LIVING SURFACE

A critical **material exploration**, questioning the synthetic surface

ABSTRACT

The synthetic surfaces we are surrounded by today cause damage to nature and humans. In this master thesis, we are defining surfaces as **paint and coatings, consisting of pigments and binders.**

According to recent research, “paint accounts for 58% of all the microplastics that end up in the world’s oceans and waterways every year.” (Hailstone, n.d.)

– How might we reveal hidden processes to challenge the contemporary aesthetic of the surfaces that surround us?

By using comparison as a tool, we are suggesting a shift from synthetic to living surfaces. Acknowledging that this shift requires a change in mindset, both in production and aesthetic expression.

The outcome is a handbook, a vocabulary list, a video, and an artifact that together questions the synthetic surface and showcases an alternative now.

This master thesis is a critical material exploration, within Industrial Design. It is led by research, and supported by visual communication. Instead of solving one specific problem, our process has been possibility-driven, exploring alternatives to synthetic surfaces by learning from tradition and combining this knowledge with new inventions.

Oslo School of Architecture and Design
Autumn 2023

Field: Industrial design, material exploration
Approach: Critical, explorative and, communication

Candidates: Elida Iben Høvik and Luca Verde
Supervisor: Nina Bjørnstad

This project began with a mutual wish to work hands-on with material exploration yet within a relevant field. Diving into the realm of biomaterials, and learning about paint pollution, triggered an engagement in both of us.

Synthetic surfaces started to reveal themselves,
covering the materials around us.

We started thinking of ways design could raise awareness on this matter, a process that has opened up more questions than when we initially started.

/Elida and Luca

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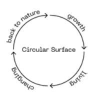
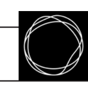
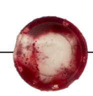
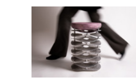


METHODS

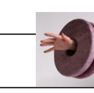




CONCEPT



DISCUSSION



REFERENCES

Introduction

UNDERSTANDING THE SURFACE

Surfaces are everywhere. Surfaces protect, hide, and reveal what is underneath. They form the outer layer, and they are distinctions between two parts, separating the inside and the outside of something or someone. The word itself carries a symbolic undertone, often describing the first impression, the outer layer of not only objects but people as well.

Materialized in combination with the solid, a surface cannot exist alone; making surfaces easy to confuse with the solid. In trying to address the environmental issues behind the synthetic surface, the confusion between the solid and the surface can create a dilemma.

While investigating wicked problems related to environmental issues, Timothy Morton invented the term ´hyperobject´, defined as; "entities of such vast temporal and spatial dimensions that they defeat traditional ideas about what a thing is in the first place." – Timothy Morton (Morton, 2013)

– are surfaces so difficult to grasp that we can look at them as hyperobjects?

Revealing hidden processes behind the surface might help to understand what it consists of, forming an accessible debate. In "Deep Layers of 'Flatland'", Benjamin Blackwell comments on philosopher Avrum Stroll, who "distinguished between two means of viewing physical surfaces: the ´ordinary person's´ and the scientists' conceptions." (Blackwell, 2023)

When scientists look through the microscopic lens, surfaces reveal uneven structures, patterns, and the look of living. Yet, what we see with our eyes is the outer layer, the condensed summaries of all these microscopic structures that sometimes appear flat and lifeless.

Blackwell raises a discussion on surfaces as a place of encounter. He concludes that surfaces are multiple, stating that; "moments of coming together, interaction, relation, and exchange are to be found at the surface." (Blackwell, 2023)

Perhaps the solid has to be part of the surface. Creating context and understanding, by using comparison as a tool to interact with the surface.

COLOR POLLUTION

The synthetic surfaces we are surrounded by today causes damage to nature and humans. In this master thesis, we are defining synthetic surfaces as; paint and coatings, consisting of pigments and binders.

Throughout history, humans have extracted pigments and mixed them with various binders for a wide range of purposes. Taking materials out of their natural cycles, and misplacing them without closing the circle. Leaving gaps in nature.

These pigments have been essential for cultural identity, artistic expression, and more functional applications such as coloring our clothing, houses, and surroundings. The most common form of white pigment today originates from titanium dioxide (TiO_2), which was invented and extracted from the mines in Sørkedalen in Norway in the early 1920s. Nowadays, titanium white can be found in all sorts of white surfaces, outdoors and indoors. Until recently, it was even used as a whitening agent in food, known as the substance E171. (Younes et al., 2021)

Binders are substances that hold compounds together, maintaining the grip between the pigment and the solid material.

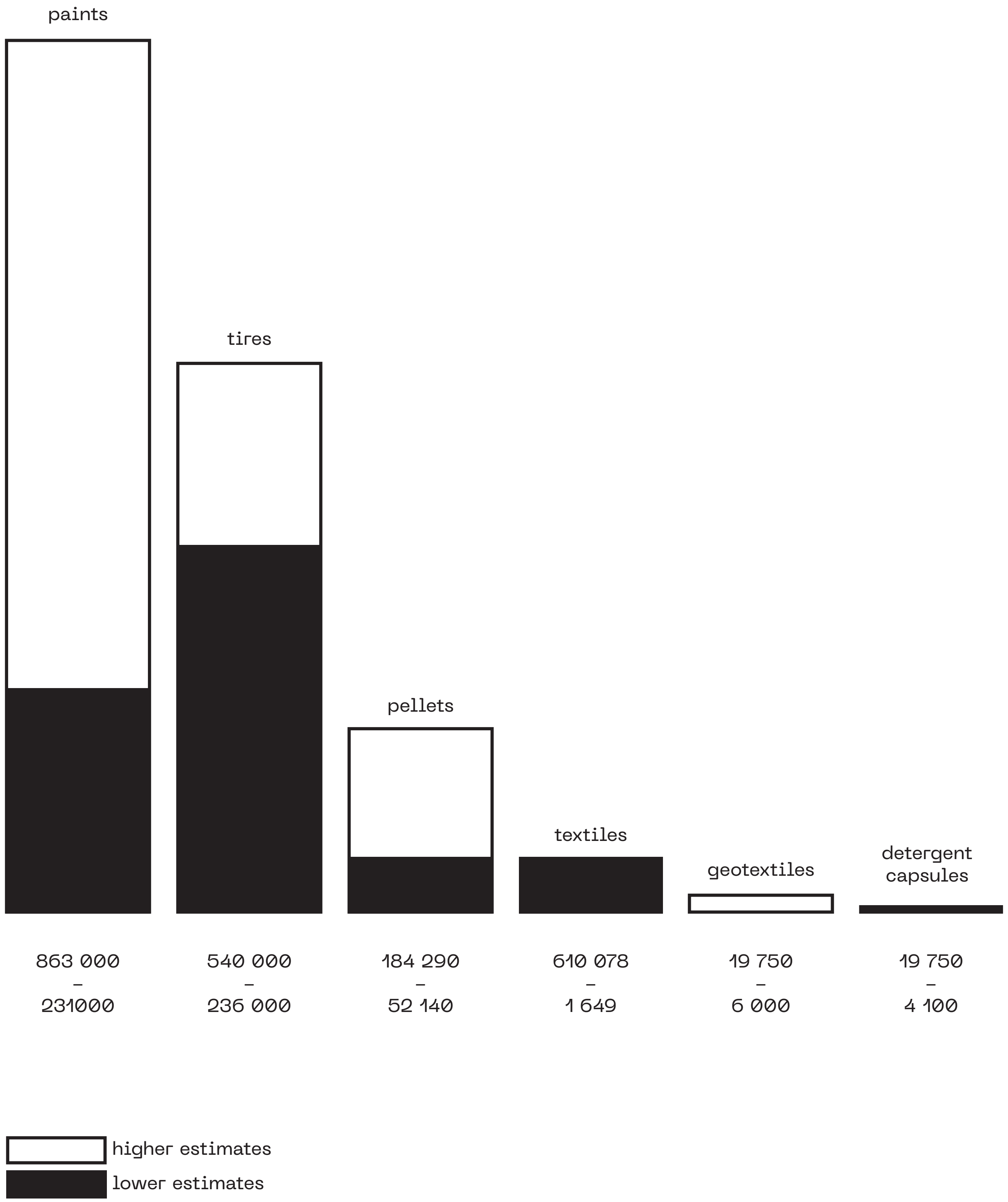
Although there are several natural alternatives to both pigments and binders, the synthetic options tend to win.

Plastic was invented less than a hundred years ago, yet acrylic has become the most common binding agent in paint and coatings. Acrylic binders are plastic polymers of fossil origin, meaning that they can end up as microplastic pollution. (Dcceew.gov.au, 2022)

In 2022, research published by the Swiss-based Environmental Action (EA), highlighted that paint accounts for 58% of all the microplastics that end up in the world's oceans and waterways every year. (Hailstone, n.d.)

58%

This was confirmed by the EU Action Against Microplastics report in October this year (2023). It is pointed out that paint and coatings account for the largest microplastic pollution worldwide, and account for a lower and a higher estimate of 231 00/ 863,00 tonnes/year. (EU Action Against Microplastics, 2023)



(EU Action Against Microplastics, 2023)

CHANGE IN MINDSET

The change from synthetic to living surfaces requires a new mindset, both in production and aesthetics.

In an interview with Laura Peeryman in Material Source Magazine, she states; “In the built environment alone, we are hearing the demands firsthand for materials with recycled or bio-based content, local origins, as well as traceable and circular life-cycle assessments. However, how can these same demands of our materials be applied to color?” (Bagshaw, 2023)

Additionally, research points out that; “80% of environmental impact is determined at the design stage”, giving designers an important role in a circular shift. (www.ellenmacarthurfoundation.org, 2022)

Throughout the last five years as design students, we have both experienced how the application of both paint and coatings is often the last step in the industrial design process. We believe that acknowledging the surface as a material of its own can bring forward a change from the synthetic to the natural. To achieve this we also have to change our aesthetic preferences.

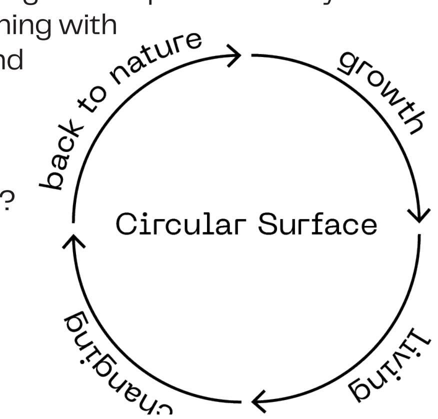
Researcher, art –and design-historian Ingrid Halland states that:

Further, she encourages this change by saying; “Our aesthetic desire for surfaces can be a key driving force for change”. (University of Bergen, 2023)

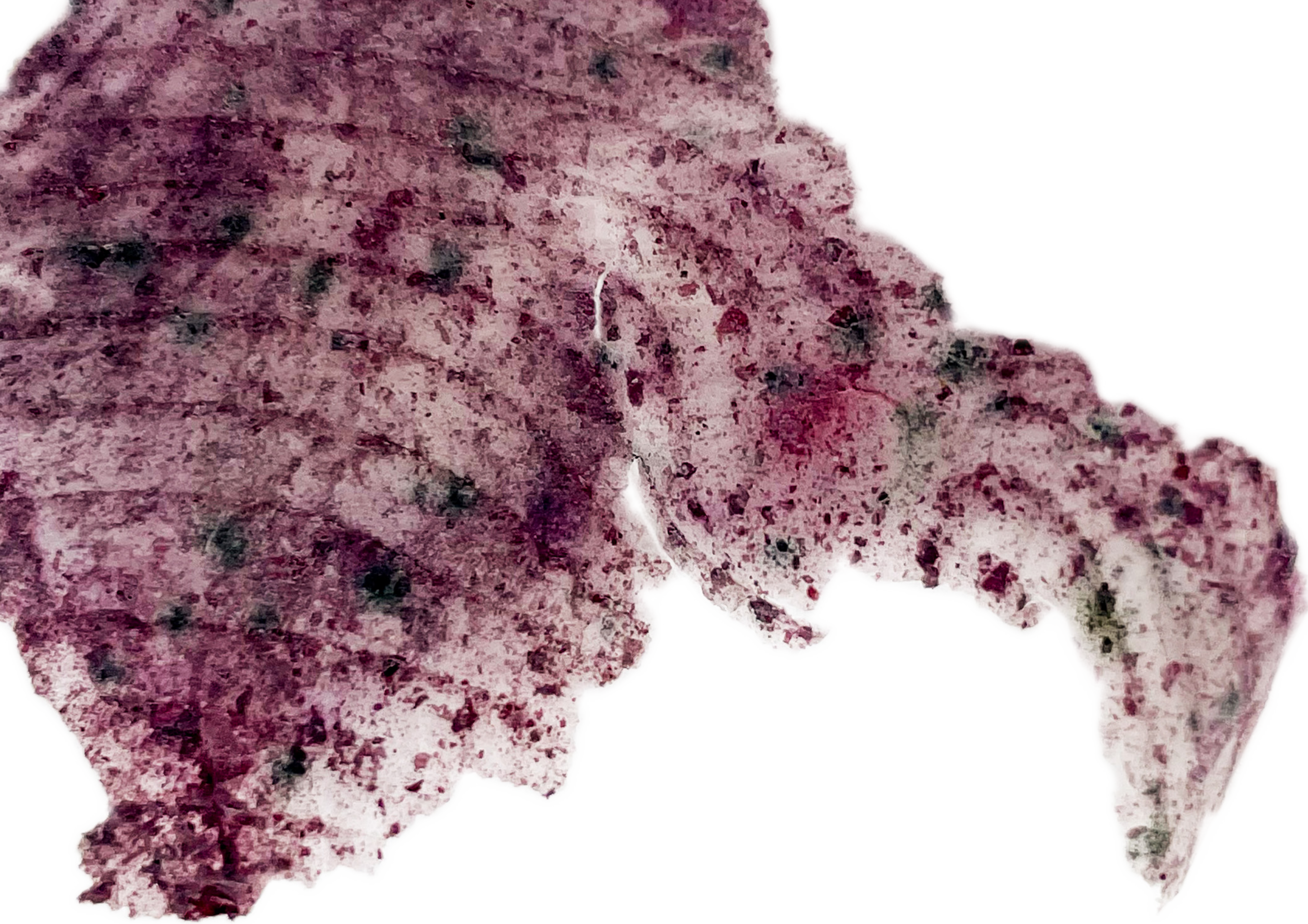
So what characterizes the synthetic surface that we are suggesting to change from, and how to define such an aesthetic?

Synthetics are predictable materials humans construct to behave and look in a certain way. Paint and coatings are often used to cover and make a surface look more even. This aesthetic is characterized by predictability and durability, and a desire for permanence. In contrast, nature is a circular system, embodying irregularity, unpredictability, and constant change.

Considering this, can we acknowledge the unpredictable by co-designing with nature, and adopting a design-to-fade aesthetic?



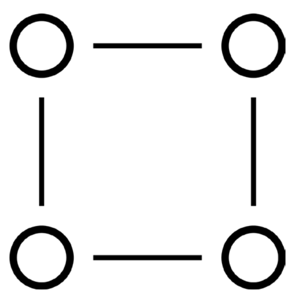
“the materials of a more sustainable future cannot mimic the aesthetics belonging to the paradigms we must leave behind”



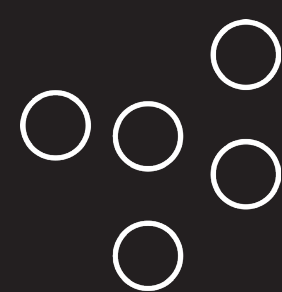
Methods

VOCABULARY

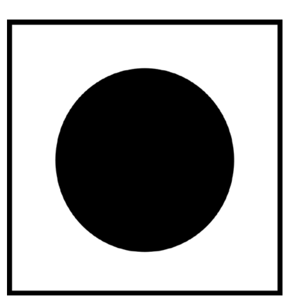
While synthesizing our research, we created a vocabulary of contrasts as a tool to better understand the framework of change that we are aiming for. This vocabulary became our requirement specification while developing the concept:



SYNTHETIC
: constructed by humans with a certain purpose.
described as
predictable, chemical, stable, lifeless.



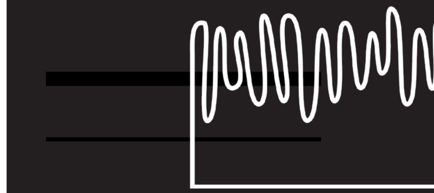
LIVING
: originates from nature with multiple purposes.
described as
unpredictable, natural, adaptable, ever-changing.



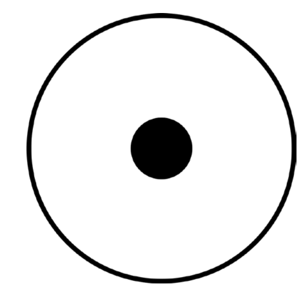
EXTRACTION
: materials taken out of their natural cycles, leaving gaps in nature.
described as
decreased, reduced, shrined.

GROWTH
: increasing on nature's own premises.
described as
increased, multiple.

FLAT
: an equal plane without raised areas.
described as
even, smooth, clean.

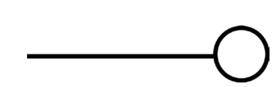


IRREGULAR
: an asymmetrical plane.
described as
uneven, textured, patterned.



HUMAN-CENTRIC
: focused on human needs, without considering nature.
described as
anthropocentric, inwards, consumeristic.

NATURE-CENTRIC
: encompassing environmental needs.
described as
naturogenic, outwards, biodegradable.

