# GLITTERING MACHINES

PAUL MYODA

2008 — 2013

This is dedicated to Jake Mills,
the hardest thinking man in Alamance county.

# PROLOGUE

Picture yourself in the warm waters of a tropical bay at night, stars towering over your head. Something in your periphery catches your attention, a swoosh of light, a bright splash, and it’s gone. Run your hands through the water, and your fingers are revealed as dark silhouettes outlined by quiet blue halos, like so many comets’ tails. Look closer, the star field is in your palms, billions of points of light.

You close your eyes, but the insides of your eyelids explode with white noise, phosphenes slipping away from your direct focus, waves of vertigo growing stronger in amplitude, closer in frequency, you suspect it might be time to find solid ground...

# CONTENTS

# BIOLUMINESCENCE

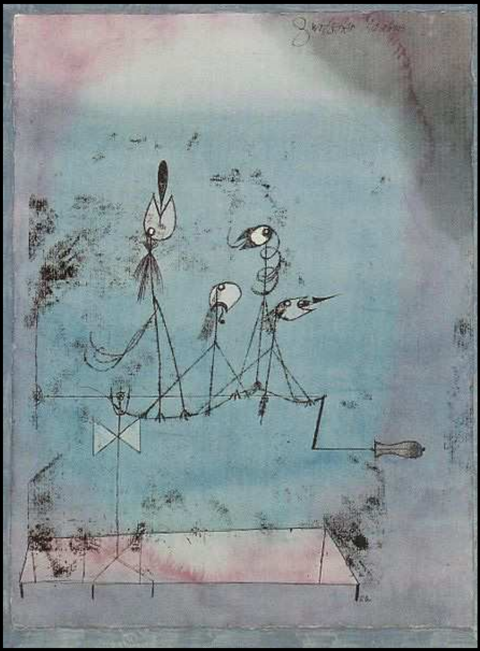
I'm fascinated by bioluminescence—the ability of natural organisms to create light. As a child I'd chase fireflies around the neighborhood, catching them in jars to make organically powered lanterns. I was always sad when their lights went out; not only was their light-emitting chemical energy spent, but that also usually meant I had to go in for the night. The arrival of my bedtime was good news for the fireflies, for little did I know that I was disrupting an elaborate mating ritual—the male shows off his reproductive fitness with the intensity and duration of his illumination, and the female signals her interest by turning her lights on.

The experience of swimming in a bioluminescent bay also made a deep impression on me. The organisms in this case were marine plankton, a colony of single-celled dinoflagellates. These organisms create light when agitated, and so cause a startle response in their predators (copepods). These lights also serve as a burglar alarm, and attract a secondary predator (fish) to come and eat the dinoflagellates' foe.

There are many mysteries associated with bioluminescence, but it is clearly associated with a wide range of functions, both offensive and defensive, attention-seeking and camouflaging. For this reason bioluminescence has been my artistic muse, providing a rich set of analogies—a biomimetic frame of reference—for interactive sculptures. Another reason is more obvious: bioluminescent organisms create some of the most spectacular, awe-inspiring and sublime visual displays under our sun.

They turn my lights on.

# GLITTERING MACHINES



Paul Klee
TWITTERING MACHINE
1922

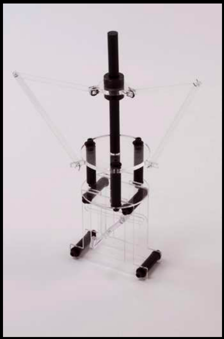
In 2008, I began a new body of work and gave it a name—*Glittering Machines.* This name was inspired by a small watercolor by Paul Klee that I admire because of its strong suggestion of interactivity with the viewer, and the relationship it sets up between sound and form. Klee's painting is titled *Twittering Machine* and I think its strength has to do with synesthesia, the condition in which stimulation in one sensory pathway leads to automatic experiences in a second sensory pathway. Klee's painting causes us to hear what is shown, and in so doing underscores a sense of time within the experience of the work. This sense is further suggested by the hand-crank driven mechanical apparatus, poised as if awaiting the viewer's interaction.

While Klee's painting works on a representational level, I wanted my *Glittering Machines* to physically come alive, to both trigger and provide different sensory experiences, and to be literally responsive to their viewers in real-time, actual spaces. This book is a document detailing the steps and context for the creation of this body of work.

There are five groups of *Glittering Machines,* members of an extended family. Each *Glittering Machine* is comprised of components from three interconnected sculptural systems:

1) Structure & Kinetics, 2) Light & Shadow, 3) Interactivity

Modular structure based on hexagon

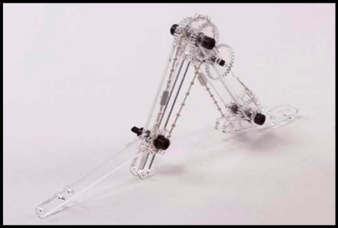


*Kinetic design:* umbrella with scotch yoke

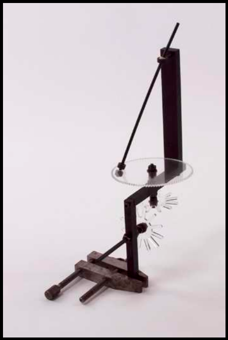
## Structure & Kinetics

When I finally did go indoors as a child, I spent countless hours in the middle of a pile of LEGOs. I suspect I came to understand more about engineering and physics from my (seriously) playful explorations with LEGO than I did in subsequent classes in school. This construction set has been with me ever since, and during graduate school I began to think about developing my own modular set of sculptural components. I embraced various 2D and 3D computer design applications, but was always stumped by how to get from the screen to a satisfying material manifestation. I settled by designing on the computer and then using a number of traditional fabrication techniques to make things in three-dimensional form.

In the last decade, more affordable computer numerically controlled (CNC) manufacturing technologies have become available, such as waterjet and laser cutting, and 3D printing. Again I feel like a child in the middle of a pile of pieces and parts, but now these are things that I both designed and created.



*Kinetic design:*
geared linkage with
beadchain pulleys



*Kinetic design:*
spider gears and
ball joint linkage

*Kinetic design:*
armillary sphere

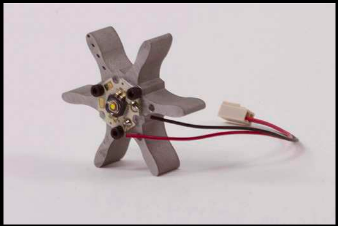
To date, however, I have yet to make a single piece that works in more than one sculpture—and so realize even more just how brilliant LEGO is. Instead, I have developed a system of construction and attachment logic. In effect, each work is a customized example of this structural system.

My structural system is based on the hexagon (6 sides) and the icosahedron (20 faces). The hexagon allows the static associations of the grid to be broken, and the icosahedron offers a greater number of axes than a cube would allow while still providing a rigid structure. This system works modularly, insofar as different components can be designed to work together with a certain speed and predictability. Components can also be aggregated to create compositions with greater degrees of complexity, and resized to different scales, from the tabletop to the human-sized.

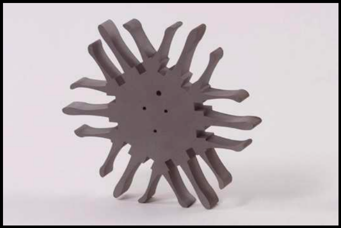
While all of the *Glittering Machines* are mounted to walls or tethered to the ceiling, many of them include mechanisms to create physical, or kinetic motion. I typically imagine a motion, or a gesture that I'd like to emulate, and then search the history of various fields, such as clock making, steam engine, automata, tool, or product design, to find machine elements that can be reproduced and customized for my purposes. These are kept as simple as possible, and also made visible and part of the sculpture's composition. Electromechanical processes are avoided when possible.

## Light & Shadow

High power LEDs



High power LED
mounted on heat sink



LED heat sink

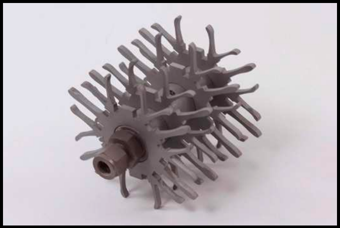
Just as the system for *Structure and Kinetics* gives shape and form to *Glittering Machines,* so does the system of *Light and Shadow.* Here, the shape and form is transitory, illusive and incorporeal; strictly speaking, it is electromagnetic radiation, or its absence.

High power LEDs are used to emit light from within each sculpture. This is a rapidly changing technology, with new models continually being developed and brought to market.

I first used LEDs in sculptures 20 years ago, because they were inexpensive, low profile, battery powered, and most importantly, they did not get too hot (the sculptures were made from paper). When I began researching LEDs for *Glittering Machines,* I was surprised by how much the technology had changed. High power LEDs get incredibly hot, but this is not because they are inefficient—they are at least an order of magnitude more efficient than incandescent bulbs—it is because they are so powerful. I soon realized that I needed to design heat sinks into my sculptures to prevent catastrophic consequences. Initially, I believed that I had to negotiate between opposing criteria to optimize either an engineering function, i.e., heat dissipation, or aesthetic considerations. However, I quickly realized both were possible if the structure of the LED mount is construed as but another modular component rather than something to be hidden.

LEDs in
icosahedron structure

Lasercut and thermobent
acrylic lenses



Fiber optic illuminator

By situating high power LEDs within an interactive circuit, a number of different light effects can be programmed, such as intensity, pulsing, and flashing. By combining more than one color of LED, a number of different hues and color temperatures can also be generated.

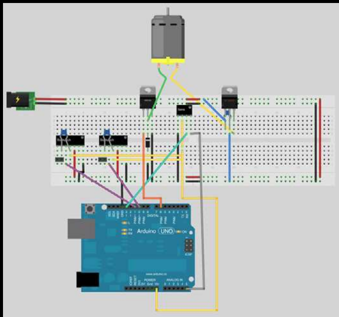
In addition to the number, placement and programming of these lights, light is also shaped by directing it through cut and thermobent transparent and etched acrylic shapes. Informed by the basic principles of optics, such as reflection, refraction and interference, these shapes act as lenses that project, redirect, or occlude light emissions in controllable, i.e., sculptural, ways.

## Interactivity

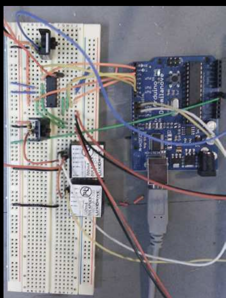
Like the great Pygmalion myth, I have always yearned to breathe life into my sculptures, situate them within narratives, or imbue them with force fields that are revealed only through interaction. The growing discipline of *physical computing* has allowed me to take steps in these directions.

Physical computing explores different ways to input information into a computer, i.e., with motion, light, temperature, or touch sensors, etc., and then different ways a computer can output reactions, i.e., with motion or with lights and sounds, etc.

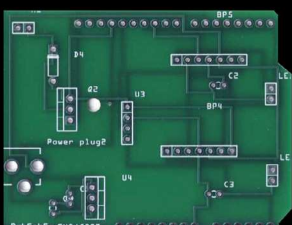
Every space and object has the potential to become interactive within the realm of physical computing, and every physical attribute has the potential to be integrated into a system of interface.




Circuit design



Breadboard
with Arduino
microcontroller




Custom printed
circuit board

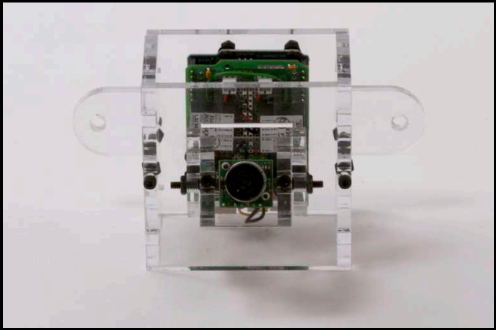
To achieve this dynamic, I use Arduino microcontrollers and programming language. The electrical circuits designed to date integrate all of the aforementioned systems within a set of interactive parameters. For instance, a viewer will enter a darkened gallery space and see a gently pulsing pale blue light. As they approach, the light becomes brighter, and begins to blink a bit quicker. If the viewer continues to approach and arrives directly in front of this light, a scissoring arm will extend towards the viewer's face, and blindingly intense hot colored light will start strobing quicker and quicker, brighter and brighter, until the viewer moves back and away, at which time the sculpture's arm will cautiously retract, the lights will dim, and the pulsing pale blue light will gently return.

To unpack the steps of this interaction: this circuit is made up of a stepper motor to extend the scissoring arm, a small 5mm cool white LED, a series of three high power hot white LEDs, an ultrasonic sensor that can register the exact distance of a viewer, and a microcontroller programmed to run the aforementioned interaction.

