



TONALLI



A TRIBUTE TO THE ULTIMATE TEACHER:
QUETZALCOATL

FABRICADEMY PROJECT



BIOGRAPHY

I'm a Fashion Designer. Fashion has been my passion since I was a little girl. I consider myself very dedicated, sharp-eyed and structured. My inspiration comes from observing nature, the colors and the essence around. Love to observe and admire art in all their ways, as the way of being of the people around me.

I had the opportunity to live in different countries, to meet new people, to learn from other cultures and that I think enriched the way I look at things, my thoughts and all that transformed me into the person I am today.

I have worked designing and making tailored garments and at the same time teaching at University. That challenge me and makes me get out of my comfort zone.

I believe that every day is an adventure, a way to potentiate who we are and make a change around us, to transcend. love to be in constant search for new challenges and opportunities. Having a good attitude and helping others is the best way to reach happiness and leave a legacy.

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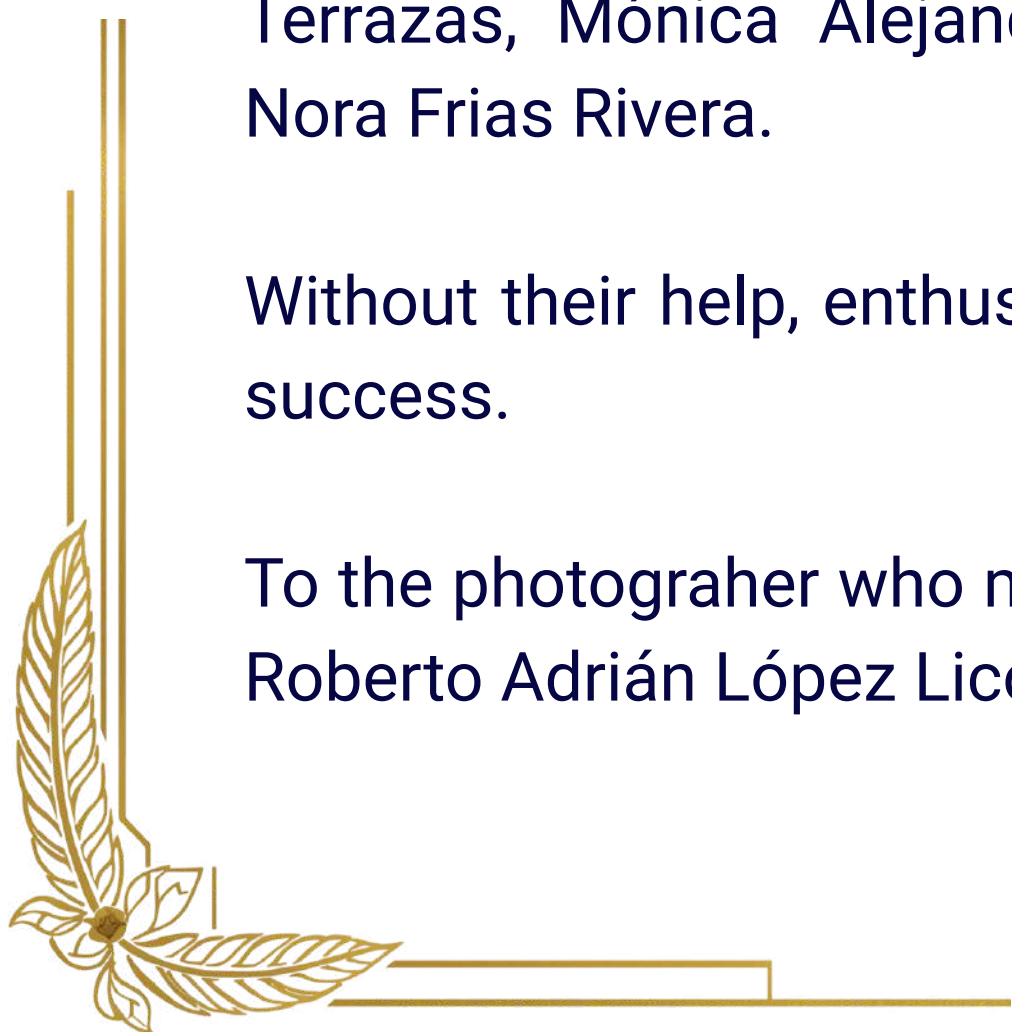
I also wanted to thank The FabLab Queretaro for all the support, advice and help during this roller coaster journey.