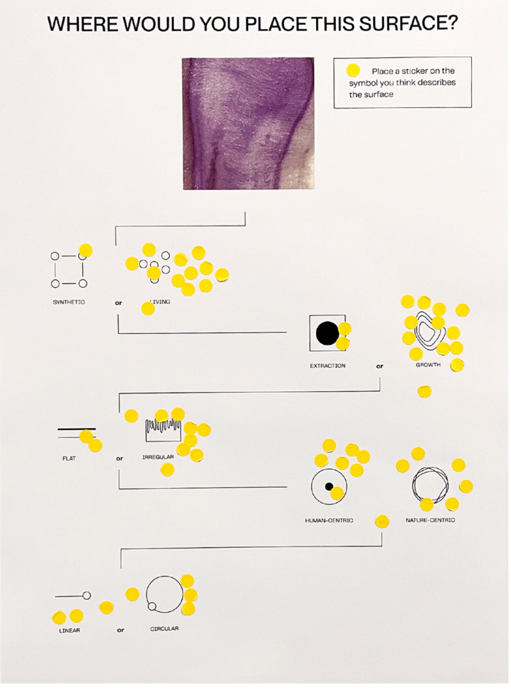


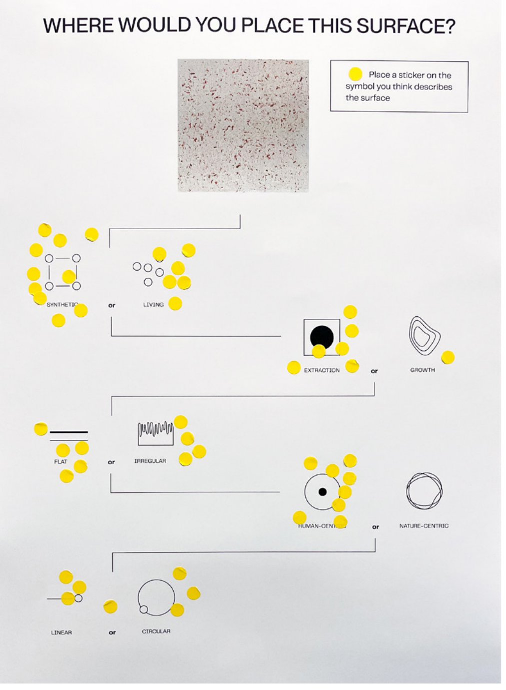
LINEAR
: take, use, and discard materials.
described as
momentarily, fragmented.

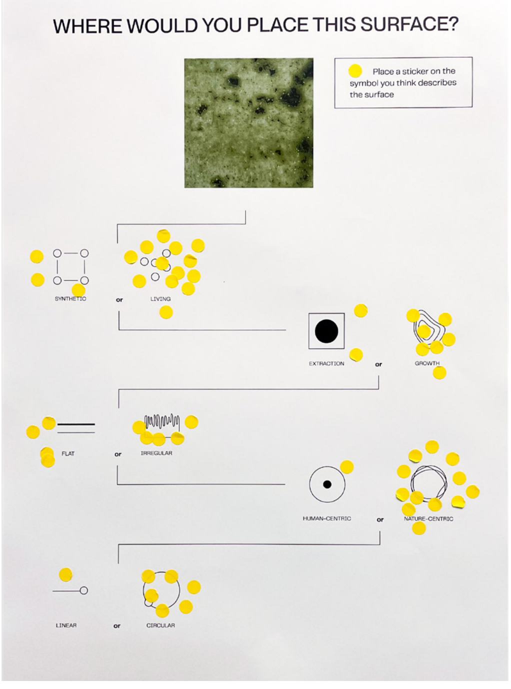
CIRCULAR
: keeping the materials in a loop.
described as
long-term, intertwined.

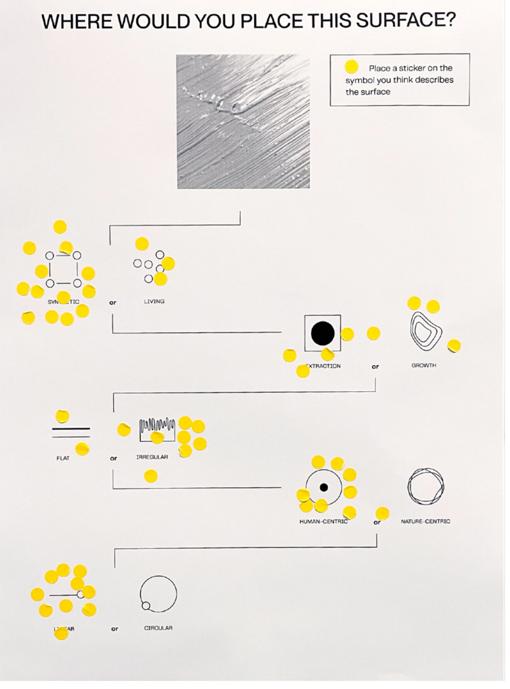
USER TEST: VALIDATING THE VOCABULARY

We designed four interactive posters, to test if the vocabulary we created to describe the contrasts between synthetic and natural surfaces, correlates with people's perception of the actual surfaces. Each poster contained one picture of a surface, asking the participants to place a sticker on the symbol they thought described the surface best. We hung them up in the queue area at AHO to get feedback from the students. The result shows that approximately 28 students participated.



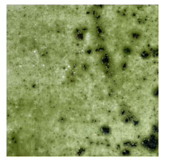






Takeaway 1:

'ASSOCIATIONS'



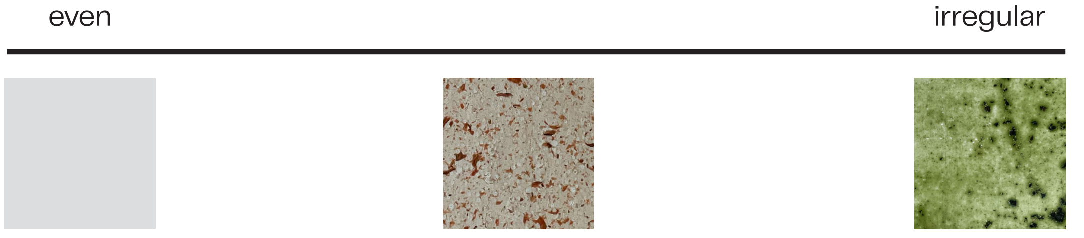
"It looks like mold"

The poster with color from carrots did not confirm the vocabulary. 10 out of 16 placed it as a synthetic surface. This might be because the photograph can be associated with materials such as linoleum. Compared to the green, with comments that it looks like mold, the contrast becomes even bigger.

Takeaway 2:

'THE IRREGULAR SWEETSPOT'

This made us ask ourselves if there is a sweet spot between an even and an irregular surface where the natural can be confused with the synthetic?



These results became important guidelines for our further explorations, **navigating associations.**

QUESTIONS THAT GUIDED OUR RESEARCH

In the first phase of this master thesis, we gathered all our research into 41 insight cards, which we used as a tool to create 8 key insights. Furthermore, we transformed these key insights into guiding questions that followed us throughout the whole project;

– How can we make people reflect on acrylic paint as a plastic surface that causes pollution?

– How can we rethink pigment and binders to create environmentally conscious colors?

–How can we learn from tradition when designing?

– Is it possible to design without contradictions between nature and humans?

– Can we utilize waste resources that are already in circulation, and look at bio-compostable alternatives?

– How can we learn from regulations, and at the same time be able to bend them when we design for change?

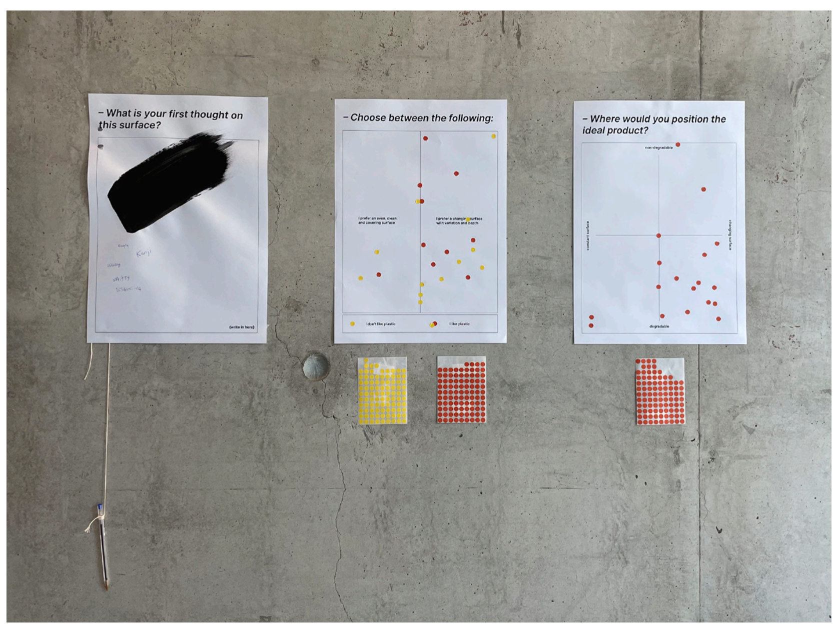
– How to approach our role as designers in this matter?

– Can we use aesthetic desire for surfaces as a tool when designing for change?

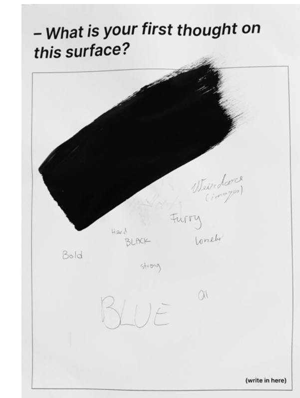
USER TEST: PERCEPTION OF SURFACES

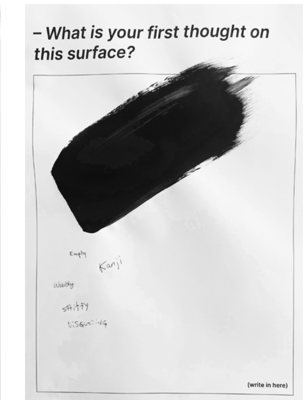
After doing a market analysis, we noticed that what is sustainable for humans (non-synthetic) and what is environmentally friendly (bio-degradable) is often confused, but are actually very different. Most of the paint alternatives referred to as “green”, “non-synthetic”, “environmentally friendly” and “zero-VOC”, contain acrylics.

We wanted to test how future creators look at surfaces. Therefore we created three interactive posters that we hung up in transient areas inside of AHO and KhiO. We collected answers from approximately 66 students. The three posters were based on the following:



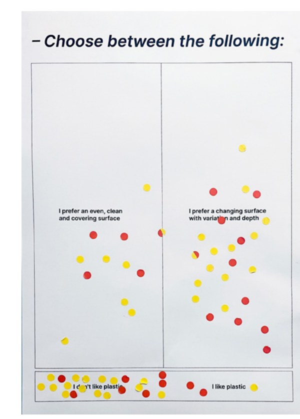
The acrylic surface: Get to know people’s immediate associations when confronted with an acrylic paint surface.

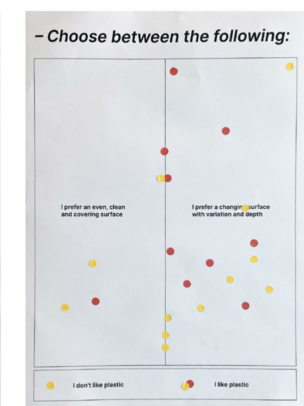




Result: The answers made us realize that people think of color more than a tactile surface.

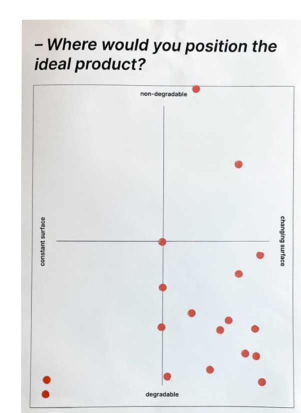
Aesthetic desire, hypothesis: people want even surfaces that plastic can provide, but they don’t like the idea of plastic itself.





Result: The majority of the participants answered that they prefer changing surfaces. But, many also found it hard to choose, which shows that it´s still a question worth asking.

Durability dilemma, hypothesis: people wish for durable products (surfaces), but these types of products are often not bio-degradable. At the same time, people care for the environment and its best.



Result: We can see that people are open to bio-degradable, changing surfaces. But is this out of correctness, or is it a market demand?

MANIFEST

After the first insight phase, we created a manifest to position the project. This is based on the **Dunne and Raby A/B** model, which differentiates between affirmative and critical design processes.

(a)	(b)
affirmative	critical
problem solving	problem finding
design as process	design as medium
provides answers	asks questions
in the service of industry	in the service of society
for how the world is	for how the world could be
science fiction	social fiction
futures	parallel worlds
fictional functions	functional fictions
change the world to suit us	change us to suit the world
narratives of production	narratives of consumption
anti-art	applied art
research for design	research through design
applications	implications
design for production	design for debate
fun	satire
concept design	conceptual design
consumer	citizen
user	person
training	education
makes us buy	makes us think
innovation	provocation
ergonomics	rhetoric

(dunneandraby.co.uk, n.d.)

Habitual acrylic
Why cover-up?

Borrowing expertise,
uncover old ideas,
unveil through design,

resilient plastic
painting(ing)
pattern

disrupting conventions
bringing surfaces alive
we use the aesthetic drive

to rethink your purpose

changing our needs to suit the world,
not the world to suit us.

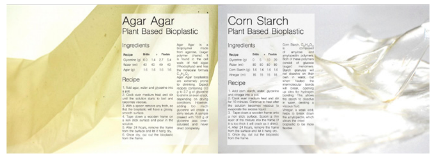
STATE OF THE ART

Projects and thoughts that have given us an overview of the debate about this matter, as well as functioning as inspiration and eye-openers throughout this project;

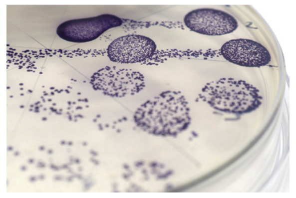
'Deep Surface' and 'With-On-White': Two research projects led by Ingrid Halland. With "Deep Surface", she states that 'aesthetic desire for surfaces can be a key driving force for change'. "With-On´White" dives into the history of Titanium Dioxide, highlighting how the huge application of one single pigment can change a whole industry.
(Ingrid Halland, n.d.)

(Farup's Archive, the Norwegian Mining Museum., 1910)

Bioplastic cookbook: A collection of bio-compostable plastic recipes created by Margaret Dunne, highlighting qualities and challenges with each material. We used this cookbook as a reference when experimenting with agar agar. (Dunne, 2018, pp.4-5)



Colorifix: First company to use a biological process to produce, deposit, and fix pigments onto textiles, that we have been in dialogue with. They sent us documents with information on their technology; a process that starts by identifying color in nature, building DNA codes, and engineering microbes to produce color. Learning about their process gave us a broader perspective on the use of microbial pigments, and scalability..
(Colorifix, n.d.)



(Colorifix Life Cycle Assessment Report., 2022)

'Moving Pigment': A project by Charlotte Werth, a London-based designer who created a bacteria dye machine, utilizing Janthinobacterium Lividum. Her project "Moving Pigment" aims to scale up the process of co-designing textile patterns with pigment-producing bacteria. An interesting balance between the poetic yet relevant to the industry.

(Werth, n.d.)

Material Matters: The podcast 'Material Matters,' featuring in-depth interviews with designers and artists on material techniques, hosted by Grant Gibson, has offered intriguing viewpoints and sparked interesting conversations about methods and values and the features of materials within the realm of design.
(materialmatters.design, n.d.)

Pearson Lloyd: Pearson Lloyd is a product design studio established in 1997. Their project 'Material Change' shifts the designer's role beyond the traditional scope of user experience, form, and functionality of products, to now consider material sources, supply chains, distribution, and the processes of reusing, repairing, and recycling. Person Lloyd's approach helped us ask questions about the design process, provided new perspectives as designers, and brought awareness of how we design. (Pearson Lloyd, n.d.)

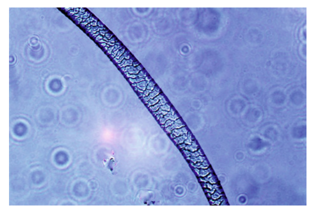
(Material change, Modus, 2022)

Franklin Till: Franklin Till is a research agency reimagining future materials, color, and processes. In 2019, they published the book 'Radical Matter,' a compendium of experimental materials and approaches that rewrites conventions within design and introduces a new model for production and consumption. Shifting our perspective to look at materials as systems, not objects. (www.franklintill.com, n.d.)

Oxman: Led by Neri Oxman, pioneer within bio-design, from MIT Media Lab. Oxman company consists of a cross-disciplinary team working at the intersection between scientists, biologists, engineers, and designers, aiming towards a complete synergy between nature and humanity. Their projects and philosophy have been a great inspiration for thinking of radical ways to shift from human-centric to nature-centric design. (Company, n.d.)

(Silk Pavilion II, 2020)

Studio Plastique: Studio Plastique is a research-based design studio. Their practice combines critical reflections and scenarios with complex material research, and with that pushing the boundaries of what design aims to achieve. Their projects have inspired us to focus on alternative ways to use communication and exhibition design as a part of our diploma. (studioplastique.com, n.d.)



(Krieck, 2020)

The Ethical Color Report: Ethical Color is a research project led by Laura Perryman, a color and material designer from London. Creating an in-depth dive into how ethics and responsibility have become parts of design decision-making through the lens of color. Through our diploma it has functioned almost like an encyclopedia, gaining the perspective that “no solution fits all”. (colourofsaying, 2022)

Plastivore Dictionary: A project that is a visualization of 12 terms related to plastic pollution, created to explain the entanglement between nature and plastics. It is one of several projects led by Plastic Justice, an educational collaboration between five art and design academies in The Hague, Reykjavík, Barcelona, London, and Vilnius. Plastivore Dictionary made us reflect on how visual communication can be used to explain difficult terms, making complex issues more available for understanding and further discussion. (talita virgínia, n.d.)

SWOT

STRENGTHS
Well explored
Exemplified many times
Self-growing (minimal extraction)
Secondary health benefits
Non-synthetic (closed loop)

WEAKNESSES
Unexplored color range
Liquid form
Within one field (fashion)
Greenwashing, hard to know what is bio-degradable

OPPORTUNITIES
Range of application methods
Scalability
Transformation to powdered pigment (evaporation techniques)
More sustainable production (Zero by-product)

THREATS
Need for sterilized production due to risk of contagion
Other competitors such as algae and fungi
Potentially changing ecosystems, if not well-regulated

By doing a state-of-the-art analysis, we could see that most projects rethinking color are within the fashion and textile industry. They are fields in which biologists, technologists, and designers meet, starting in the laboratory. Now, the usage of pigments from bacteria can be seen not only in research projects but also in the industry. This inspired us to bring the knowledge from soft materials, into the solid ones. To help understand the differences better, we did a SWOT analysis of textile dyeing with bacteria.

