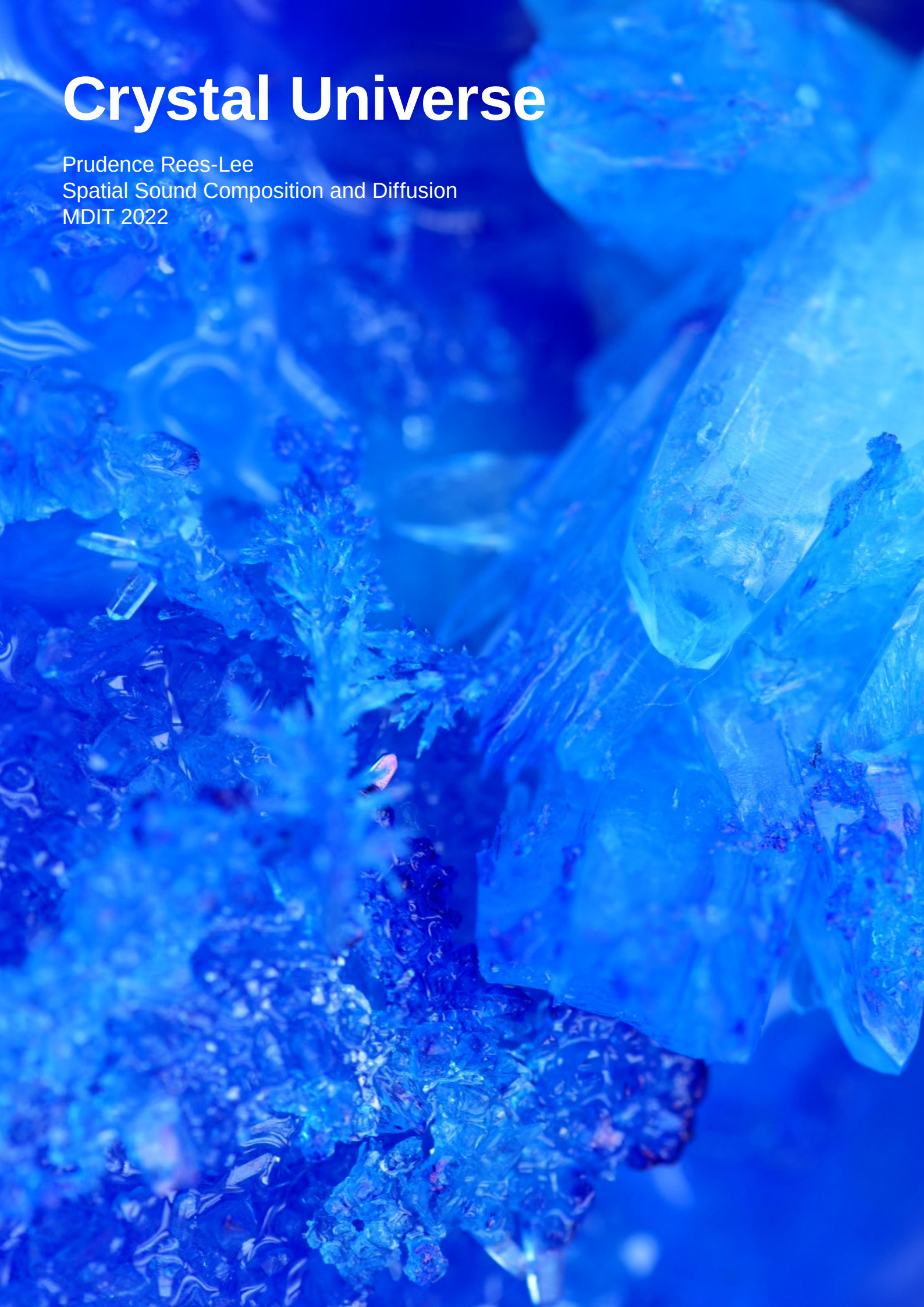

Crystal Universe

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Spatial Sound Composition and Diffusion
MDIT 2022

“The world is full of magic things, patiently waiting for our senses to grow sharper.”

W.B. Yeats

Contents

Introduction

The limits of human sensory perception has concerned both poets and scientists for centuries.

When considering the theme of time-lapse, it is the ability of time-lapse to reveal to us things which may not ordinarily be discernible which interests me. Like a magic power, it allows us to see patterns in things which move too slowly for our natural sensors to interpret.

The main concepts which drive my work include the development of complexity and ability to reveal what is hidden.

Additionally, I want to create something visually arresting, using bold colors, and abstract shapes.

Like time-lapse, electronic instruments offer possibilities which would otherwise be beyond human capacity. They can play impossibly short or long notes, bending sound from low to high frequency ranges with super human elasticity.