Specially thanks to Luis Alberto Hernández Vega and Jonathan Iván León Santibáñez for their unconditional support, teachings and advice.

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Without their help, enthusiasm, commitment, this wouldn't had been a success.

To the photograher who make posible all the final photos of this project: Roberto Adrián López Licona

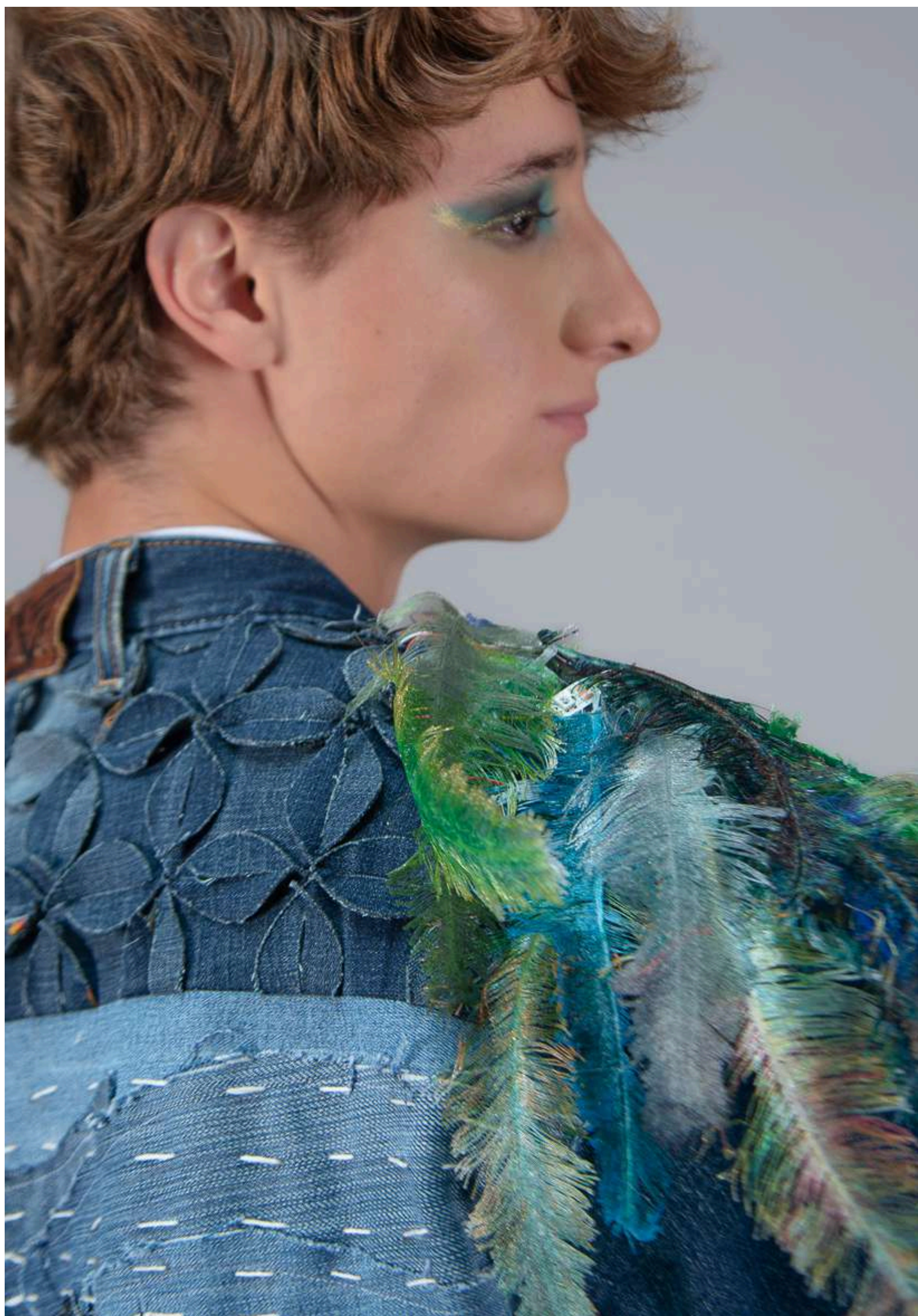


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“THROUGHOUT CULTURES, MYTHICAL
CREATURES HELP US UNDERSTAND
TRANSFORMATION, WISDOM, AND OUR
CONNECTION WITH NATURE.”



