



fermid
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ABSTRACT

Fermid is a kinetic sculpture that uses technology and parametric design principles to explore the natural movement that can be found in living organisms along with its relation to human perception and space.

Keywords

Open-source Hardware, Parametric Design, Kinetic Sculpture, Paper Craft, Responsive Environments, Kinesthesia

INTRODUCTION

Fermid is a kinetic sculpture representative of the natural kinesthesia found in organic living organisms. My interests in movement and space lead me to explore alternative technologies to obtain the kind of fluid movement existing in living organisms, such as the chest raising and dropping during the act of breathing. Our human capacity of involuntary movement of our bodies as agents of delivering biological necessities is significant to our health. How are we affected by our visual and auditory sensorial perception by kinesthetic response to movement in our environments? And is it possible to create an environment that can have a subconscious effect on our state of mind and the decisions that we make? The following is a series of experiments and research I conducted recently in order to conclude a physical form of concept.

Movement + Body

Movement is by definition a change in position. The motion that is created through movement is often a displacement as it relates to velocity, acceleration and time. Movement related to the body comes from the conscious and the involuntary response reaction to action. “Capitalizing on recent investigation of neural networking and brain mapping, cognitive science demonstrates how our reality is not independent from our body’s sensory parsing of our environment, but is, in fact, constitutive of that reality itself.” [1] Our cognitive reality is by result what is perceived in the environment around us allowing for motor and sensorial response to occur. These responses affect our sense of reality, seeing is believing. Much of the nineteenth the belief was that the mind was the controller of the body and the body acted as a machine responsive to thought. However early neurologist have suggested that the process is in reverse, “the concept of power from is something acting on the body from the outside or above, like the mind, to something generated by the body itself.” [1] Concluding, our body has the ability to control our cerebral reality making reality a manifestation of sensory feedback.

Movement + Space

Space can be defined as a 'geometric' space or an 'anthropological' space. [2] An anthropological space is defined as an area in which some have journeyed through and thus creating a history and a footprint. The geometric space is undefined or without the substance, usually defining spaces such as meeting-rooms or airports. This abstract term of space can be applied to an area around the body, the body's environment. Our invested interest in a space is a result of whether there are emotional interactions and/or responses. A hybrid environment may be an alternative to the cold unrelatable, public space that currently bombard on daily lives. "The role of mood and motivational factors in influencing spatial perception, adding to the previous work showing that energetic potential can influence perception." [3] Provided that our spaces are intelligent, would the introduction of supportive technology assist in evolving the way humans interact with their environments?

Human Computer Interaction

Our interactions with computers are relatively a new experience in which we interface with magical screen and retrieve information and data immediately without needing to put on pants. This phenomenal computer revolution has broken down the persona of the evil computer age and many companies and engineers are

looking to push it even further through ubiquitous computing. Dam concludes in his research of user interface experience that,

"User interfaces will finally get out of their desktop metaphor, WIMP GUI rut and use much more natural and efficient interaction mechanisms and styles that take better advantage of our human capabilities, and indeed let us transcend them—prostheses for the mind, using our senses far more fully than is possible now." [4]

This realization of using more natural interactions when thinking about technology helped me shape *Fermid* into the kind of organic nature I wanted.

PRECEDENTS

While researching for inspiration for this project I found myself drawn to kinetic sculptures that moved and interacted with users. I found this interaction to be useful in grabbing the attention of an audience as well as drawing emotions from them with the experience of the space. One such example is *Metamorphosis Shimmer* (by Philips Design) (*Figure 1*). A dynamic space in which the walls are creating a transformative space in which asymmetrical forms are made as well as, air and light can play organically in the space. This beautiful interplay of kinetic architecture and organic forms and function really appealed to me and my aesthetic.



