

VISIBLE
POSSIBLE

THESIS PDF

BY

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ABSTRACT

Visible Frequencies was a prototype for what I like to call analogue surface pattern design – a process for generating pattern that relies on real world physical forces to shape the final result.

But more than anything it was a prototype for a life system – to see if my preferred hobbies, essential tasks and goals for self development might come together and actually support each other – to have more variety in my day, which is when I'm the happiest.

I wondered, could hard tasks become easier when paired with something fun? And could the things I do anyway or habitually waste, become resources for opportunity?

I therefore knew the project should revolve around my favorite pastimes: fashion, music (sound), gardening, research and photography.

My habitual waste and essential tasks were things like:

- Food scraps
- Garden clippings
- Documenting the process
- Integrating into a new city (Montreal)

And I seized the chance to wrap long standing aspirations / goals for self development into the mix:

- Buying a film camera and learning to shoot 35mm black-and-white film
- Getting comfortable asking strangers for portraits (every single one said yes)
- Committing to only speaking French in public (my second language which I have always wanted to get to a conversational level) (I did).
- Learning the basics of animation and video editing
- Getting better at embracing interim discomfort for the benefit of my future self

This project began with growing plants and collecting food scraps. These materials were then turned into pigment. By combining my love of Ebru (water marbling) and the phenomenon of cymatics, I developed a machine that helped me capture waves (both liquid and sound). And using indigo and sumi-ink, I showcased these prints on natural fibre (silk) in the form of a robe that I designed and built.

This project was loosely inspired by “Do Nothing” farming, a term coined by farmer and philosopher Masanobu Fukuoka. In short, while Fukuoka's method still required work, contrary to what the name suggests, it was about observing and harnessing nature's rhythms and building his systems around them instead of trying to control them, which ultimately resulted in less work and healthier crops.

By the same token, I don't see analogue surface pattern design to mean digital processes can never be used. I'm simply far more interested in the kinds of things that result when we work with nature and relent a bit of control.

Because anyone who works with natural material knows, it can be hard to achieve the exact same results twice!

But also, by embracing the unexpected and building it into the process, the experience became far more exciting and self-reinforcing than anything I've conceived on my own – like a surfer so focused on catching the next wave, they forget how much energy it takes!

I think the best ideas come from strange combinations – the non-linear, non- searchable solutions that crop up when we're least expecting – the kind we only usually stumble upon because we're out engaging in the world, when we have a chance to be particularly non-self conscious because we are doing a task for the enjoyment of the task itself. This is what I think analogue design encourages.

But I mostly like strange combinations because they are just fun! Which is perhaps the point after all – to make space for play...

I hope I'll always be fortunate enough to include play in my life. I also recognize it's not something everyone can prioritize. But at the same time I don't see it as a frivolous thing. I see it as essential to the human spirit, to retaining optimism and a sense of wonder and curiosity about the world. So I also know that keeping this a priority has to come from me.

*So while I'm thrilled with the results of visible frequencies, the goal is to eventually move on...to new experiments and new strange combinations, and to bring more people into the mix
– to **share** ideas and the excitement of play.*

Because there is so much beauty that constantly surrounds us, even when we can't see it.



ACKNOWLEDGEMENTS

*Behind every project is a sea of visible and invisible influences.
An immense thank you goes out to:*

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*My mentors **Cecelia Raspant, Capucine Robert** and **Maarten Smith**.*

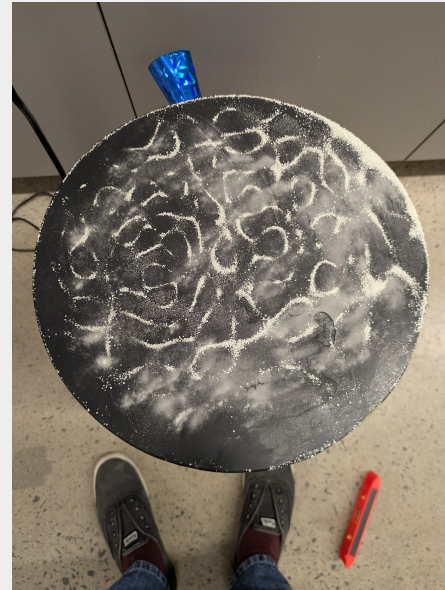
*Jurors **Becky Earley**, and **Troy Nachtigall**.*

*The **team** at **FabLab /échofab***

The many friends who opened their homes to me during my time in Montreal.

