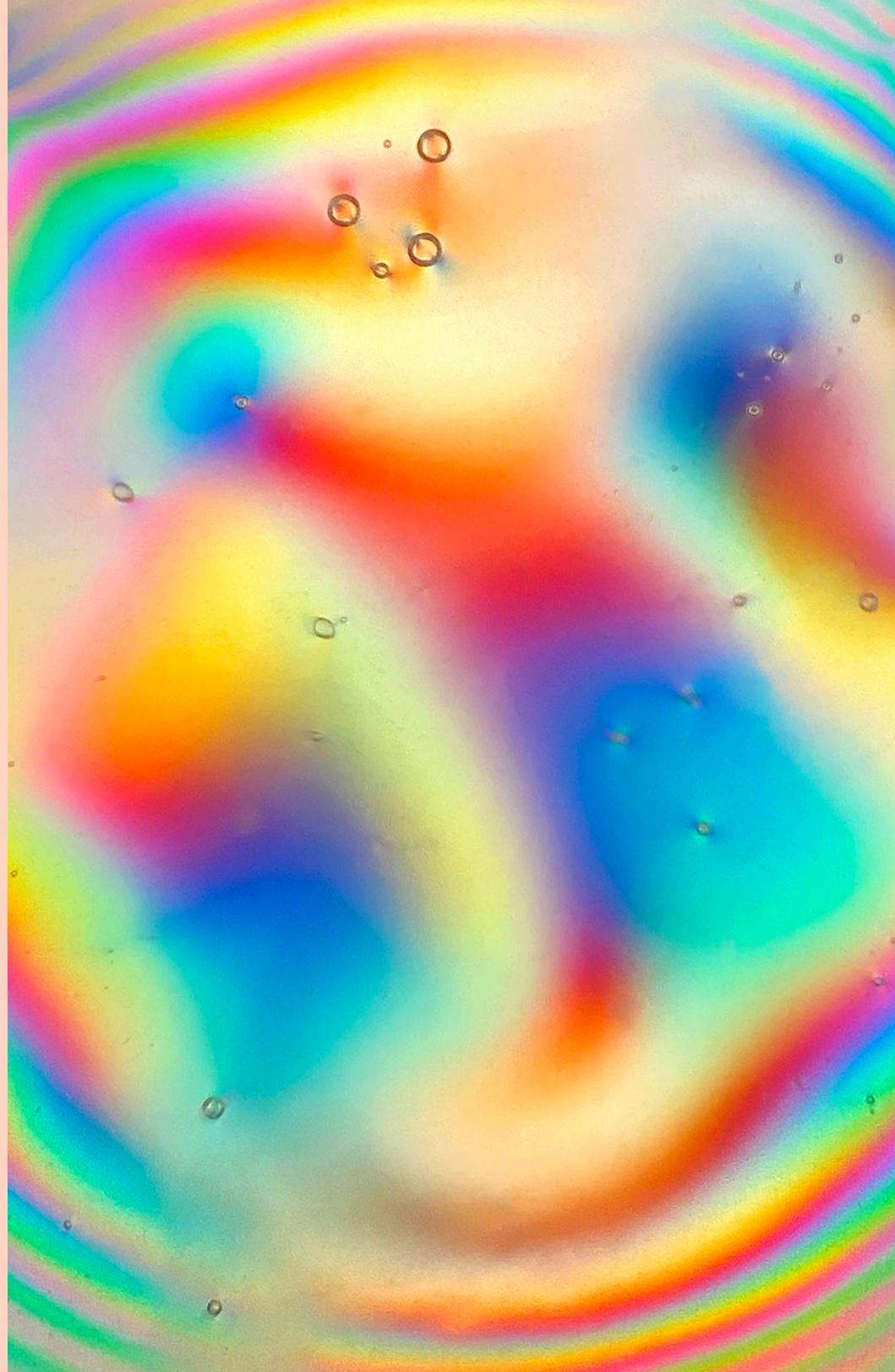


***The colors
of stress***

Park Jiemin





***The colors
of stress***

Park Jiemin

The Colors of Stress

A thesis presented in partial fulfillment of the requirements
for the degree Master of Fine Arts in Glass in the Department
of Glass of the Rhode Island School of Design, Providence,
Rhode Island

by



Park Jiemin, 2022

Approved by Master's Examination Committee:



Jocelyne Prince

Department Head, RISD Glass, Thesis Chair



Rachel Berwick

Professor, RISD Glass, Thesis Advisor



Tristan Duke

Independent Artist, Thesis Advisor

Table of Contents

<i>Abstract</i>	9
<i>Introduction</i>	11
<i>Giving stress to glass</i>	14
<i>Ways to reveal the colors of stressed glass</i>	
- <i>Hidden Colors</i>	25
- <i>Stressed Flowers</i>	36
- <i>What time is your stress now?</i>	50
<i>What Color is your stress now?</i>	
<i>Conclusion</i>	62
<i>Bibliography</i>	64

Abstract

This thesis examines the physical and emotional process by which stress in glass can be visualized through color by using a polarization effect.

A conceptual account of three different projects using this process of discovering and revealing the colors of stress hidden within clear glass will be addressed. The mainstays that catalyze the visual metaphor of extreme stress and beauty are; the making process, evidence of the making proc and the polarization effect. These two contradictory concepts of beauty and stress are central to this thesis.



Introduction

How can I materialize emotion, specifically stress?

What color would you choose to express your stress?

I visually reveal the colors of stress hidden within the clear glass and try to explore emotions through stressed glass pieces.

I approach the word “stress” in the context of stressed glass as having a dual meaning: in the physical sense stress is manifested in the physical structure of glass, while metaphorically stress has an emotional meaning and is manifested in the mind and body of an individual.

Glass is an amorphous solid at low temperatures, but becomes liquid at high temperatures and expands and contracts when it is heated and cooled. When a piece of glass cools down too quickly, the outside cools and contracts while the inside still expands from the heat, causing stress in the glass. When a glass piece is not annealed for an appropriate time, it will get stressed and explode or break upon impact. In order to stabilize the glass and prevent exploding or cracking, there is a need to slowly anneal it after forming the glass at high temperatures.

To determine whether or not glass is stabilized, the glass piece should be checked through a polariscope. A polariscope is an optical inspection device used to detect internal stresses in glass and other transparent materials.¹ It reveals hidden stress in glass by using polarized light to manifest rainbow colors.

Through the polariscope, stable glass does not show any color, but stressed glass shows various colors.