Figure 1

Secondly, I was inspired by the works featured in the Huffington Post written by Zakout ^[5] where he describes “parametric design is a method of intelligently designing architectural objects based on relationships and rules using the computer. These are defined in parametric software and are easily manipulated to quickly generate multiple iterations of the design in 3D.” Some of the work featured Son-O-House by NOX and Gunagzhou Opera by Zaha Hadid Architects (*Figure 2*).

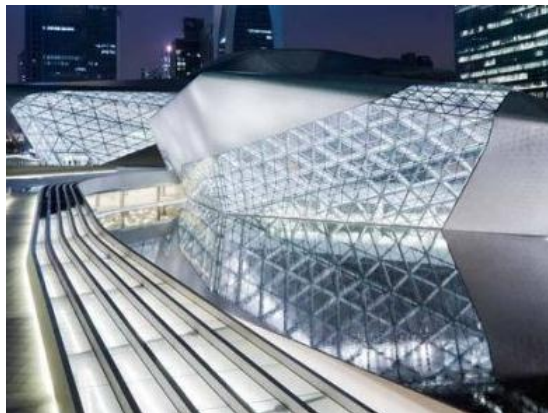


Figure 2

Finally, I was inspired by the paper circuit work coming out of the collaboration course offered this semester called Soft Circuit.^[6] As well as the incredible works by Richard Sweeney. ^[7] His work pushes the

boundaries of paper as a medium into the world of sculpture. *Figure 3*, is an example of the beautiful aesthetic quality that achieved through the use of this medium.

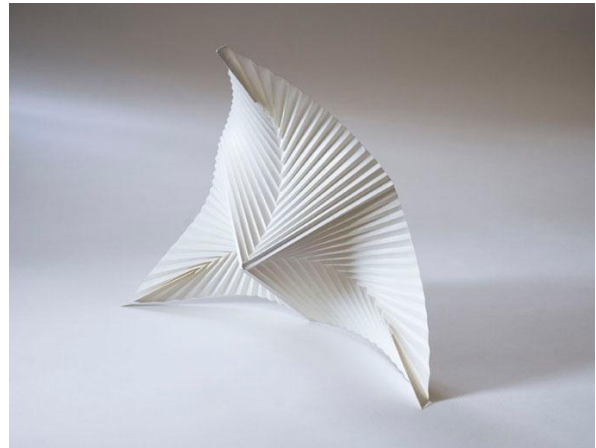


Figure 3

I found two key elements in design aesthetics continuously appear while researching, those being repetition and form. I am constantly attracted to the repetition of lines and shapes in a given form. I find there to be more drama and interest that is created when keeping these elements in mind. By utilizing parametric design techniques I was able to achieve this quality in my work. Additionally, a delicate fragile quality is gain through the use of paper as medium.

EXPERIMENTATION

My research in alternative technologies began with experimenting with memory alloys and polymers. I was interested in obtaining a natural movement that is found in organic living organisms, however this

movement is difficult to obtain with the greatest fluidity without the interrupting nature of embedded technology. Shape memory alloys (SMAs) are a composition of metals that can be one-way or two-way in memory. The memory form is set at a very high temperature and when heated again will return to that form. As the metal has cooled, the metal returns to the pliable relaxed state and allowed to be reshaped into a new form. Two-way alloys allow for both the cooled and heated states to be controlled and shaped. This metal is often used in industrial applications of medical and aerospace engineering. I was able to find product concepts of SMAs being used, however they are not realized working products (*Figure 4*).



Figure 4

However, the SMAs proved to be quite resistant to mold into the shape that I wanted them to form into. I was limited with the resources to really get the SMAs to function as I saw fit. In the image below, (*Figure 5*) I attempted to test to possibilities of

forming the SMAs through heating them inside an oven set to a temperature of 400°F (*Figure 6*).