CONVERSATIONS WITH PEOPLE

To gain a broader perspective on the matter, we have been in contact with people from a wide range of fields:

BIOLOGY

A coffee with : Damian Petrkovic Karlsen (Biology master student – UIO)

Provided us a broader perspective on color in nature. **"I work a lot to build that bridge between most people and biology"**

A Zoom meeting with : Katharina Nøkling-Eide (Marine biologist – SINTEF)

Taught us how to extract pigments from algae. **"Without access to a lab, you can soak the algae in acetone"**

A phone call with : Marit Låg (Seniorforsker, Ph.D./Senior scientist – The Public Health Institute)

Helped us get in contact with microbiologists who could have experience with cultivating bacterial pigments.

Mail Dialogue with : Per Bruheim (Professor at the Department of Biotechnology and Food Science – NTNU)

"I have worked on optimizing the production of natural pigments but not their physico-chemical properties and area of application such as in paint"

A phone call with : Størker Moe (Bioengineer – NTNU)

Inspired us to think broadly about the bindings. **"In principle, linseed oil paint is a polymer like natural plastic".**

Mail dialogue with : Reidun Kavli Sirevåg (Biochemistry and molecular biology – UiO)

Made us realize the complexity of isolating bacteria. **"When it comes to the production of these pigments, I would assume that there is no quick fix. It is probably fine to grow the bacteria, but isolating large quantities of the pigments is more chemical work"**

Mail dialogue with : Gustav Vaaje-Kolstad (Professor, Research groups, KBM)

"Unfortunately, I do not have much expertise in the use of bacterial pigments in paint, but as a biotechnologist, I know that bacteria and fungi can produce many fine pigments"

A coffee with : Adelisa Lliani Biologist and design student – AHO

Helped us understand why it was challenging for us to cultivate pigments from bacteria. She also gave us some tips and tricks, while at the same time warning us about hygiene measurements and regulations; **"normally we don´t make the agar agar ourselves. There are special machines that boil-wash the Petri dishes after use".**

HISTORY

Interview and tour at Gallery ROM : Ingrid Halland (Researcher, art – and design-historian – UiB and AHO)

Taught us about the invention and the history of titanium dioxide, as well as giving us valuable perspectives on surfaces that have been following us throughout the diploma. **"Synthetic materials are hard to grasp because it is a process"**

Artist talk at Gallery ROM : Maiken Stene (Artist and founder of Velferden in Sokndal)

We learned about artist-run Velferden, which is located next to the titanium dioxide mines in Sokndal. **"Living in a city we use all these things, but we don´t think of where they come from. When you go there and see it, something happens with the participants"**

ART

A coffee with : Taylor Smith (Artist – Art Academy at KHIO)

Working with photosensitive bacteria Shared her experiences and gave us insight into working at the crossroads between biology and creative disciplines. **"I spent two years in an art residence working closely with a biologist to learn the process"**

Mail dialogue with : Nora Vaage (Working at NOBA – Norwegian Bio Art Foundation)

Nora Vaage provided us with references working with microbial pigments and invited us to their symposium about soil futures. **"We have not had people working on microbial pigments per se at NOBA, but there are many great projects where this is done. See Faber Futures, for instance."**

Several physical workshops with : Hilde Reh (Binder and pigment expert)

Guided us and participated in the first steps of our explorations, teaching us how to make hide-glue grounding, gesso, and mix it with earth pigments. She also made us reflect on color as a resource: **"People think of color as something constant"**

A coffee with : Henriette Mauritz Nordbeck (Artist – Art Academy in Berge)

Works with place identity and the materials from there, making paint and dyes from natural resources. We shared our experiences, and she explained to us the methods she utilizes to extract pigments from plants. **"The pigments are affected by its surroundings, earth quality, and seasons".**

DESIGN

Supervision with : Nina Bjørnstad
(Main supervisor at AHO)

Support throughout our diploma with supervising, insightful conversations, and knowledge about the form, aesthetics, and semiotics.

Mail dialogue with :
Serina Tarkhanian
(PhD-student at AHO)

Shared her knowledge on working with microbes, and gave us advice regarding material exploration that involves living materials. **"Material research takes time and microbes are living materials that take time to figure out"**

Supervision with : Steinar Kilii
(Head of design department at AHO)

Contributed by answering technical questions and gave us valuable feedback during mid-term reviews.

Supervision with : Mosse Sjaastad
(Interaction design teacher at AHO)

Mosse provided valuable supervision, diving into previous diplomas that had explored bio-materials. Additionally, she led the design sprint which helped us to gain important perspectives while developing our concept.

Supervision with : Enrique Encinas
(Speculative design teacher at AHO)

We talked with Enrique to share some ideas about radical future scenarios who questioned; **"why the future, why not now?"**. This conversation led us to the idea of an alternative now.

INDUSTRY

A Zoom meeting with : Andreas Vesterlund
(Working at Jotun)

Gave us important insights into production methods in Jotun and a better understanding of the commercial paint industry. He explained to us how changes in regulations affect decision-making towards sustainable paint solutions. We were also discussing standards and expectations towards paint today. **"You don't want to paint the house red, then two years go by, and then it's pink"**

Mail dialogue with : Esmee Watts
(Business Development at Colorifix)

Shared a Google-docs with information so that we could get insight into their process of developing bacterial pigments.

Mail dialogue with : Sondre Lomeland
(Working at Borregaard)

Helped us to get a sample of microfibrillated cellulose, that we used for our experiments.

ARCHITECTURE

A coffee with : Stian Alessandro Ekkernes Rossi
(Architect, CEO at Saferock and OIOIOI)

Stian gave us insight into the process of tackling complex environmental problems through design, with a focus on the material itself. **"Why talk about form, when you can talk about the process"**

ECONOMY

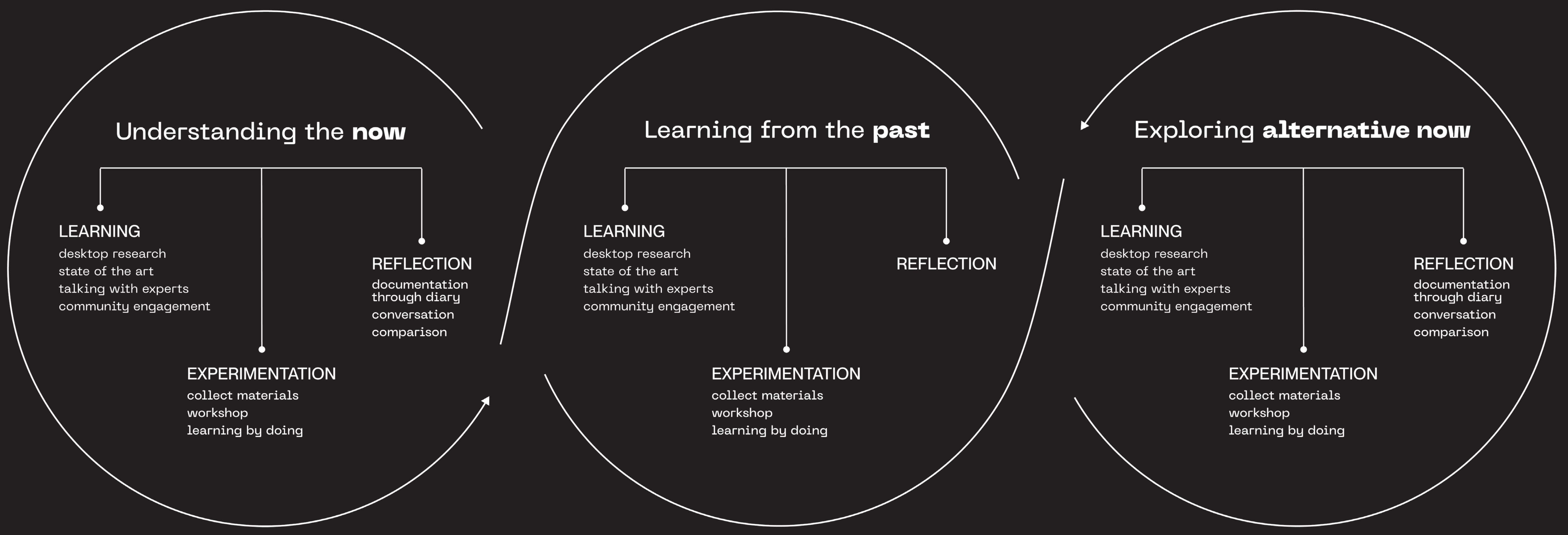
Meeting with : Ellen Anette Høvik
(Head of Communication at Circular Norway)

Invited us to Circular Norway at Skøyen where we attended a lunch dialogue with the other employees, followed by a presentation explaining the main principles behind circular economy including reuse and regeneration of materials and products. **"Without a circularity indicator to define your baseline, you get no incentive to measure your progress"**

FRAMEWORK

We created a framework for our exploration. Starting with understanding the now, followed by learning from the past, moving on to exploring the alternative now.

We designed a handbook to document the process.



THE HANDBOOK

The handbook is divided into several parts: **“Now”**, **“Past”** and **“Alternative Now”**. Within each timeframe, we executed several experiments based on research, conversations, and guidance from experts. Each experiment is concluded with final reflections.

We designed a template that we used to fill in our experiences, reflections, and main takeaways alongside each experiment. The intention with this was to follow our process and discover patterns, to be able to adjust for the next experiment.

TITLE *PART 1

00.00.00 – DAY

HOW

Step-by-step explanation

INVENTORIES

- Tools & ingredients

NOTES

Reflections along the way

Main takeaway

name_name_name_name

NOW

While exploring alternatives to synthetic surfaces, we started by looking at the actual material we wanted to change from. We tested titanium white, which is the most common synthetic white pigment used today.

STRETCHING ACRYLIC *PART 1

30.08.23– WEDNESDAY

HOW

Start by installing a thread to hang the balloons.

Paint the first balloon and blow it up so that it's slightly filled with air. Tie it on the thread. Repeat with the next 6 balloons, by increasing the amount of air each time.

INVENTORIES

- acrylic titanium white
- 1 paint brush
- 1 cup of water
- 1 pallette
- 7 balloons
- thread

NOTES

The paint is sticky until it dries. The smaller balloon, the thicker acrylic with a synthetic “plastic-like” opaque appearance. As the balloon expands, the layer of paint becomes more translucent, the strokes appear, and the surface gets a life-like character.

The strokes appears, giving the surface a life-like character.

Luca Verde_Elida Iben Høvik

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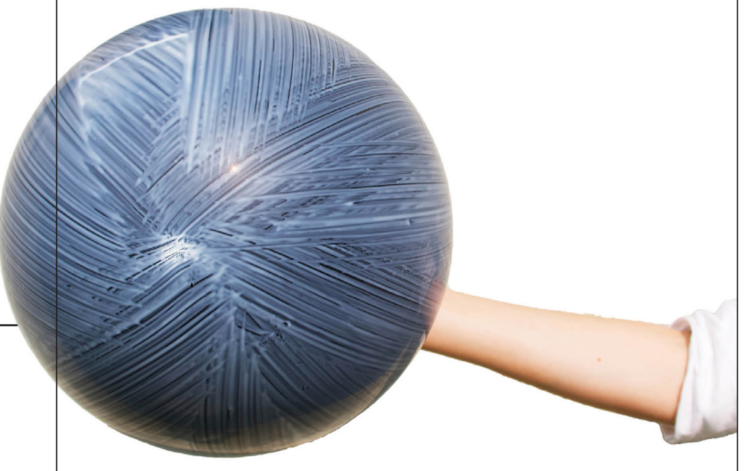

Irregularity and variation give the surface a life-like character, despite being synthetic.

PAST

We did a workshop with a traditional paint expert, Hilde Reh, who taught us how to make a grounding out of hide-glue, and gesso and combine it with various earth pigments. This was a valuable experience that gave us a lot of insight into how to work with pigments and binders, which helped us to execute the following experiments.

It looks compact, non-reflective and it breaks the light differently than acrylics.

HIDE-GLUE GROUNDING *PART 1
31.08.23 – THURSDAY

HOW

Mix the water and hide-glue and let it stay overnight. When ready, warm up the hide-glue in a water bath, until it reaches 37 degrees. Keep it warm while using.

Apply on the desired surface (MDF), with a paintbrush. Be decisive with the strokes, without going back and forth. Wait until it dries before applying another layer.

INVENTORIES

- 4L water
- 50-70 g hide-glue
- MDF
- Brush
- Boiler
- Stove
- Stir tool
- Container

NOTES

The hide glue doubles overnight. It feels sticky and jelly. When warmed up, it quickly turns liquid. It smells, but less than expected. It dries fast. It's nearly invisible when dry.

The hide-glue grounding is nearly invisible, allowing the material to shine through.

Hilde Reh_Luca Verde_Elida Iben Høvik

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After learning how to make grounding from hide glue that originates from animal skin, we wanted to look at the potential of plant-based binders. This led us to cellulose. Cellulose is a polysaccharide forming the primary component of plant cell walls, and it is the most abundant biopolymer in the biological world. Carboxymethyl cellulose (CMC) is water-soluble and degrades at low rates in the environment. It is often referred to as “wallpaper glue”. At the same time, it is used for a variety of industrial applications such as a food thickener, and as a moisture-proof agent in coatings, as well as lacquering for wood and metal. (VanGinkel and Gayton, 1996), (Allied Market Research, n.d.) & (McNamara, Morgan and Zimmer, 2015)

CELLULOSE MIX *PART 1
06.10.23 – FRIDAY

HOW

Fill the bowl with water. Add the powder and stir around immediately. Continue until the mix is even. Wait approximately 1 hour before applying.

INVENTORIES

- 100 gram cellulose powder
- 1 liter cold water
- Bowl
- Stir tool

NOTES

The cellulose powder quickly hardens when added to the cold water. In lack of an effective stir tool, it's challenging to mix it into an even paste. An electric beaten would make it easier.

The cellulose powder quickly hardens when added to the cold water.

Luca Verde_Elida Iben Høvik

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Before it dries, the surface is clear and glossy, almost like a ceramic glaze.

ALTERNATIVE NOW

There is no solution fits all

It can be hard to navigate while looking for natural alternatives to synthetic pigments and binders. During this project period, we came across several products and reference projects that presented themselves as a “solution”. We realized that the potential of circular color might lean on several natural alternatives. We changed our focus on aiming for one solution for the future, to seek various possibilities that could exist in an ‘alternative now´. These possibilities are combinations of forgotten techniques and new inventions, which together open up potential in both production and aesthetic expression.

CMC AND MFC

– biodegradable binders made from cellulose

Borregaard uses the remaining parts of Norwegian spruce and chip residues from sawmills in the Norwegian forest-based industry as raw materials for their product line. 94% of the sourced wood is utilized, making it a circular production system;

1. Wood consists of fibers, lignins, and sugar, which Borregaard converts to cellulose.

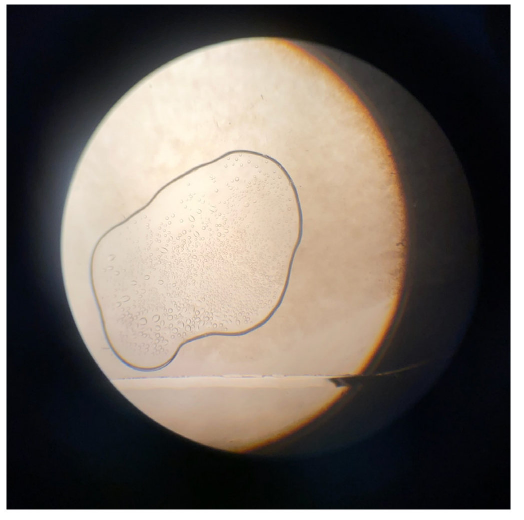
2. Sidestreams of the cellulose production are utilized to create bioethanol before the rest is converted into lignin-based biopolymers.

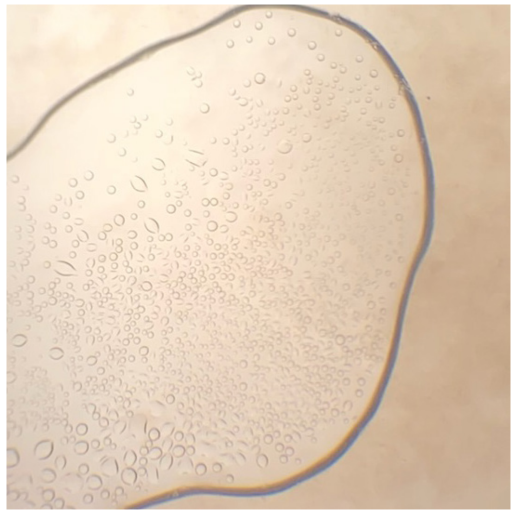
3. Parts of the lignin are used in the production of biovanillin, while other parts of the cellulose are converted into cellulose fibrils. (www.borregaard.com, n.d.)

While CMC is well established in the industry, MFC (microfibrillated cellulose) is a new technology first commercially produced by the Norwegian company Borregaard. MFC consists of an entanglement of cellulose fibers, which provides a unique combination of properties. It retains its crystallinity, and it has a high water retention capacity while at the same time being bio-degradable. It is multifunctional, working as a thickener and a dispersant additive for paint and coatings. (www.borregaard.com, n.d.)

In October, we contacted Borregaard and some weeks later we were lucky to test a sample of MFC.

MFC is easy to apply and less sticky compared to CMC. When applying it to wood, the color is drawn into the material leaving a vibrant color. This results in a layer of paint that looks thinner, allowing the qualities from the wood to shine through. In general, both MFC and CMC make the color seem brighter than synthetic paint and coatings, enhancing the natural qualities of the pigments that we utilized.pigments that we utilized.



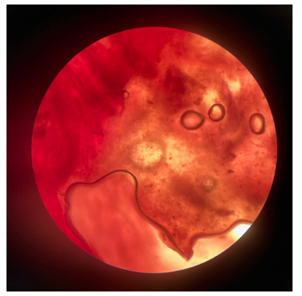


Photomicrograph of MFC, captured by us.

RED ONION

– utilizing color from food waste as a circular principle

Photomicrograph of MFC + Waste, captured by us.