I tried to express my emotions through polariscope color in stressed glass. I screamed at the glass, said bad words to the glass and played beautiful classical music to the glass to try to affect it with emotions. However, glass stress occurs in response to only physical phenomena. I struggled to find a formula to link my emotions with the glass.



Rather than directly connecting my emotions with the colors, I started trying to observe the glass pieces through my own filter, just like the polarizing filter which shows the hidden color in clear glass. I focused on the glass object itself at first, and then tried to show its projection instead of the glass pieces. After that, my gaze shifted to both glass objects and their projections.

This thesis shows how my artistic inspiration has changed based on the polarization effects in glass. I have arranged the work in chronological order to show how my installation process has evolved as well as my perception. Although I worked with the same materials with a single theme, each of my works have resulted in different points of view. As my work progressed, I began to explore different aspects that I did not intend.

The core of my work is not to create glass pieces to make a specific color, but to expand the possibilities by observing the reaction of materials according to my actions.

¹ Dept. of Health, Education, and Welfare Public Health Service Food and Drug Administration *ORA/ORO/DEIO/IB*, "Polariscope", May 21, 1973, http://www.fda.gov/ora/inspect_ref/itg/itg9.html

Giving stress to glass

Glass is very sensitive to temperature. Annealing with appropriate time is one of the most important basic skills for a glass artist, who trains in techniques to maintain the temperature while minimizing contact with the glass to avoid stressing it.

This practice of creating pieces of stressed glass goes against industry norms. The process of deviating from the standard mode of operating and loosening up has been so liberating and cathartic. I tried to change my relationship and understanding of stress and not be afraid of processes which increase stress causing cracks or explosions.

I thought of ways to give glass blocks a huge temperature difference. First I used various tools to give sudden changes in temperature to the surface of molten glass. Examples of these actions are; hitting with a hammer, sprinkling water, shooting cold air, writing with chalk, using glass plates, and rubbing the surface with cold metal tools, a wood paddle, and a brick. I chilled a few tools in the refrigerator before using them to give a more dramatic temperature difference.





In the first experiment, tools that can quickly change the temperature of the glass blocks were used, in the second experiment, different types of glass were mixed.

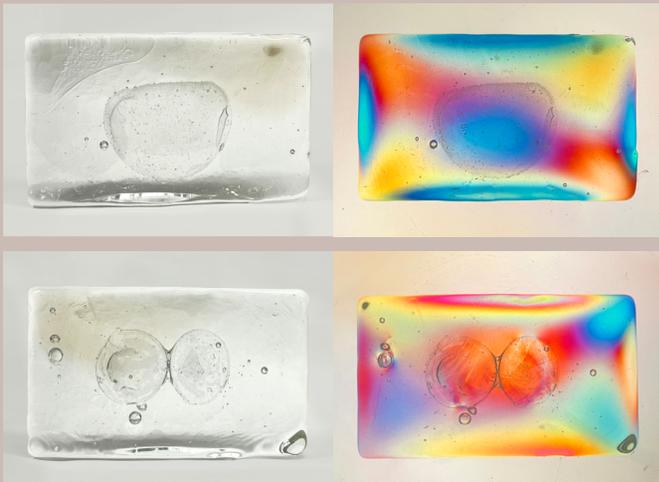
Stress also occurs when mixing different kinds of glass which have a different coefficient of expansion (COE). A COE is a measurement of the rate that glass will expand and contract when it is heated and cooled.² Mixing glass of different COE together creates stress as the glasses contract at different rates when they are annealed at the same time.

I first poured molten glass into a mold, filling it halfway, then put another type of solid glass in it and then filled it again with the molten glass.

I tried mixing various types of window glass with different thicknesses, glass nuggets, cracked glass, and the same type of glass but cold nuggets which did not melt. A collection of different types, but all of them were clear transparent glass.



² Jenn Raskin, "Get the Exact Glass You Need with the Glass Finder Tool at Delphi Glass", The Delphi Blog, May 08, 2018, <https://www.delphiglass.com/blog/how-to/get-the-exact-glass-you-need-with-the-glass-finder-tool-at-delphi-glass>,



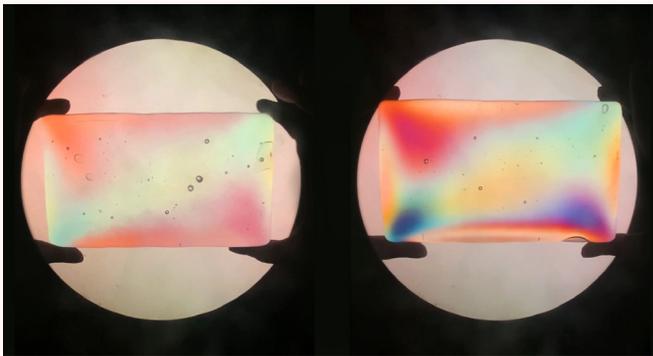
Along the way, I checked the stressed glass bricks made by various methods through a polariscope.

As a result of comparison, the mixing of different types of glass showed more dramatic patterns and colors than the glass bricks that were stressed by the temperature difference.

However, what I was more interested in than comparing the results of the two methods was that the intensity varies according to the level of stress. Depending on the level of stress, low stress shows faint colors and strong stress shows intense colors.

Here lies the irony, the most beautiful and vivid colors are actual markers of extreme stress. We usually have positive associations when we see a variety of colors. It is hard to believe that negative words are linked to vibrant colors. The idea of beauty could be an expression of suffering.

I was attracted to the stressed glass that could combine two contradictory concepts of stress and beauty into one, and I wanted to develop this idea into my work.





Hidden Colors

Pieces of clear glass are hanging in the air. They come in a variety of sizes and forms and are located at different heights. Rather than mixing different types of glass, I decided to create pieces of glass that were stressed by various temperature differences. Observing the glass produced and installed through this process, I poured molten glass so that no shape was intended. The texture of the table surface on which the glass was poured is engraved on the glass bottom. Also, the broken pieces of glass that couldn't withstand the stress were glued back together.