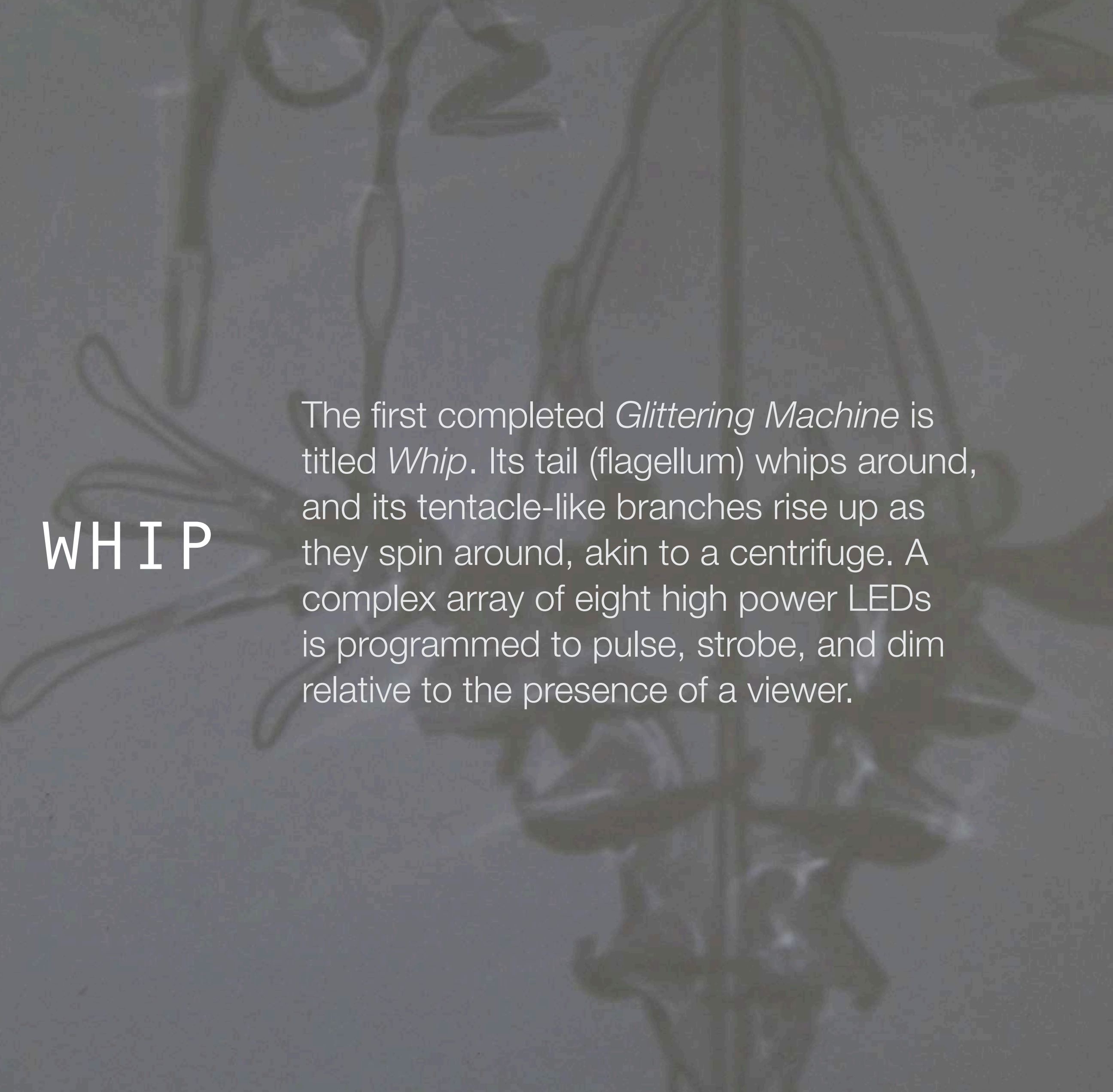
In addition to having different structures, motions, lights and lenses, all of the *Glittering Machines* have different circuits and coding, giving each sculpture a different interactive potential or behavioral attitude. These attitudes range from predictability to spontaneity, the propensity to attract or repulse a viewer, and that to camouflage or reveal.

In the future, I will continue to develop more complex interactions, not only between a viewer and a *Glittering Machine,* but between the *Glittering Machines* themselves, so making them aware of one another.

I envision cross-breeding them to create offspring both better adapted to the jobs I ask them to perform, but also monstrously mutated, with unimagined trajectories and life stories outside of my control.

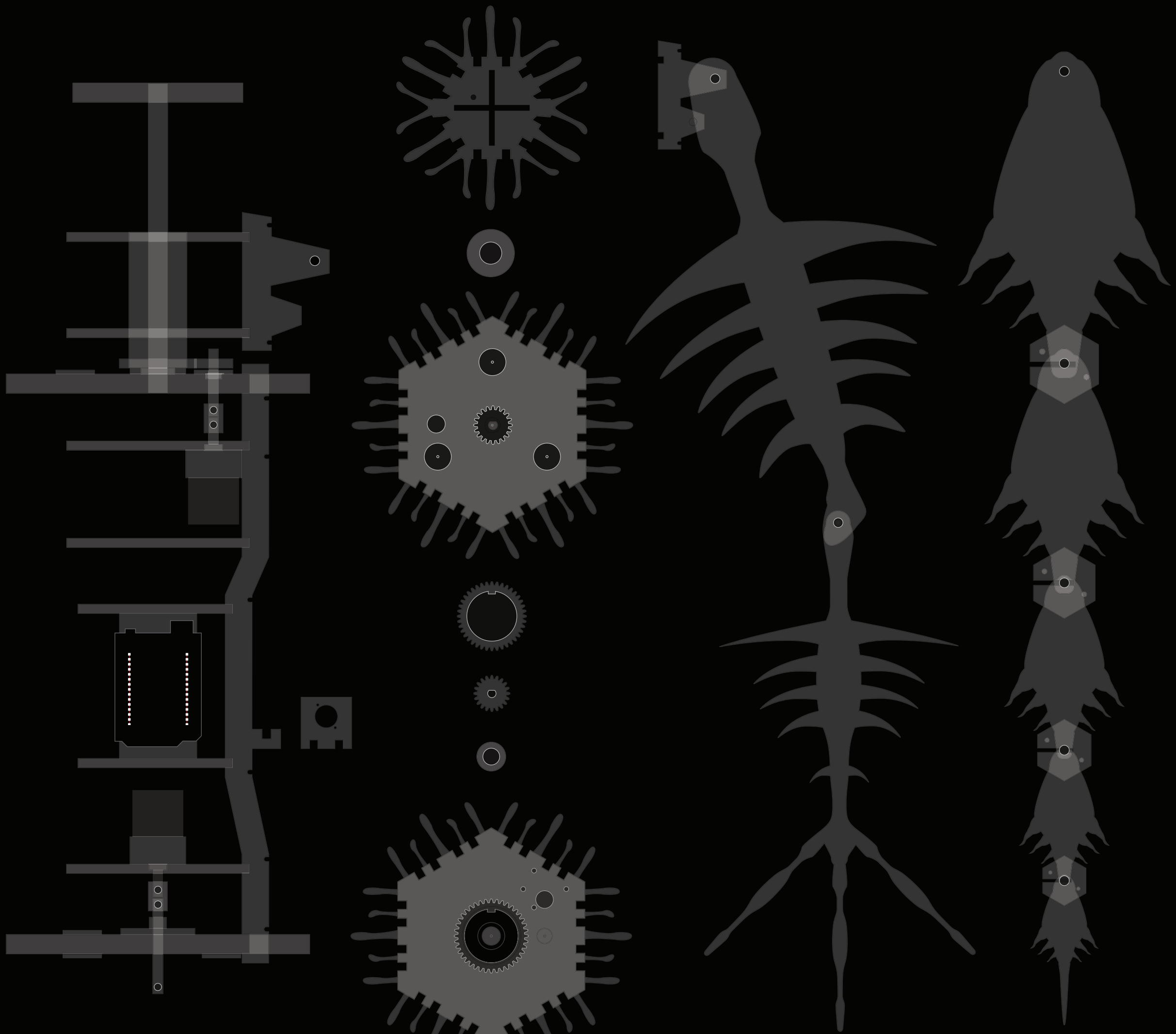


Circuit with ultrasonic sensor and microcontroller in wall mount



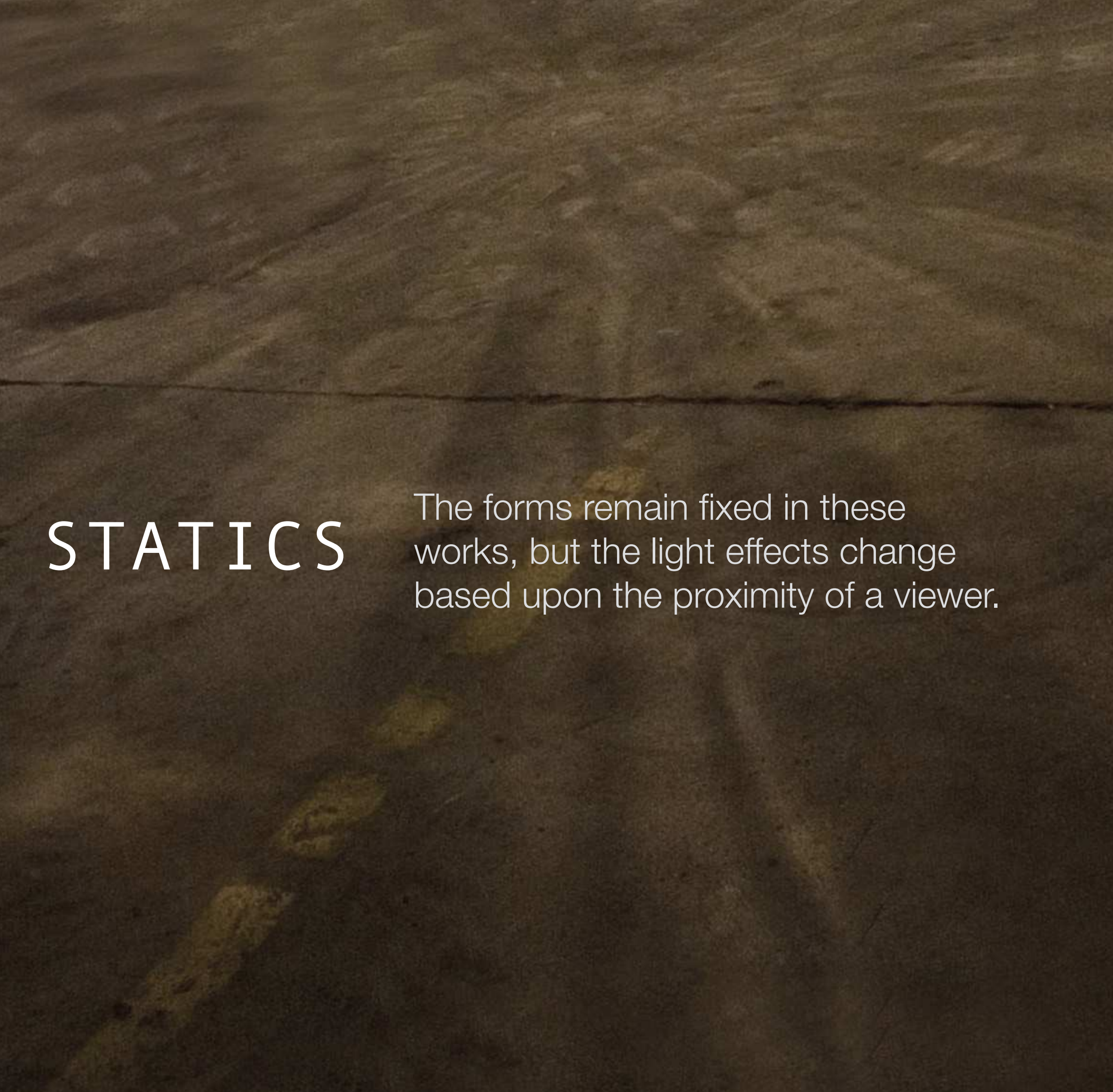
# WHIP

The first completed *Glittering Machine* is titled *Whip*. Its tail (flagellum) whips around, and its tentacle-like branches rise up as they spin around, akin to a centrifuge. A complex array of eight high power LEDs is programmed to pulse, strobe, and dim relative to the presence of a viewer.