ABSTRACT



In this work I explored the meeting point between a mythical powerful symbols around the world, The Dragon. The representation of the dragon varies according to the culture and its spiritual believes. Mexico is a country with a lot of heritage and history that evocates a very mythical and spiritually dragon: The Feathered Serpent: Quetzalcóatl. We can find simmlarities with other countries like Japan.

Quetzalcóatl, connects the earth and sky, representing creation, knowledge, spiritual guidance, and rebirth. These two figures serve as metaphors for movement, transformation, change, and learning – values that deeply resonate with the experience of this course itself. Through out cultures, mythical creatures help us understand transformation, wisdom and our connection to nature.

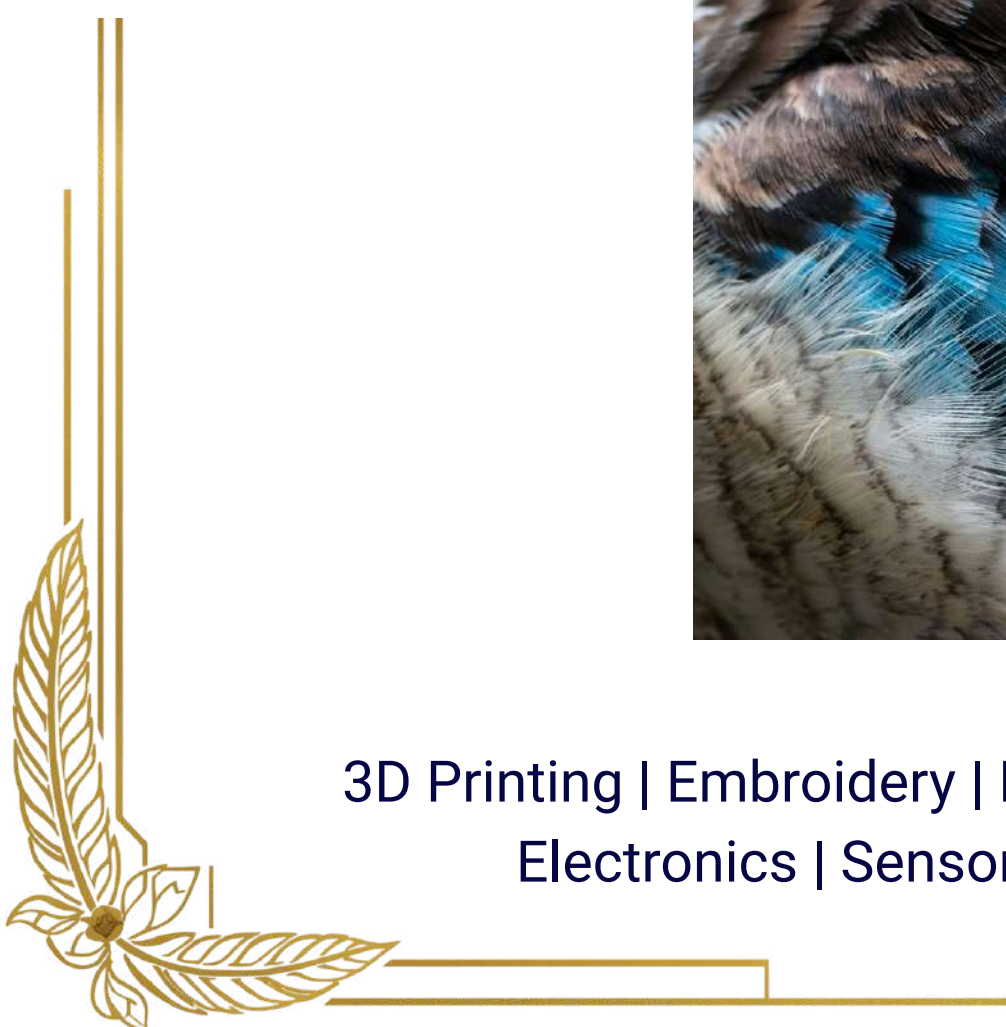
The goal is to merge handcraft and digital technology into a “Contemporary Male Capsule Collection” that carries essence, fluidity, and adapts to the moment in a symbolic way. A reference of movement, transformation and change. Representing a duality of softness and structure, tradition and technology all together in harmony. This duality highlight the "semantic gap" in purely automated or globalized design. Al-Ghamdi argues that generic digital tools often flatten or misrepresent intricate, non-Western cultural details (like symbolic motifs or traditional textures).(Al-Ghamdi, S. M., 2026). Tonalli is a project that tries to close this gap by merging both things into a deliberate, hybrid hand-and-machine design rather than in a generic fabrication garment.