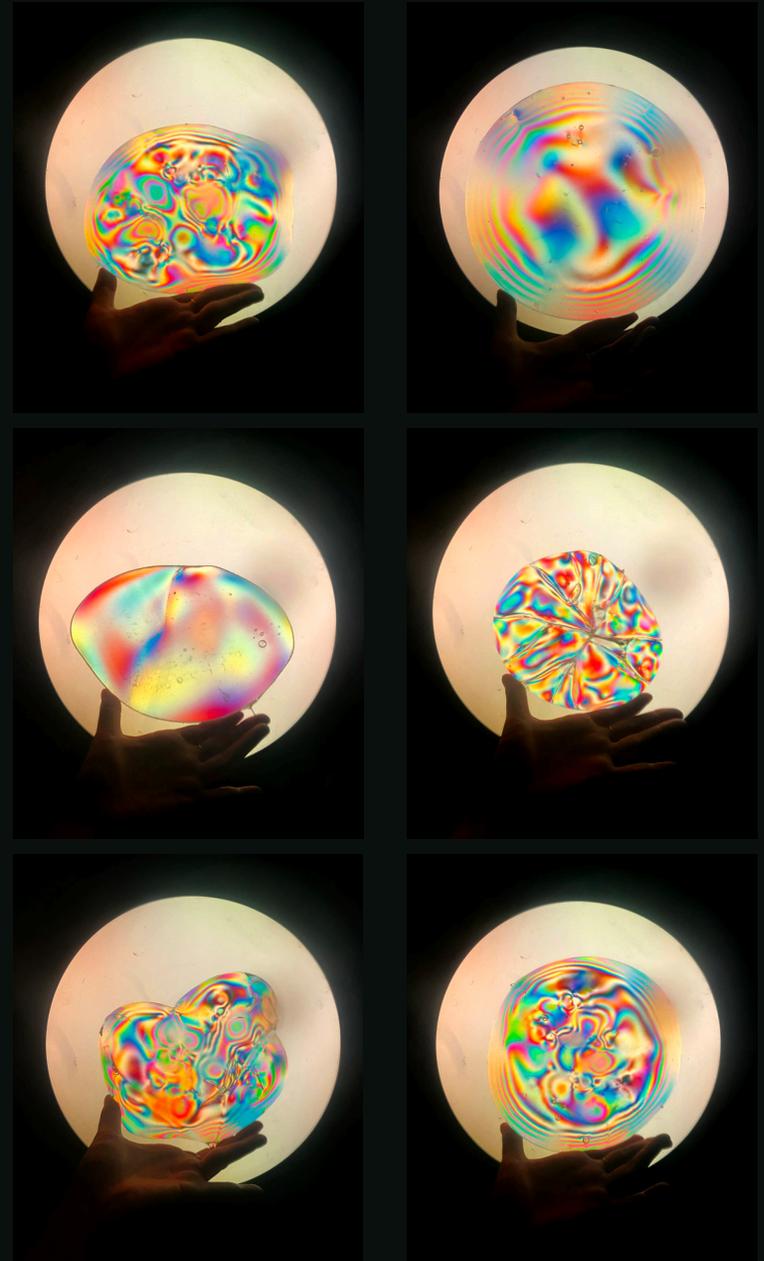
Since these glass objects rely on fishing line to be installed in the air, they rotate naturally without being fixed.

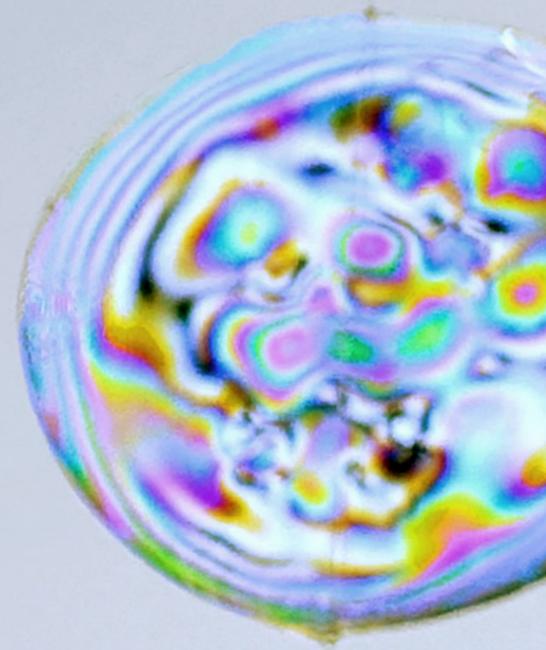
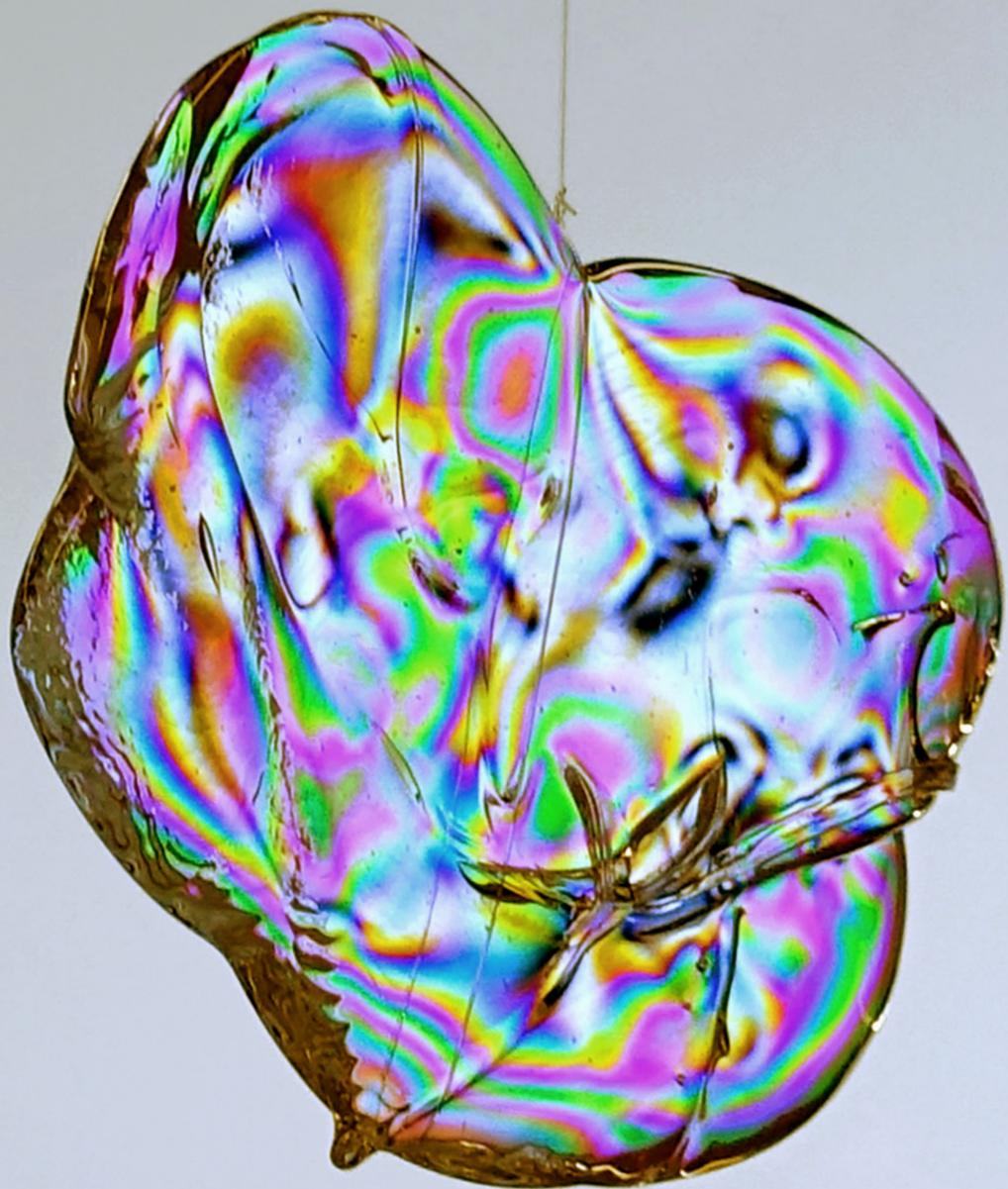
Each glass that rotates slowly at different times continues to show different appearances and to reflect light depending on the angle, revealing a new composition.