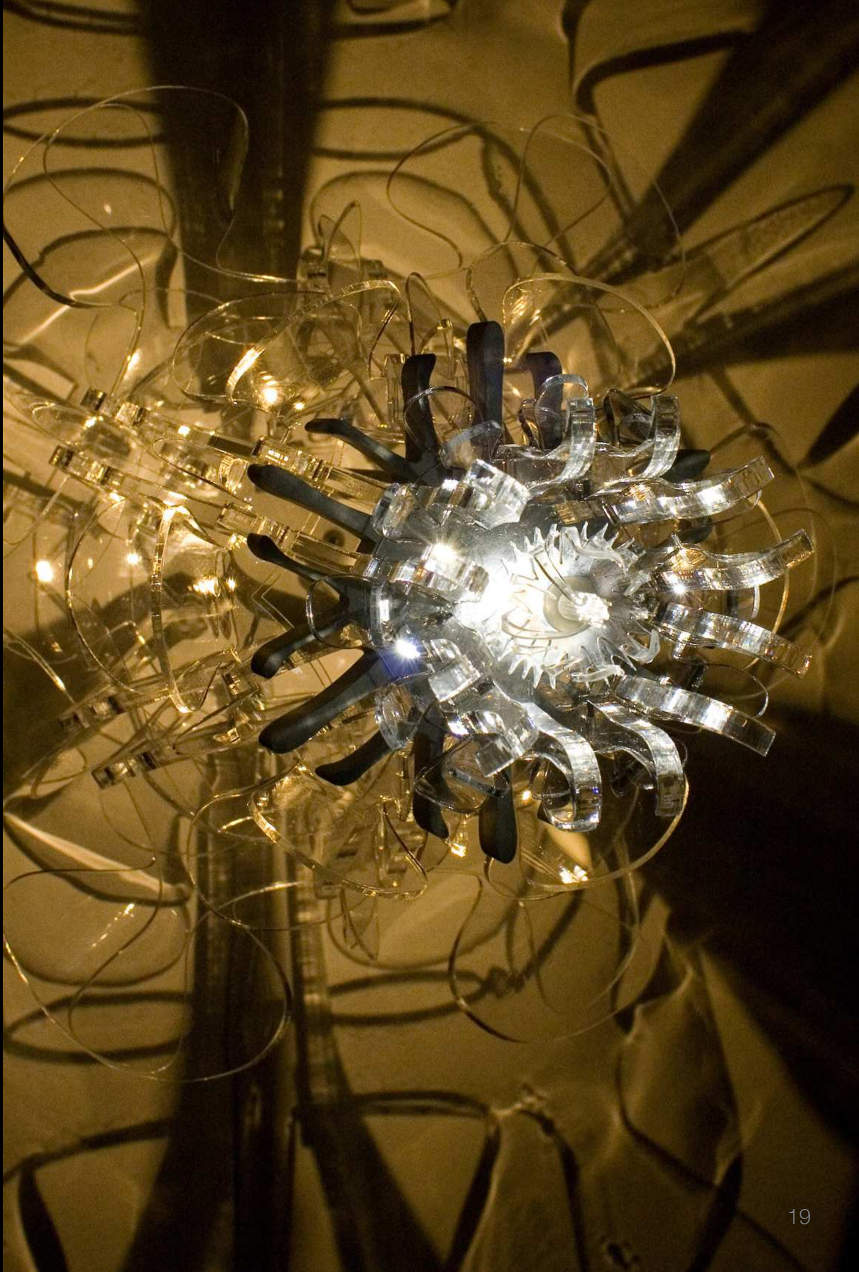
GLITTERING MACHINE Design: WHIP, 2009

**WHIP**, 2009
Aluminum, thermoplastic,
high power LEDs, motors,
microprocessor, circuit
6' x 5' x 5'

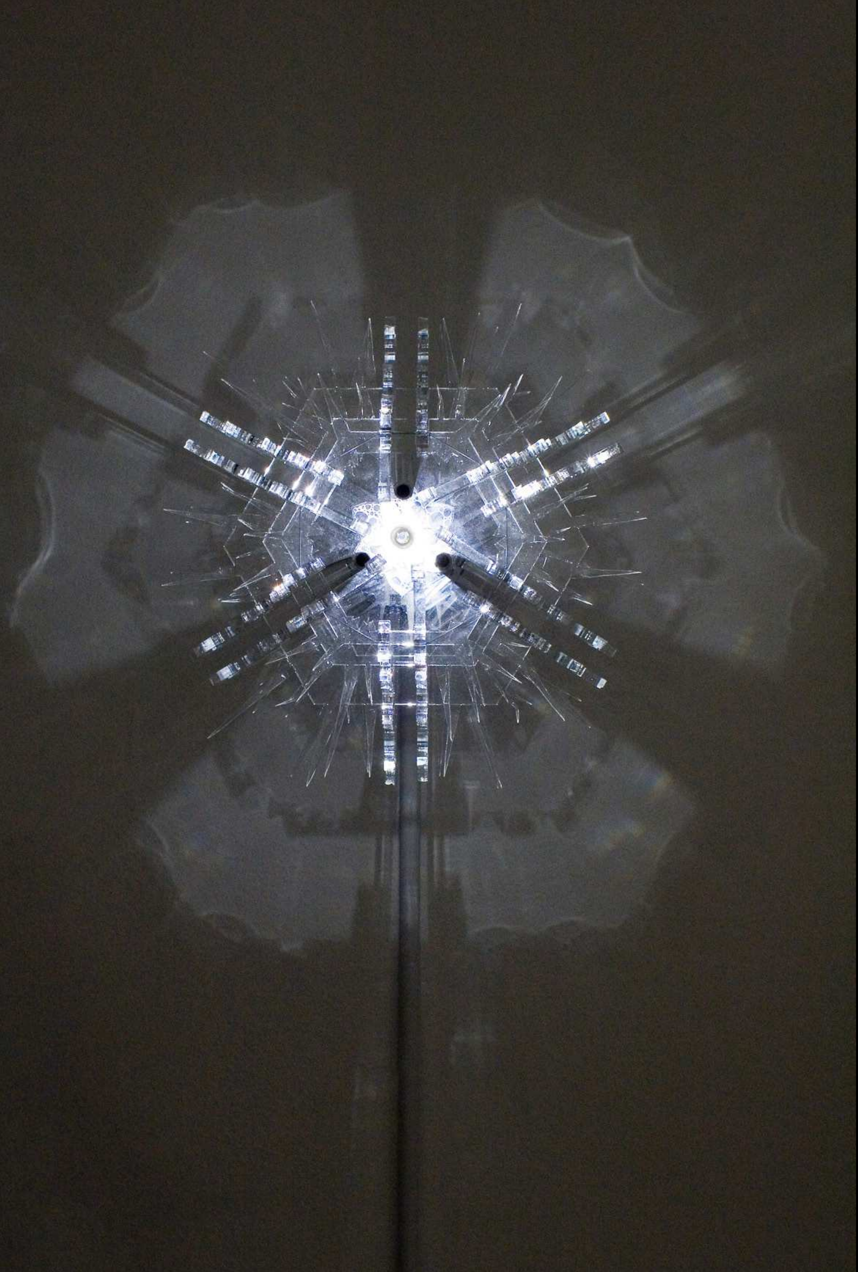


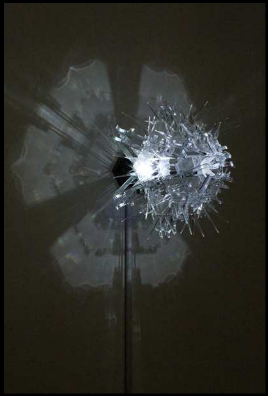
# STATICS

The forms remain fixed in these works, but the light effects change based upon the proximity of a viewer.

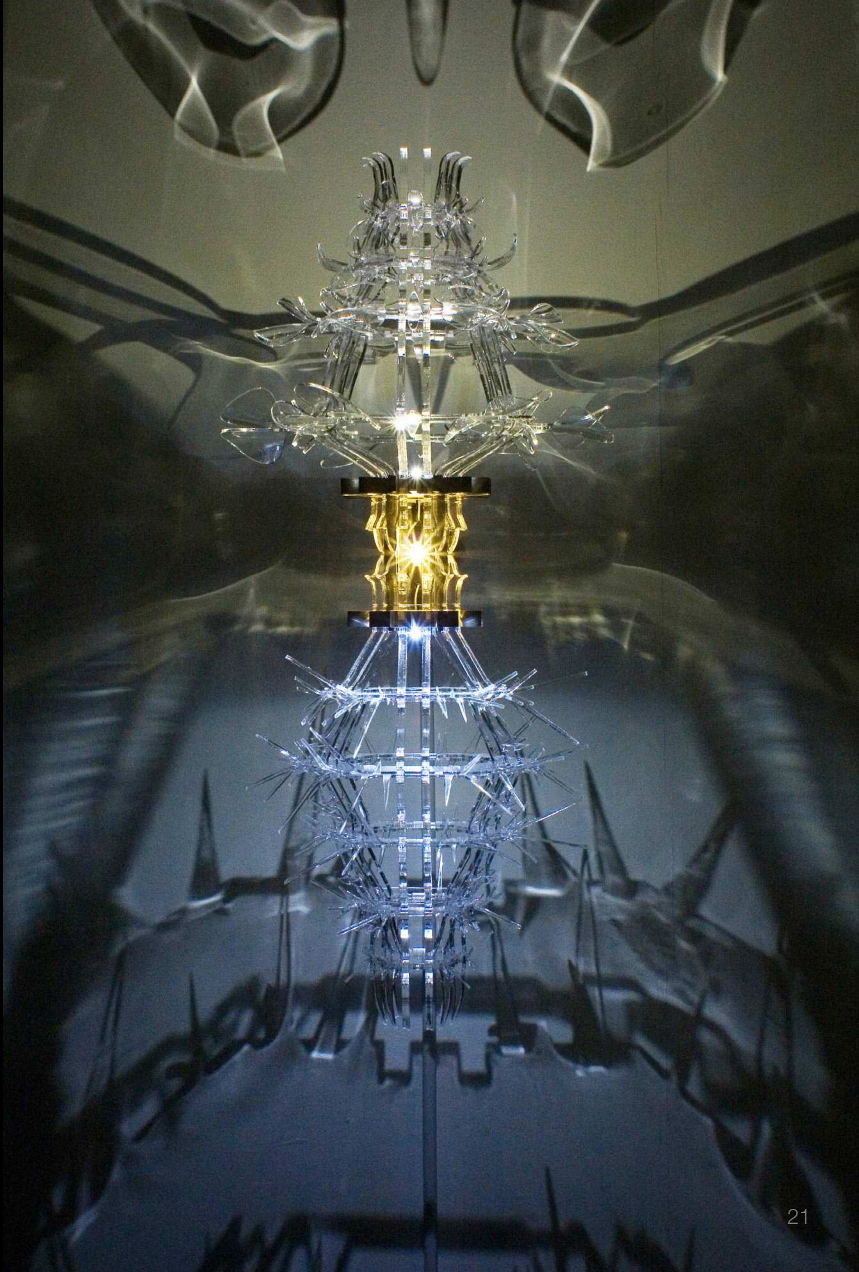


BILLOWY SCONCE, 2010
Aluminum, thermoplastic,
high power LEDs,
microprocessor, circuit
12” x 12” x 14”

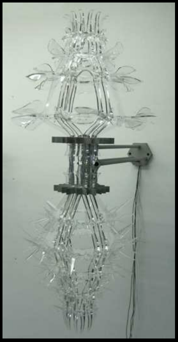


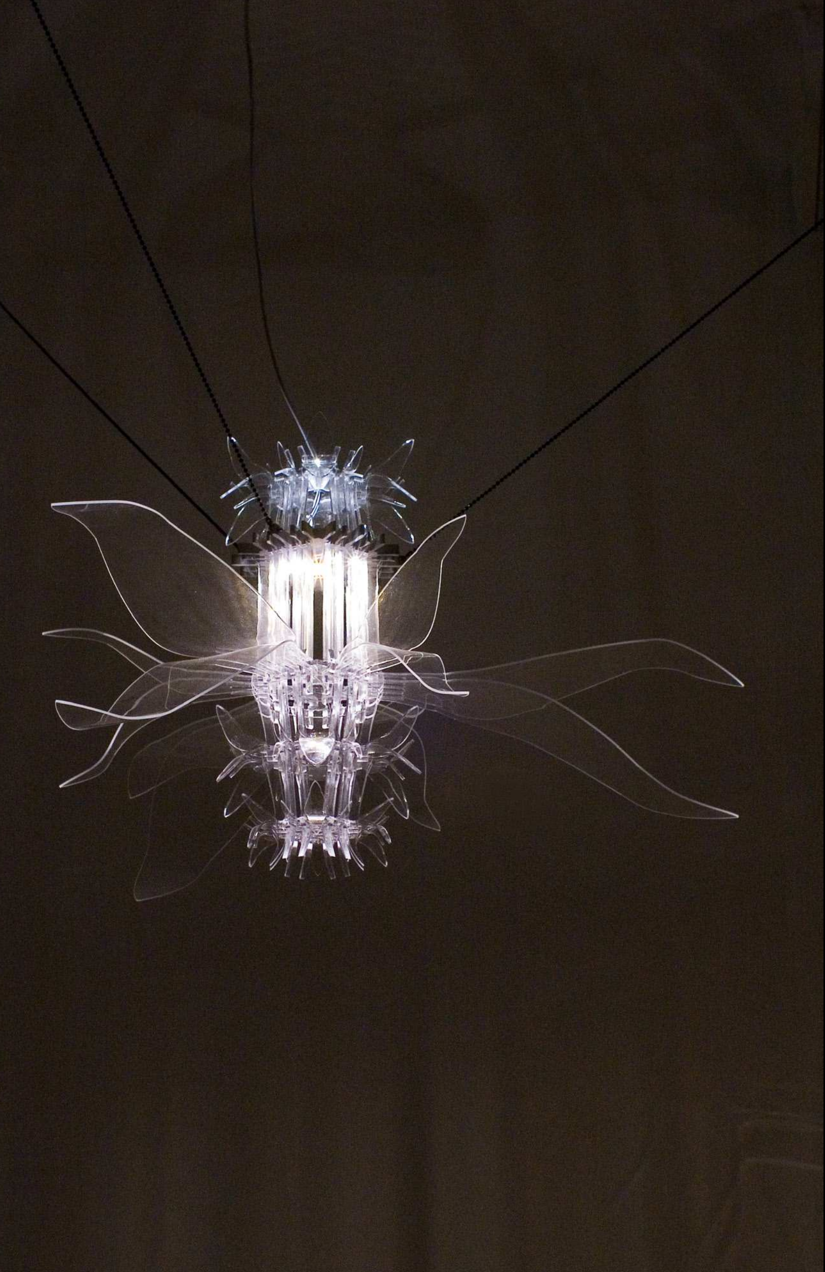


THORNY SCONCE, 2010
Aluminum, thermoplastic,
high power LEDs,
microprocessor, circuit
12” x 12” x 14”



DOUBLE SCONCE, 2010
Aluminum, thermoplastic,
high power LEDs,
microprocessor, circuit
30” x 12” x 20”

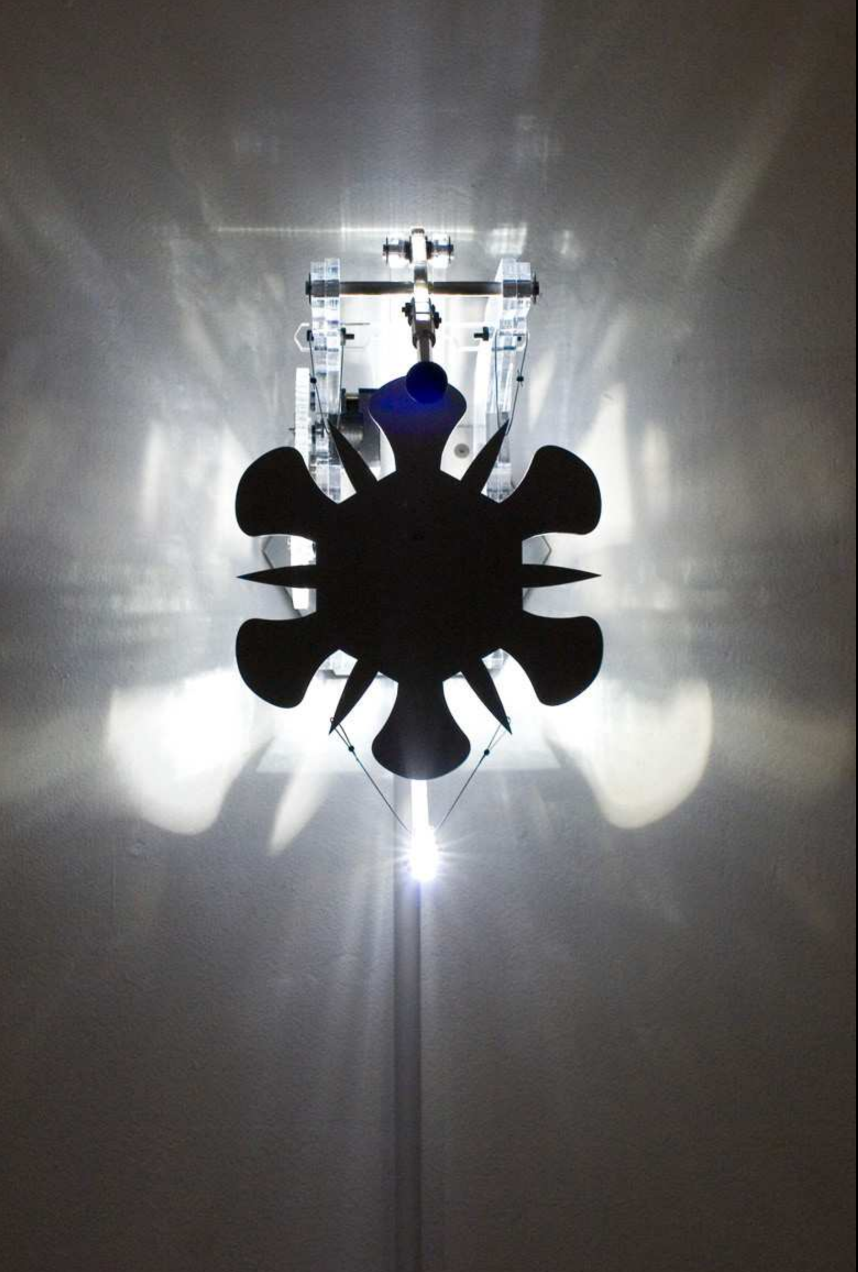




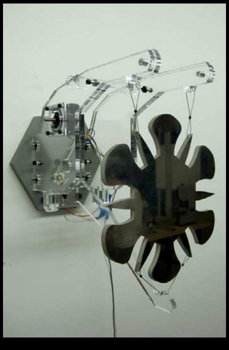
**CHANDELIER**, 2010
Aluminum, thermoplastic,
high power LEDs,
microprocessor, circuit
30” x 12” x 20”