The principle objective is to work with and for the students of different disciplines. To encourage them to do and experiment different materials and things.To interact, explore their creativity, develop new abilities and implement them in Fashion or different products. I want them to visualize that Fashion is more than just clothes, that there is a universe of creativity, innovation, technology and sustainability to explore. The main idea is to be able to implement as many topics as possible seen learned during the Fabricademy course, like parametric patterns, reused clothes, biomaterials, natural dyes, ancestral embroidery techniques, 3D printing and wearablility and interaction.



KEYWORDS

3D Printing | Embroidery | Neopixels | Biofabrication | OS Fashion | Biochomes|
Electronics | Sensor | Upcycling | Sustaintability | Colaboration | Image |





INTRODUCTION

Conceptual Background and Context

In the contemporary globalized landscape, Fashion Design increasingly sits at a critical intersection between the ancestral past and the technological future. Historically, textiles have served as vital repositories of intangible cultural heritage—carrying the cosmologies, spiritual beliefs, and visual identities of communities across generations. Concurrently, the rise of the digital era and the democratization of physical computing have transformed the garment from a passive, static covering into an active, responsive interface capable of communicating complex human experiences.

This research project introduces a wearable art collection that explores the profound duality between traditional handcraft and advanced digital fabrication. The project is rooted in the synthesis of diverse cultural iconographies, weaving together the symbolic spiritual energies of Mesoamerican cosmology with the intricate structural practices of the embroidery like the Sashiko or Boro from Japan. Central to this exploration is the concept of Tonalli—the ancient Nahuatl belief in an internal, vital force that flows through living beings, shaping their presence and energy and Quetzalcoatl as the guardian of the Great Threshold. Quetzalcoatl is the Serpent—rooted in the earth, the master of raw material, and the strength of the hand and the Feathers—the breath of the wind, the spark of the mind, and the flight of imagination that represent the interaction between them. A vehicle for embodiment, through fashion materializes this unseen spiritual flow, transforming internal human energy into a tangible, externalized narrative.



Friction Between Tech and Craft



Despite the rapid evolution of wearable technology, a persistent gap remains within the fashion industry and design education. The integration of electronics and smart textiles often defaults to a "gadget-centric" approach, where microcontrollers and sensors are treated as superficial additions rather than structural or poetic elements of the garment. This often results in rigid, unwearable designs that prioritize utility over human expression or cultural depth. We have noticed throughout time that traditional artisanal craftsmanship faces the risk of stagnation or displacement in a hyper-industrialized market.

Digital fabrication tools (such as 3D printing and laser cutting) are frequently viewed as opponents of the human hand, rather than partners. There is a profound need for a design methodology that establishes a "wisdom duality"—a space where the historical knowledge of handcraft and the precision of digital fabrication do not compete, but instead elevate one another to create emotionally durable, culturally grounded, and technologically responsive garments.

The project proposes a new philosophy of design: Wisdom through Duality. This work seeks to prove that innovation does not require the abandonment of tradition, but rather a "flow" between the technical discipline of the hand and the limitless potential of the machine. Formally merge traditional Mexican artisans techniques with structural manipulation to create a visual language. Implement a hybrid manufacturing workflow where handmade elements (such as biomaterials and hand embroidery) with digital tools (such as 3D printing flexible TPU, laser cutting) to create an embodied interface where physical computing elements (low-profile microcontrollers, proximity sensors, and responsive LED/NeoPixel lighting arrays).

All this is created to manifest the concept of internal energy (Tonalli) flowing together handcraft and digital technology in dynamic wearables interacting together and joining both concepts: Quetzal and Coat. This capsule collection is designed for "The Modern Seekers", a framework for students to learn the balance and explore this duality, because the future of fashion lies not in the choice between technology and craft, but in the masterful flow between them in balance.