The natural paring of time-lapse, electronic sound and macro photography make for an immersive work.

Motivation & Inspiration

“Every man takes the limits of his own field of vision for the limits of the world.”

Schopenhauer, *Studies in Pessimism: The Essays*

Extending perception

How can we see that which is not visible? Things can become invisible to us if they are too big or too small, or move too fast or too slowly. I want to use time-lapse techniques, together with macro photography to make visible something that is ordinarily hidden.

In extending the limits of our vision do we extend our vision for the limits of the world? Do we reconsider our relationship to that which can and can’t be seen?

Brining awareness to a universe of materials, interactions, shapes and structures which usually lie beyond our perception presents the opportunity to foster empathy with things we may not be able to immediately see.

“If you have a truly complex system...then the exact patterns are not repeatable. And yet there are themes that are recognizable.”

M. Mitchell Waldrop, *Complexity: The Emerging Science at the Edge of Order and Chaos*

Evolution of complexity

I worked on a project with some of the scientists from NASA’s Mars 2020 mission. They were tasked with developing assays to identify if there were signs of life on Mars. They told me that they were looking for very simple lifeforms, but something more than a single cell.

A single cell wouldn’t tell them anything interesting. It exists in a vacuum, with no relationship to anything. Interest comes with complexity, because complexity offers more information. If something exists in relation to something else it gives you information about it’s existence.

This sparked by interest in complexity as it relates to my sound practice. A single sine wave in pretty boring, it doesn’t provide any information. But introduce an envelope, different frequencies or harmonics, then in becomes interesting, both sonically and visually (as the wave is affected), it can start communicating.

The evolution from simplicity to complexity is something I want to explore in the audio and visual components of this piece. What themes and patterns might emerge?

“I’ve been filming time lapse flowers continuously, 24 hours a day, 7 days a week, for 35 years. To watch them move is a dance I will never get tired of. Their sensual beauty immerses us with color, smell, taste and touch.”

Louis Schwartzberg

Beauty of form

Like Schwartzberg, I am interested in the aesthetics of my subject. Watching something grow and change in time-lapse is akin to gaining access to a secret world, a private universe. I want this universe to be sensual, saturated with color and mesmerizing.

I’m looking for abstract shapes and patterns. Works by visual artists such as Rothko or Yves Klein.

Yves Klein *Anthropometry: Princess Helena* 1960

Mark Rothko *Yellow and Blue (Yellow, Blue on Orange)* 1955

Research Question

What sound and visual techniques can I use to creative an immserive world of evolving complexity?

Crystal Universe

Crystal Universe is an audio visual work for 16 speaker array that uses time-lapse to explore the limits of our perception and evolution of complexity.

It invites it’s audience to consider the various shapes and textures generated during the crystal growth process, rewarding them with a vibrant, colorful display. Scored with 1970s modular synthesizers, listeners become immersed in a warm sonic ecosystem, pulsating with life, and as dazzling and detailed as the visual material which inspired it.

Early Research

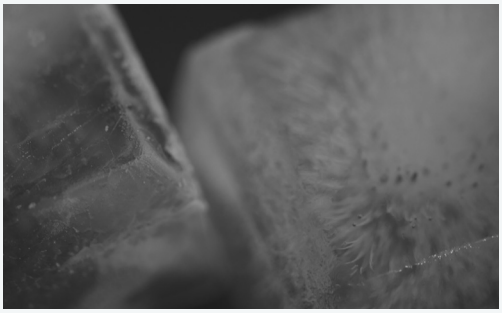
Early Visual Research

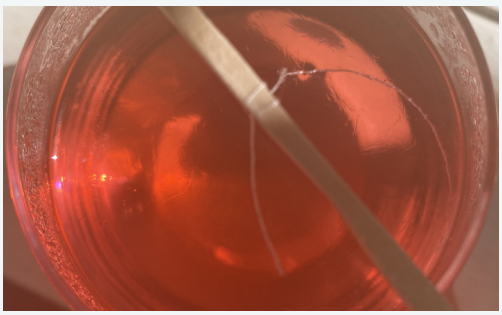
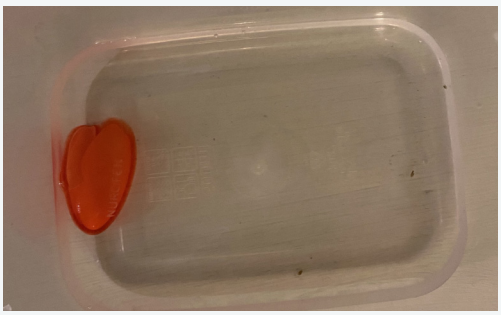
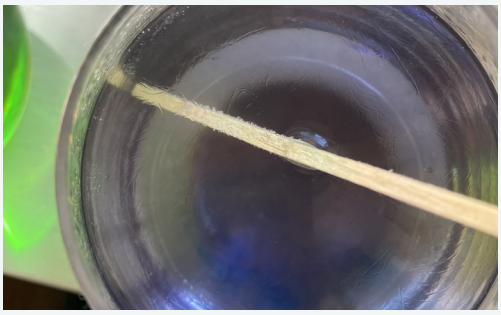
Criteria