Bobby, Rémy, Emily, Mark.

And all the people who consciously or unconsciously shaped my thinking around analogue surface pattern design...



USEFUL UNDERSTANDINGS

The Principles Of Marbling:

The goal with water marbling is to achieve balance between the following elements:

- Pigment + Binder
- Size surface tension
- Surfactant (spreading agent, i.e. oxgall)

Dyes Vs. Pigments:

Dyes go inside fabric. They bond with fiber at a molecular level.
Pigment bonds to the surface of fabric.

In the lake process, you are binding dye molecules to alum, which makes it a particle. The particle is then too big to go in the fabric so it binds to the top. This is why, with fabric marbling, you need to use pigment, not dye.



PROCESS - CARRAGEENAN

Carrageenan (size):

The reason we use carrageenan (among other substances like Methyl cellulose) for the marbling bath (called the “size”), and not just water, is because we want the surface to have tension. The pigment has to spread on the surface, not integrate into the liquid. This is what allows you to manipulate the look and shape of your pigments, by raking or combing them.

The Carrageenan mixture gets thinner over time. But that’s not always a bad thing. Sometimes it can start to smell bad but I was able to push this. If you are repeating my experiments I recommend keeping all your various carrageenan mixes. Having thinner and thicker baths helped me identify if the trouble stemmed from my pigments or my size.

I used the Jacquard brand of carrageenan. There are different types of carrageenan so if you use another brand look for **Lambda** carrageenan. As per the package instructions I started with this recipe below:

- Basic ratio: 4 teaspoons (roughly 19g) of carrageenan powder per 1 gallon of water (3.79L).
- Slowly add carrageenan to warm water in a big jug or bucket. Mix with an immersion blender or hand mix vigorously and pour into a regular blender to mix further until fully combined.
- Pour mixture back into a big jug / bucket and let the solution sit for up to 12 hours (or at least 1 hour) until all the bubbles are gone.

PROCESS - PIGMENT

To make pigment you first have to make a dye bath by boiling down your organic material. You then “lake” the bath to make the pigment by a chemical process the binds that dye molecules to alum particles.

The pigment reactions on the size changed day to day and sometimes even hourly. This was due to environmental and circumstantial factors. I will break down how to trouble this stuff on the next few pages.

The process of making lakes from plants is well documented so I will not include it here, however you can find it by searching the Fabricademy Handbook > Natural Dyeing > Lake Pigments. The link to Cecelia Raspanti’s tutorial is here:

<https://vimeo.com/1125585104/c9593dc9ea?share=copy&fl=sv&fe=c>

Model Pigment Recipe

After much trial and error, the following recipe proved to be the best starting point for every plant and mineral colour I tried. After this, they were each adjusted “to taste” based on how they reacted to the bath.

Hydration:

Pigment: 2.05g

Hot water: 0.75ml

- Make a “crater” shape and add a few drops of water in the middle to hydrate the pigment. Mix until fully wet.

Mulling:

Water for spreading: 10ml

Binder (gum arabic) 2 drops

- Once hydrated, add more water for spreading.
- Then add a binder such as gum arabic.
- Mull the pigment with a glass muller on a glass plate in a figure-eight pattern until smooth and fully blended. It should be the consistency of “mayo” or gouache.

PROCESS - PIGMENT

Marbling Prep:

Ox Gall: 2.05g

Water: 2 drops

- Collect a “cherry-pit” sized amount of pigment and place in an airtight glass jar.
- separate the rest of the remaining uncollected pigment into separate small jars the same way.
- In the jar you will use first, now add 2 drops ox gall and 2 drops water.
- Mix with a paint brush. You're ready to test it out.

Finding Balance

If your pigment sinks on the size it is usually one of two things:

It is either too heavy,

and / or

There is not enough surface tension in the size.

Pigment can be “heavy” for a few reasons. Sometimes the laked particles have not been mulled well enough. They are too thick **or** there is too much binder in the pigment weighing it down, **but** it can also be because there is **not enough** binder. If the pigment is too watery it won't float, it will try to integrate into the bath (a.k.a sink).

This is my preferred trouble shooting order for sinking pigment:

1. Replace your size:

Natural pigment is valuable! It takes days to make. A wrong adjustment can ruin it. So start here.

- Does replacing your size with a thicker one help the pigment float better (even just a little bit?) If so, then it's a safe bet to move on to adjusting your surfactant.
- If not, then it's usually not a size problem (in my experience it rarely ever was). So now assess the pigment.