# KINETICS

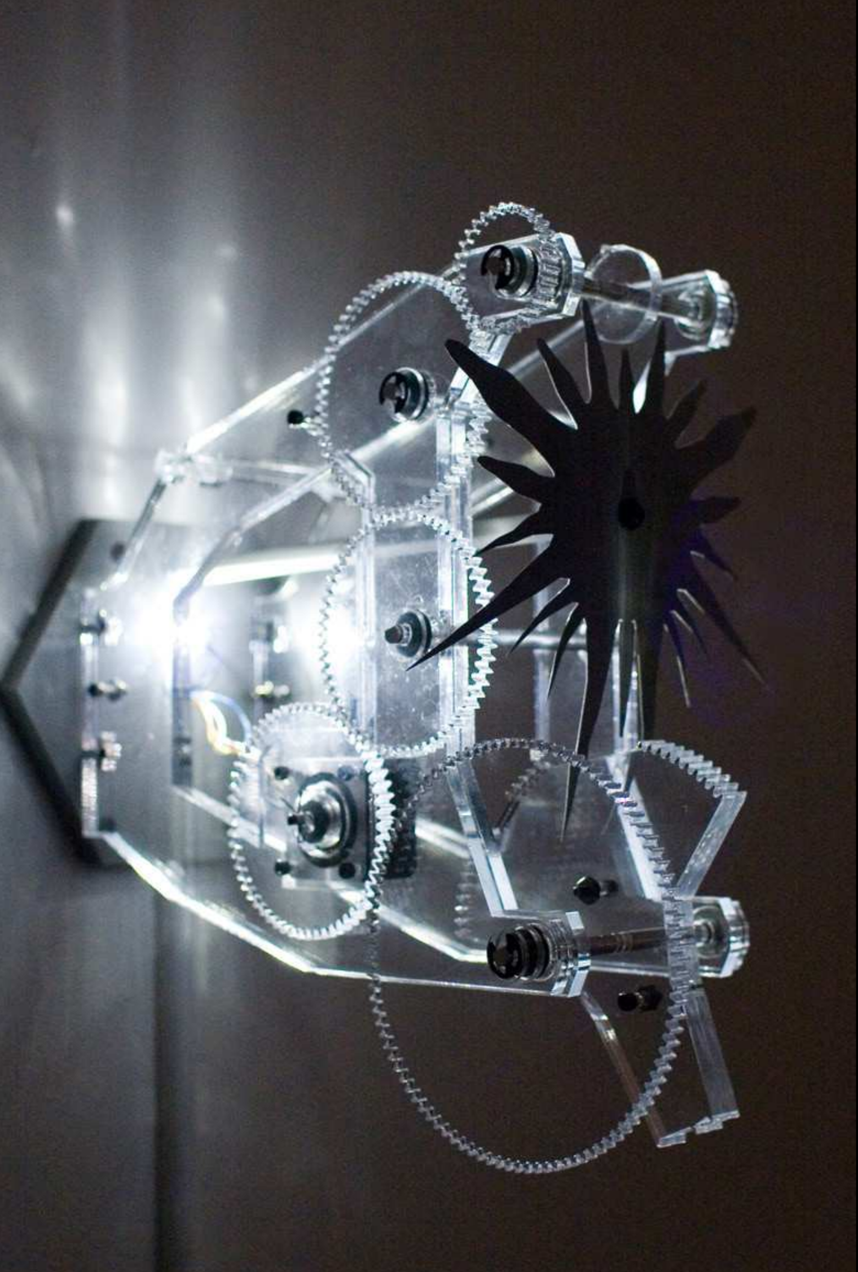
In these works not only do the light effects change, but there is a mechanized motion and a sounding element, such as a chime, bell, ratchet or drum, that also moves when struck, producing vibrating patterns of light and shadow on the walls.



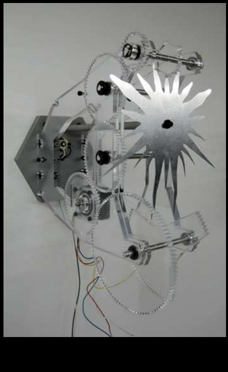
BELL #1, 2010
Aluminum, thermoplastic, wood, high power LEDs, motor, microprocessor, circuit
12” x 12” x 14”



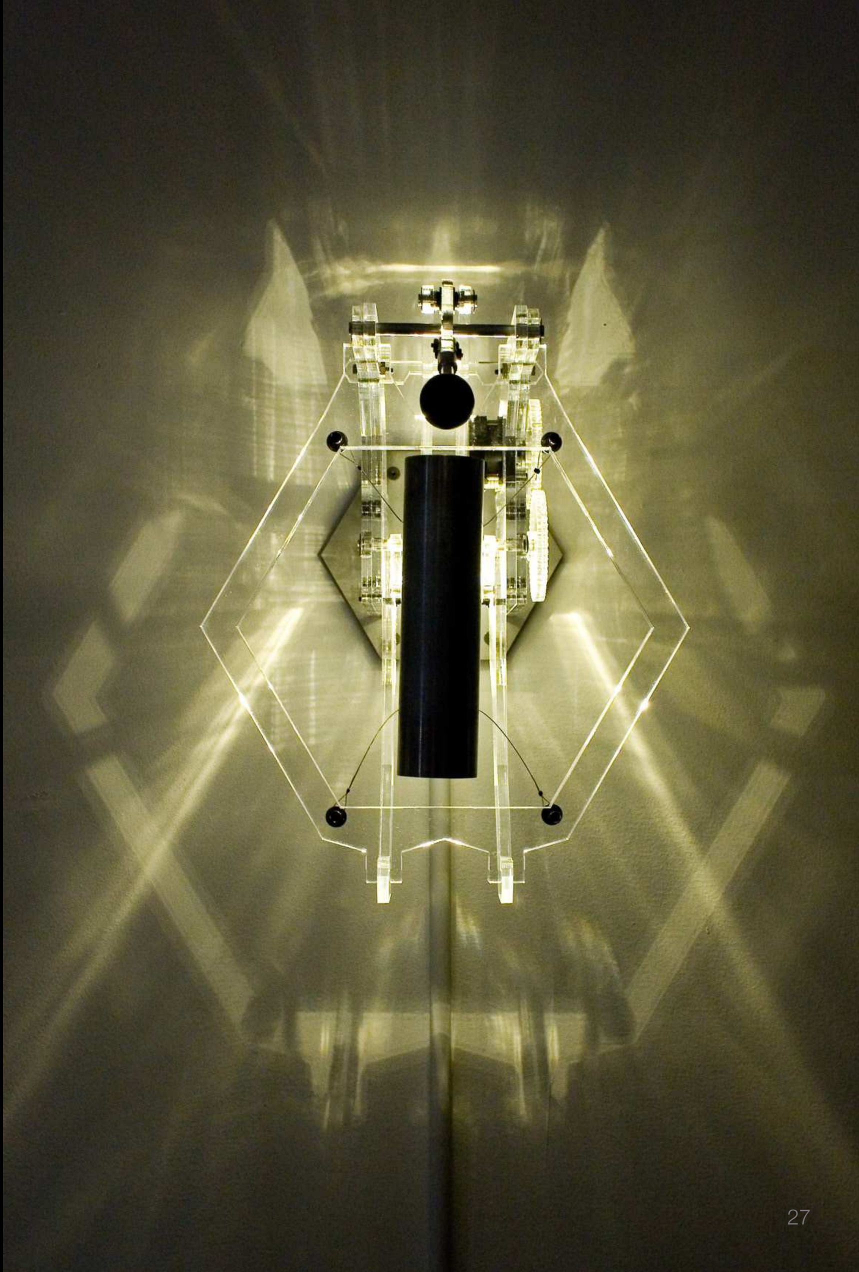
**DRUM #1**, 2010
Aluminum, thermoplastic, rubber, high power LEDs, motor, microprocessor, circuit
12” x 12” x 14”



RATCHET #1, 2010
Aluminum, thermoplastic, high power LEDs, motor, microprocessor, circuit
12” x 12” x 14”



**CHIME #1**, 2010
Aluminum, steel,
thermoplastic, rubber, high
power LEDs, motor,
microprocessor, circuit
12” x 12” x 14”



GLITTERING MACHINES: Installation views
Dorsch Gallery, Miami, FL, 2011

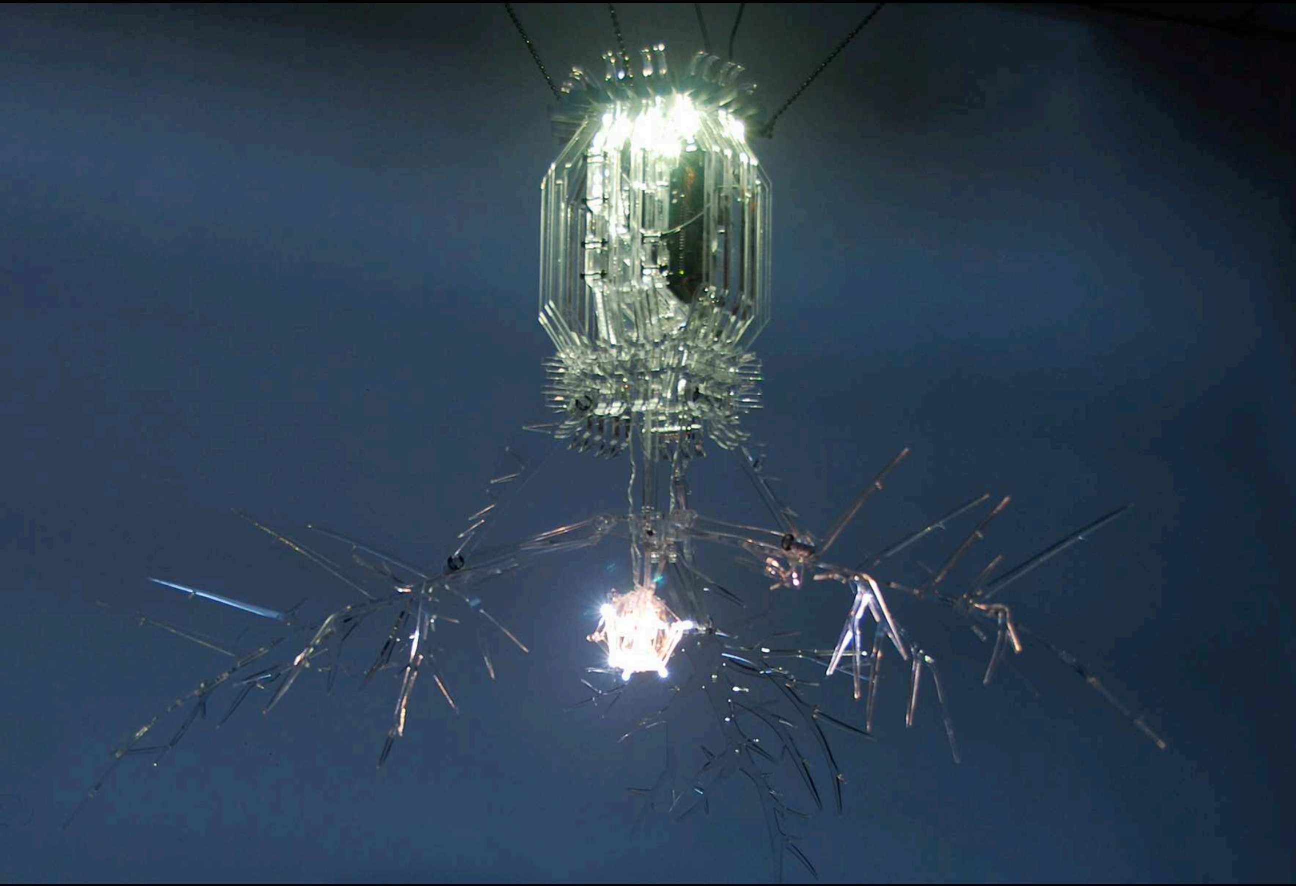
# PERSONALITY DISORDERS

After a number of *Glittering Machines* reliably worked, I asked what kind of work should the next ones do?

During the design and fabrication processes, I had become aware of how catastrophic a line of bad code, an open circuit, or a loose connection could be. But when it was fixed, all of that technology disappeared—and in large part, this was my intention.

I wondered if this isn't happening on a much larger scale, if we are becoming complacent and unreflective with respect to technology's impact on our consciousness. Perhaps we only notice these implications when our technologies fail us. Therefore, I decided to design failure into this series of sculptures from the outset. I drew inspiration from several clinically defined *Personality Disorders (PDs)*, which are a class of personality types that deviate from social expectations in distressing or disabling ways. The sculptures each manifest some aspect of a personality disorder, in both their sculptural forms and their behaviors.