STATE OF ART



THE TEXTURED LIVES

Throughout history we can find deities and mythological symbols that have guided civilizations and represent the roots of their cultures. This is the case of Japan and Mexico. These are countries that, despite being geographically distant, have many things in common. We share values and philosophies and one example are the feathered serpent of Mexico, Quetzalcoatl and the dragon of Japan, Ryū.

The Feathered Serpent, one of the major deities of the ancient Mexican culture. The word Quetzalcoatl is a combination of Nahuatl words: Quetzal is the magnificent bright green bird and coatl means snake. This deity refers to the union of terrestrial and rain waters. Quetzalcóatl, connects the earth and the sky, representing creation, knowledge, spiritual guidance, and rebirth. Ancient myths describe Quetzalcoatl/Kukulcan as revered throughout Central America and Mexico for his gentleness, intelligence, and his patronage of arts.

The Aztecs believed that he “created the world,” and they dedicated temples to him like in Chiche Itza. The Aztecs believed that Quetzalcoatl was a redeemer, and that he would someday return and claim his kingdom.

The origins of the Japanese dragon trace back to a blend of indigenous beliefs and influences from Chinese and Indian mythology where the dragon reside in deep seas or under lakes and are known as guardians of the water. Often serving as mediators between heaven and earth. The Japanese dragon is a revered figure, a symbol of strength, wisdom, and protection. The Japanese dragon is a creature of water and Air, associated with protection, wisdom, fluidity, and transformation. The Year of the Dragon, known as “tatsu-doshi” in Japan, holds cultural significance in the country, where it is revered as a water god. This mythical creature is associated with health, energy, bravery, and trustworthiness. In the lunar calendar, the Dragon is the only imaginary creature considered an auspicious symbol.

All cultures have their own identity and characteristics that defined them from the others, but at the same time there are things that resemble with others as in the case of Mexico and Japan talking about the dragon creature their philosophy and its values.

Since the dawn of human imagination, few creatures have captured our collective consciousness as powerfully as the dragon. These magnificent beings, living in the space between myth and reality, have appeared throughout stories, religions, and art. From the benevolent celestial dragons of China to the treasure-guarding wyrms of European legend, dragons symbolize humanity’s effort to understand and represent the most basic forces of existence: creation and destruction, wisdom and power, chaos and order. The fundamental Dragon form The serpent symbolizes ancient wisdom and the life force flowing through all creation. The wings represent transcendence and the ability to shift between earthly and celestial realms. The breath signifies the power of transformation, capable of both creating and destroying depending on how it’s used.



From the high altars of the Americas comes the Quetzalcoatl, the Plumed Serpent bridged the gap between the earth and the heavens. It shows the ancestral harmony legacie that flows through wisdom and creation, design and sustainable craftsmanship, the celebration of the dragon as a universal symbol of transformation and transcendence. Quetzalcoatl as the ultimate dragon, the feathered serpent. The Dragon through out the shores and eras has stood as the guardian of the Great Threshold. It is the Serpent—rooted in the earth, the master of raw material, and the strength of the hand. It is the Feather—the breath of the wind, the spark of the mind, and the flight of imagination.

True Wisdom is not found in one or the other, but in the Flow between them. This duality can be explored by weaving the weight of ancient scales with the lightness of celestial feathers. We do not just dress the body; we dress the intellect, honoring the seeker who understands that to touch the sky, one must first be firmly grounded in the craft.



In contemporary fashion design, the boundary between structural garment fabrication and interactive technology is increasingly blurred. Rather than treating electronic components or material ornamentations as mere topical embellishments, recent research advocates for a unified approach where materials guide form and tech-embedded interfaces deepen human experience. As demonstrated by Brisson and L Dubrovski (2024) in their work on Flatfold3D, 3D printing geometric configurations directly onto flexible textile substrates allows designers to program complex, three-dimensional spatial behavior into an otherwise flat surface. This structural changes how garments conform to and interact with the human body, providing structural integrity while maintaining fluid, organic movement.

During all my years as a professor of Fashion Design at the University, I have noticed a lack of vision on the part of the students, towards all the opportunities that the Fashion Industry offers them. Fashion goes beyond the classic garments that you can find on the shop, Fashion is creativity, innovation, the development and the use of new technologies where they can explore and make a difference, have a voice and transform the world we are living in.