PROCESS - PIGMENT

2. Assessing the pigment:

- Always split your raw pigment into multiple batches and store them in separate airtight containers. This way if you ruin one batch, you still have some left from the same recipe, which is important when troubleshooting. Laking can yield such a disappointingly small amount of pigment, so treat it with respect!
- With one batch of pigment, assess the particle size. Rehydrate the pigment on the mixing plate just enough to get it to a smooth mulling consistency and keep grinding it. You're looking for a smooth syrup-like consistency that isn't too watery. It's too watery if the muller sticks or "hiccups" along the mixing surface.
- If this doesn't help, add more binder (Gum arabic). Go slow. Adding only two or three drops at a time. Re-mull. Test on the bath.
- Some people add glycerin or honey at this stage to help with consistency. If you do, go one drop at a time. Now try it on the bath again.

3. Adjusting your surfactant

- If the pigment now floats you can work on making it spread. Sometimes it will float, but in a tight little pearl.
- Plant based lakes are very sensitive. So go especially slow with surfactant. Even one too many drops can push it over the edge and make it start splitting apart. After that it's really hard to fix.
- For this reason I recommended splitting up your "floating" batch again at this stage.
- Add one drop of ox gall to your mixing pot at a time. Mix thoroughly and test. Watch carefully. The pigment will start to open up.
- If it over-spreads or splits apart, you've pushed it too far. Go back to your reserve batch and add surfactant to the point just below when this happens.

PROCESS - PIGMENT

Characteristics of Pigment.

Pigments have varying degrees of solubility. Indigo for example is notoriously hydro-phobic, meaning it takes a lot longer to hydrate. In this case it was actually a blessing because it can be slightly easier to float without too much adjustment.

The particle size of plant-based laked pigments can also be hard to control and measure. They vary from batch to batch.

What I learned after many plant based tests is that traditional Ebru was mostly done with mineral pigments for this reason. For the same reason as indigo, they can be less water soluble and a bit easier to grind to consistent levels.

Pre-Made Pigment Alternatives

For my project I ultimately worked with indigo for the aforementioned reasons. I also used Sumi - ink (closely related to China ink and India ink).

All of these are black carbon based inks mixed with a natural binder. It can be a natural resin like shellac, animal glue, or gelatin.



PROCESS - CYMATICS

Resonant Frequencies

When it comes to cymatics, many factors impact the success of your prints showing up. This can include:

- Carrageenan thickness
- The type and material of your plate / container
- The size of your plate / container
- The size and power of the transducer / speaker you are using
- The way the plate is attached to your transducer / speaker
- The frequency you are driving into the system.

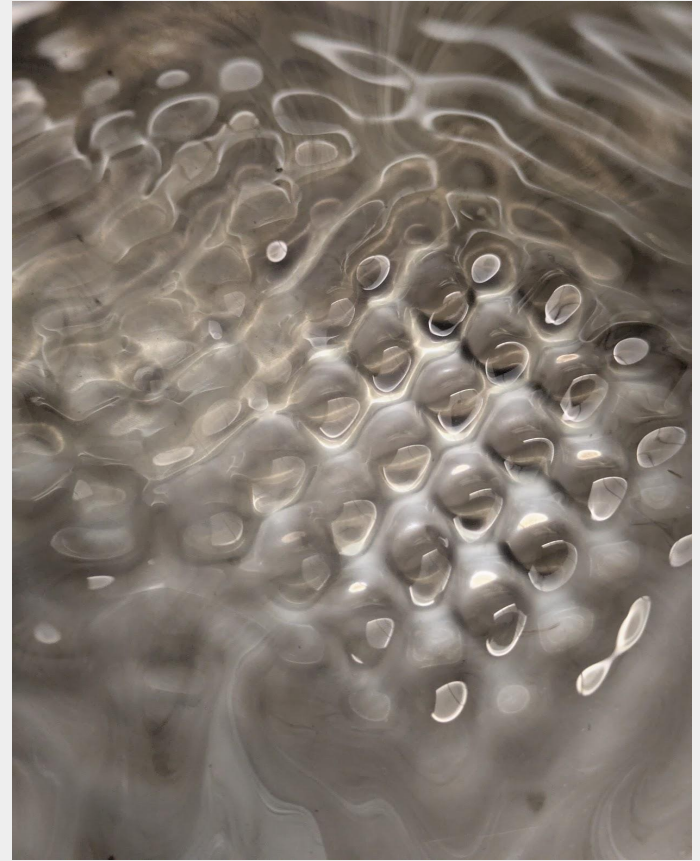
Machine Building Recipe

The following machine is my recommended method for generating cymatics to marble with.