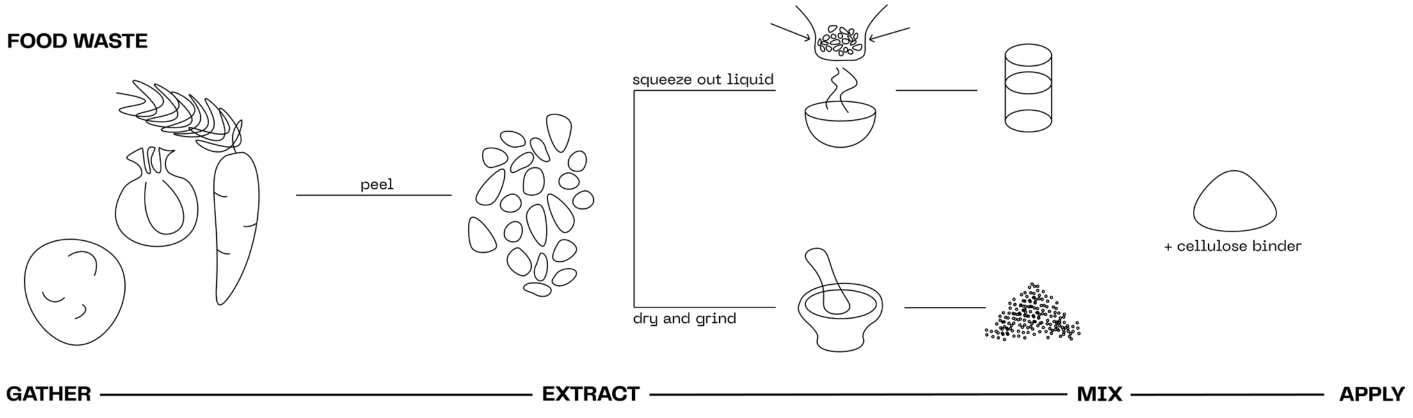


Nature produces the same pigment in many different places, and a single pigment can result in a wide range of colors. Plant pigments, responsible for the majority of colors derived from plants, can be classified into four main categories: chlorophylls, anthocyanins, carotenoids, and betalains.

Chlorophylls are responsible for the green color in all plants. **Anthocyanins** are blue, red, or purple. **Carotenoids** have a spectrum of colors, ranging from yellow, and orange to red and purple. **Betalains** contain nitrogen and can be found exclusively in families of the Caryophyllales and some fungi, where they replace the anthocyanin pigments. (Dikshit and Tallapragada, 2018)

To explore the potential of plant pigments within a circular context, we gathered local food waste, specifically focusing on vegetables that thrive in Norwegian growing conditions.

Red onions can be found in every household, and their peels, which are often considered waste, can potentially be a resource. The red is from pigments called anthocyanin, which is highly concentrated in the onion peel. This pigment can be extracted as a liquid dye or powdered pigment. We created pigment by grinding the dry onion skin. (Samota et al., 2022)



Although plant pigments have a concentrated pigment, they are unpredictable and can be affected by PH level, temperature, and light. The lightfastness which measures the permanence of the pigment and its resistance to light, depends on the chemical nature of the pigment. In comparison with other plant pigments, red onion is reasonably lightfast. (François Delamare, Guineau and Hawkes, 2010)

When combined with CMC and/or MFC, it makes up a plant-based colored surface that enhances the natural colorants.

+ WASTE *PART 1

06.10.23 – FRIDAY

HOW

Prepare the pigments by gently blending them with water until they are fully dissolved. Add the cellulose and stir until even.

Apply on desired surface (MDF).

INVENTORIES

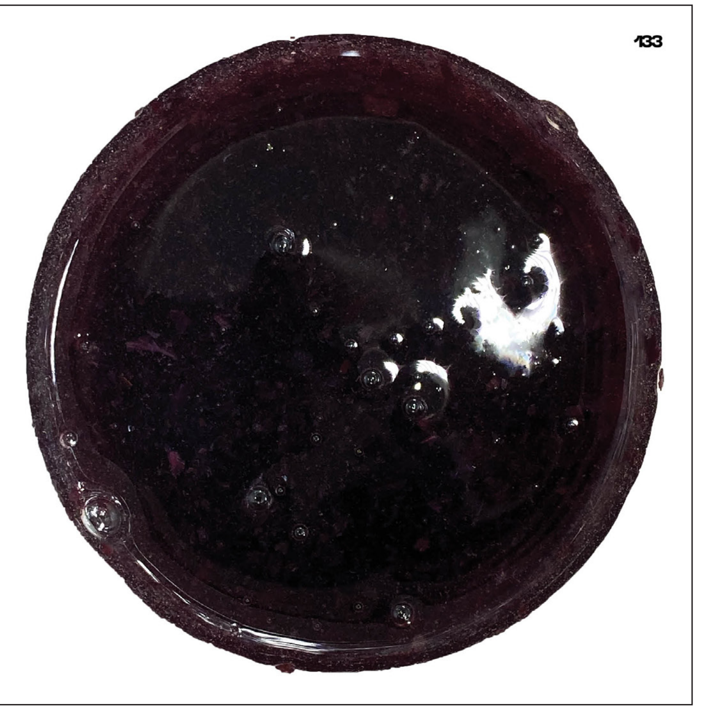
- 2 parts cellulose mix
- 2 parts water
- 1 part Burnt umber
- 1 part Burnt sienna
- 1 part Yellow ocre
- 1 part Green Umber
- Stir tool
- Bowl
- MDF
- Brush

NOTES

The brown MDF surface reduces the intensity of the natural colorants. Compared to mixing with hide-glue, the colors appear more true to its origin.

The brown surface reduces the intensity of the natural colorants.

Luca Verde_Elida Iben Høvik



ALGAE

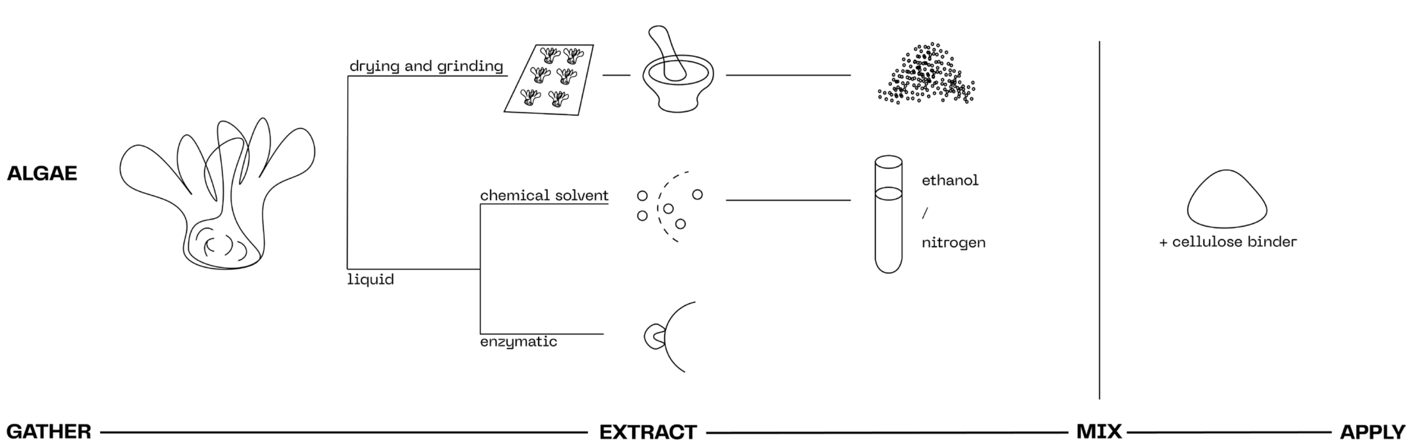
– a local resource

Algae are aquatic organisms that perform photosynthesis by using a range of pigments to harvest sunlight energy. The pigments found in algae are chlorophylls, phycobilins, and carotenoids. Depending on the amount of these pigments, algae are normally divided into green, red, and brown.

There are two main ways of extracting pigments from algae;

1. By drying and grinding it.
2. By liquid extraction through chemical solvents or by green enzymes. (Patel et al., 2022)

When extracted, algae provides a wide color spectrum, from light pink hues, to bright corral, turquóise and shades of green. Algae are also vulnerable to sunlight, causing the color to fade over time. With its vulnerability to sunlight, as well as its property as a starch material, we asked ourselves if the potential might lie in adding the color directly to the solid material. This led us to experiment with algal pigments, both as a layer of paint and directly incorporated into the material.



sample of algae pigment extract.

With algae, there lies potential on a larger scale. Norway, with one of the world's longest coastlines, is estimated by SINTEF to produce over 20 million metric tons of macroalgae by 2050. Algae grows at a fast rate making it easy to harvest frequently, providing a steady supply for various applications such as food, biofuels, animal feeds, and pharmaceuticals. (businessnorway.com, n.d.)

Algae can both work as **purifiers** and as **polluters** in water ecosystems.

Excessive growth of algae is often a result of nutrient pollution from other industries. Nitrogen and phosphorus make algae bloom, resulting in more turbid water that reduces the amount of light for organisms living on the sea bottom. This can cause gaps in the food chain for other species living in the water. To avoid pollution, the algae industry depends on responsible cultivation practices and management. (National Ocean Service, 2009)

Their ability to grow using nutrients from wastewater can also be a beneficial feature, reducing the need for freshwater resources. Additionally, algae absorbs CO_2 while growing and releases oxygen, making clean air the by-product.
In general, its versatile properties make algae a valuable source of a circular economy.

COLOR FROM BACTERIA

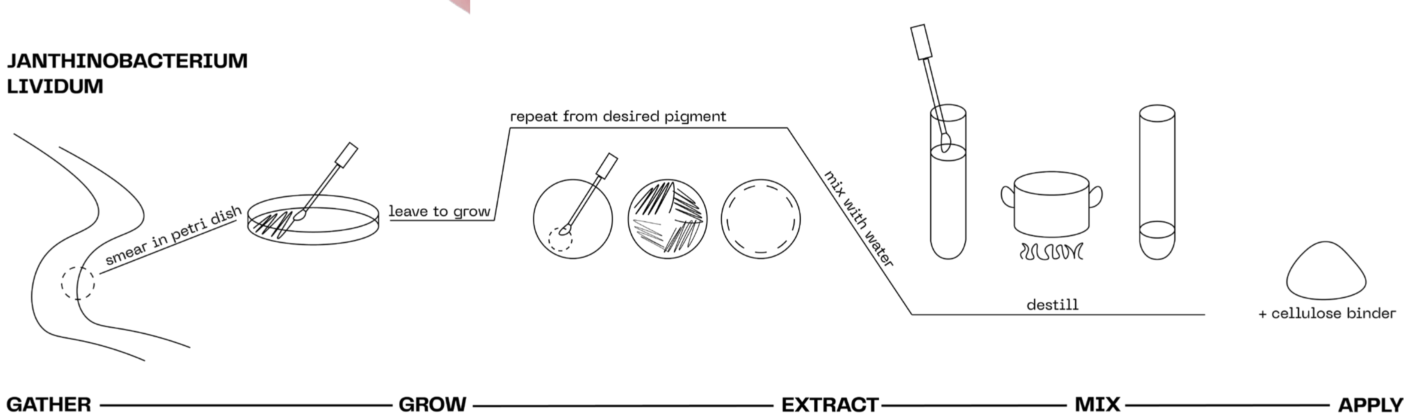
Micro-organisms are everywhere around us and have been our partners for millennia, they play an essential role, helping us with everything from making bread to digesting our food.

Certain bacteria produce pigments, referred to as **'bacterial pigments'**. They contribute to the color of bacterial cells and serve various functions for the bacteria. These pigments are self-producing and bio-degradable, without any toxic chemicals. (Venil et al., 2020)

To be able to produce bacterial pigments, the bacteria need to be cultivated under specific conditions that promote pigment synthesis.

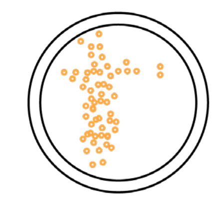
1. A small amount of the bacteria is introduced into a growth medium, then cultivated allowing the bacteria to grow and multiply.
2. The conditions, such as temperature, pH, and oxygen levels, can influence the cultivation process.
3. Once the bacteria have reached the desired growth phase, the cells can be harvested. This can involve separating the bacterial cells from the culture medium.
4. The pigment is separated from the harvested bacterial cells, using solvents or other methods to isolate the pigment from the bacterial biomass.
5. The specific steps and conditions vary based on the type of pigment and the characteristics of the bacteria. (www.youtube.com, n.d.)

JANTHINOBACTERIUM LIVIDUM

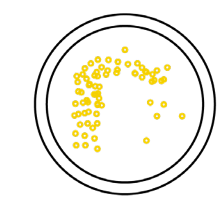


To be able to understand the process, we looked deeper into the production possibility of the bacteria janthinobacterium lividum. A bacteria that is commonly found in soil and river surfaces and produces a violet pigment called Violacein. The pigment is non-lightfast, so the color will slightly change over time. (www.micropia.nl, n.d.)

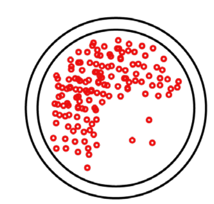
Bacterial pigments are considered safe and can be used as natural colorants. They can produce a wide range of colors and can potentially magnify the existing color palette.



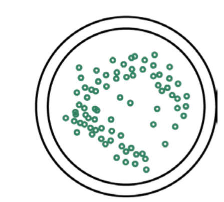
Orange:
carotenoids,
flexirubin



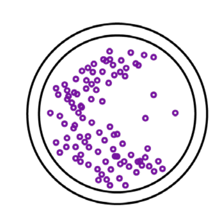
Yellow;
carotenoids,
staphyloxanthin,
xanthomonadin,
zeaxanthin



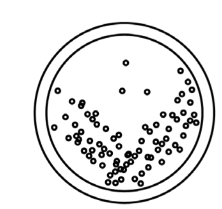
Red:
astaxanthin,
canthaxanthin,
prodigiosin



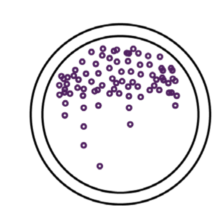
Green:
phycocyanin



Violet:
violacein



Black:
melanin

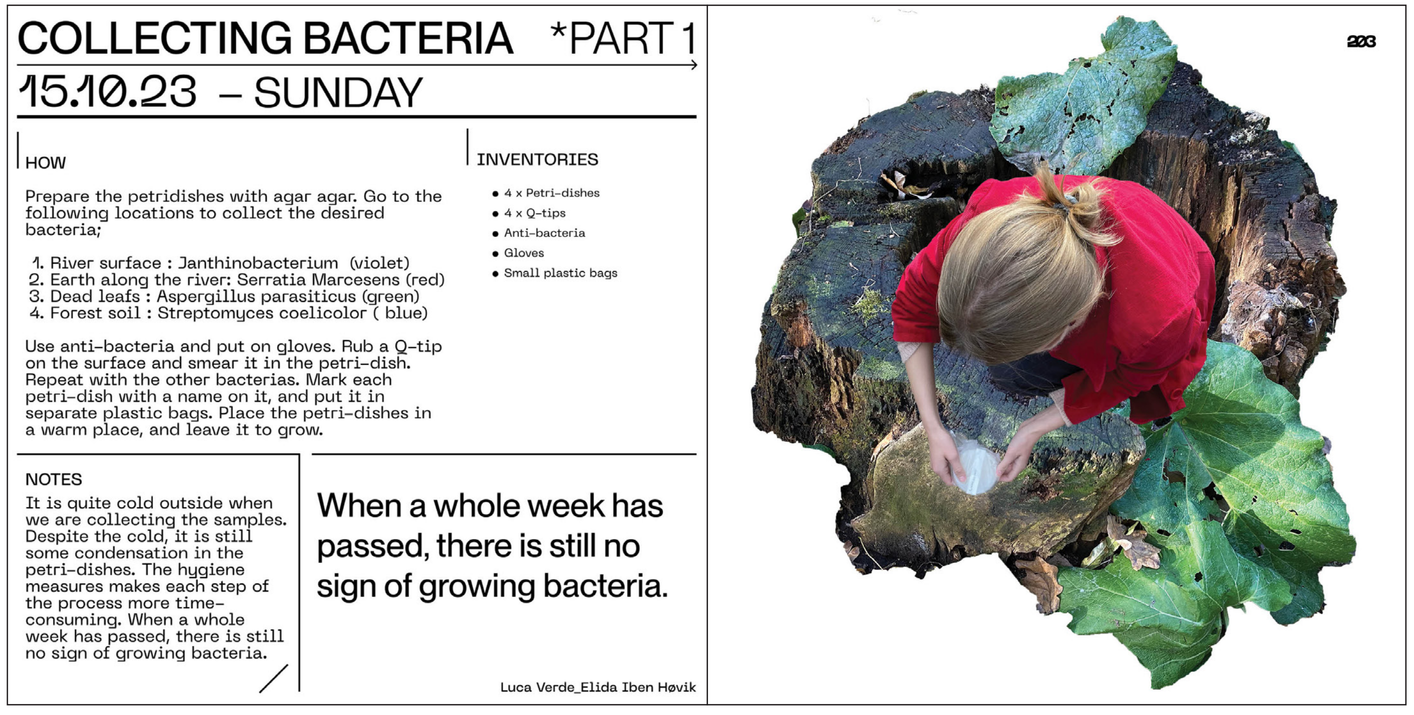


Indigo:
indigoidine

After experimenting with various extraction techniques, we were triggered to learn and experiment further with the potential to grow color.

Working with living materials also means a lot of unpredictable things can happen. Factors such as condensation, contamination, temperature, and light conditions affect the bacteria growth. While exploring and talking with experts, we have realized that growing pigments from bacteria requires a lot of knowledge within microbiology, access to a lab, and takes time.

A struggle during our process has been to get the right knowledge from experts to experiment further. Although we have reached out to several biologists and microbiologists, it turns out this is a field still in the research phase. We noticed that the people working within this field are often connected to London, the Netherlands, and MIT Media Lab. Although we were in contact with several of them, the lack of access to a lab and physical guidance was a challenge. In Norway it seems like this field is still unexplored, leaving a potential to investigate further.



COLLECTING BACTERIA *PART 1

15.10.23 – SUNDAY

HOW

Prepare the petridishes with agar agar. Go to the following locations to collect the desired bacteria;

1. River surface : Janthinobacterium (violet)
2. Earth along the river: Serratia Marcesens (red)
3. Dead leafs : Aspergillus parasiticus (green)
4. Forest soil : Streptomyces coelicolor (blue)

Use anti-bacteria and put on gloves. Rub a Q-tip on the surface and smear it in the petri-dish. Repeat with the other bacterias. Mark each petri-dish with a name on it, and put it in separate plastic bags. Place the petri-dishes in a warm place, and leave it to grow.