As Fashion is more that just clothes and the country where I live is a place full of history, colors, mythical an spiritual, transformation and much more, and as now a days the influence of different countries, especially Japan, with their philosophy way of living and their garments, we can create a to merge between these two mythological cultures into garments that carries their essence. Not a costume, but a wearable: something fluid, adaptative and symbolic at the same time. A offit that not only reference them visually, but behaves like them, changing, adapting ans responding to the surrondings.

Fluidity - Movement Transformation - Change Duality - Softness and structure Tradition and Technology.

The students are today learning new things, a new discipline. It is important for them to realize that outside the competition is fierce and they need to stand out by applying all what they have learned, innovating, creating and experimenting new things. This project can help the students develop new skills, adquire new knowledge ans experiment new materials and technology in their day by day journey through University breaking boundaries, and setting new challenges to overcome.

RESEARCH & BUILT PROCESS



Since the dawn of human imagination, few creatures have captured our collective consciousness as powerfully as the dragon. These magnificent beings, living in the space between myth and reality, have appeared throughout stories, religions, and art. From the benevolent celestial dragons of China to the treasure-guarding wyrms of European legend, dragons symbolize humanity's effort to understand and represent the most basic forces of existence: creation and destruction, wisdom and power, chaos and order. The fundamental Dragon form The serpent symbolizes ancient wisdom and the life force flowing through all creation. The wings represent transcendence and the ability to shift between earthly and celestial realms. The breath signifies the power of transformation, capable of both creating and destroying depending on how it's used.

Across cultures, dragons are consistently linked with ancient wisdom and the deep knowledge gained from witnessing the rise and fall of civilizations, the cycles of the cosmos, and the everlasting patterns that shape existence. This wisdom isn't just academic; it's a profound understanding that arises from direct experience with the core forces of creation and destruction. In many traditions, dragons act as teachers and guides for heroes, sages, and spiritual seekers. They hold knowledge of hidden treasures, secret pathways, and ancient mysteries that can only be accessed through the right approach and respectful relationship. This teaching role reflects the idea that true wisdom cannot be taken by force but must be earned through patience, humility, and the willingness to face difficult truths.

From the high altars of the Americas comes the Quetzalcoatl, the Plumed Serpent bridged the gap between the earth and the heavens. It shows the ancestral harmony legacie that flows through wisdom and creation, design and sustainable craftsmanship, the celebration of the dragon as a universal symbol of transformation and transcendence. Quetzalcóatl, (from Nahuatl *quetzalli*, "tail feather of the quetzal bird [*Pharomachrus mocinno*]," and *coatl*, "snake"), the Feathered Serpent, one of the major deities of the ancient Mexican culture. The word Quetzalcoatl is a combination of Nahuatl words. Quetzal is the magnificent bright green bird that is native to the Guatemalan highlands, and *coatl* means snake. The Mayan name, Kukulcan, is derived from the Yucatec Maya dialect, combining *kukul*, feathered, and *kan*, which was used for both "sky" and "snake."

This deity was popular in Hispanic tradition and refers to the union of terrestrial and rain waters, which, among agricultural peoples, was essential for their survival, thus signifying the origin of life itself. Thus, Quetzalcoatl is depicted as a snake adorned with feathers. Ancient myths describe Quetzalcoatl/Kukulcan as revered throughout Central America and Mexico for his gentleness, intelligence, and his patronage of arts. The Aztecs believed that he "created the world," and they dedicated temples to him like in Chiche Itza. The Aztecs believed that Quetzalcoatl was a redeemer, and that he would someday return and claim his kingdom. Unfortunately, the Aztecs believed he was returning in the same year that Cortes landed. They mistakenly thought that hernán Cortés was Quetzalcoatl.





The project's core is the Wisdom through Duality, moving from a fashion collection to a "Philosophy of Design" by collaborating with the students, working together, that becomes a lesson in balance: the balance between the hand and the mind, the material and the vision.

Another important part of this ideation, was to find out information about embroidery and traditional symbolisms from mexican culture, specially from Amealco and which is a comunity near Querétaro city and I wanted to add some of them to my garments and maybe combine them with japanese techniques liked Sashiko o Boro. Looking for information about Queretaro's traditions specially on embroidery, I found a video of Amealco's artesan, Doña Josefina Pascual Cayetano, with whom I have worked many times before. This artesans are descendent of the Otomi. The Otomí are one of the oldest indigenous civilizations in central Mexico, with roots predating the Aztec Empire. They are renowned for their resilient agricultural systems, vibrant textile arts, and rich spiritual traditions that thrive today.