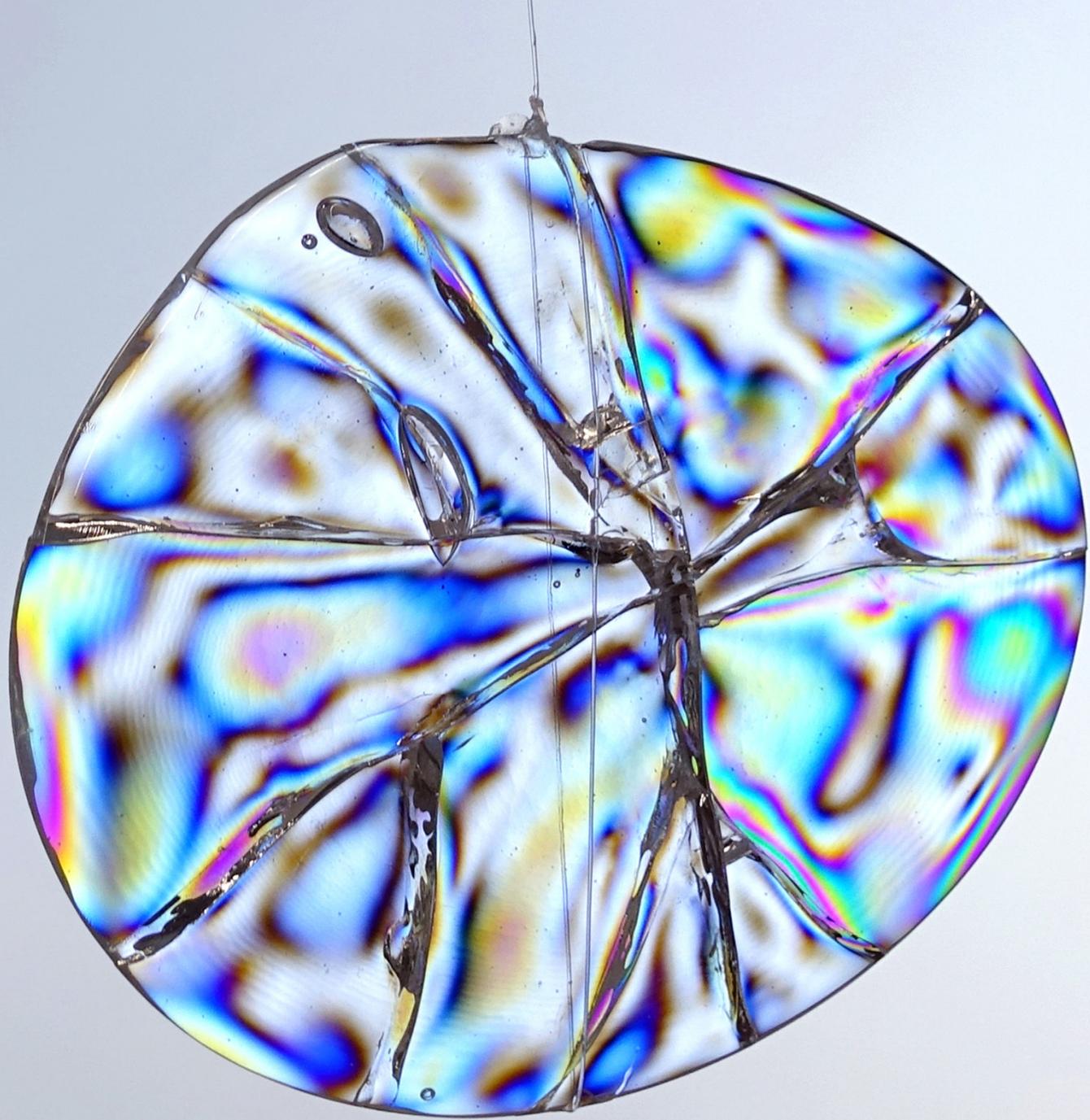
Even without observing the color inside through a polariscope, it is interesting to see the transparent glass shining and reflecting the light in the air.