INVENTORIES

- 4 x Petri-dishes
- 4 x Q-tips
- Anti-bacteria
- Gloves
- Small plastic bags

NOTES

It is quite cold outside when we are collecting the samples. Despite the cold, it is still some condensation in the petri-dishes. The hygiene measures makes each step of the process more time-consuming. When a whole week has passed, there is still no sign of growing bacteria.

When a whole week has passed, there is still no sign of growing bacteria.

Luca Verde_Elida Iben Høvik

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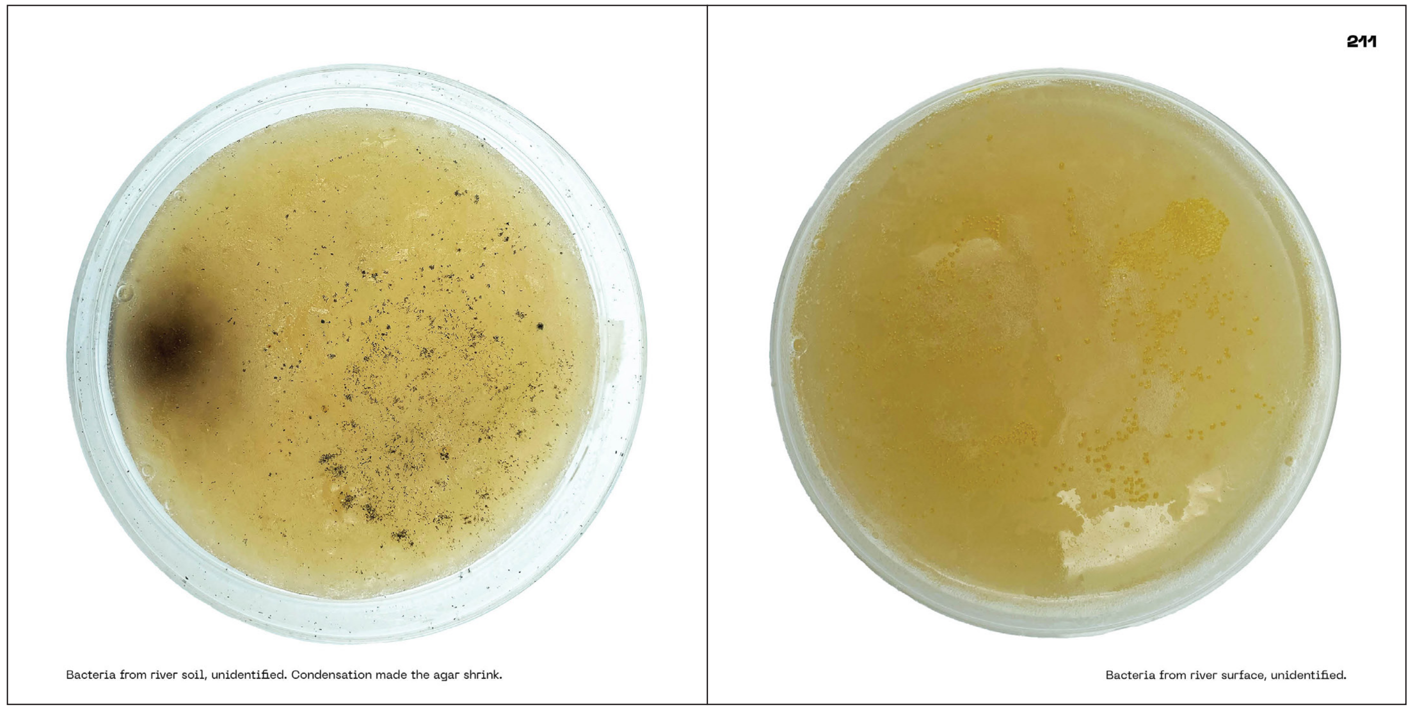

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Bacteria from river soil, unidentified. Condensation made the agar shrink.

Bacteria from river surface, unidentified.

MAIN TAKEAWAY

While synthetic pigments are lightfast and constructed to be identical, often to fit into a mass-produced system, natural pigments provide uniqueness. This raises the question about the importance of color consistency in design.

Can we design with unpredictability and with that facilitate the material's ability to change?

COLOR WHEEL

While transforming the material exploration to an object, we gathered a selection of the results and turned it into a color wheel. We brought this color wheel to the interior store Sofacompany and the paint store Fargerike, where we talked with the employees to get their **sales perspective** on the surfaces we presented.

Employee at The Sofacompany:

“Perhaps on a tabletop in combination with walnut, for example.”

“I like the details here, I am envisioning that it could be a nice design element on a cushion.”

From the feedback at the Sofacompany we were left with the impression that there is a potential of showcasing growing surfaces in combination with known and established materials.

Employee at Fargerike:

“Personally, I think it’s much more exciting when there’s a bit of play and variation.”

After talking with Fargerike, we asked ourselves what people want. It seems like they separate what they like themselves and what they think sells.

“Things should be very clean, you know. Except when it’s a wooden material”

HOW TO COMMUNICATE?

We were divided between all the insights gained from our experiments, that we worked on transforming **science** into a clear concept and **design** a message. The experiments we did while looking for alternatives to synthetic surfaces made us dive deep into material technology. When navigating in such a technical landscape, the boundaries between science and design can sometimes be unclear. We started to think of ways to communicate the knowledge that we gained ourselves through this process.

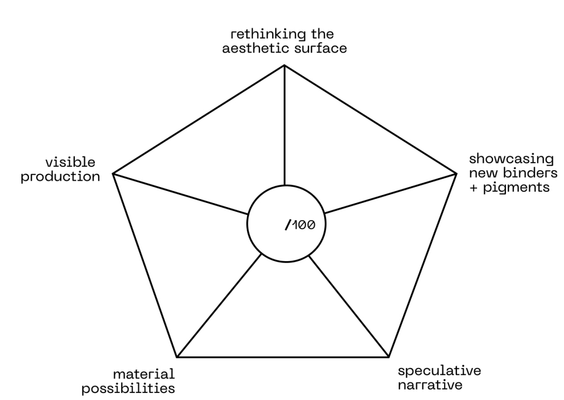
This made us create a **concept evaluation sheet**, to measure ideas:

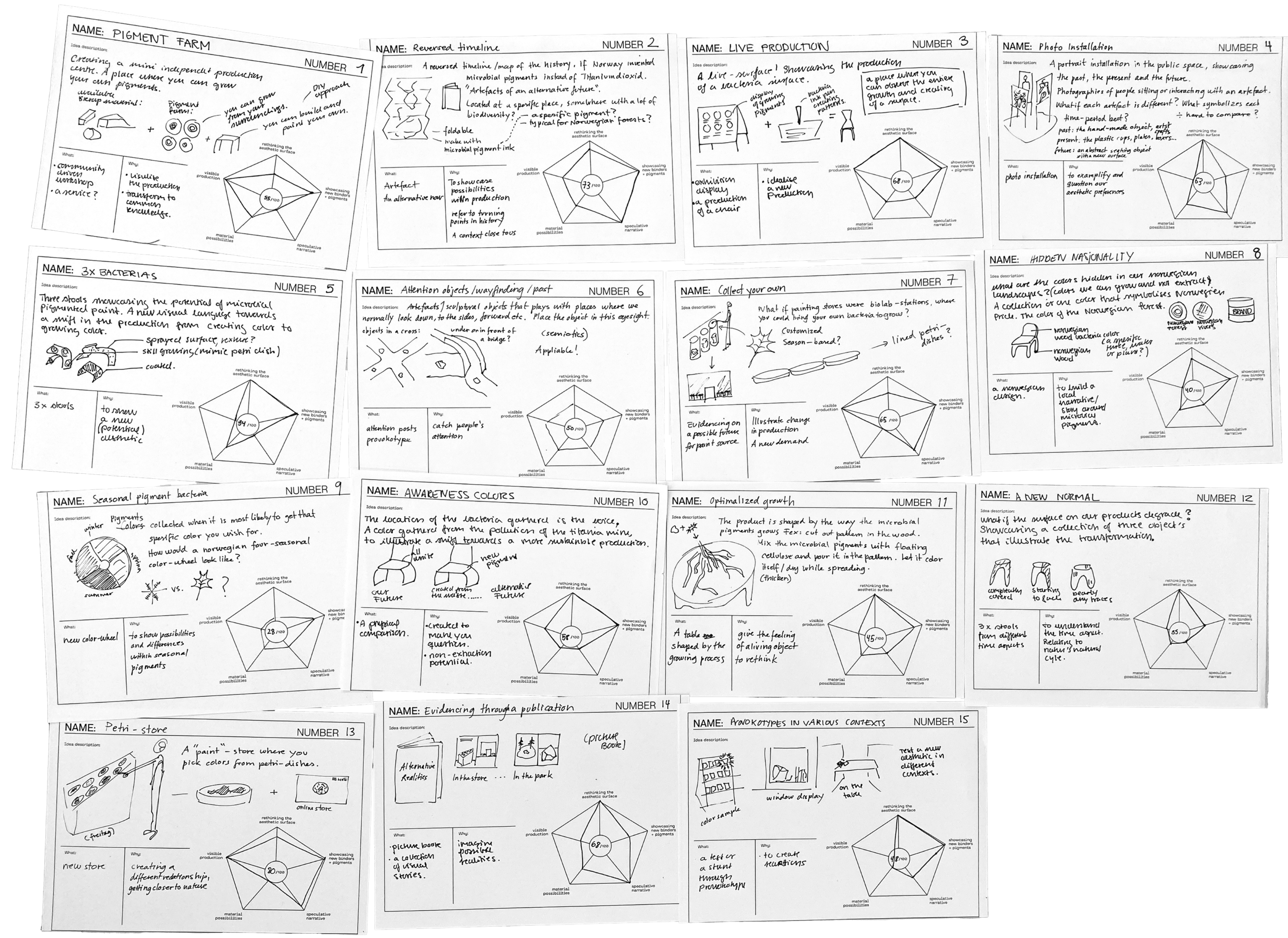
NAME: NUMBER

Idea description:

What:

Why:





At the end of October, we did a one-day design sprint led by Mosse Sjaastad in collaboration with other diploma students. This helped us to gain some important perspectives that guided us toward our final concept. The day was divided into several steps based on the **5-day design-sprint model:**

1) Understand
7 min challenge
5 long-term goals
25 min SWOT

2) Sketch
25 min miniature user journey
5 min success metrics
15 min "How might we"
30 min ideas
15 min affinity mapping

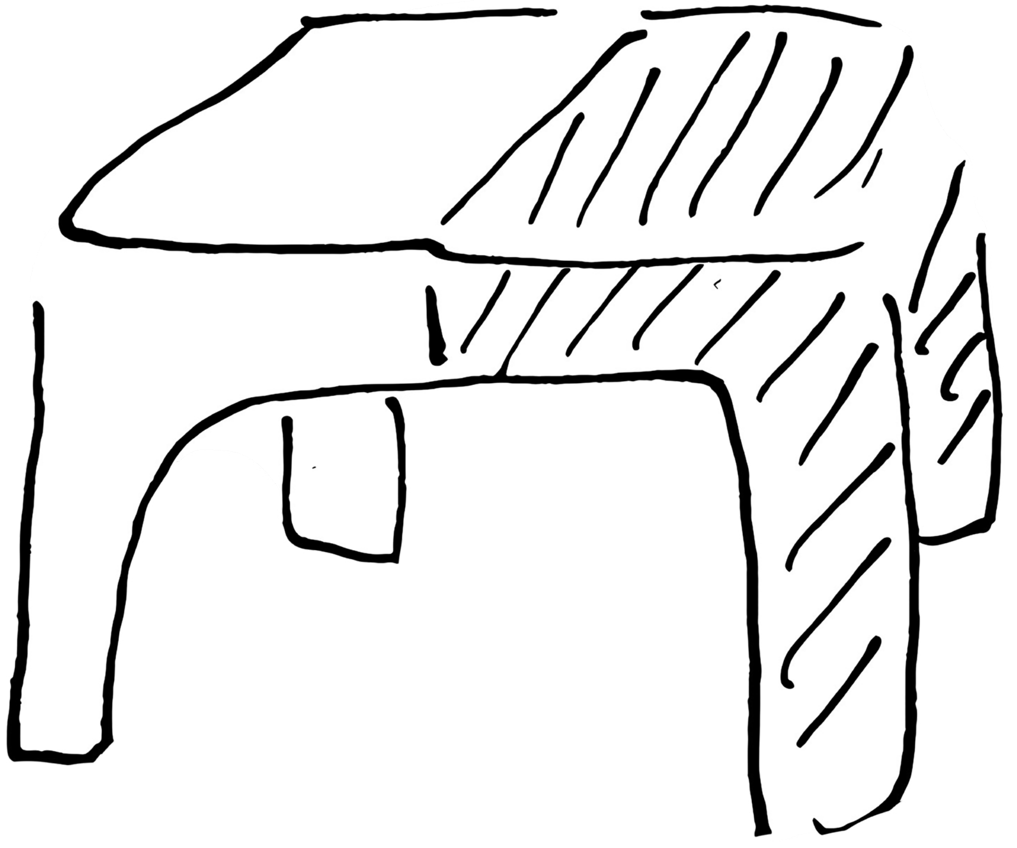
3) Decide
3 min 1st voting
10 min presentation
10 min 2nd voting
Final decision time!

4) Prototype
Until the end of the day

5) Validate
Final discussion in plenum

From material technology to visual communication

When voting on each other's concepts, one of our ideas became a clear winner collecting all the votes. This idea was based on the concept of **comparison**, simply by showcasing a stool that is half-and-half covered in a synthetic and a natural surface. While the other concepts were more complex, we got the feedback that this one was easier to grasp and reflect on further.



Concept

CONCEPT

What is hard to understand, might be easier to grasp by presenting it in contrast. **Contrasts arise through comparison**, unveiling similarities or dissimilarities. To create context for our comparison and embody dialogue we designed a physical artifact.

The artifact : A physical object bringing the 'alternative now' into materiality, showcasing our material exploration.

The artifact is facilitating comparison through several changeable parts. Each one is a different material sample, based on what we refer to as "the now" and "the alternative now". The samples are placed on a supporting structure that acts as a pedestal and impersonates the living surface.

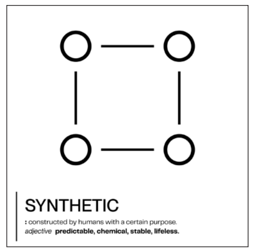
How might we reveal hidden processes to challenge the contemporary aesthetic of the surfaces that surround us?

The artifact **is**

Symbolizing the shift from synthetic to living surfaces.
An object of contrasts facilitating comparison.
Communicating the values of the living; the irregular, nature-centric, circular, growing.

the artifact **is not**

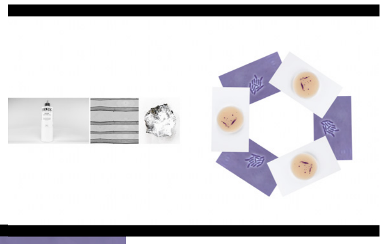
A functional object.
An answer.
Mass-produced.

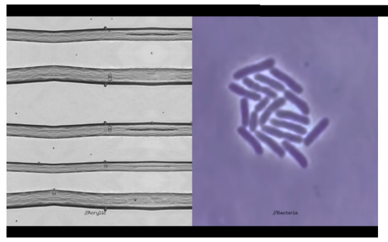


Vocabulary : A tool created to compare, discuss, and understand the shift from the synthetic surface to the living. Flipcards making complex and hidden processes available, describing both production methods and aesthetic expressions. The vocabulary consists of 10 contrasting icons, each one with additional terms and definitions. These are a result from synthesizing our insights.

Handbook : Created as a guide alongside our experiments, which has been valuable to validate and identify patterns while experimenting. The handbook can be a source for people wanting to learn and experiment with natural pigments and binders themselves.

Video : Moving images communicate our vocabulary in a visually engaging manner, narrating the shift from synthetic surfaces to the living.





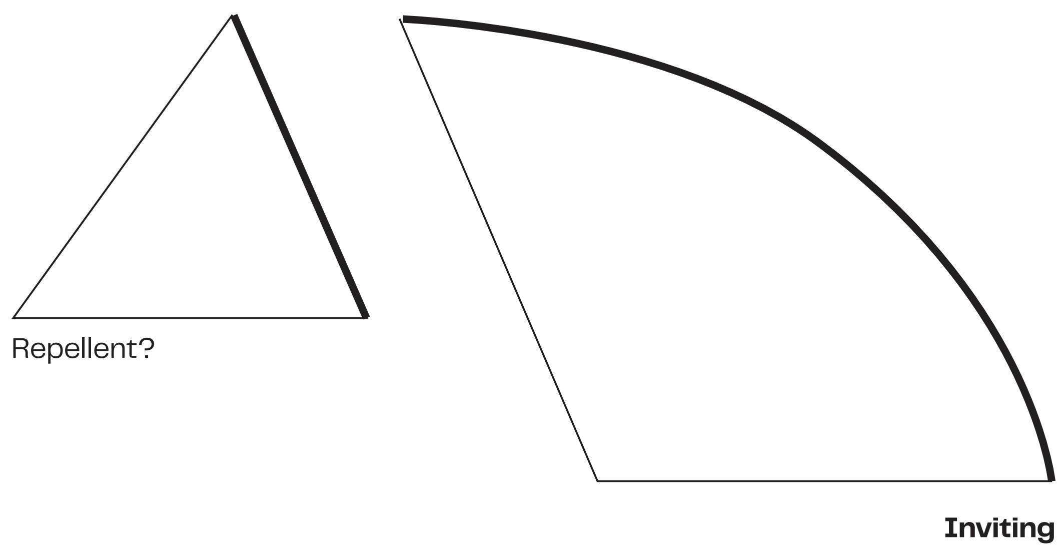
Exhibition : A platform where all the parts come together, forming an experience of contrasts that can provoke reactions. A space where we can test and validate our work.