PARANOID PD *is overly protective of itself, hyper-vigilant, and suspicious of others*

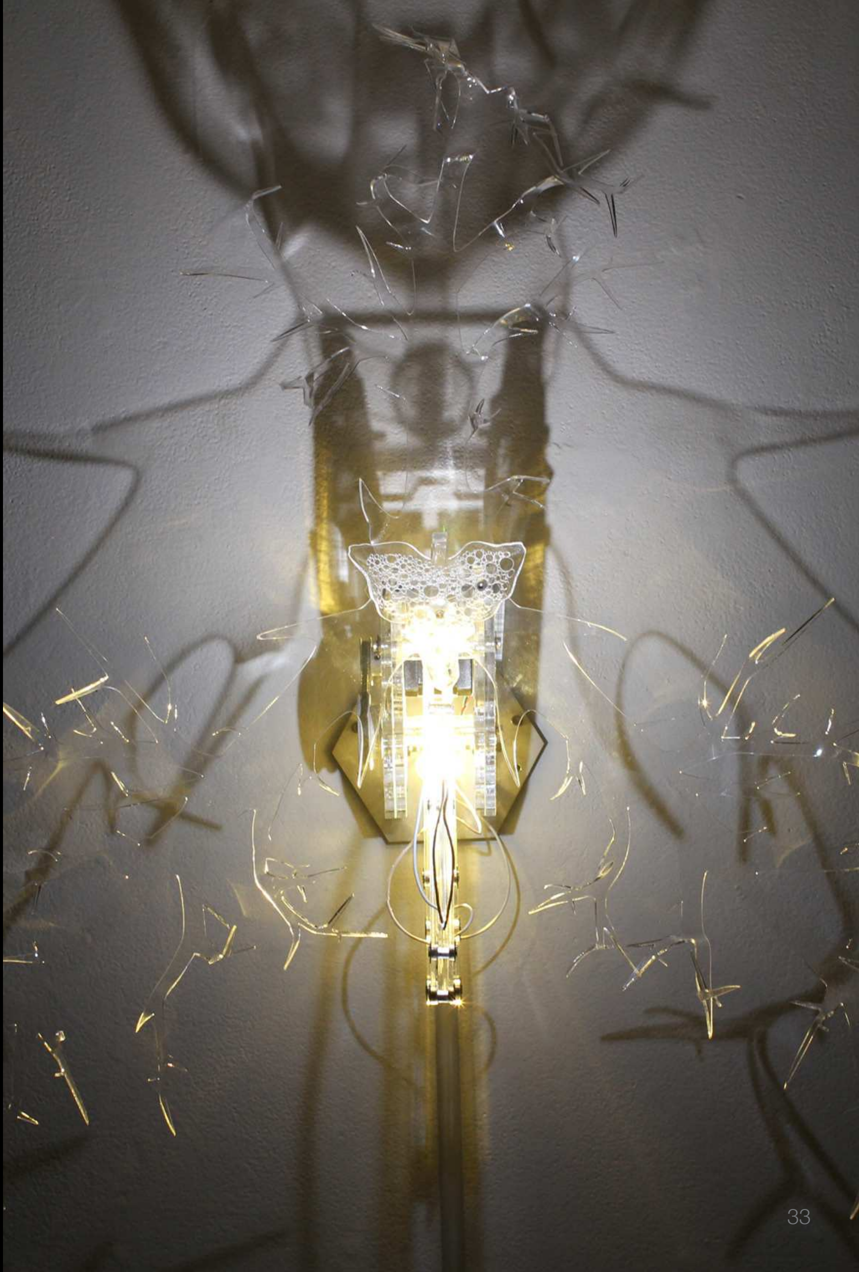


PARANOID PERSONALITY DISORDER, 2011
Aluminum, thermoplastic, high power LEDs, stepper motor, microprocessor, circuit
26” x 40” x 40”

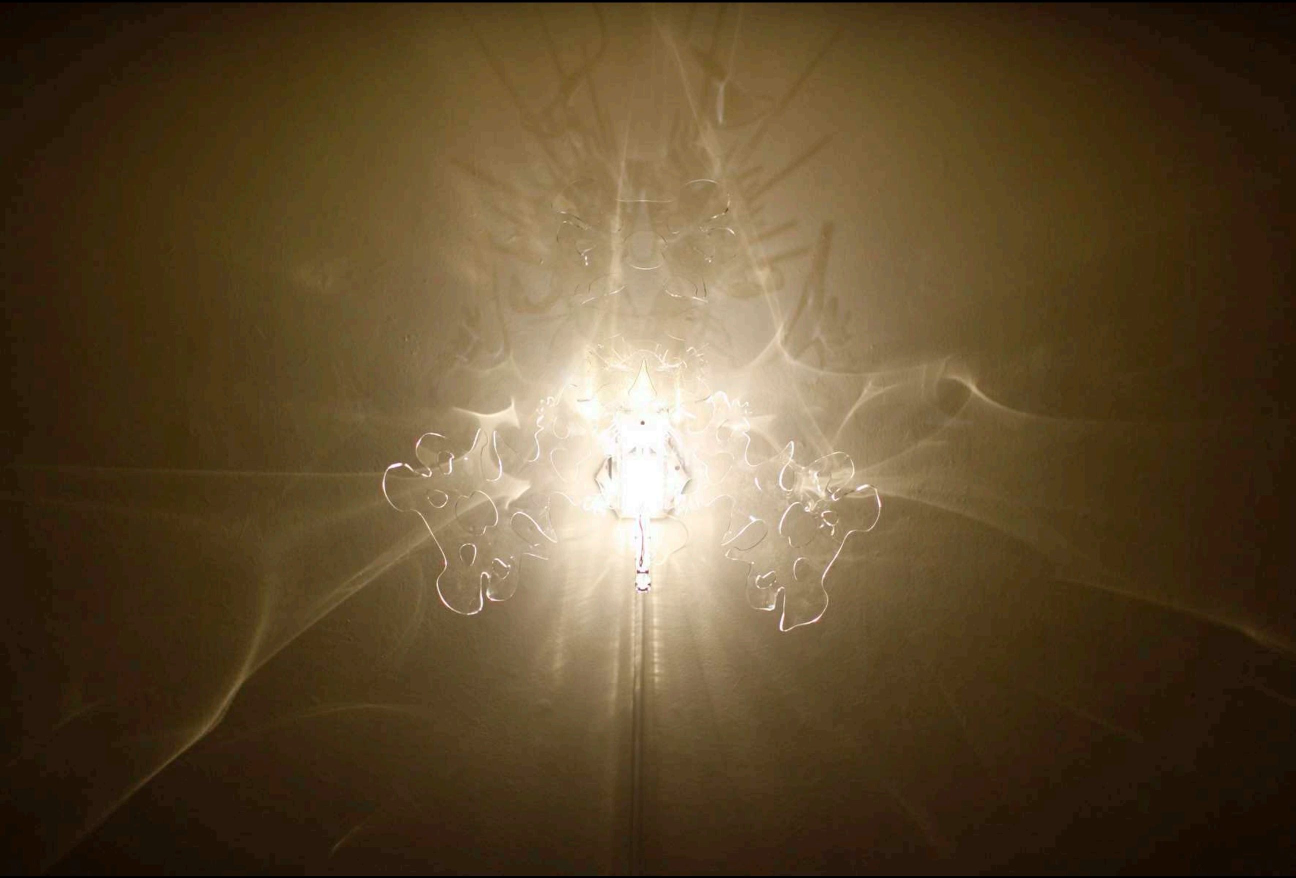

APPROACH
CLOSE branches quickly
OFF fruit lights
ON top lights
ON branch lights
CLOSER
OPEN-CLOSE branches
PULSE fruit lights
PULSE top lights
PULSE branch lights
CLOSEST
CLOSE branches
STROBE fruit lights
STROBE top lights
STROBE branch lights

# BORDERLINE PD
*is unstable, reactive and impulsive*

BORDERLINE PERSONALITY DISORDER #1, 2011
Aluminum, thermoplastic, high power LEDs, stepper motor, microprocessor, circuit
26” x 26” x 22”

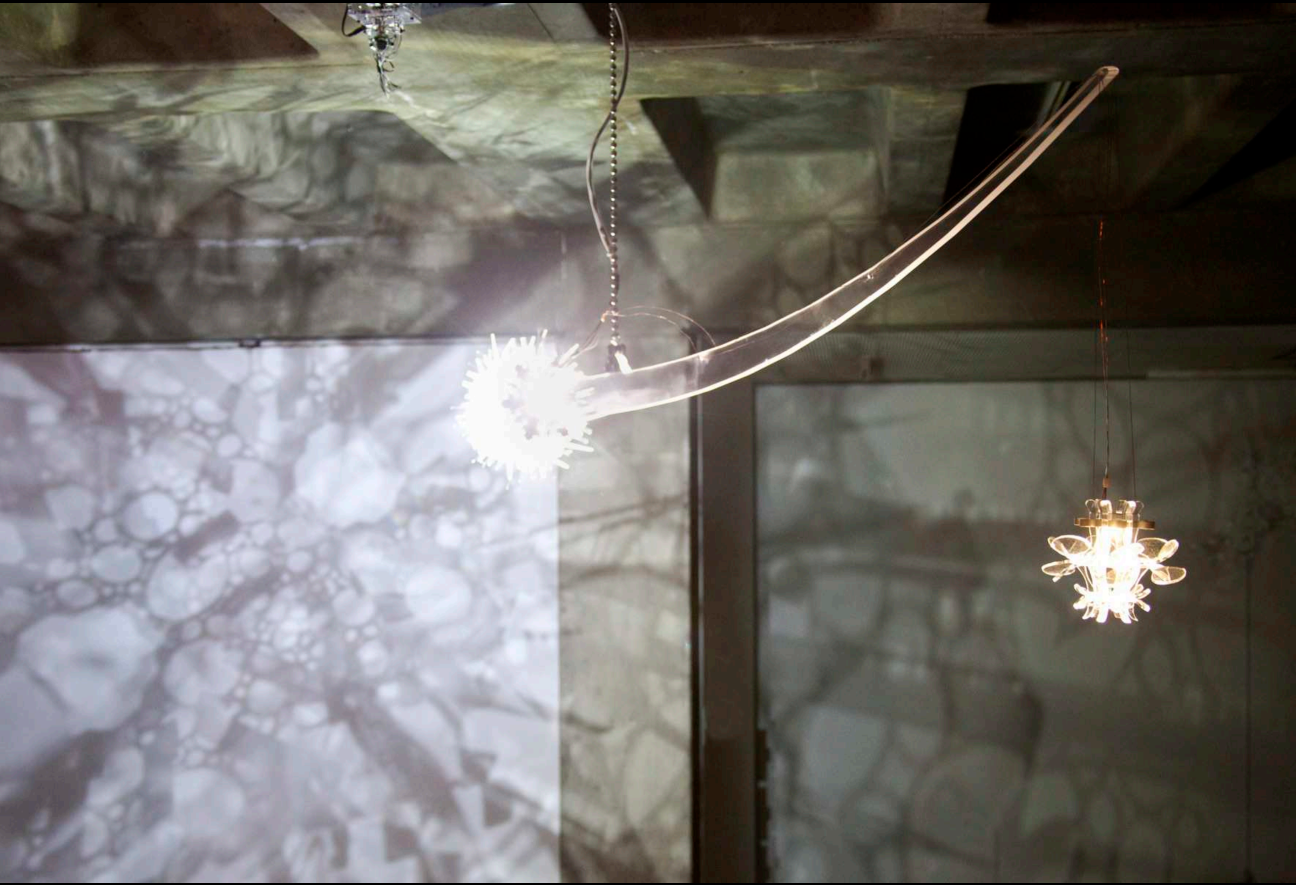


BORDERLINE PERSONALITY DISORDER #2, 2011
Aluminum, thermoplastic,
high power LEDs,
stepper motor,
microprocessor, circuit
26” x 26” x 22”

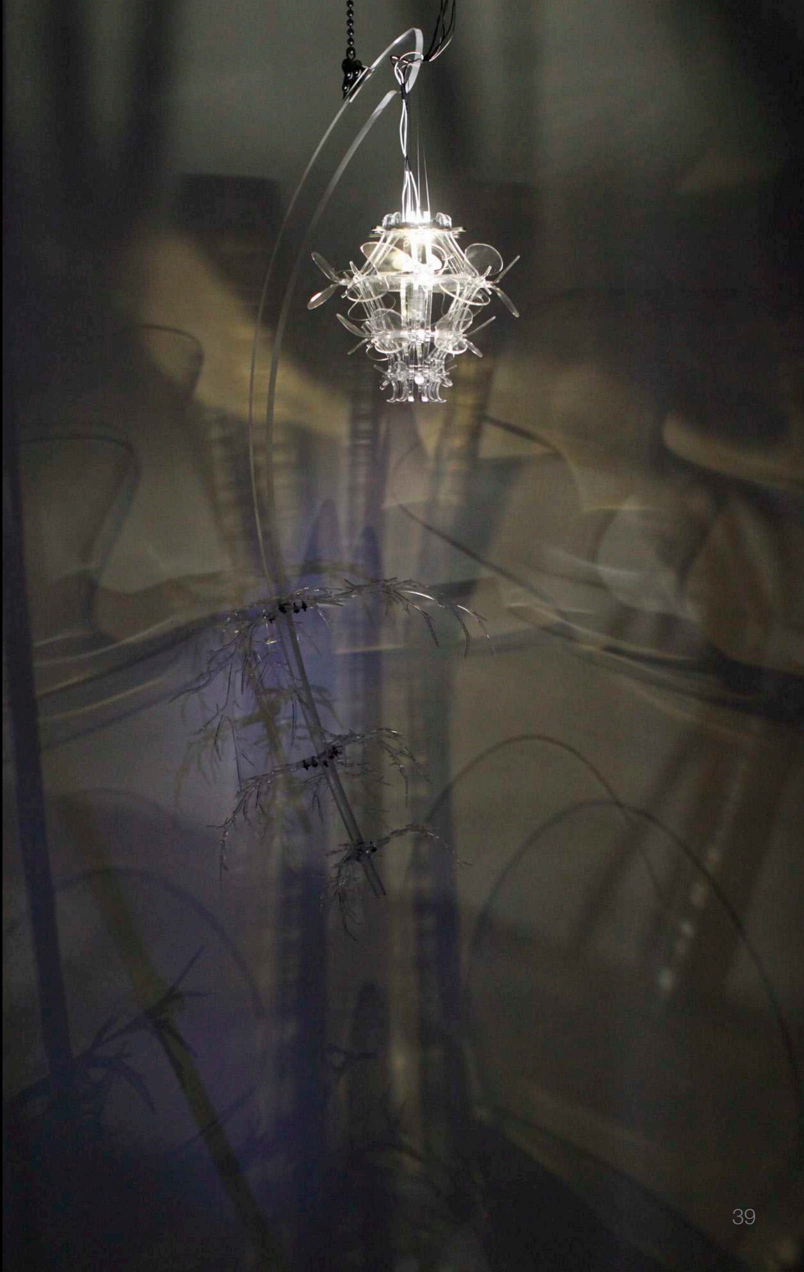


## HISTRIONIC PD *is seductive and attention-seeking, with exaggerated emotional reactions*

HISTRIONIC PERSONALITY DISORDER #1, 2012
Aluminum, thermoplastic, high power LEDs,
motor, microprocessor, circuit
20” x 12” x 72”