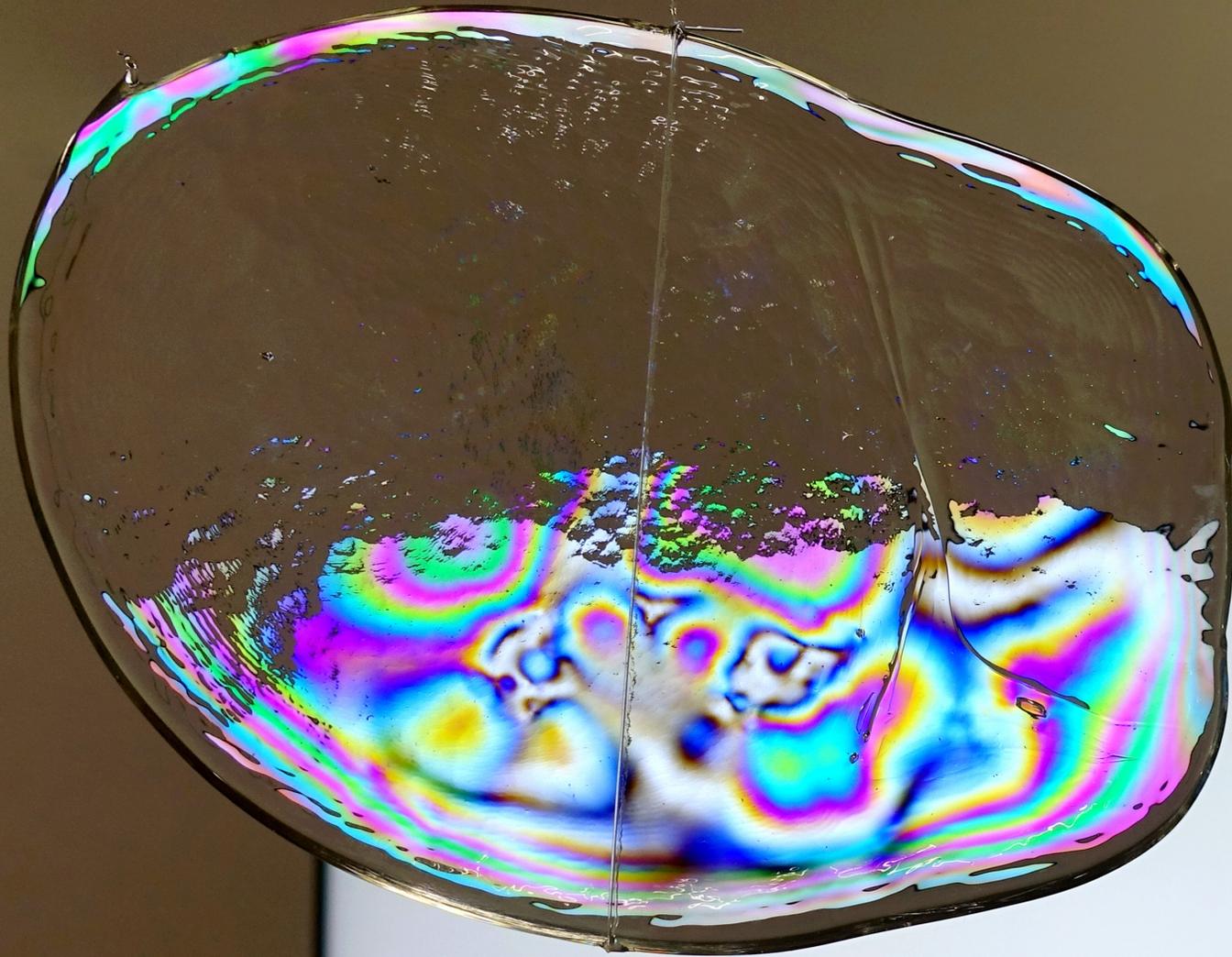
These installed glass elements that look transparent are actually stressed glass, so when I view them through a polariscope, they show different patterns with various color ranges.

However, it was impossible to show the installed glass objects with a polariscope, so I designed my installation based on the principle of the polariscope, enlarging it to fit my work. In polariscope, polarizing film is attached on the ground plate and the analyzer. I used an LCD monitor which included polarizing film inside and installed it behind the work. The ground plate of a polariscope was replaced with an LCD monitor with a white screen, and the analyzer was replaced by handing out polarizing filters to the audience.



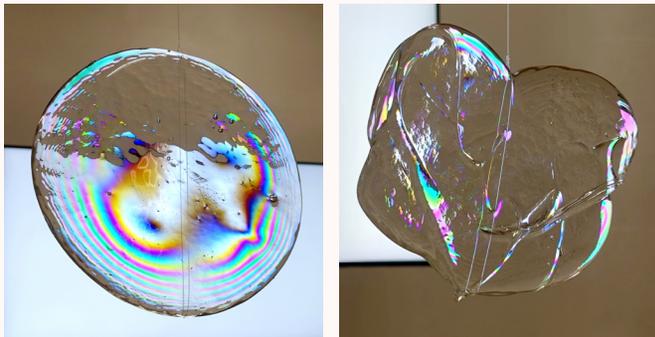






The white screened monitor only covered a portion of the wall behind the installation. Due to the small size of the monitor compared to the overall size of the installed work, all the glass could not be seen in front of the screen at the same time, but rather an interesting phenomenon could be observed.

The viewer observes the glass while moving between the work, and depending on the viewer's position, the glass is located either in front of the monitor or in front of the bare wall. The transparent glass shows a hidden color when it is located in front of the monitor, but the color disappears again when the position of the glass is changed as the viewer moves.



Even if the glass is in front of the monitor, the viewer can only see the colors if they are looking through a polarizing filter.

This work gives many options to the viewer.

People can observe the glass and light by walking between the pieces without using polarizing filters, or can discover the colors and patterns created by stress while standing where the entire glass is encompassed by the monitor. They can also observe that the color of the glass appears and disappears while changing location. Visitors can experience the work by choosing the viewing method they want according to their will.

Stressed Flowers

The previous work 'Hidden colors' was a work conducted by researching a method of showing the hidden color of glass to the viewer without using a polariscope.

In order to check the color inside the glass through the monitor, the viewer has to look at the glass through the film so polarizing filters had to be given to observe the work.

However, I wanted to let the audience perceive the colors of stress without any explanation, and without asking the audience to use filters to view the colors. In particular, during the Covid-19 period, I thought of a way to allow the viewer to see the work more naturally without any tools, as there was a reluctance to use it with many people putting it on their face.

I did more research on the polarization effect and found a way to use a polarizing film and LED light to make the projections of the glass. Instead of showing the color of the glass itself, the color projections of the tension within the glass appear on the wall, allowing the viewer to observe the colors expressed by the stress of the glass with the naked eye without any restrictions.







In 'Hidden colors' the viewer looks at the glass object itself. However, since the 'Stressed Flower' is not showing the color of glass pieces, there is no need to install a ground plate like a monitor screen.