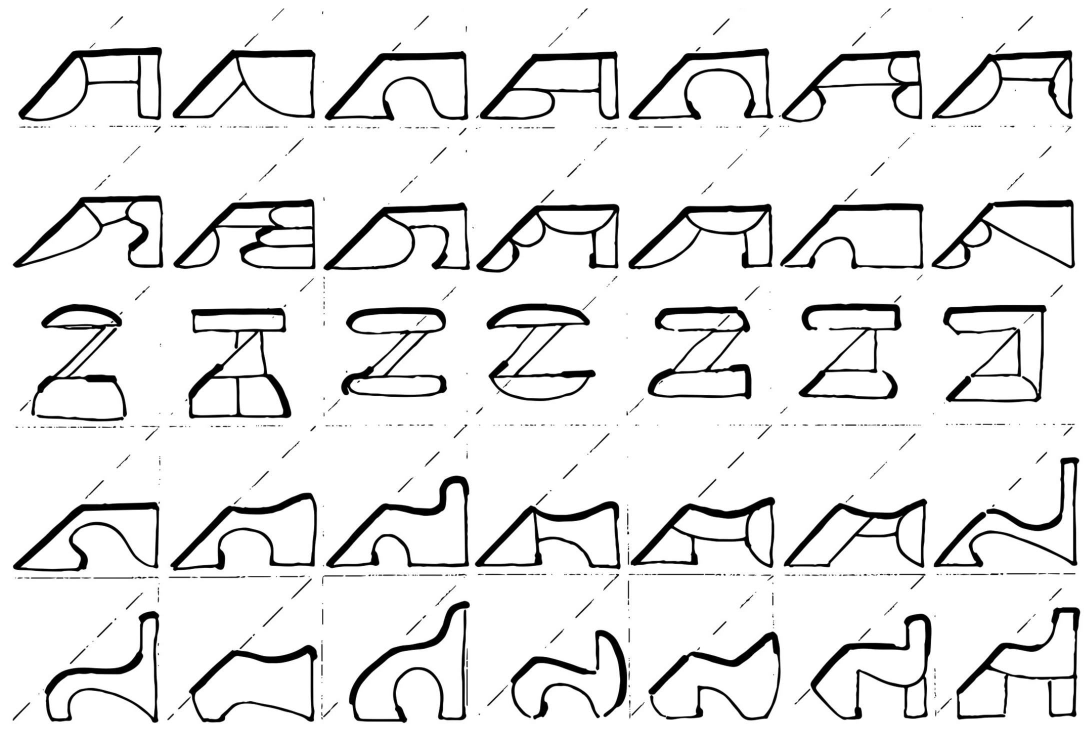
FORM DEVELOPMENT

While developing the form, we worked hands-on with different materials and approaches, allowing each exploration to be influenced by the material we worked with. Each material gave us different outcomes; clay gave the feeling of a molded shape, while paper was valuable for a lighter expression. Steal provided us with a better understanding of a structure, using it as a tool to reveal the main movements in the form.

Considering aesthetic semiotics, how can high and low-degree angles communicate the surface in different ways?

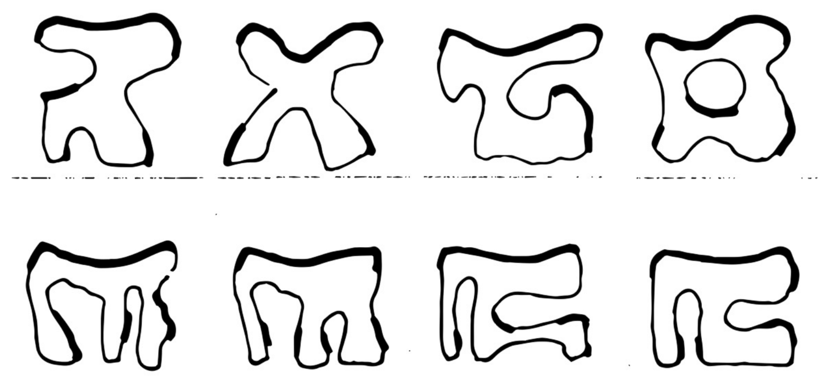
We started by drawing thumbnails, to generate multiple ideas. This method made us realize that high-degree angles are inviting, making the surface visible.

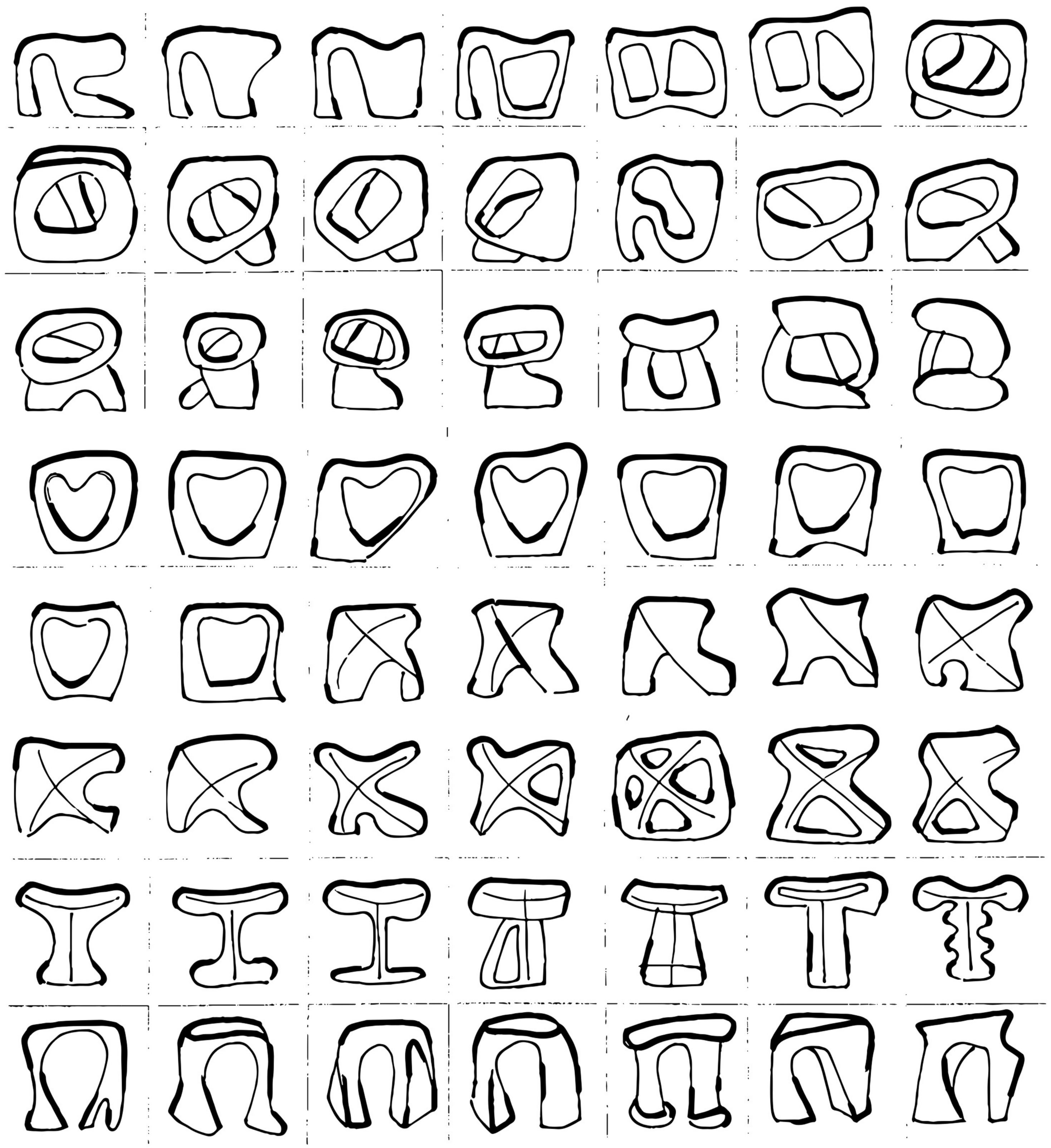




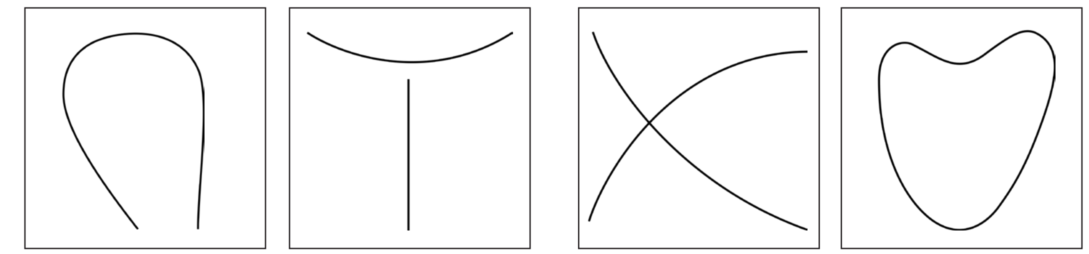
As the surface cannot exist alone, which types of solid materials can we utilize and how can these solids affect the surface expression?

We continued ideating on production methods, creating thumbnails considering the solid and the surface as one. Asking ourselves if the binder could act as a resin, or if we could give new life to misplaced resources. This idea became valuable later in the process.

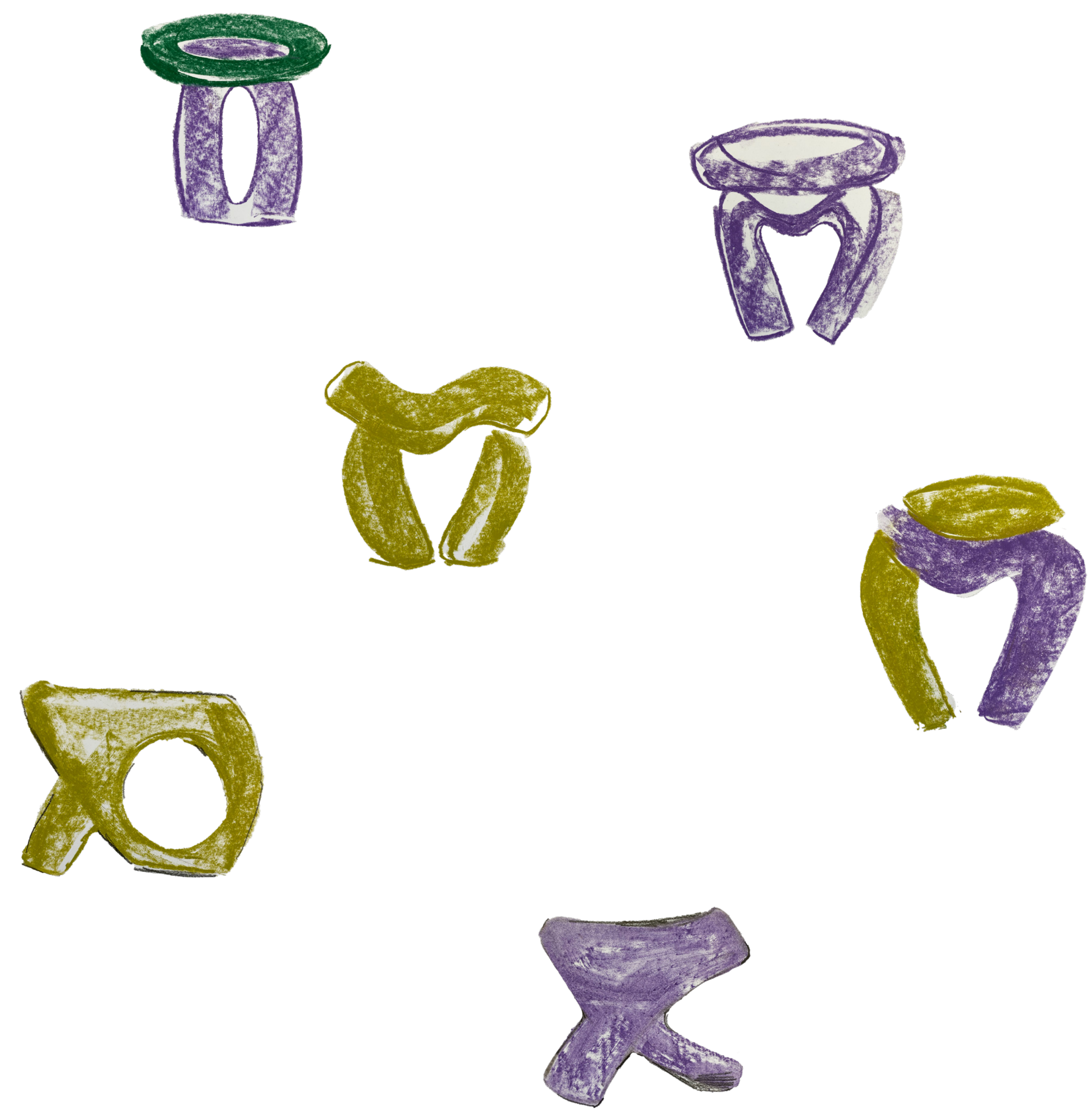




Form analysis: when analyzing all of our thumbnails, we identified four repeating patterns. Based on these axes, we created emotional sketches including colored surfaces.

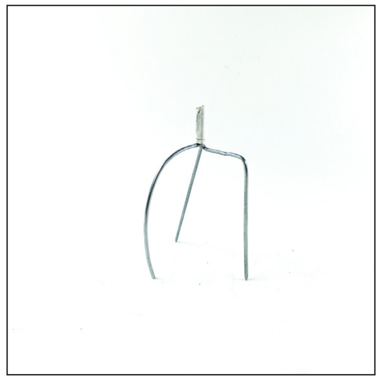


(Arc) (T-shape) (X-axes) (Cutout)



Tanslating axes into 3D structures

These axes also triggered us to explore the movement of a shape through simple structures. A tripod that carries the material samples.



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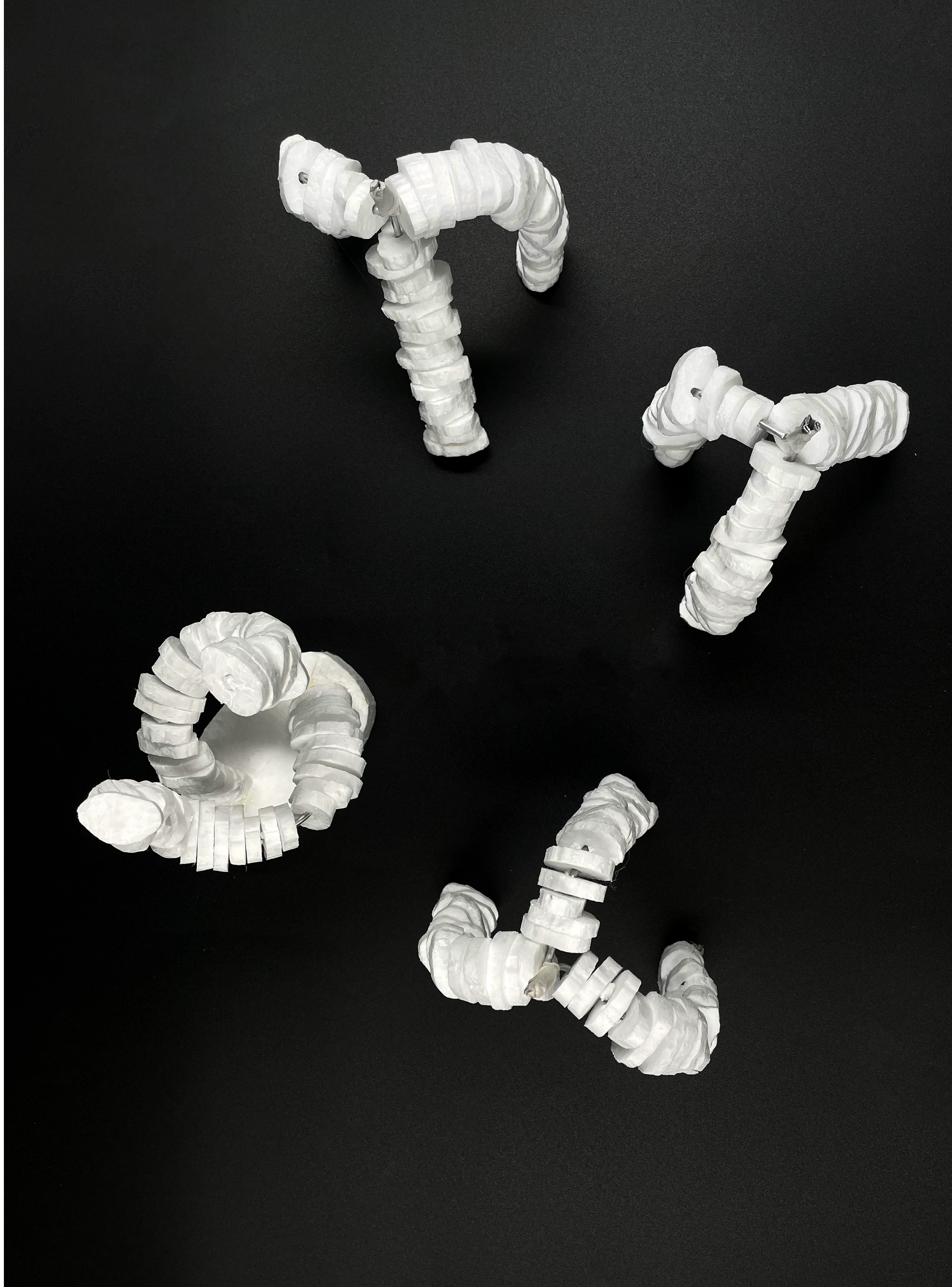

Clay mockups


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The idea of several changeable parts

Interacting with the clay mockups created the idea of several changeable parts. Replacing them, to be able to touch and compare the material samples.