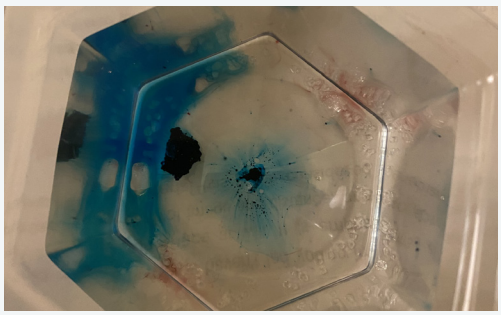
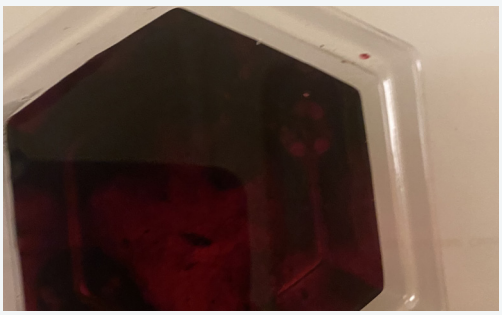
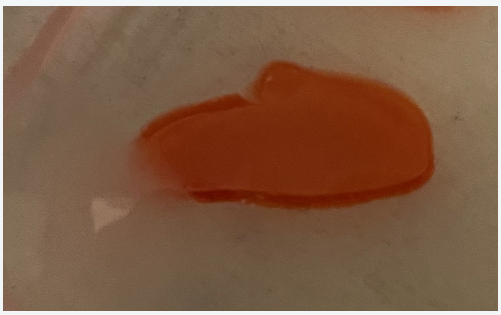
As part of my early visual research I considered what type of images I could realistically capture which would support my goal. When determining what would be suitable I had a number of criteria:

- Something that would be visually compelling enough to inspire an interesting sonic response.
- Could be grown from scratch to completion within two days. I chose two days as I wanted to film enough material over the period of a weeks, and wanted to grow multiple iterations.
- Could be grown in my home studio without the need for complicated sets ups or materials.
- Would grow reliably.
- Would produce interesting and varied shapes and colors.

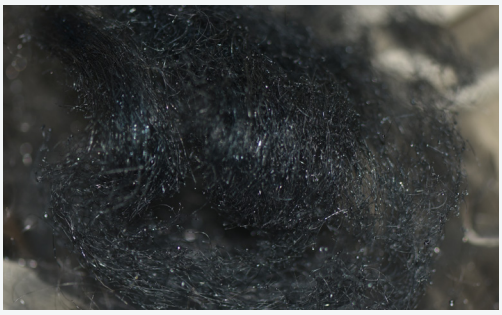
Documentation from early material experiments




Material Tests

I tested a number of things including melting ice cubes, fizzing baking soda, disolving medicine, growing sugar crystals and burning steal wool. I trailed each of these at home, however none gave the results I wanted. After watching some time-lapse YouTube videos I found that growing crystals with a kit from the Internet would be the best way forward.

I ordered the *4M Crystal Growing Experiment Science Kit* and was able to test it before shooting. I also ordered a number of ‘magic trees’ which I knew to grow quickly and reliably.

From these tests I found that I only needed to add a small amount of colored dye, as if the solution was too dark the crystal wouldn’t be visible as it grew.

Equipment

During my material tests I also familiarized myself with the equipment I would use to shoot the final video. I determined that my iphone8 camera wouldn’t be sufficient, so borrowed a Nikon D750 and Macro lens from the AV Loans department and practiced with them.

I also purchased a small product photography light-box. I did this so I could have a constant light source during the time-lapse filming, and also a clean background.


CRYSTAL GROWING
EXPERIMENTAL KIT
CONDUCT 7 CRYSTAL GROWING EXPERIMENTS. IT'S FUN TO WATCH THE SPARKLING CRYSTALS GROW IN FRONT OF YOUR EYES. DISPLAY THEM IN THE SPECIALLY DESIGNED DISPLAY CASES. IT'S A COOL CRYSTALS COLLECTION.
WARNING:
CHEMICAL COMPONENTS FROM BELGIUM AND AUSTRALIA. PACKED IN HONG KONG.
4M


PAPER MAGICIAN
SUPER PACK
3 TREES :
ONE 14CM TREE & TWO 10CM TREES
ONE PC
14CM TREE
ONE PC
10CM TREE
ONE PC
10CM TREE
BLOSSOMS THAT
5-6 HOURS
BLOSSOMS GROW FROM PAPER
The flower begins to grow frow the tree after 1-2 hours, and will be fully grown in 6 hours.
1-2 HOURS...