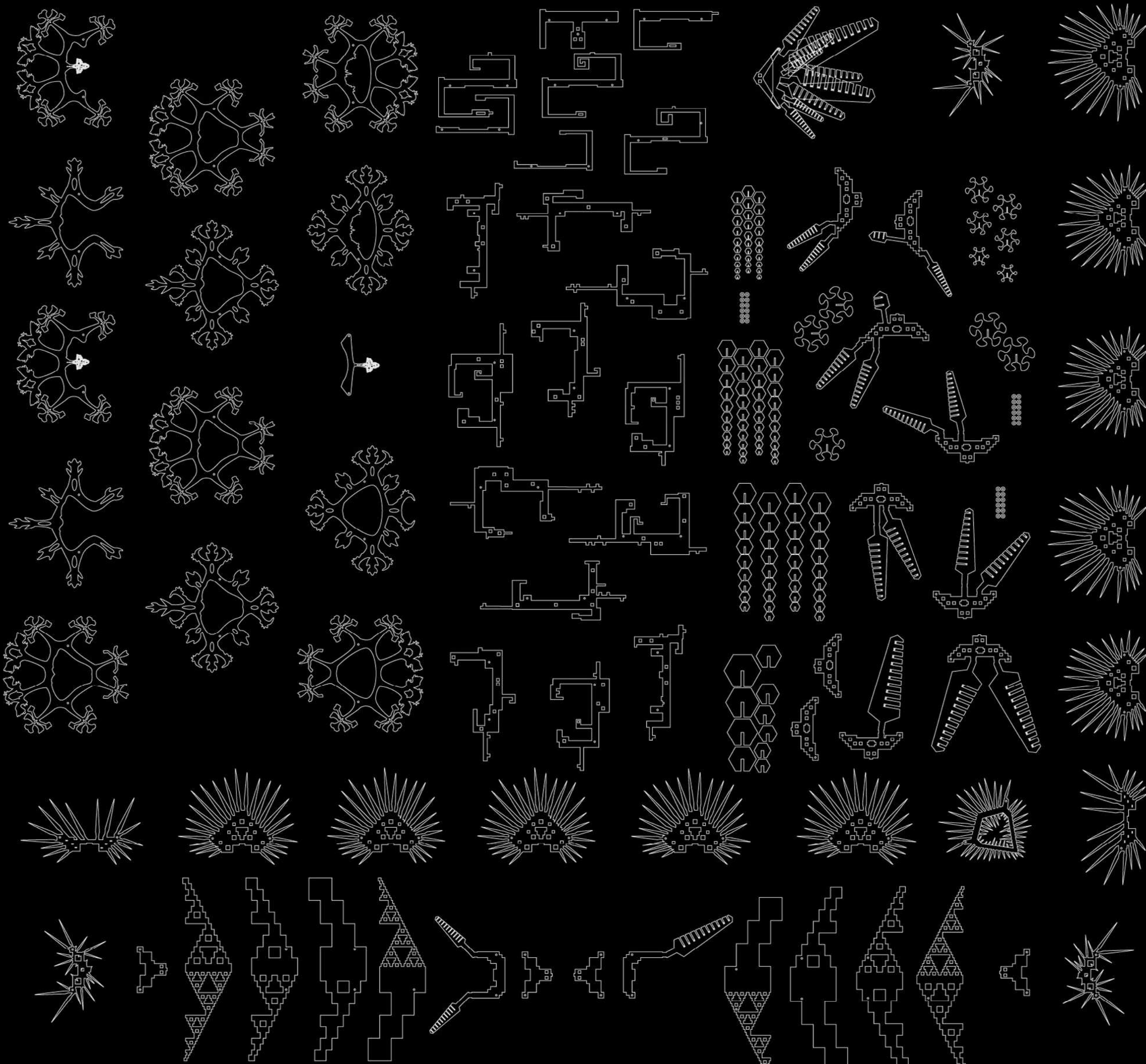
Installation view, Chazan Gallery, 2012



HISTRIONIC PERSONALITY DISORDER #2, 2012
Aluminum, thermoplastic, high power LEDs, motor, microprocessor, circuit
20" x 12" x 72"

# SCULPTURAL SCONCES

In this most recent set of wall-mounted works, a mash-up genetic set of forms was developed, akin to recombinant DNA. They are informed by a wide range of references, such as bioluminescent fauna, crystal morphology and computational geometry.

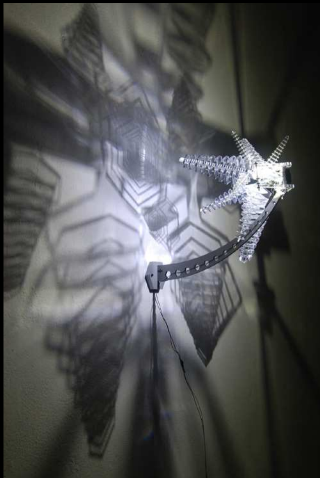


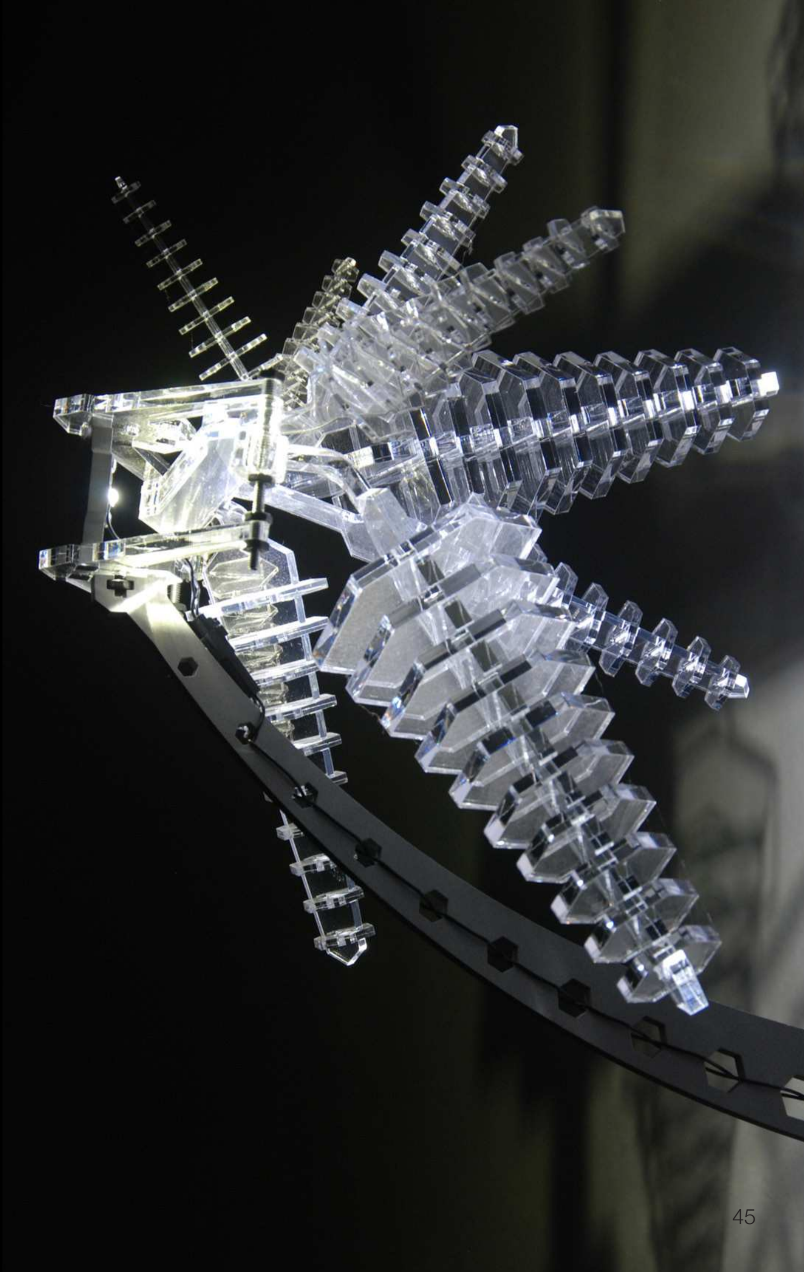
Sconce Designs, 2012-13

UNFURLED #1, 2012
Aluminum, thermoplastic,
high power LEDs,
microprocessor, circuit
16” x 10” x 18”

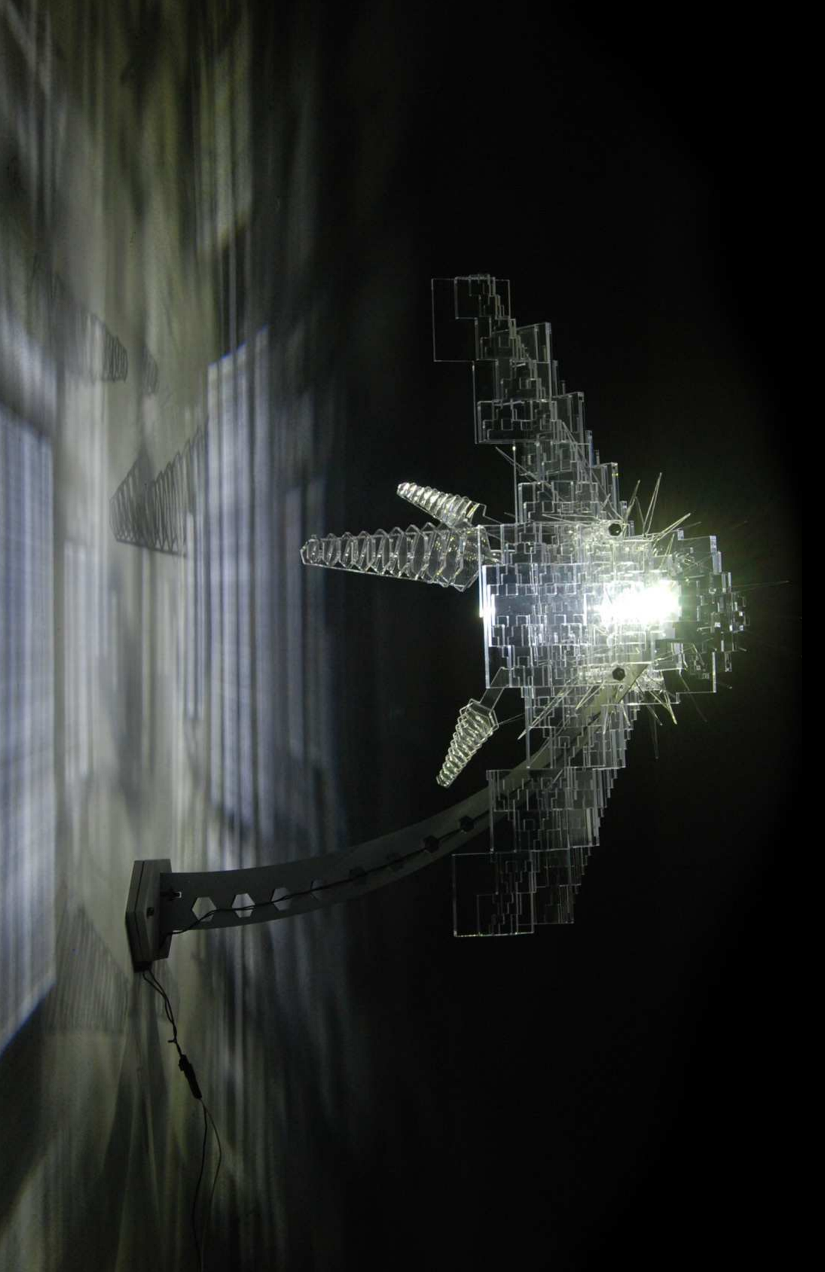
**SPINES #1**, 2012
Aluminum, thermoplastic,
high power LEDs,
microprocessor, circuit
16” x 10” x 18”

RECURSION #1, 2012
Aluminum, thermoplastic,
high power LEDs,
microprocessor, circuit
16” x 10” x 18”