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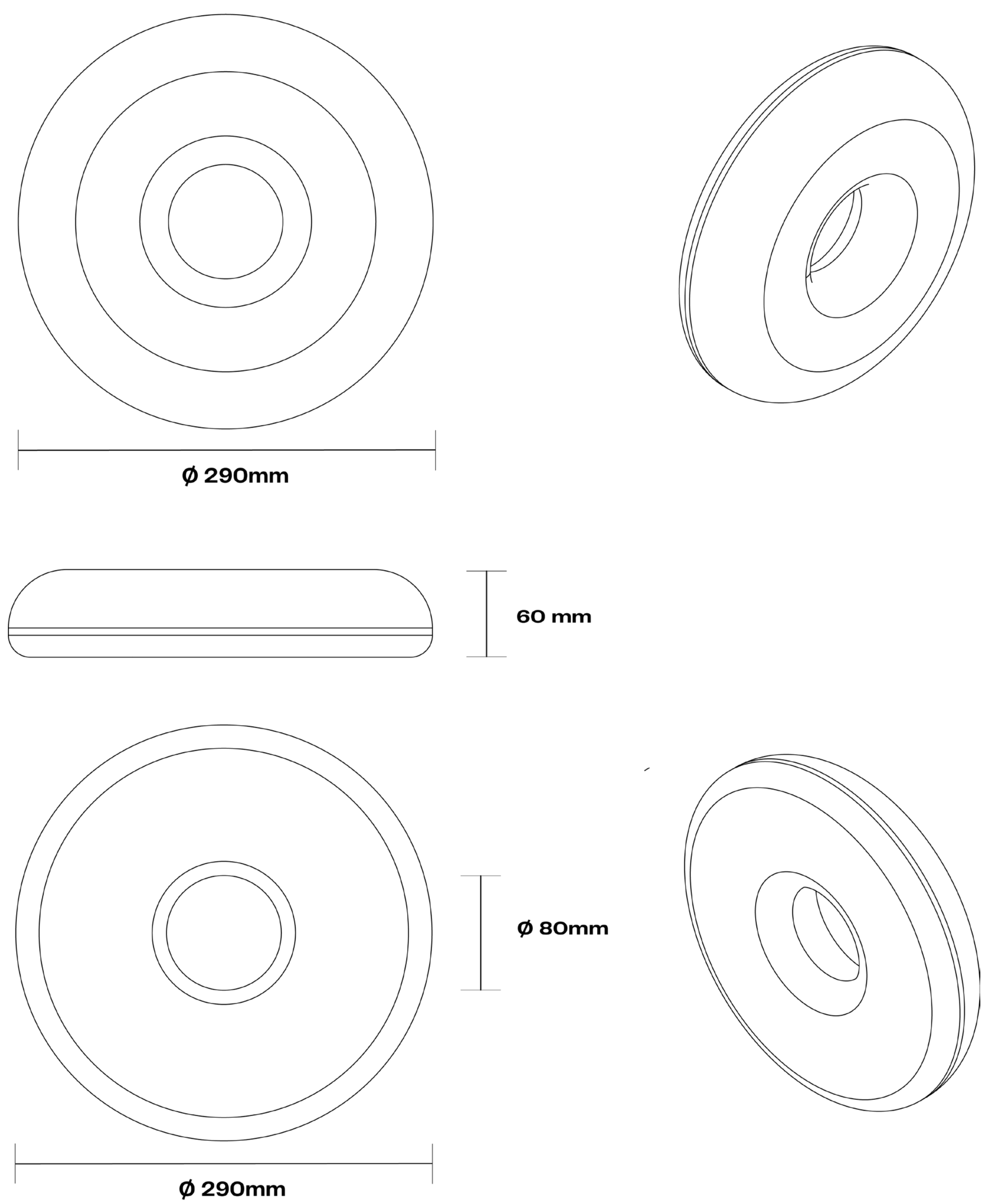
The balance between the tripod and the material samples

As the idea of changeable material samples was more specific, the tripod got our attention. This made us see the importance of the balance between the two parts, aiming for a tripod that functions as a contrast, while not taking up the attention from the material samples.

The changeable material samples

The changeable parts are objectified samples. It creates context beyond a squared, standardized, material sample. Being both plane and curved, they allow the surface to be perceived from different angles, catching the light in various ways. The round edges underneath create an opening, giving the form a space to breathe. The circle refers to the circular, while the cutout in the middle makes it easy to lift, change, and interact with.



Solid and surface as one?

As the surface cannot exist without the solid, choosing the right secondary material became important.

Solid wood, coated with pigments from food waste and microfibrillated cellulose:

As we utilized microfibrillated cellulose which is sourced from wood, we wanted to use the same material as a solid. This material sample is locally produced and completely plant-based.

It is painted with powdered pigment derived from red onion dissolved in water and combined with microfibrillated cellulose as a binder.

Hunton dyed with bacterial pigments:

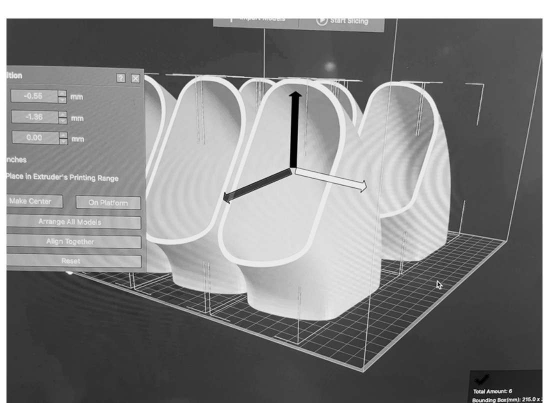
Huton is produced in Norway from wood fiber taken as waste chips, sawdust, and off-cuts from sawmills. It conforms to the Norwegian laws regarding sustainability of the environment and forest management and is PEFC™ certified (Hunton Fiber, n.d.). With its soft material qualities, we were curious to see its ability to absorb the bacterial dye.

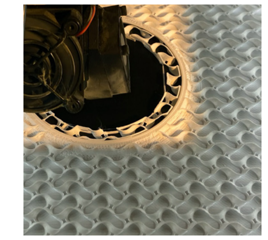
We created a visual model as we didn't manage to cultivate the bacterial dye ourselves. This material sample is based on references, replicating how a bacterial dye would behave with a solid.

Sawdust molded with bioplastics colored with algae extract:

Agar agar is used in a range of bioplastic products, which made us curious to see if it could function as a resin. We added sawdust as a filler, as we were already exploring wood as a secondary material.

The agar agar bio-plastic shrinks by 12.5% when molded. To be able to achieve the correct measurements, we had to scale the mold. We printed it with a flexible filament in six parts. We colored the sawdust with the algae extract, before mixing it with the agar agar solution.



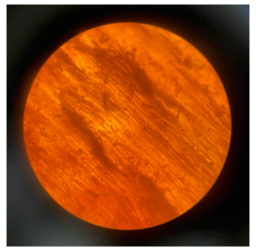


PLA painted with acrylic titanium white:

We 3D printed it in PLA and coated it with acrylic titanium white. This makes up a completely plastic-based material sample.

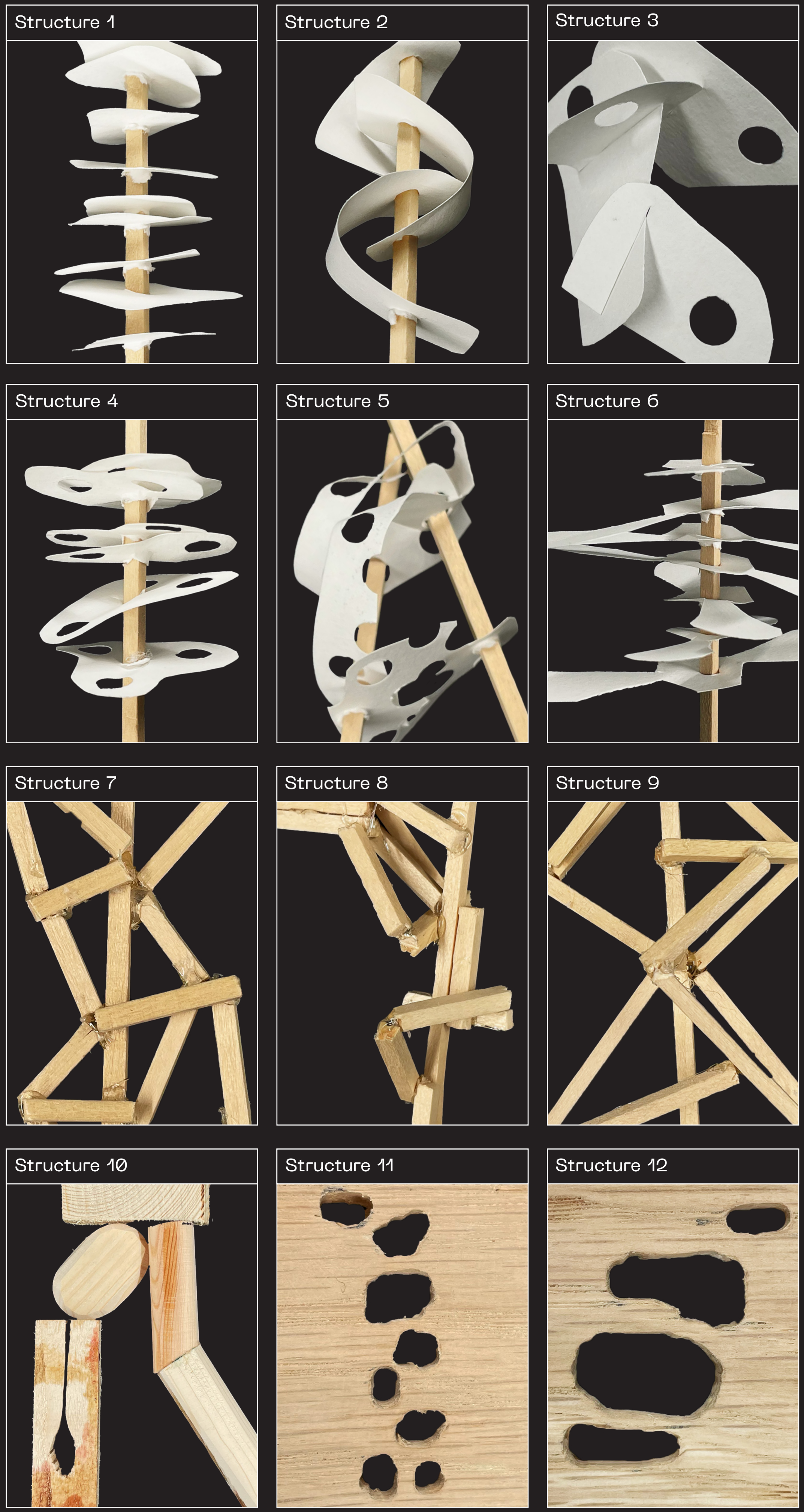
Rethinking the tripod communicating our values:

To communicate the living surface, we got inspired by looking through the microscopic lens. We could see intertwined structures and repeating patterns revealing themselves, creating movement. With this, we changed from the previous sketches and mockups of the tripod, compact



and molded in their expression. Moving on to abstract structures, focusing on sensible expression, and trying to capture microscopic qualities.

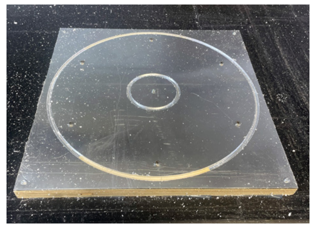
The tripod functions as a pedestal, bringing our values into form; the living, growing, irregular surface. It is especially Inspired by our nature-centric symbol that consists of multiple irregular circles on top of each other, together creating an intertwined form.



(Photomicrograph of solid wood, captured by us)

Finally, we chose aluminum as a material to contrast the changeable parts. **Aluminum** is a material that can be recycled repeatedly without losing its properties, making it a circular material. We hammered it to create irregularity, communicating the living expression and the shift from the even mass-produced expression.

With no prior experience working with hammering aluminum, our craftsmanship rapidly improved.



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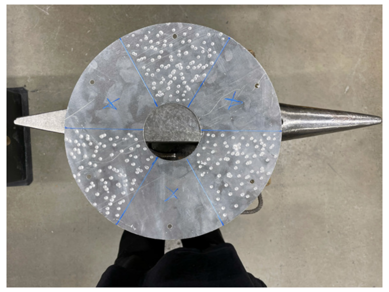

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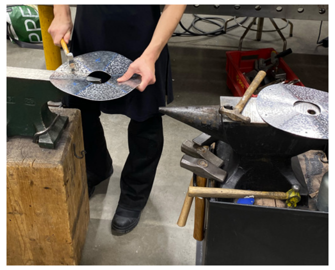

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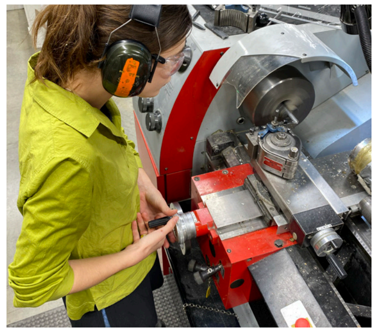

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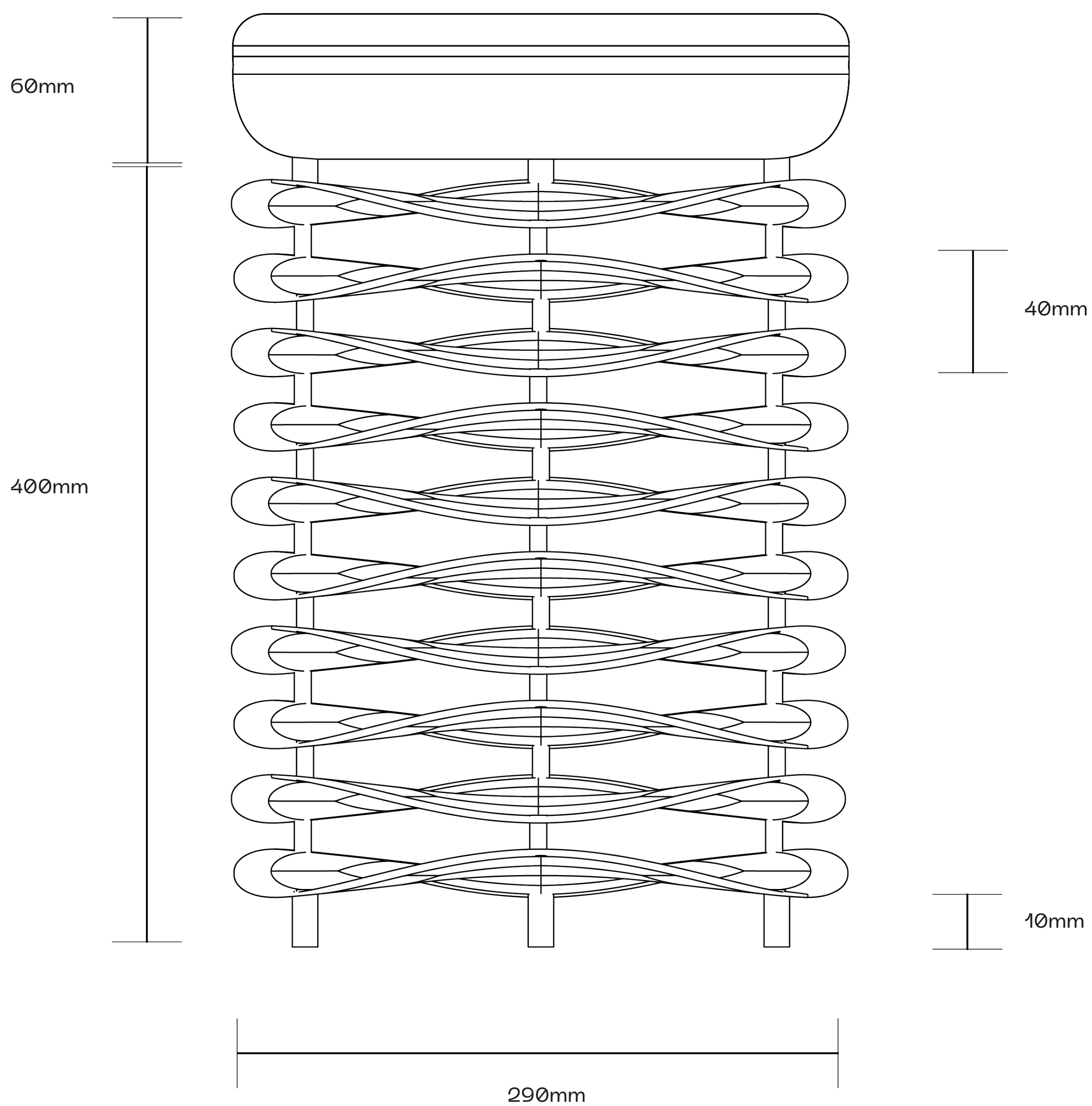
60mm
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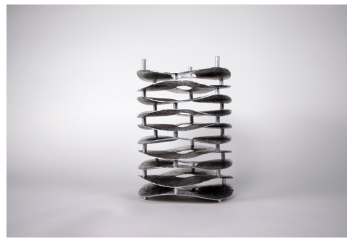
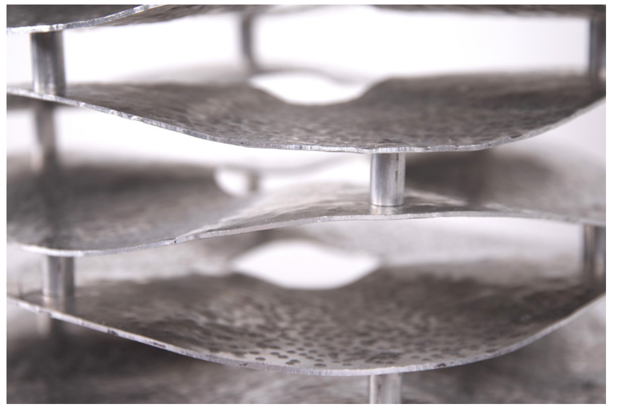





FINAL USER TEST

At the beginning of December, we went to Deichman, the main library in Oslo, to do a final user test and get feedback from the general public. The aim was to investigate if the concept answers our thesis question: 'How might we reveal hidden processes to challenge the contemporary aesthetic of the surfaces that surround us?' We brought three main comparison elements, and got feedback from 15 participants.

1) The material samples of bacteria, waste and titanium.

COLOR FROM BACTERIA
JANTHINOBACTERIUM LIVIDUM

This pigment is called **Violacein** and it is produced by the bacteria **Janthinobacterium Lividum**, which is commonly found in soil and rivers. The pigment is non-lightfast, so the color will slightly **change over time.**

The sample is collected from the **river surface** and cultivated in a petri-dish. Under the right growing conditions the bacteria will **multiply every 20 minutes**, making it a self producing pigment. The pigment is isolated in a solvent, before it is used as a liquid dye.

Bacterial pigments are considered **safe** and they have the capacity to produce a **wide range of colors.**

COLOR FROM FOOD WASTE
RED ONION

Red onions can be found in every household. The peels which are often considered **waste**, can be a **resource**.

The purple color comes from pigments called **anthocyanin**, which is highly concentrated in the onion peel. This sample was created by **grinding** the dry onion skin and mixing it with **microfibrillated cellulose** as a binder.