Early Sonic Research

Reading

Harrison's *Sound, space, sculpture: some thoughts on the 'what', 'how' and 'why' of sound diffusion* and Emmerson's *Aural landscape: musical space* were the two primary texts I consulted regrading sound diffusion. I also watched a number of Stockhausen's lectures on youtube.

Listening

I listened to a number of works which were mentioned in the readings including Stockhausen's *HYMNEN,* and *Klavierstu¨ck I, Poème électronique* by Edgard Varèse. I found I was more drawn to computer music compositions and electronic compositions over Musique concrète or field recordings. Listening to these works, even in stereo, gave me a good idea of how a spacial work could be organized.

Practice

I made use of the NSpace speaker system early in the course to familiarise myself with Reaper, ReaSurround and correctly routing my piece. I brought in audio from previous projects I had worked on and experiemented with stereo difusions, and also mapping tracks to various speakers, automating the work.

I am comfortable using various effects, software instruments and mixing my work, so I required less practice time for these elements.

Right: Stockhausen, from https://www.soundonsound.com/people/karlheinz-stockhausen, accessed 28/10/2022

Exploratory visual design development

Process for capturing images

I wanted all the images used in this piece is exist in their own universe. A world of saturated color, developing complexity and interesting geometries.

To achieve this I used an LED light-box with colored backdrops. I also wanted to capture small details and movements, so I used the Nikon D750 and Macro lens on a tripod.

I set the camera to take one photo every 3 minutes. The battery life meant I generated approximately 1 minute of footage before it required changing. When imported into Premier Pro I would speed that 1 minute up to last around 5 seconds.

Images used within the piece

The images used in the piece fall broadly into 4 categories. The movement from the first to the fourth phase represent emerging complexity.

1. Preparation

A primarily liquid state where the crystals are being prepared. For the magic trees this includes seeing the liquid travel up the tree.

2. Early Growth

The first signs that the crystal is growing.

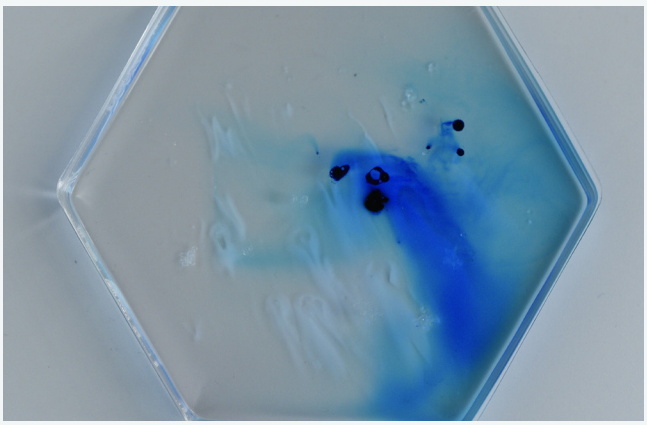
3. Full Bloom

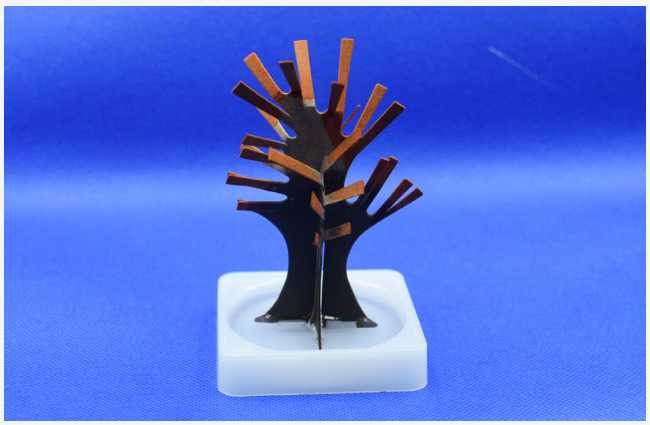
The crystals taking interesting, complex shapes, growing outward.