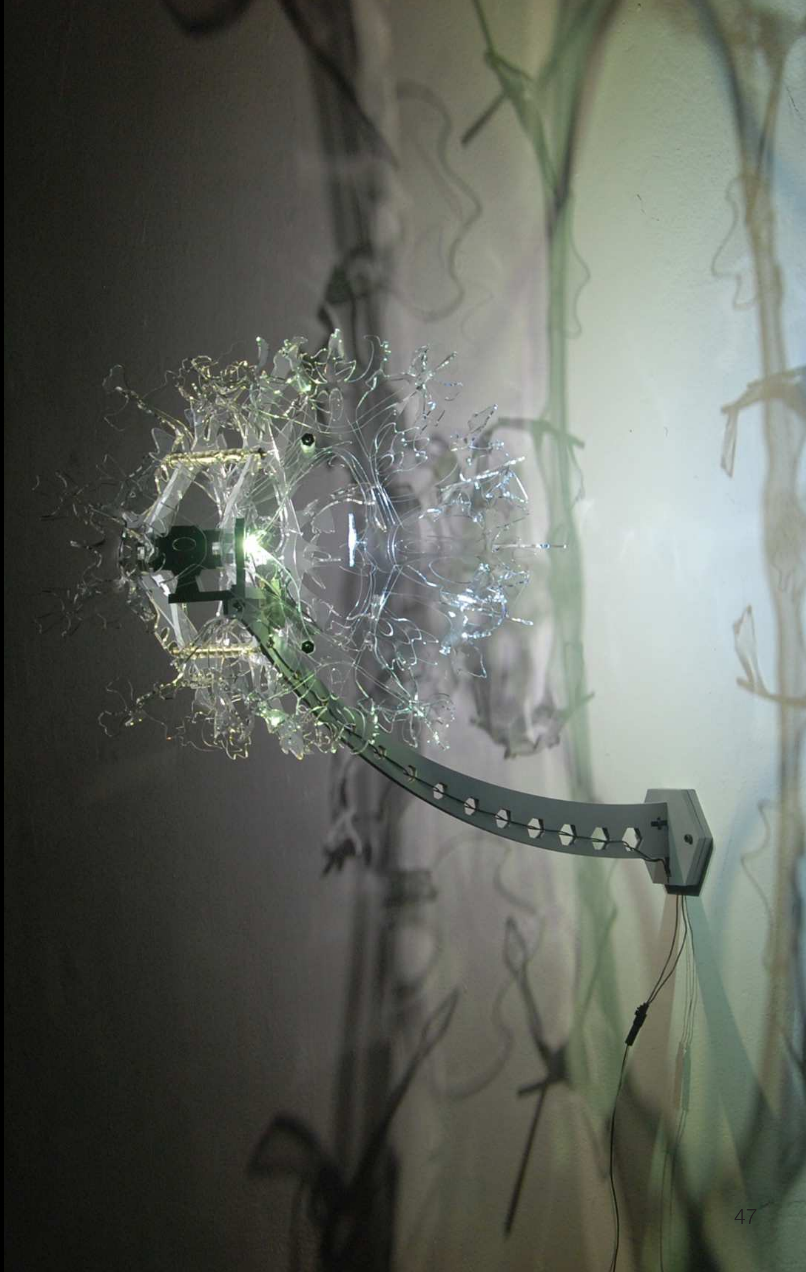




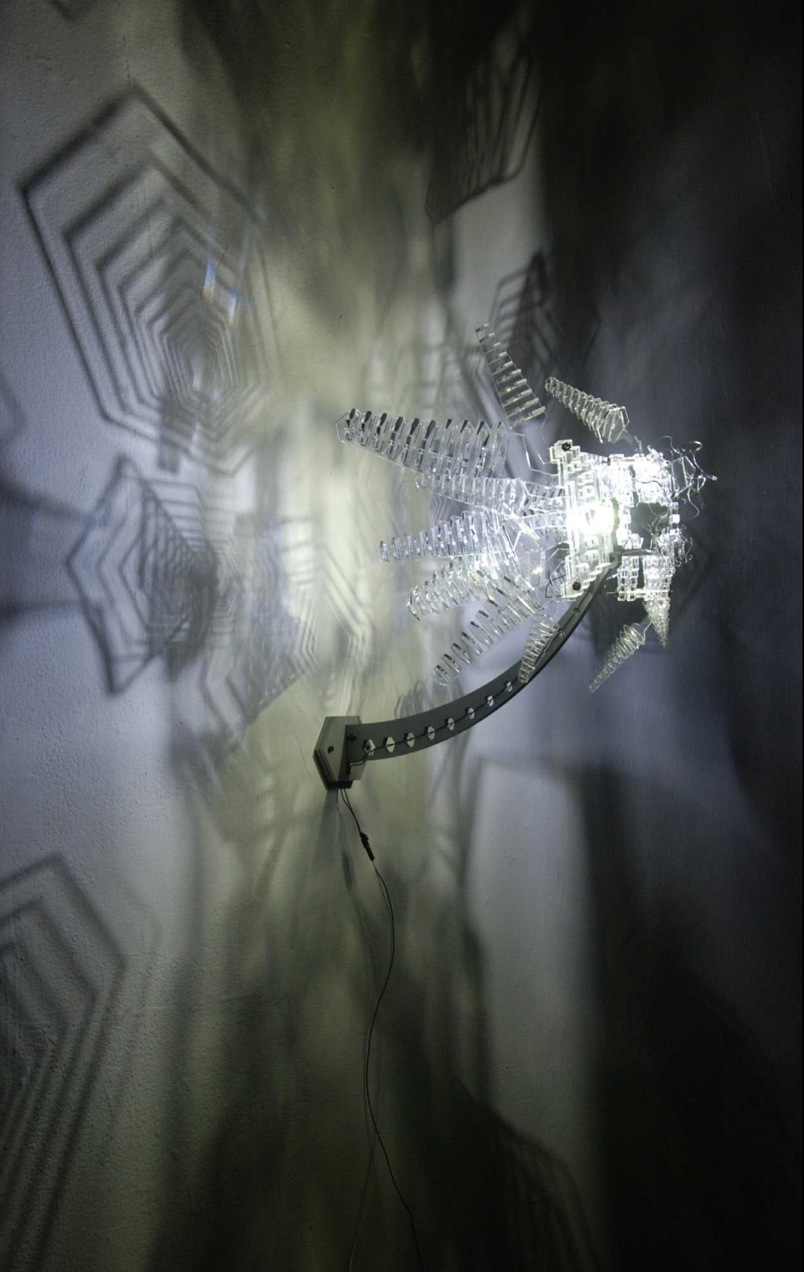
CRYSTAL #1, 2012
Aluminum, thermoplastic,
high power LEDs,
microprocessor, circuit
16” x 10” x 18”

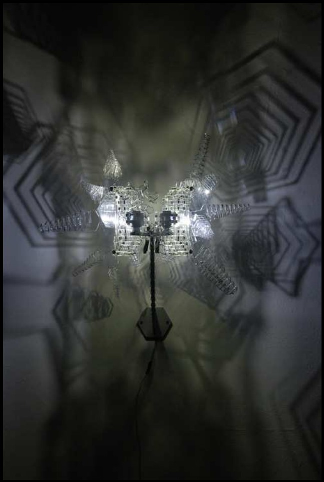


RECURSION #2, 2012
Aluminum, thermoplastic,
high power LEDs,
microprocessor, circuit
16” x 10” x 18”

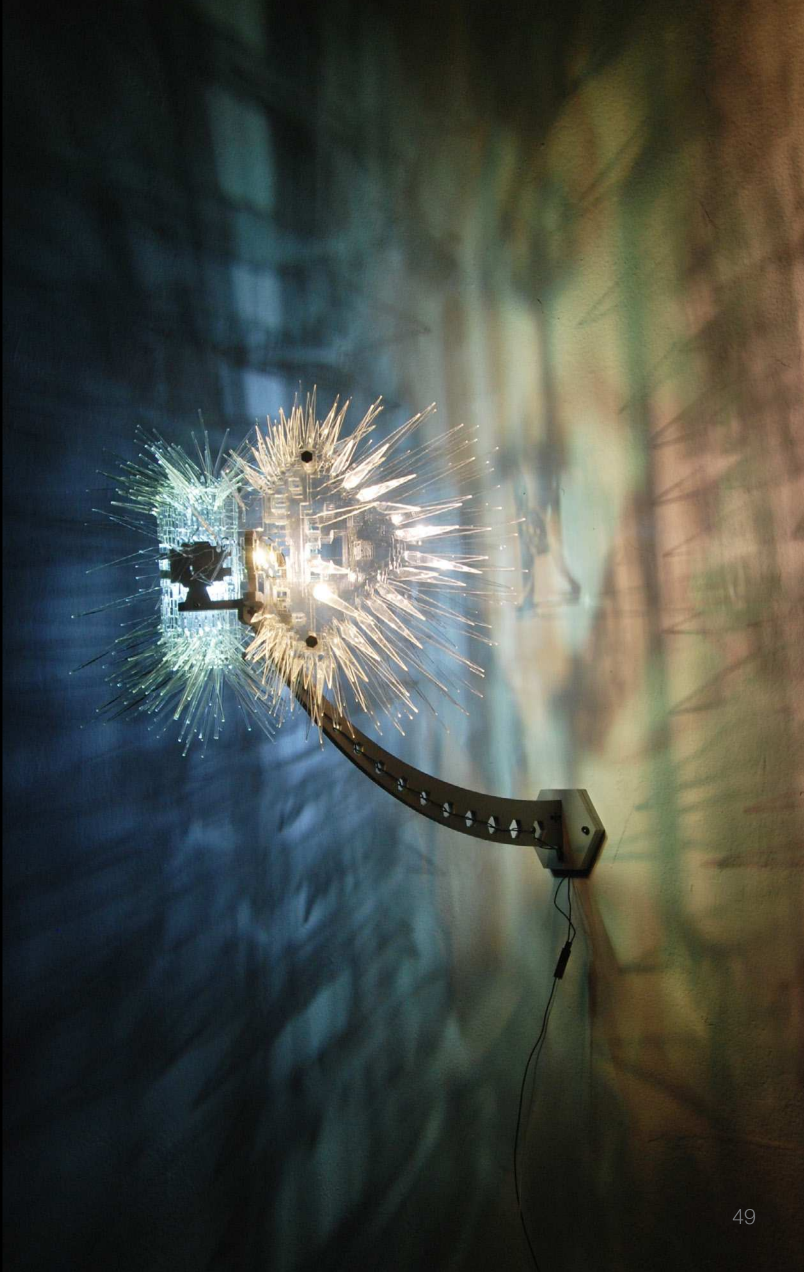


UNFURLED #2, 2012
Aluminum, thermoplastic,
high power LEDs,
microprocessor, circuit
16” x 10” x 18”

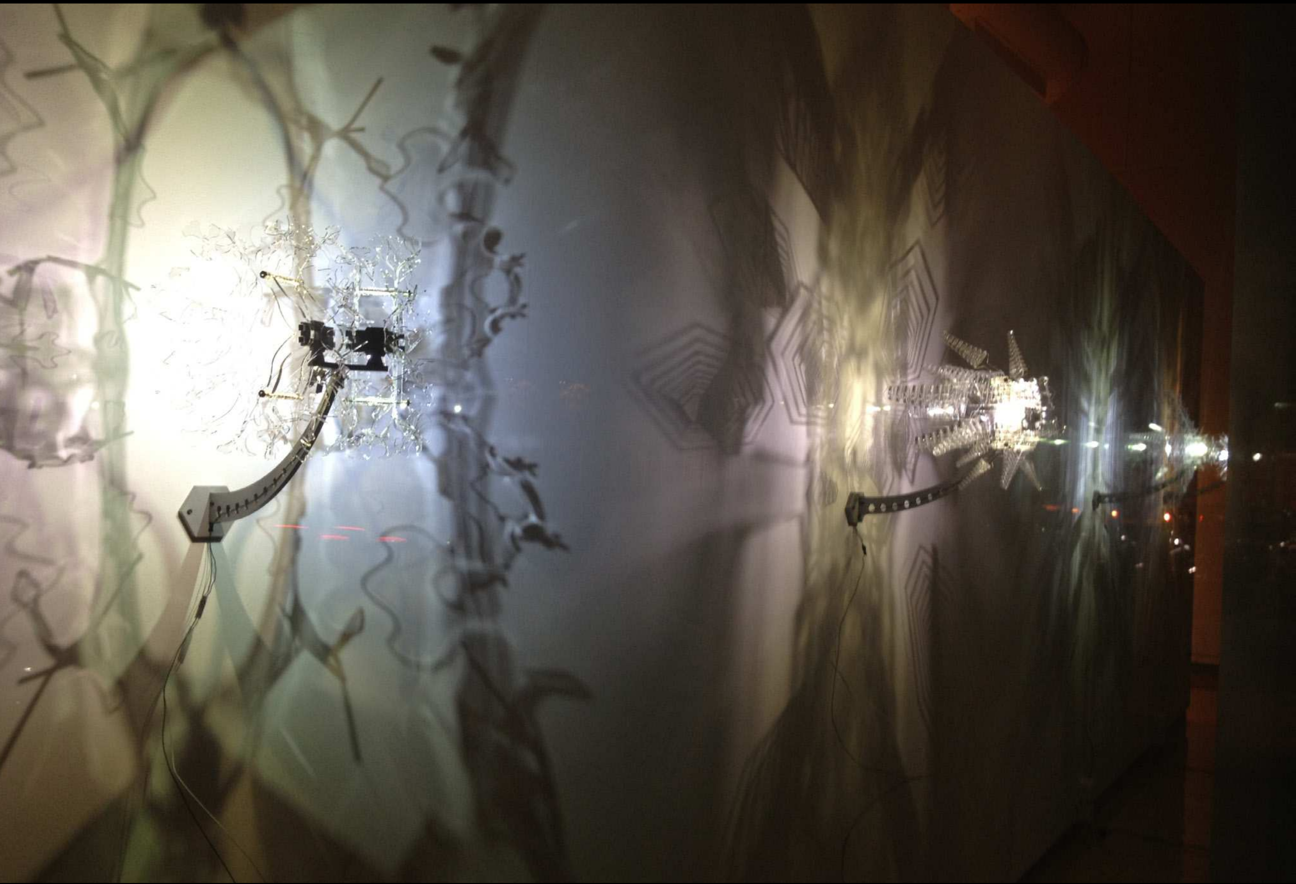




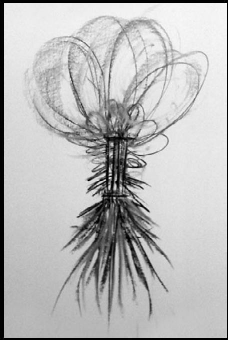
CRYSTAL #2, 2012
Aluminum, thermoplastic,
high power LEDs,
microprocessor, circuit
16” x 10” x 18”



SPINES #2, 2012
Aluminum, thermoplastic,
high power LEDs,
microprocessor, circuit
16” x 10” x 18”

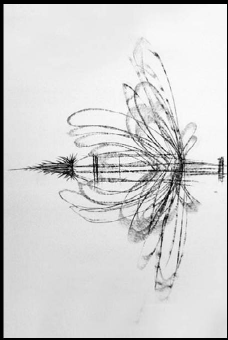


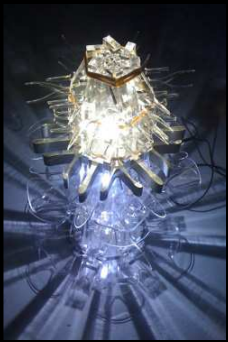
Installation view, Sol Koffler Gallery,
Rhode Island School of Design, 2012

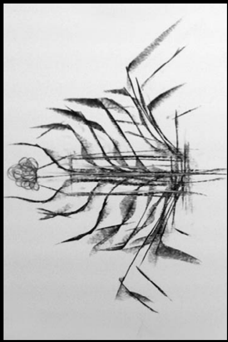


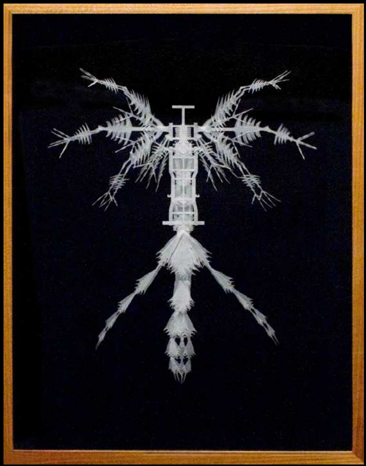
# DRAWINGS

The drawings that accompany this work are often quick charcoal sketches. There's an immediacy—and a dirtiness—that is so radically different from all of the subsequent steps required to bring a sculpture into the world: structural designs, lens designs, circuit designs, computer coding, CNC cutting and machining, white glove assembly. The steps often happen again and again in the prototyping stage. On occasion, after a sculpture is completed, designs are brought together, recomposed and laser cut from vellum to make a collage. More often, I jump back into the prototyping stage for the next sculpture.