Plant pigments are **unpredictable**, affected by PH-levels, temperature and light-conditions. Red onion can create a **green, purple or pink** color depending on **PH-level.** Despite this, red onion is considered **reasonably lightfast.**

COLOR FROM TiO2
ACRYLIC TITANIUM WHITE

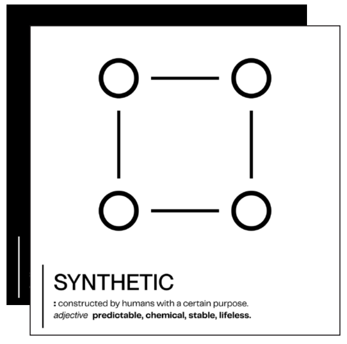
Titaniumdioxid (TiO2) is extracted from **mines**, to create the titanium white pigment. The powdered pigment is mixed with an acrylic binder of **fossil origin.**

Titanium white is the most **common** form of whitening agent today. It can be found in electronics, and even **tooth paste**.

Acrylic binders are plastic polymers, meaning that they can end up as **microplastic pollution**.

As a paint, it is sterile, non-breathing, and it **isolates** and **protects** the material underneath.

2) Tags with a description of each production method.



3) The vocabulary.

Additionally, we created a **form** that each participant filled out, validating to which extent each seating part answered the vocabulary:

	extraction	less	in-between	less	growth
BACTERIA	○	○	○	○	○
WASTE	○	○	○	○	○
TITANIUM	○	○	○	○	○

	synthetic	less	in-between	less	living
BACTERIA	○	○	○	○	○
WASTE	○	○	○	○	○
TITANIUM	○	○	○	○	○

	flat	less	in-between	less	irregular
BACTERIA	○	○	○	○	○
WASTE	○	○	○	○	○
TITANIUM	○	○	○	○	○

	human-centric	less	in-between	less	nature-centric
BACTERIA	○	○	○	○	○
WASTE	○	○	○	○	○
TITANIUM	○	○	○	○	○

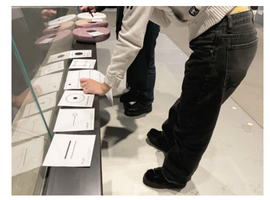
	linear	less	in-between	less	circular
BACTERIA	○	○	○	○	○
WASTE	○	○	○	○	○
TITANIUM	○	○	○	○	○

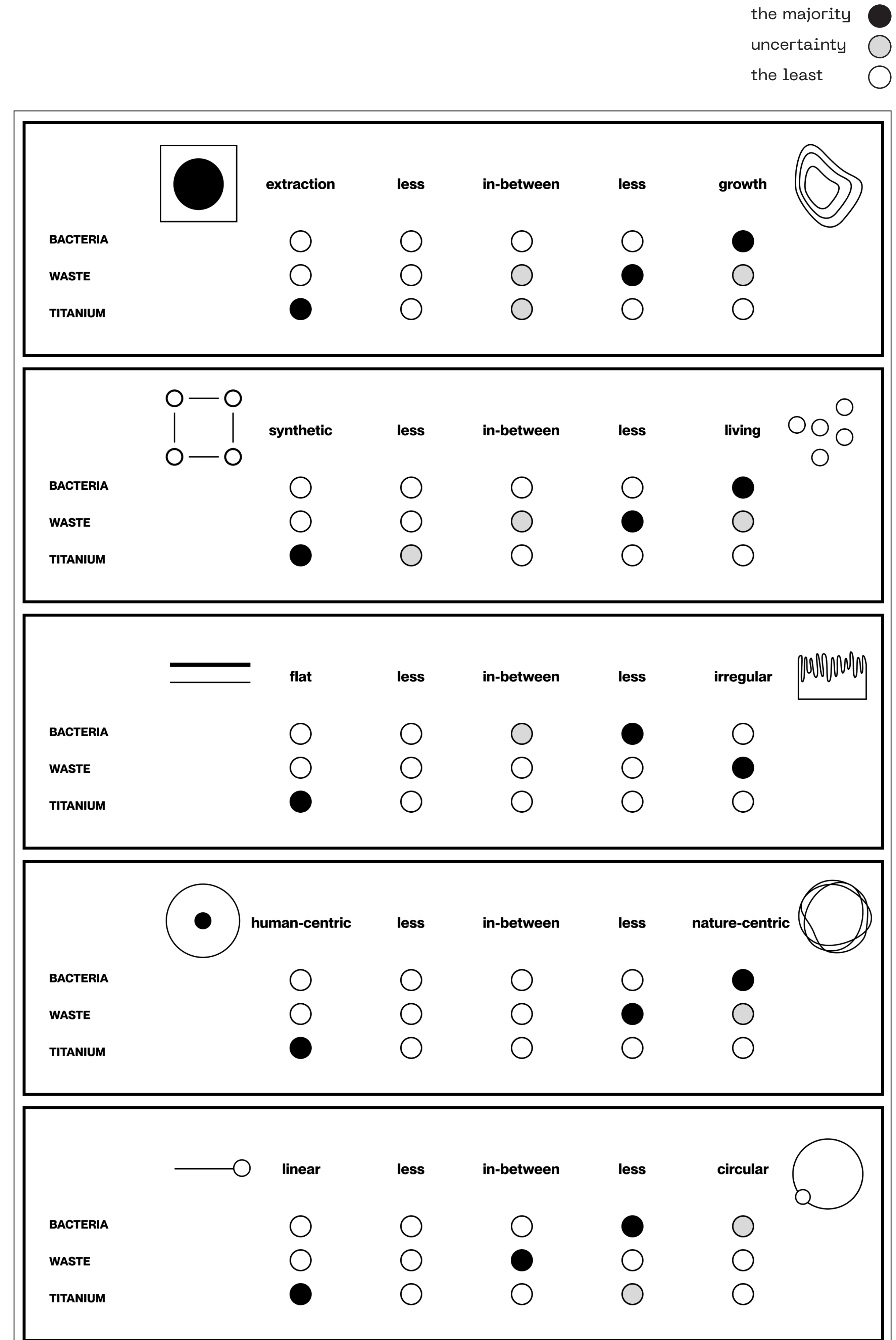
The vocabulary as a conversation starter: a group of friends was discussing back and forth until they understood the production process, which made them change their minds and thus found it easier to answer.

Generational gaps: Two daughters re-explained to their mother how they understood the instructions. Later, a daughter explained to her father how she interpreted the test, and he filled out the form after her. In general, the younger people seemed to understand the tasks quicker, while the seniors needed time and questioned more. This might indicate that the younger generation has a mindset closer to the alternative now, compared to the seniors.

The balance between time and information: An older man found the vocabulary somewhat difficult. This may indicate that the evaluation format was too abstract to be understood quickly. Additionally, the descriptions of the material samples might have been too long for people to read.

Result: The overall result creates a scale in which titanium is understood as the most synthetic, and color from waste is in the middle, while bacteria is the most living. People still expressed a liking towards the titanium white, while at the same time reflecting and discussing its origin as a concern. In general, the answers indicate an understanding of the hidden processes we aimed to reveal. However, there are variations in the answers from extraction/living, as well as linear/circular. We got feedback that the words describing them were too abstract, leading to confusion. Based on this, we did final adjustements on the vocabulary.





VALUE PROPOSITION

Product

Benefits:
Biodegradable cycle;
from nature,
going back to nature.

Experience : New aesthetic preferences; Acceptance of change, unpredictability, design-to-fade.

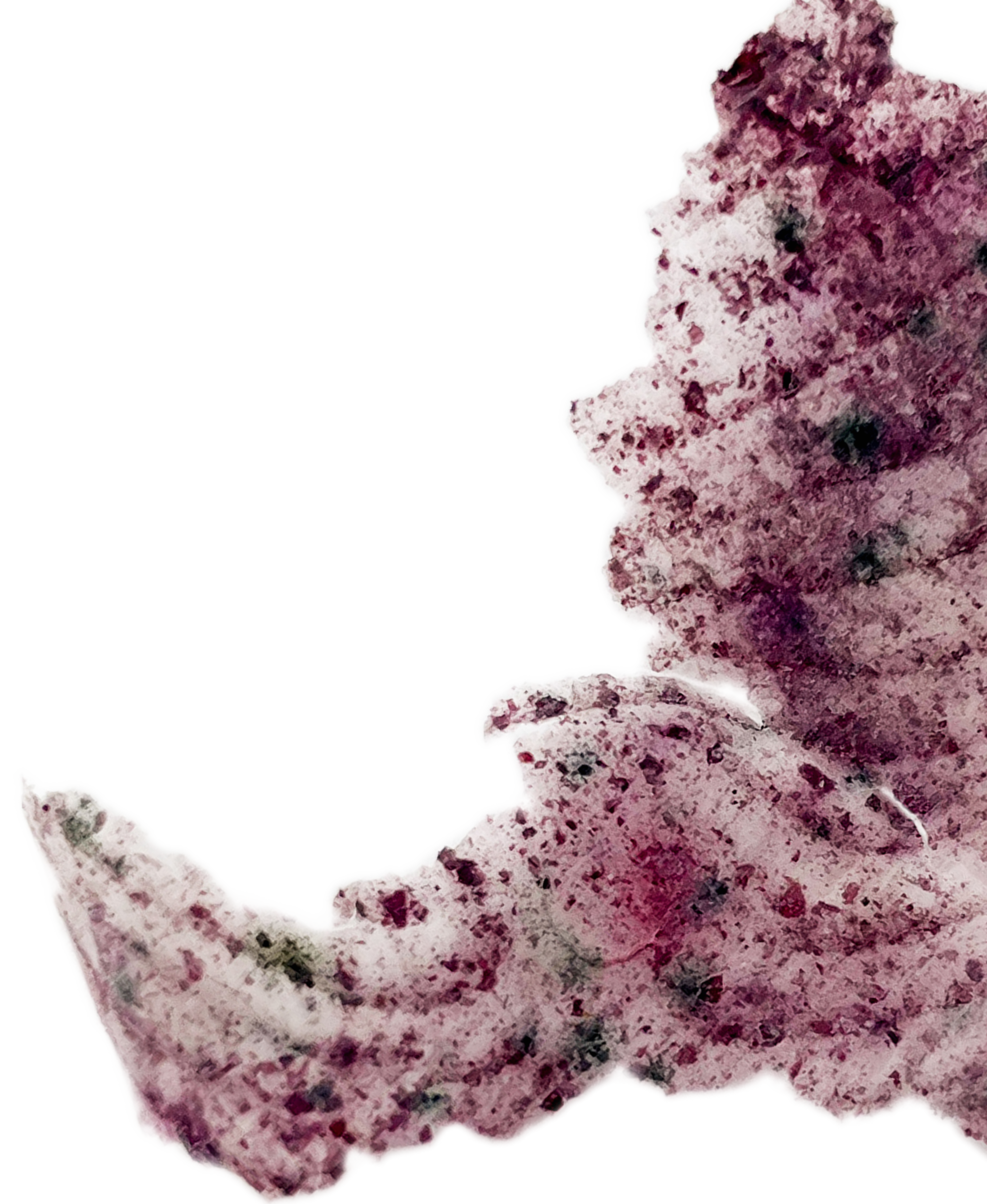
Features:
Sensible, irregular, changing color.

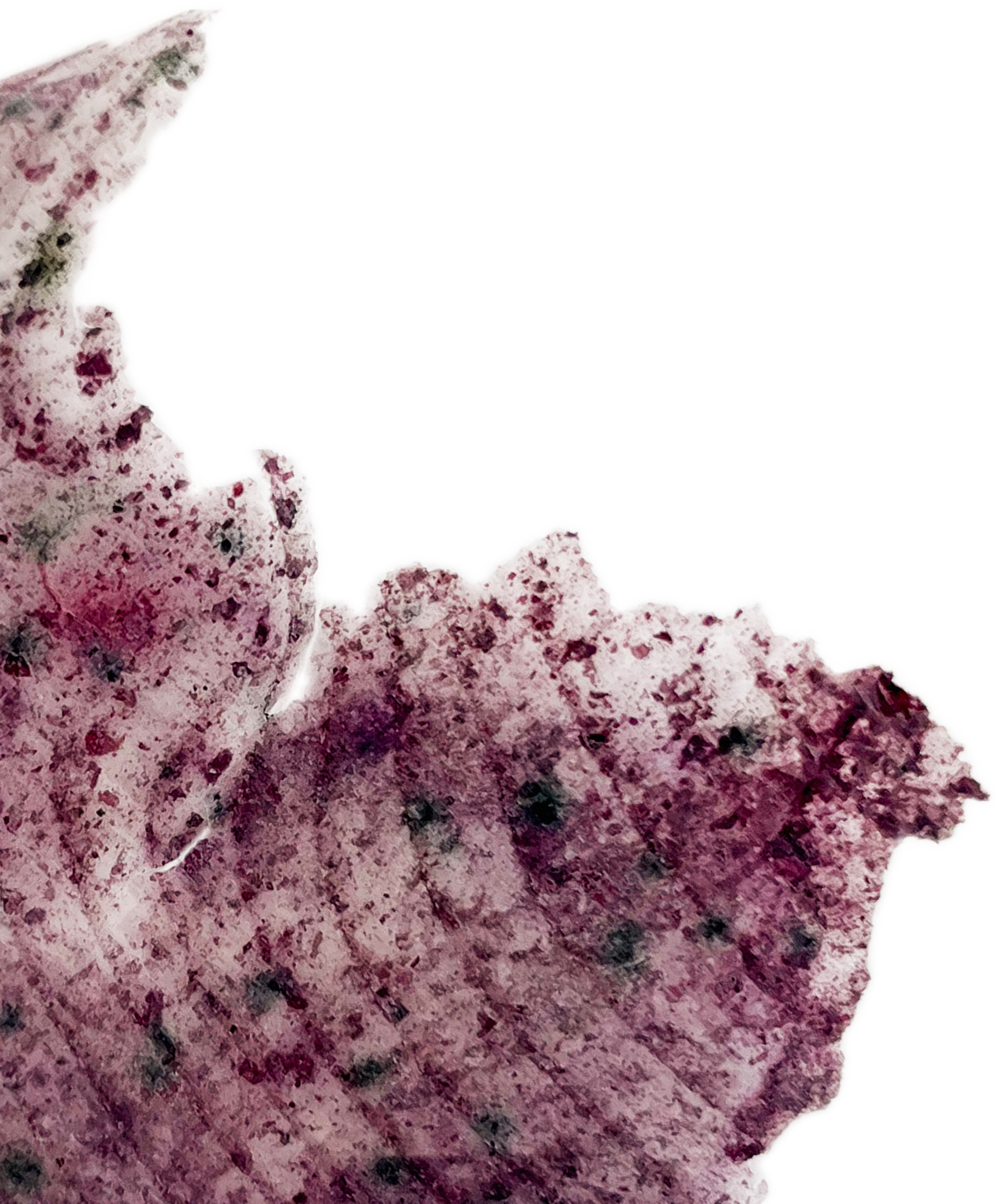
Costumer

Wants:
A guilt-free alternative.

Fears:
Not the same material qualities as existing alternatives.

Needs:
Apply color that encompasses not only humans but also nature's needs.





Discussion

DESIGNERS' VALUE

We see ourselves as mediators translating scientific insights to create relational objects and experiences that can help envision new ways of seeing things. Making information graspable by combining visual, emotional, and logical languages. This perspective has been valuable throughout the process when learning from material technology and biology, to rethink surfaces.

Knowing that 80% of the environmental impact happens at the design stage, we can contribute to change through a shift in the design process starting with understanding the material, its role, life cycle, and end-point. Encompassing not only human needs but also the needs of our environment.

When looking at the surface as a material, we observed that the ongoing debate is often focused on the solid, separated from the surface. While internationally, design projects rethinking color and surfaces are increasing. Recognizing this, we see a potential to engage in this discussion within Norway.

LEARNING OUTCOMES

Shaping our project through material exploration, allowed us to design with the material, acknowledging unpredictability. Influenced by light, temperature, and pH values, material properties started to reveal themselves. These discoveries guided our process and became pointers for the following experiments.

While working within a field rich in tradition, it has been important to understand the history of the material and the context we are designing from, to make forgotten knowledge visible, combine it with new perspectives, and add new value. We can advance traditional and natural ways, such as taking natural pigments from bacteria and letting them multiply.

Gaining new knowledge also means new limitations. We realized while exploring bacterial pigments, that the methods and results we were aiming for required a different time frame.

With guidance from a microbiologist, as well as more time at our disposal, we could have dived deeper into the materiality.

A possibility-driven mindset pushed us to raise questions and open up new paths to explore, rather than aiming for one answer. With this non-linear process, we constantly had to evaluate in what quantity and complexity we were to follow each path. This was especially challenging at the beginning of our material experimentation, when all paths were captivating and appeared valuable for the project. Throughout the material exploration, we became more trained in the evaluation, and it became easier for us to identify potential misleads.

This project has also been an eye-opener creating a possibility space that we both are intrigued to investigate further. This has increased our interest in working as designers in a cross-disciplinary context.

FINAL THOUGHTS

How might we reveal hidden processes to challenge the contemporary aesthetic of the surfaces that surround us?

Details about paint pollution at the beginning of this master's thesis gave us a clear indicator that the topic was worth investigating, while the process itself has opened up more questions than when we initially started.

We began by trying to understand the surface as a material, defining it as paint and coatings consisting of pigments and binders. Further, we explored a wide range of natural pigments and binders to bring forward an alternative now. Aiming for a change in mindset, both in production and aesthetics.

A challenge has been to work within an established, yet abstract field. To understand the solid and the surface as a unity, still being able to discuss it separately. Acknowledging the surface as a hyperobject, was a valuable insight that made us shift our focus from material technology to communication.

We have seen the value of making environmental issues graspable and tactile, and how comparison can be an impactful tool to achieve this. By creating a vocabulary, we were able to synthesize, design, and validate our project. Together with the artifact, it facilitated dialogue. We observed how conversations about production methods brought awareness to the surface, and made people reflect on what different aesthetic expression represents. Encouraging an altered perception of how a surface should look and behave.

We hope that this master thesis can function as a catalyst for further discussion in this matter. Creating new questions and trigger further explorations of the living surface.

A special thanks to

All the people we have talked to
sharing their knowledge,
our supervisor Nina,
fellow students at AHO,

and our loved ones who have been
sharing valuable perspectives and
supported us throughout this project.

Litterature

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