4. Maturity

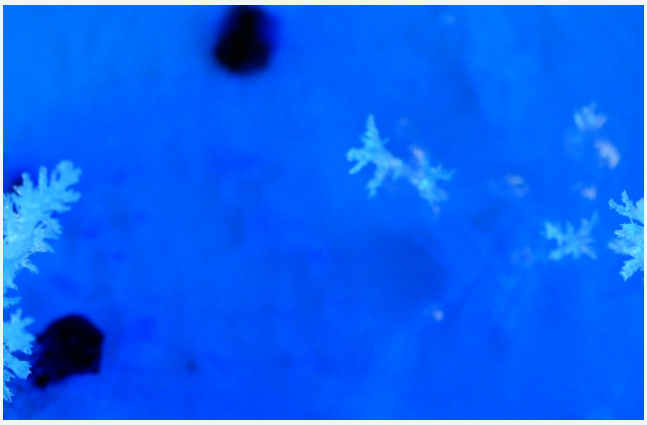
These were not shot in time-lapse, but capture the crystals in their maturity

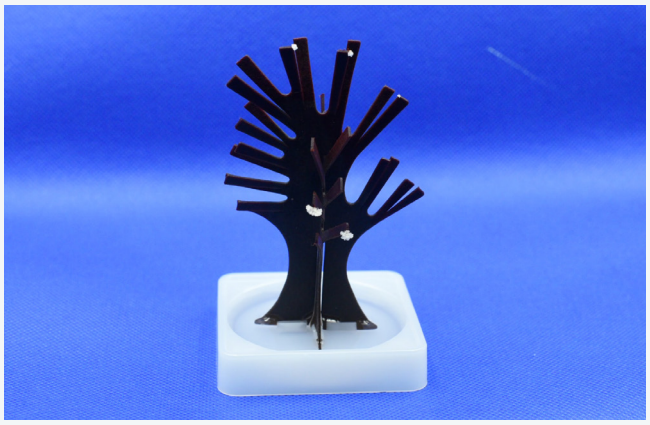
Preparation



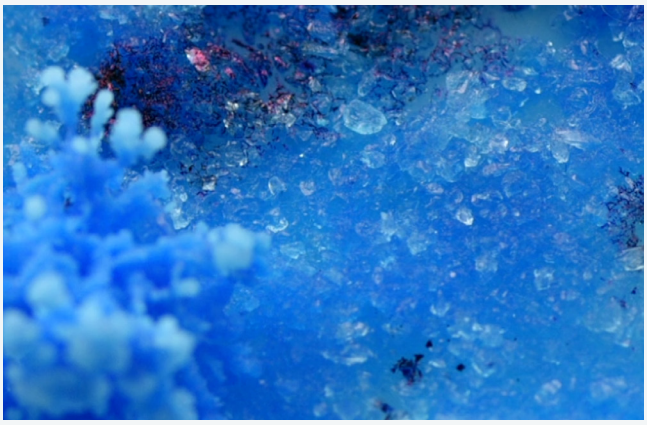


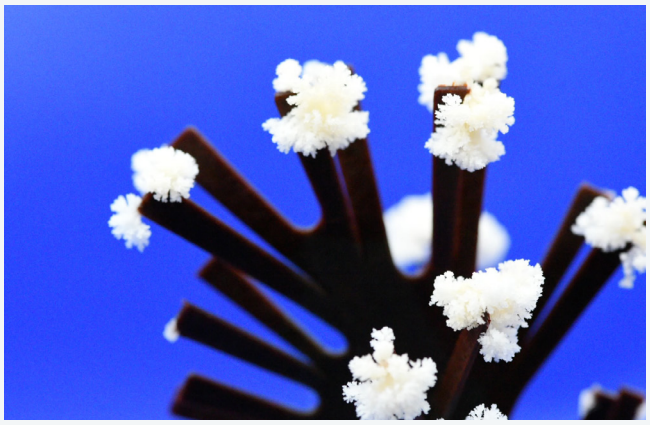
Early Growth





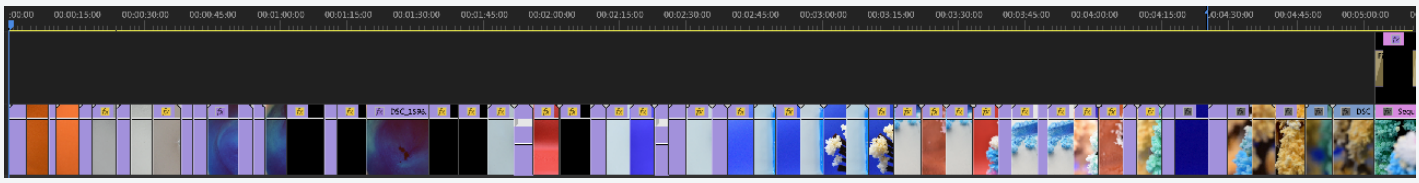
Full Bloom





Maturity

Building the structure



The visual structure of this work tracks the growth of numerous crystals from infancy to maturity. After I had gathered the footage I spliced it so that it would cut between each crystal, so their growth happened simultaneously.

Rather than watch one crystal grow completely, you saw them all at their beginnings at the start of the work, and then all at maturity at the end.

My storyboard evolved organically during filming. As an aleatoric work there was a degree of experimentation and unpredictability in the footage I was capturing, so I wanted to see what the most compelling shots were and then build my piece around them.