1. Cut the top off a plastic bottle. Keep the lid aside.
2. Cut a hole in the lid of your container. The bottle top will feed through this.
3. Carefully strip back the plastic covering on your speaker wire.
4. Solder the negative and positive speaker channels to the speaker respectively.
5. Drill a small hole (for your wires) in the side of your plastic container.
6. Position the speaker in your container. Glue the bottle base to the cone of your speaker (only the part that pulses). This can cause it to degrade over time which is why it's good to use cheap speakers. I used tape in my first iteration, but it was not stable enough
7. Run your cables through the drilled hole.
8. Cut a hole in the center of a plastic sheet. The hole should be slightly smaller than the bottle top base for extra water-tightness. Drape it over the protruding base and container.
9. Now attach your cables to the amp (keep it switched off)

PROCESS - CYMATICS

10. Glue the bottle cap to the bottom of your tray. Make sure it is dead centre and level! This is essential. (If you have multiple bottles you can put caps on different trays and swap them out. Different tray sizes and materials have different optimal resonant frequencies).
11. Now you can screw your tray on the bottle top securing it to the rig.
12. Add additional "liquid catch" containers on the sides of your tray. Once you start filling it with liquid it can easily spill. Also plan to use a bigger screw lid / base combo for a bigger tray (an old peanut butter jar etc...).
13. Fill your tray with carageenan slowly. It should be just enough to float the paint but not so heavy that it tips the tray or weighs down the speaker cone.
14. using an RCA cable connect your phone to the amplifier. Pull up an online tone generator. There are many free online.
15. Start at a frequency around 20hz. It will be faint. Move up from here.
16. Keep the volume of your phone consistent and only adjust the volume on your amp or vice versa. Start at low volume and gradually turn the volume up.
17. Now you can play with different frequencies, and marble away!



PROCESS - KOMBUCHA LEATHER

As a bonus project I made a bag using kombucha leather that I dyed and sewed onto cotton denim. Below is the process of making kombucha leather.

Steps:

1. Mix vinegar tea and sugar in a pot and bring to a low simmer. Let cool.
2. When sugar dissolves and tea is room temperature (20-30 degrees celcius), transfer to a glass or plastic container.
3. Add liquid starter and a piece of kombucha mother (reserve some for other batches if desired).
4. Mix gently with a non metal spoon. Kombucha will change colour where it contacts metal so be wary of this.
5. Place muslin cover over jar and tape down. The goal is to prevent mold from forming.

6. Put the container in dark place with a temperature of around 25 degrees celcius for at least two weeks.
7. After waiting period, remove kombucha from the container and gently wash with non-abrasive soap, using gloves. The concentrate is like vinegar and acid burns are possible from the liquid. (Also wear clothes you don't care about. Liquid splashes can leave a funny smell.)
8. Lay washed kombucha flat on a sheet of MDF.
9. Rub glycerin on the kombucha sample to ensure it stays pliable once the trapped liquid evaporates. The more glycerin used the more pliable it will be. Too much will make it sticky. Too little and it will be prone to snapping. I applied mine without measurement but you can try different ratios.
10. Wait one week, or until excess liquid in kombucha evaporates.
11. Peel off kombucha leather slowly. You can now dip it dye and leave overnight or keep the existing colour.

You're ready to make something!

IMPROVEMENTS

Fibre Preparation Mistakes

I want to emphasize the importance of proper scouring when preparing your material. I highly recommend using a large pot. There needs to be room for your fibre to float freely. Because my pot was slightly too small for the volume of fabric I used, it did not scour uniformly. As a result, pigment did not adhere to all parts of the silk evenly. Some areas would not grab it at all.

This may also have been due to the soap. I used “The Unscented Company” hand soap. Next time I would recommend Synthrapol or a gentle detergent that is recommended specifically for silk.

Discoveries for Further Investigations:

Adding cornstarch to the carrageenan bath allowed the pattern to linger for a while after the tone had stopped, but it was harder to capture the prints then too because of the new chemistry. I have seen people use cornstarch alone as a size, but I have yet to try this. It's a promising avenue for more pattern control.



GALLERY