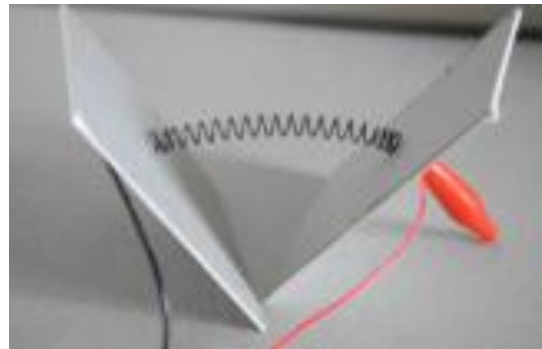


Figure 5



Figure 5

The memory alloys proved also to be very strong. With one .002_{um} wire I was able to pull more than three pounds of weight. (*Figure 6*) The alloys have strength much stronger than aluminum or plastic.



Figure 6

Through the experimentations I came to the conclusion that although the shape memory alloys were moving in the kind of fluid, organic manner that I wanted to achieve, they would prove to be unrealistic in obtaining the large movement that I would need in a large scale sculpture form.

PROTOTYPES

As a result, I decided to use simple servo motors and a programed Arduino to design the movement of the sculpture. Additionally, I added an IR proximity sensor so that the movement will be triggered by the presence of a viewer below. (*Figure 7*)

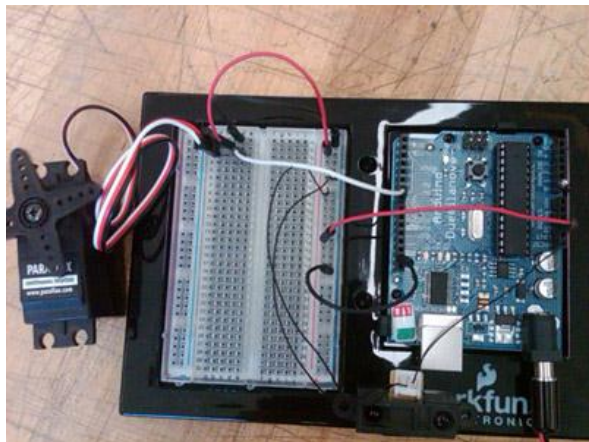


Figure 7

Inspired by the parametric designs from earlier, I decided to create my own shapes and devise my own parametric shape. (*Figure 8*), the paper pieces are all linked and waiting on the table to be assembled. One of my early prototypes, I linked a few of the pieces from the back and pulled on them using a thread. (*Figure 9*)



Figure 8

When linked together, these individual pieces fold into one another giving a beautifully organic scaling effect that I had unintentionally stumbled on. The shape reminded me of the forms found in nature, such as pine cones and underwater plantations (*Figure 9+10*).



Figure 9



Figure 10



Figure 11



Figure 12

My earlier prototype (*Figure 11, 12*) deemed the IR proximity sensor to be irrelevant and unnecessary. I was able to get the kind of kinesthetic sensorial response from viewers with the motion occurring independent of any sensor. I created a sketch of the prototype as it would relate to a larger scale ceiling installation that would breathe and move according to random variables set by the software. In *Figure 13*, you can see that the installation would be immersive and engulfing the viewer in an organic world that would inspire emotions of fear and curiosity. Yury Gitman, my studio professor suggested the addition of lights as a way of

accenting the beautiful *petals* that the paper pieces were creating.



Figure 13

Finally, the prototype was refined with the appropriate changes allowing for the movement to take center stage as it captures the viewer.



CONCLUSION

After some user testing, it was apparent to me that the kinetic sculpture was a success in giving the user the sensorial experience, as well as the attracting nature that I was aiming to achieve. Many of the viewers were amazed at how calming viewing the motion was to them. While others were more drawn to the texture of the parametric design and had the desire to go near and touch the surface.

My aim with *Fermid* is to inspire for more architectural archetypes to be created to form an environment that promotes emotional response that allow for individuals to become more open and relaxed in this threatening environment that is our world today.

ACKNOWLEDGEMENTS

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Video of *Fermid*:

<http://vimeo.com/23731090>