For our software we utilized Arduino for reading sensors input and output while relying on Processing to create the display and visuals. We also explored utilizing a camera and computer vision programs such as Max MSP and Isadora that would communicate with Arduino which would have allowed for a higher resolution and response time. Although we did not end up utilizing Max MSP or Isadora, in part due to the difficulty of managing and implementing the game of life logic in the Max environment, we would consider these programs for future iterations of Vivo as they could provide us with the ability to increase the resolution and accuracy of our surface projection.

An apparatus was constructed to support the projector, allowing for portability which was needed as we developed and worked on the project. We utilized two pool ladders, rope, tape, tubing, and a box in which we cut a hole in order to support the projector at the needed angle. In the most ideal situations we would have attached it directly to the ceiling however, financial and installations constraints prevented us from doing so.

Analysis

User Testing and Feedback

Through experimentation, users eventually recognized certain stable or oscillating patterns; they then strived to create multiple stable ecosystems on Vivo's table top. Due to the low resolution of Vivo's sensor grid, it was hard for users to create more than three 'square' ecosystems without having them interact with each other and return to instability. The system itself is very responsive and our participant users were able to place cells where they desired. Some even tried to fill the ecosystem by laying over the acrylic board. The system promptly added the cells and ensured their survival until the user uncovered the board. The cells then slowly died due to overpopulation.

The apparatus which we created to hold the projector up was described by participants as almost like a capsule, like that of a virtual reality machine. Although, this was not our intent, we were glad to hear that it made users feel this way as we were worried that it would be a distraction. Instead the apparatus added to the experience in a positive way.

Overall, based on our participant interviews, it was understood that green cells would survive until the next generation and red cells were those that would die. However, some participants were confused why the green cells were 'breathing', thinking that the colour change had some sort of meaning. In future interations we will experiment with slowing down the colour change in order to keep the breathing aesthetic while clearing up the confusion regarding whether the colour changed is "counting down" to something. We also will be exploring different hues and shades of the same colour in hopes of reducing some confusion between the colours.

We also found that the users enjoyed exploring the different interactions and results, one of our user testers embraced the surface as if hugging it as well as explored placing objects on top of it. While another tried to created multiple living communities. There is a lot we need to explore with the gestures that are possible, and require more user testing for this.

At the moment, our users often interpret Vivo as a playful experience. Enjoyment was one of our intended goals and we feel it has been successful in that regard. However, we feel like we can improve the aesthetics so that there is more of a connection to actions and reactions within systems as well as explore the number of cells that can be formed within a tile or given area.

Conclusion

Vivo is an exploration of how we can interpret and visualize an ecosystem in an abstract manner, grab attention of people and have them think critically. In some cases our users also gained some emotional attachment. We were successful in creating a playful design that explored Conway's game of life and although it could use some more development it emphasizes our intended goals of experiencing a self-organizing system. It also was able to get our users thinking. Users explored the interaction and gestures varied from user to user, each of their approaches were unique. You could see how the cells evolved and changed, no two systems were the same and it definitely was interesting to see.

Future Plans

In the future, we intend to expand on our prototype and make it more sensitive to the user's gestures by increasing the resolution of the input such as by using a camera and computer visual techniques. Ideally we would like to integrate a touch panel that could capture a range of motions and gestures. We would also eventually like Vivo to be able to differentiate between the various objects that would be placed on the surface. By increasing the number of different sensors, this would allow for heavier objects to have a greater effect on the virtual ecosystem as they represent a greater environmental force.

Also, we would like to explore adjusting the concept and playing with time and the types of organisms or cell colonies that form from user interaction. This is something we would develop as we user test more and gain more feedback.

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