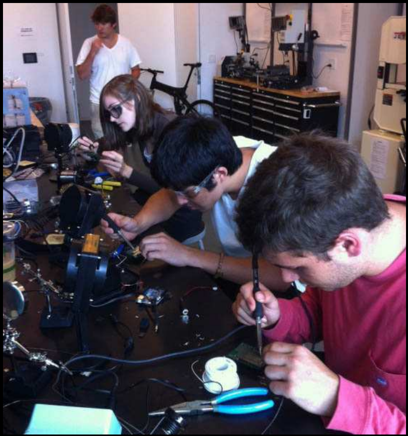








# STUDIO



A number of incredibly talented, intelligent and inspirational assistants have helped me throughout the research, development and fabrication stages of this body of work. Pictured here: Schuyler Maclay, Miranda Steele, Chris Yamane and Ethan Zisson. Thanks also to Anne Oram and Ari Weinstein.

# TRIBUTE IN LIGHT

I'm going to circle back to the beginning of this narrative, back to the bioluminescent bay, the illuminating dinoflagellates, and mention one previous artwork.

In 1998, I was invited with fellow artist Julian LaVerdiere to propose a public sculpture by the New York public arts organization Creative Time. We decided to harness the power of a colony of bioluminescent dinoflagellates, and create an illuminating beacon, which we titled the *Biobeacon.* We planned on installing the *Biobeacon* on the radio mast atop World Trade Center I.

To develop this project, we were awarded laboratory space in the American Museum of Natural History in New York, and a studio residency from the Lower Manhattan Cultural Council's *World Views* program on the 91st Floor of the World Trade Center between August of 2000 to August of 2001.

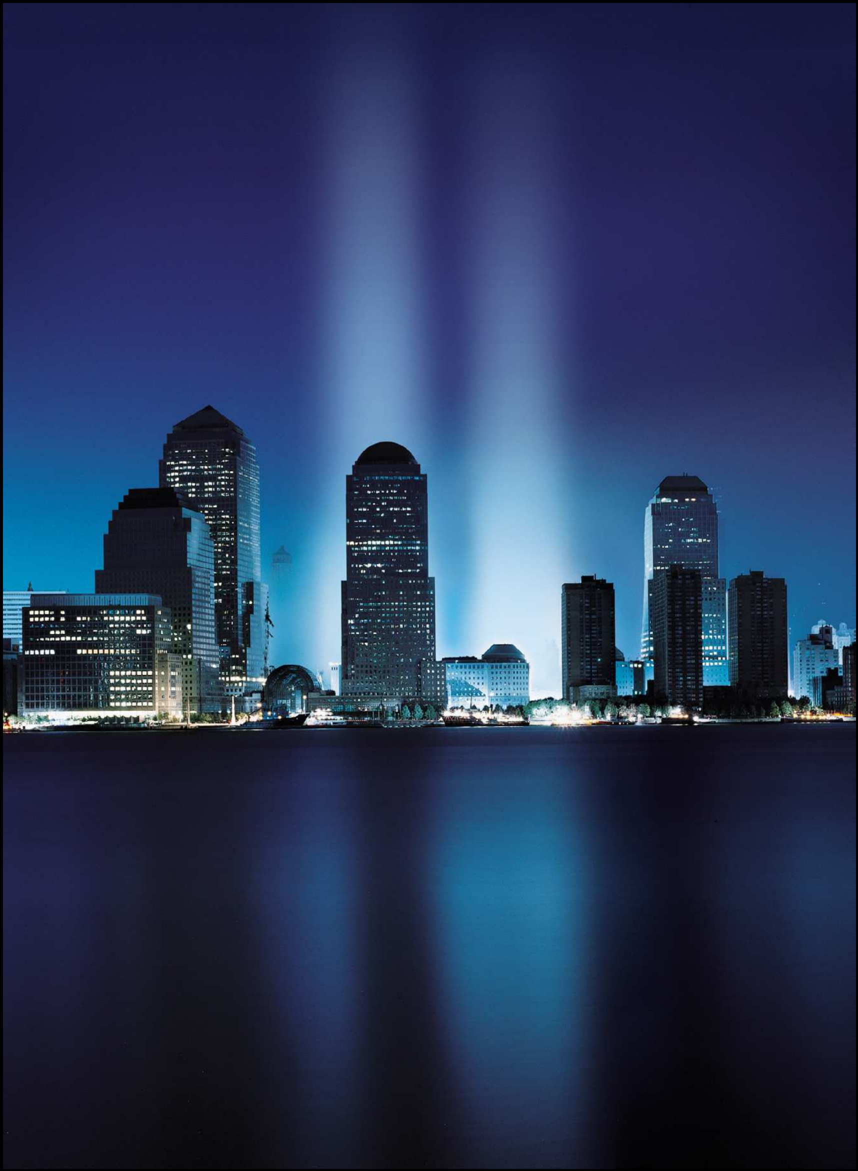
After the horrific events of September 11th, 2001, we were contacted by the editors of the *New York Times Magazine,* who knew we had been working in the World Trade Center, and asked to give some type of response. We created an image and called it *Phantom Towers,* and it was published on their September 23rd cover.

Recognizing the strange, eerie, and unsettling power of this image, we proposed creating a light installation to honor those lost in the attacks—making a virtual image into an actual experience.

This came to be known as the *Tribute in Light.* Again working with Creative Time, and with the Municipal Art Society, the *Tribute in Light* was first illuminated in March of 2002.

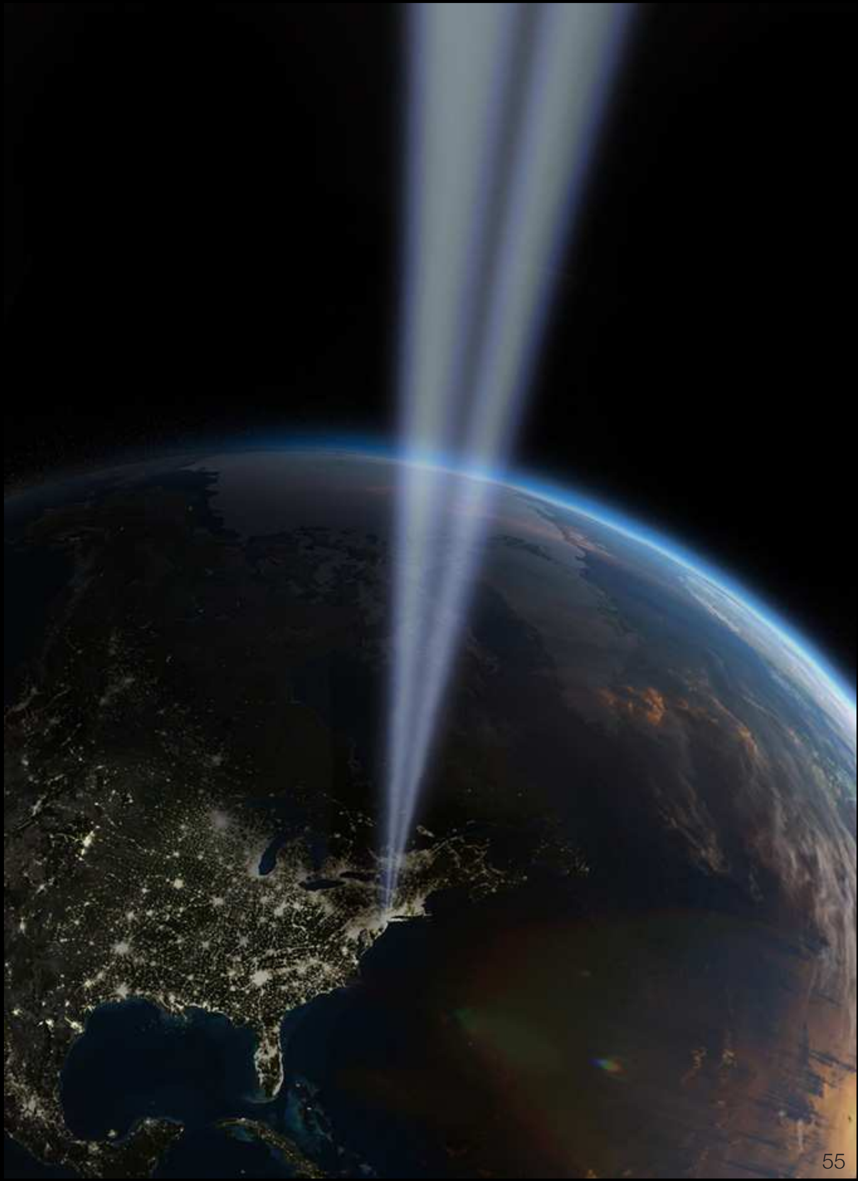
It has since become an annual installation, and is turned on every September 11th.

For the 10 year anniversary of 9/11, the editors of *Time Magazine* asked Julian and I to create a cover image for their special commemorative edition, *Beyond 9/11.* We created an image of the *Tribute* as seen from space and titled it *Tribute in Light Years.*




PHANTOM TOWERS,
digital image,
and cover of *The New York Times Magazine*,
(with Julian LaVerdiere)
9/23/01


TRIBUTE IN LIGHT YEARS, digital image, and cover of *Time Magazine*, (with Julian LaVerdiere) 9/11/11



TRIBUTE IN LIGHT, 2002
Produced by Creative Time and
The Municipal Art Society of New York

# TEACHING

In conjunction with Brown University's *Year of China,* my 2012 spring semester sculpture studio created a large-scale light installation inspired by the annual lantern festivals celebrated across China. Each student designed and produced their own sculptural lanterns.

Rashid Zia (School of Engineering), had his students help design and build LED arrays with surface mounted circuits for each sculpture.

Programmed to reference the fluttering firelight of traditional Chinese lanterns, over three hundred sculptures blanketed the facade of the Granoff Center for the Creative Arts for one night only.

LANTERN DESIGNS

Ethan Beal-Brown, Iris Behler, Amber Bledsoe, Noah Donoghue, Evan Finkle, Hasan Friggle, Julia Kim, Maya Mason, Connor McManus, Meric Ozgen, Jaclyn Ponish, Guillaume Riesen, Eric Shine, Austin Snyder, Daniel Velazquez

LANTERN FESTIVAL

Perry and Marty Granoff Center for the Creative Arts

# BIOGRAPHY

Paul Myoda is a sculptor based in the woods of Chepachet, Rhode Island. Regularly exhibited both nationally and internationally, his sculptures and installations are known for their elegance and their expression of organic forces through artificial materials and systems.

A graduate of the Rhode Island School of Design and Yale University, Myoda is recognized as an artist, designer, critic and educator. Based in NYC from 1990-2006, Myoda was represented by the Friedrich Petzel Gallery, and was co-founder of Big Room, an art production and design collective in New York City. He was also a contributor to *Art in America, Flash Art* and *Frieze.* He is a recipient of grants from the National Endowment for the Arts, Warhol Foundation and Howard Foundation, among others.

In 2001 he participated in the Lower Manhattan Cultural Council's *World Views* Program and had a studio on the 91st floor of WTC I. In March of 2002 he co-created the *Tribute in Light* in memory of the tragic events of September 11th, 2001, which has since become an annual installation. He was an adjunct professor at The City College of New York and has been an assistant professor in Brown University's Visual Art Department since 2006.

Myoda's works are part of the collections of the Queens Museum of Art, Museum of Contemporary Art, San Diego, the Museum of Contemporary Art, Miami and the Library of Congress. Recently he has had solo exhibitions at the Dorsch Gallery in Miami, the Project 4 Gallery in Washington DC, and will exhibit at the Yellow Peril Gallery in Providence, RI, in the fall of 2013.

# ACKNOWLEDGMENTS


This work would not exist without the fundamental support, patience, and encouragement of my beloved wife Mary Alice Mills. My children Marlowe and Emerson—who came along in the middle of this process—gave me moments of transcendental joy that created energy when there was exhaustion, certainty when there was doubt. To my parents: a lifetime of thanks.

Stages of this work were funded by grants from the following groups and organizations: The Howard Foundation Fellowship, The National Science Foundation, Brown University's Richard B. Salomon Awards, Creative Arts Council, Humanities Research Awards, Visual Art Department, Undergraduate Research and Teaching Awards and School of Engineering.

This work has been shown at the following galleries with support from their respective directors, curators and preparators—The Dorsch Gallery, Miami, FL: Tyler Emerson-Dorsch, Brook Dorsch and Alan Gutierre. Project 4 Gallery, Washington D.C.: Gregory Kearley, Doug Dahlkemper and Rachel Jennings. The Chazan Gallery, Providence, RI: Caroline Gray and Sue Carroll. I'd also like to thank Vanphouthon Souvannasane and Robert P. Stack of the Yellow Peril Gallery, and Jay Coogan, Kathleen Pletcher, Maya Allison, Elena Lledo and Emma Hogarth for their work with the *Pixelerations* program.

The *Tribute in Light* continues to be illuminated every year, and I am continually grateful to my collaborator Julian LaVerdiere, Anne Pasternak and Creative Time, The Lower Manhattan Cultural Council, The Municipal Art Society of NY, The Lower Manhattan Development Council, Battery Park City Authority, Mayor Michael Bloomberg, Paul Marantz, Janet Froelich and *The New York Times Magazine,* and D.W. Pine III and *Time Magazine.*

There were innumerable contributions in the form of expert advice, inspiration, critique and general support from the community at Brown University. Thanks to Leslie Bostrom, Wendy Edwards, Richard Fishman, Roger Mayer, Marlene Malik, Ed Osborn, Rashid Zia, Gregory P. Crawford, William Patterson, Joseph Rovan, Todd Winkler, Dietrich Neumann, Chung-I Tan, Cynthia Brokaw, Shana Weinberg, Jo-Ann Conklin, Ian Alden Russell, Mark Tribe, Jay Stuckey, Samuel Zipp, Sheila Haggerty, Olanda Estrada, Shirin Adhami, Daniel Stupar, Chira Delsesto, Greg Picard, Shawn Tavares, Ian Budish, Lauren Fisher, Peter Scheidt, Peter Fallon, Isabel Mattia, Taylor McKenzie-Veal, Charles Vickers and Brian Corkum.

I am deeply grateful to all of my assistants who gave me stronger hands, eyes, ears and brains: Ari Weinstein, Anne Oram, Schuyler Maclay, Chris Yamane, Ethan Zisson and Miranda Steele.

GLITTERING MACHINES
video can be viewed at
www.paulmyoda.com