Exploratory audio design development

Sound Creation

Most of the sounds in *Crystal Universe* were created using analog modular synthesizers. The instruments I chose for this project included The Moog55, Buchla 200e and ARP2600. I was able to access and record these instruments at the Melbourne Electronic Sound Studio.

I used my Macbook Air, Apogee Duet interface and Logic to record.

Like the visual development, much of the sound work I did was exploratory. I did not go into recording sessions with a specific sound I wanted to create, rather, I took visual cues as a starting point, recorded a lot of material and then edited it.

I wanted to use modular synths for this project as to me they are capable for building entire sonic worlds, which have their own logics, patterns and behaviors, much like the crystals. I also prefer the sounds and experience working with hard synths instead of in the box.

My process involved recording approximately 5 hours of sounds generated by these instruments, and then going through and exporting small segments, which I could then treat as discreet sonic objects.

I did use a two sounds which were recorded with a Zoom H2n Handy Recorder. These sounds were blowing bubbles into water, and corn popping.

“Everything has some consciousness, and we tap into that. It is about energy at its most basic level.”

Robert Moog

Moog55

ARP2600

Effects

I used many effects to create this work including reverb, delay, EQ and chorus effects. Most of these came directly from the instruments, and were applied during the sound creation process, but I added additional effects using plugins from the SoundToys suite.

Once I moved my files into Reaper I used Reapitch to shift the pitches of some of my sonic objects, and stretch and compressed some of them to better match the video.

As I was using old instruments, sometimes there would be a faint buzz, or unwanted artifacts. I removed these using EQ

Buchla 200e

Synthesis Techniques

I relied heavily on sequencers and arpegiators in this work, both for long and short sounds.

Using the frequency fader on the Buchla, together with a random arpeggiator allowed me to create sounds which represented movement occurring in the visual field. Longer sequencers gave the work structure and contributed to the feeling of growth during the ‘full bloom’ and maturity phases. While I felt it was effective to anchor most of the composition in these sequences, they could also be limiting, as they defined a rhythm which could potentially limit other types of movement.

As the work is concerned with developing complexity, I also considered how the sounds could represent this as well. Shorter, more spare, single oscillators give way to complex waveforms as the work progresses, symbolizing the emerging visual complexity.

Sound Design Process

For the diffusion, I employed a mix of live diffusion and automation.

I was interested to find that higher frequencies naturally sat higher in the space, and lower frequencies occupied lower space. Knowing this meant that I was aware of the frequency spectrum of my composition and how it would translate.

In the future I think I will either completely automate, or diffuse a stereo track.

I found it difficult to keep track of what was automated what wasn’t, and while this could be mitigated by a more detailed score and more practice, the directness of choosing one approach and sticking to it appeals to me, as there is a big difference in crafting automation and the manual, gestural act of live performance.

Building the sonic structure

Initially I had intended to match sounds to the visual imagery in a very granular specific way, however during the creative development I found that this was too restrictive. Instead I decided to use the four phases of the visual structure (preparation, early growth, full bloom and maturity) to broadly guide the sound.

In the preparation phase I wanted to keep the score quite sparse and evoke the ‘liquidness’ in the imagery. I did this by filtering white noise and adding the sounds of bubble being blown. There are also sparse sounds.

As the piece progresses and we enter the Early Growth period a quick, light sequence fades in. It is buoyant and new feeling, like spring.

During the ‘Full Bloom’ I introduced a thicker, heavier sequence, I wanted the sound to suggest growth. I achieved this with the Moog55, creating a pulsating sequence which sounds like it is trying to grow and emerge. I also wanted the sound to suggest small chemical reactions.

Finally, as crystals reach their maturity a polysynth enters, offering a sense of arrival and finality.

Some visual moments were sonically editorialized, I aligned short scatters of sound with particular edits so there was a sense that the score matched the visual.