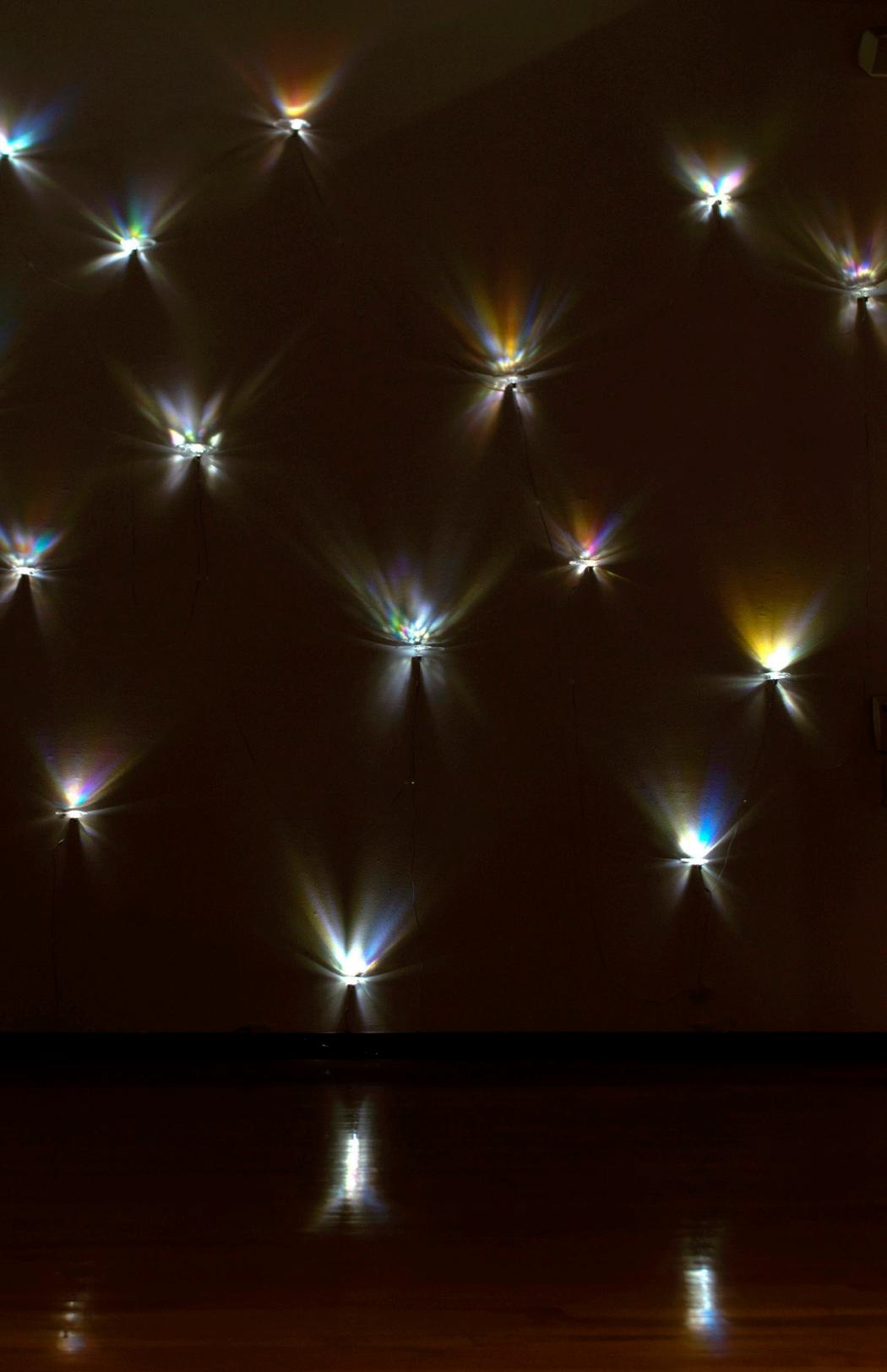
I thought of installing the polarizing film and LED lighting that were combined in the monitor separately. By attaching the film directly to a piece of glass and a lighting source, it was possible to make color projections from transparent glass in a simple way while increasing the intensity of the light.

These color projections of stress remind me of stage lighting. I majored in spatial design in my undergrad. In my junior year, my professor was an art director at a main broadcasting station. She designed all the stages and sets for all the shows on the station. Once, she brought the whole class to the broadcasting station and gave us a tour to look around the sets. We learned how a set was built for a TV show and also watched a rehearsal of a music show.

The stage itself was very ordinary. However, colorful lights were turned on and the stage looked completely different. Stages of concert halls and TV shows always look gorgeous and fancy. It is hard to imagine what it looks like behind the scenes. The experience watching backstage taught me that the more magnificent the stage with colorful lighting, the more effort and pain is hidden. Just like the colors of stressed glass.







Glass looks light due to its transparency, but it is a very heavy material. It is difficult to make large-scale work with glass not only because of the weight, but also because the annealing time increases exponentially even with a slight thickness increase.

In particular, I am working on making stressed glass, and it is impossible to do a big size because the glass breaks when it grows in size. Because of this, I have always had a craving for large-scale work as an artist working with glass as the main material.

I realized it is possible to enlarge the projections from small glass pieces by using light. In this work, the size of the installed glass pieces are from as small as 2x3 inches to not exceeding the size of the palm. Each glass object is small, but it becomes one large piece of work when the small pieces are installed together. By adjusting the number of projections according to the installation space, the scale of the work is limitless.



EXIT

Required
to Enter

6ft

2m

+

C

CON
MID

***What time is your stress now?
What color is your stress now?***

'What time is your stress now?' is the work installed in front of the gallery window showing the color projections of the glass clocks titled 'What time is your stress now?'.
After the sun goes down, the LED light attached to a clock hand turns on and the color projection hidden in the glass clock is revealed.

When installing the Stressed Flowers work, I saw that the color of the projections totally changed depending on the position of lighting even within a small piece of glass.

Even if it is a single piece that is stressed in the same way, there are parts that are severely stressed and parts that are not. As the position of the lighting changes, there are parts showing no color, parts showing faint colors, and parts showing vivid colors.

Previous work showed the color of stress by selecting a fixed part of the object according to my choice. I thought of a way to show the various colors that exist in the glass piece as the light moves.





A clock mechanism automatically rotates the light inside the glass. A quartz clock movement was attached to the glass and an LED light was installed behind the hand of the clock.



During the day, it looks like a clock made of glass, but when it gets dark, the color projection of the clock appears depending on the position of the clock hand. As time passes and the needle moves, the LED light also moves with the needle.

In my experiment, the variation in the distance between the glass, the light, and the wall shows very different results. The shape, size, and color of the projections change dramatically.