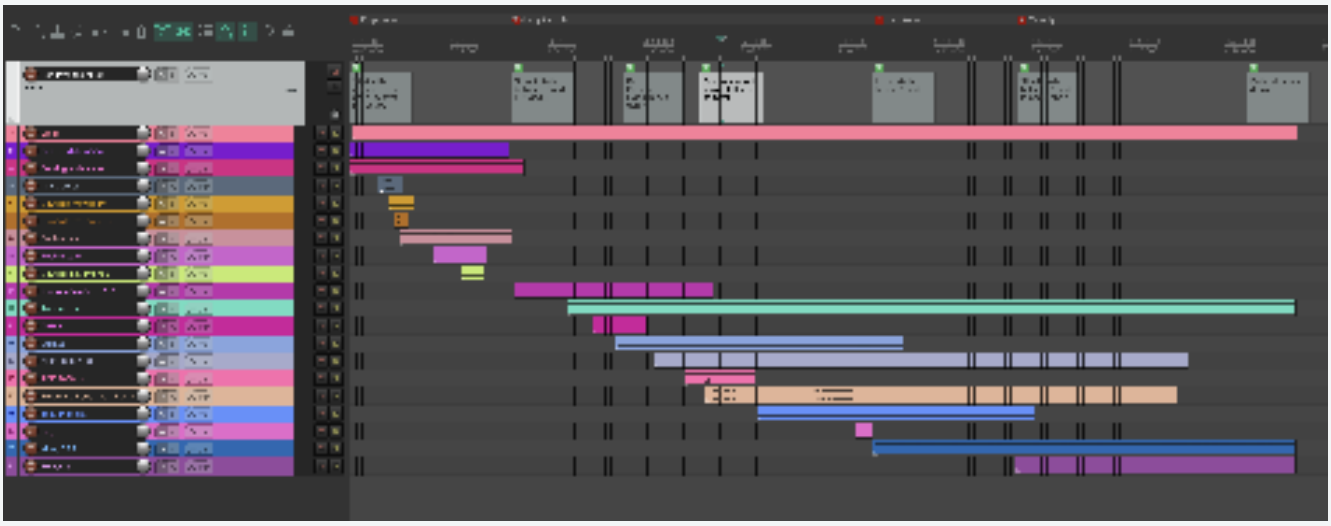
Exploratory score design development

The score for Crystal Universe was the Reaper file. Like the visual and sonic work, I did not create a score which then needed to be followed, rather I allowed the score to emerge from the compositional process.

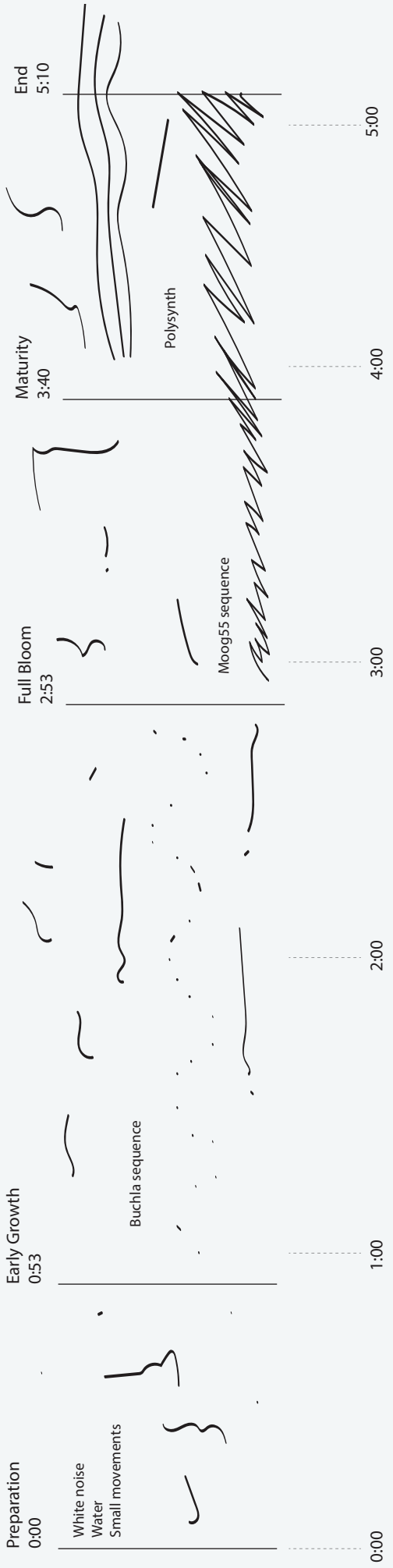
I used an empty track at the top of the Reaper project to add performance notes, which give spacial information. These notes were developed during practice on the Nspace system.

If I were to develop a graphic score for this work, I would use the chart I made to plan the sonic structure and add symbols in for each sound. I would need to conduct more research to determine best how to represent the spacaial elements in this work, but would look to scores by Stockhausen, John Cage and Xenakis. I would also look to include colour, as the visual inspiration is so anchored in bold colours.