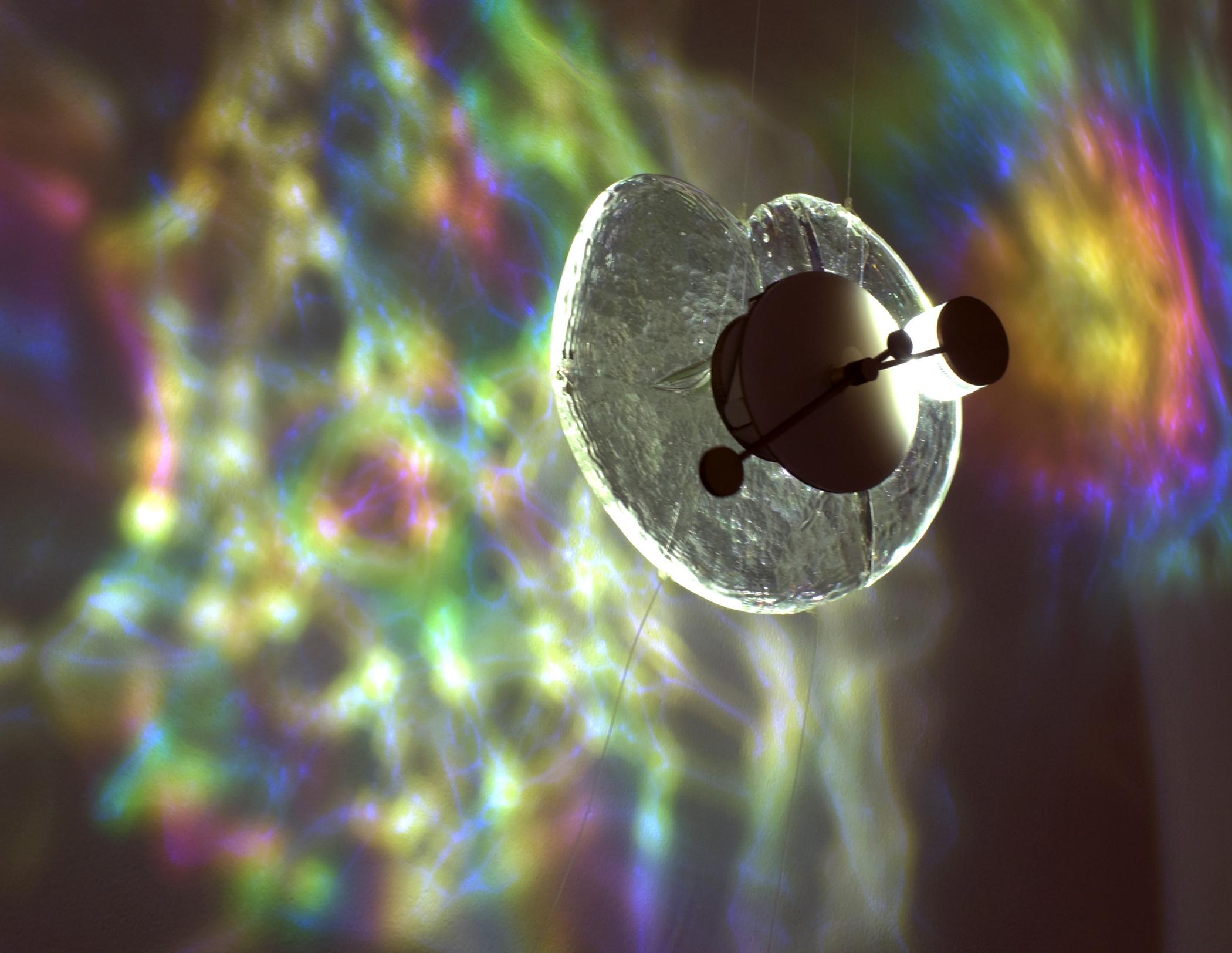
Stressed flowers made small projections by installing the glass object directly to the wall, but in this work, the gap between the glass clock and the light is wider and the projections are made larger on the gallery wall like a projector .