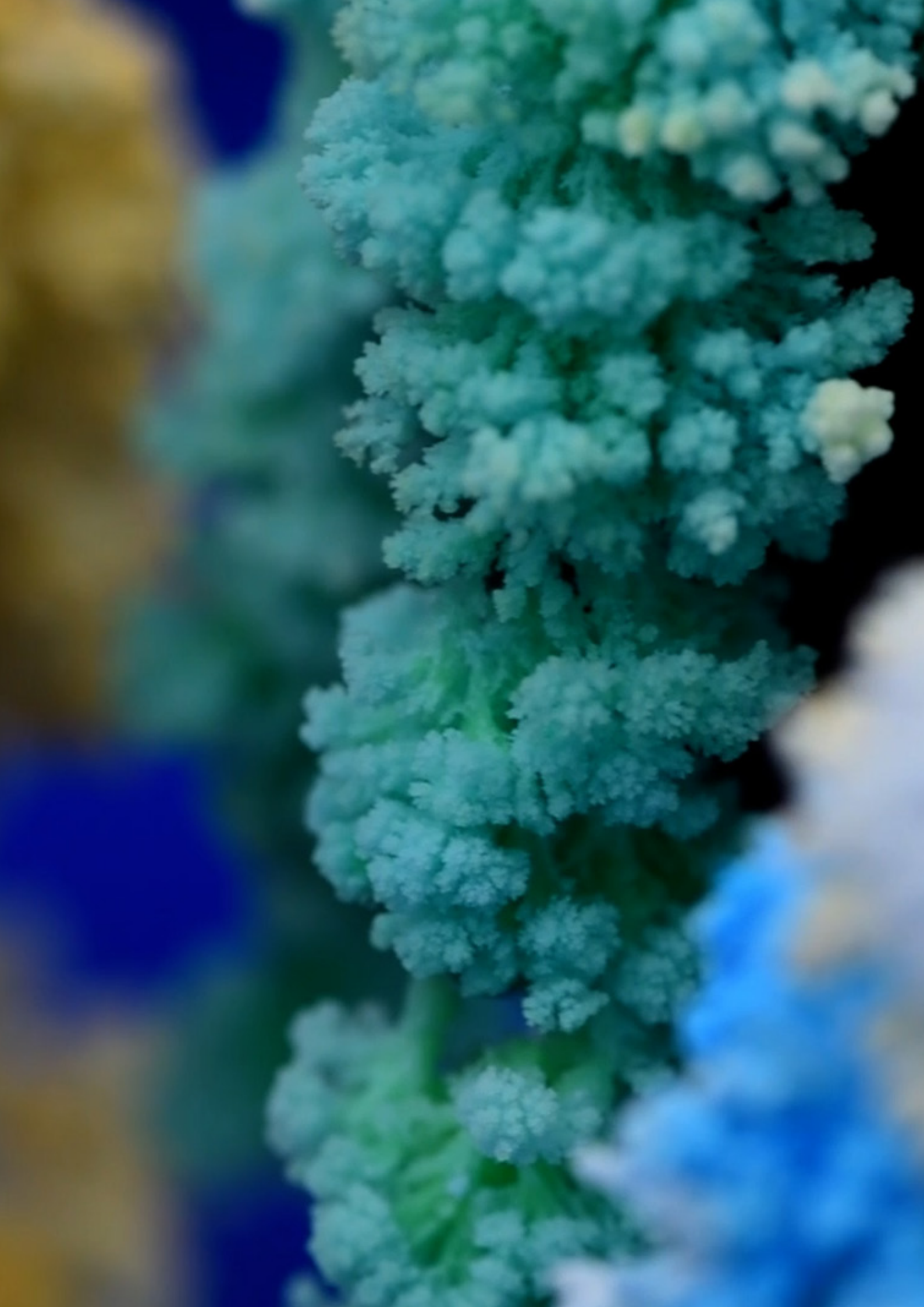
I have been collecting graphic score preecedents for inspriation and do plan to develop a creative graphic score for this piece in the future.



Early score sketches



Screen shot from my Pinterest Board ‘Graphic Scores’ of precedents I have been collecting during the semester.



Findings and reflection

I was very satisfied with the outcome of this project. I felt I was able to realize of goal of creating a work which used bold colors to track to development of complexity in a material which would ordinarily be beyond the limits of our natural perception.

It responded to the idea of time-lapse by brining into focus the movements and shapes which occur during crystal growth.

I do feel that the amount of work and research I conducted in aid of the visual development out weighed the sonic exploration, this was mainly due to time restraints, and also because I am more comfortable working with audio so I felt as though I needed less experimentation, but I do think that this balance is off.

There were a number of visual shots which I felt were very successful, and some which were out of focus. A second iteration of this work would involve re-shooting crystal growth so that the visual element is ‘all killer, no filler’. I’d also be curious to capture multiple angles of the same crystal as it grows, grow different types of crystals and be able to film the time-lapses more consistently over longer durations.

The magic trees have a short shelf life and after a few days begin deteriorating, I would have liked to have captured this as well.

Sonically, I found that I wanted more space within my arrangement, particularly during the first 1-3 minutes of the piece. I feel I could have considered the spacial aspect more when arranging my composition.

I’m am also interested to revisit the readings by Emmerson and Harrison now that I have experience working with spacial sound.

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