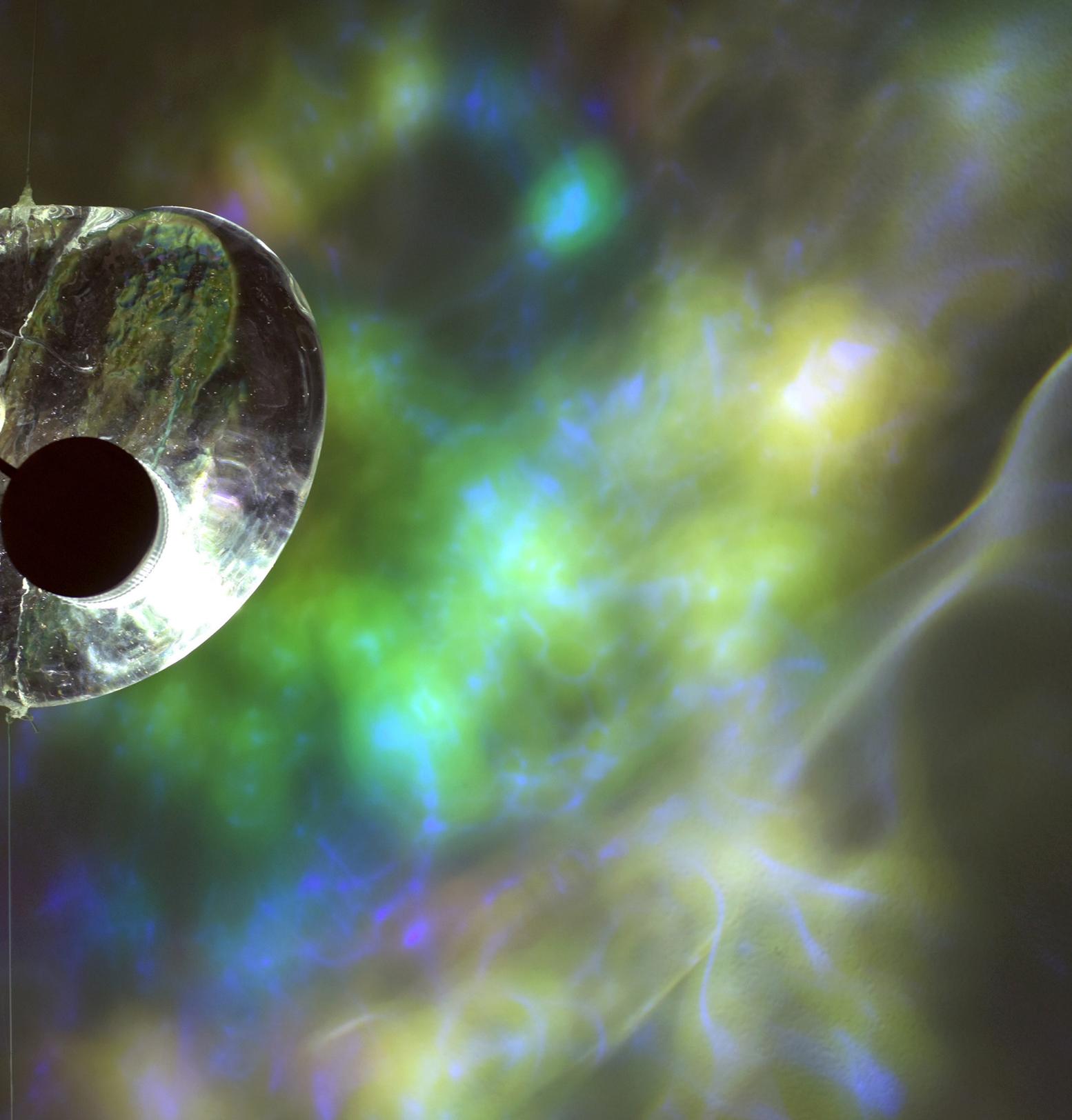
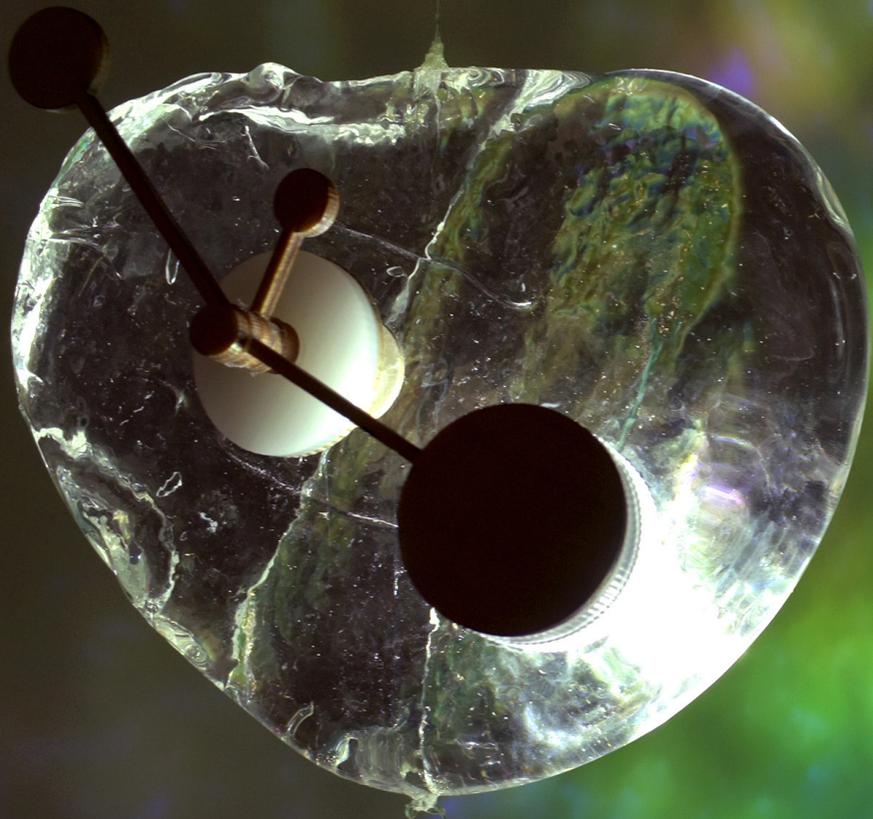
Pedestrians walking on the street can see different projections of colors and textures every time they pass in front of these windows.

From early evening when the sun starts to set, to dawn, the projections of four clocks show different color changes at different speeds.

I installed the work in front of the window so they can be observed regardless of the opening hours of the gallery.









Just as when we feel an emotion, it doesn't always stay at the same level, the stress of glass does not maintain its color with a single saturation and brightness.

Therefore, while installing 'Stressed Flowers', I observed that the color of the projection changes from yellow to purple even if the light moved only 1cm in a small glass piece. This made me think about determining the color of the piece by choosing which color and texture to show among the many colors contained within the glass. With this thought in mind, this work was created.

Like other previous works, this work also shows colored projections. But the glass sculpture itself becomes an object as a clock, and the projections also have different meanings. I gave the clocks and the projections two different titles but also related names even though it is a single work.

Conclusion

I work using the physical manifestations of stress, as expressed in glass, to parallel an exploration of human emotions.

Stressed glass is physically stressed. The result of that stress is possible to observe through the colors hidden inside, even though they are invisible, like emotions.

People normally hold their stress, until they can not tolerate it, then they start to express their emotions. Stress in humans and glass behave similarly. They are both something that is invisible unless it explodes. We don't see it but we all know it is there.

The reason I was interested in stressed glass was because I could see the colors in a clear glass object without any pigments or colored glass.

In stressed glass, the color depth is determined by the stress level when the glass is made and does not change over time. It is interesting that I can control the stress according to my decisions rather than external factors, and the stressed glass is made in response to my actions.

While previous experiments have shown that mixing different types of glass produces the greatest stress and dynamic colors, it is much more interesting to me to see how stress is generated by and reacts to my own performance.

Even before I started working on the color of stress, my main inspiration for my work had always been related to the material itself and my observation of its reaction. My focus has been on watching the results that the material creates naturally in response to my choices and actions.

In this concept of stressed glass, there are intertwined relationships between many elements such as me, a glass piece, stress, time, my actions, and colors which subtly affect each other. It is completed only after stopping the stress just before the explosion, and if any component overflows even a little, the glass will break.

I enjoy this working process which is like a tug-of-war between me and glass, me and stress, glass and stress, stress and color, or glass and beauty, and hope to explore more with the stressed glass world.

Bibliography

Goethe, Johann Wolfgang von. Theory of Colours. The M.I.T. Press, 1970

Jones, Caroline A., and Peter Galison. Picturing Science Producing Art. Routledge. 2014

Smith, Gary. "How to avoid Thermal Breakage". Building Connection. July 29, 2016. <https://buildingconnection.com.au/2016/07/29/how-to-avoid-thermal-breakage/>

Image Credits

All photos © PARK Jiemin 2022

© PARK Jiemin 2022

All rights reserved. No part of this publication may be reproduced without permission unless for educational purposes.

www.park-jiemin.com