<https://www.mexicodesconocido.com.mx/pueblo-otomi-otomies.html>

The japanese embroidery has a great influence in our country specially because it is an ancestral activity used to repair clothes by reusing garments and mending old ones. Sashiko and Boro are the most renowned ones and now a days used not only as mending but as decoration. As the project is meant to be sustainable and all the textile are going to be recycle, this technique will be useful and decorative.



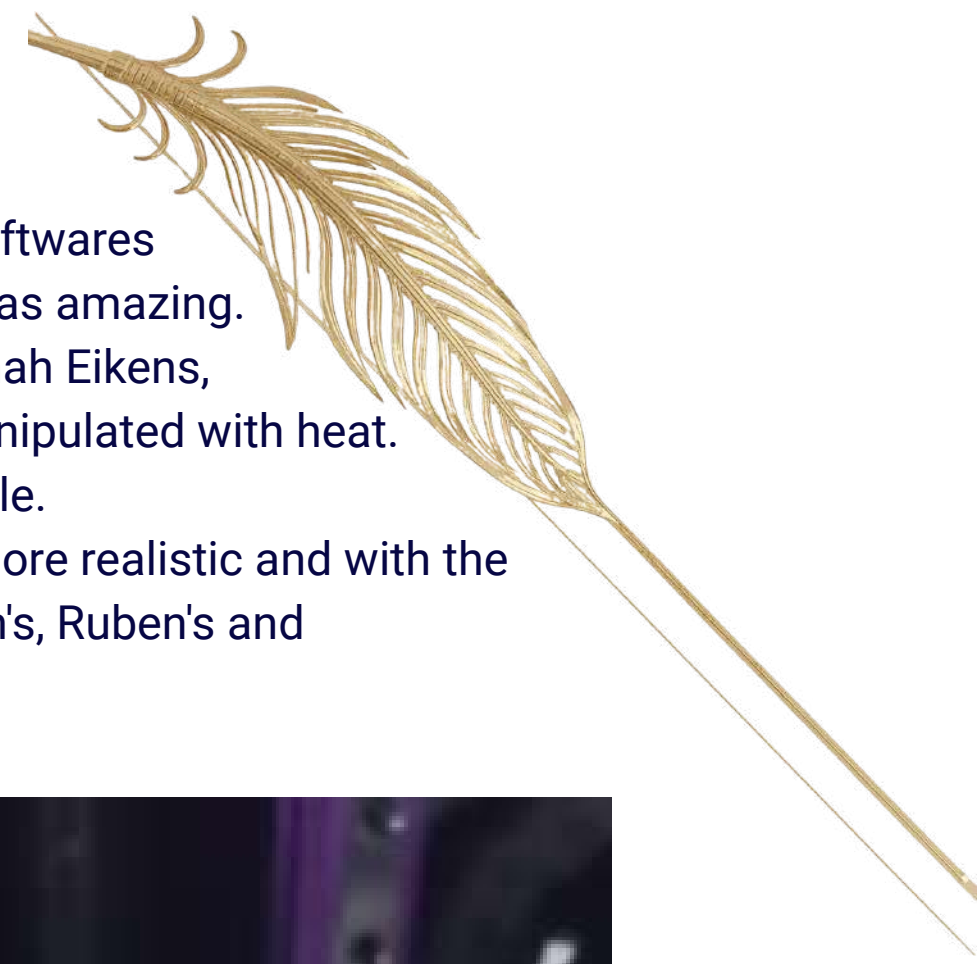
Photo (c) Jeffrey Bardzell

<https://upcyclestitches.com/sashiko-story-to-share-what-sashiko-is-for-us/>



There are extraordinary designers around the world that dominate the use of this softwares and the results that I could find were breath taken. The work of Florencia Moyano was amazing. She modelled the feathers on Rhinoceros with a fantastic result very flexible. Hannah Eikens, modelled a different type of feather a little thicker and less flexible, but it can be manipulated with heat. Billie Rubens, did a more thin feathers, but it had a perimeter that made it less flexible.

BarbMakesThings feathers's projects were great as well, but I wanted something more realistic and with the software used, the final feathers printed in TPU were really nice. The printed Hannah's, Ruben's and BarbMakesThings feathers were good but not the desired result

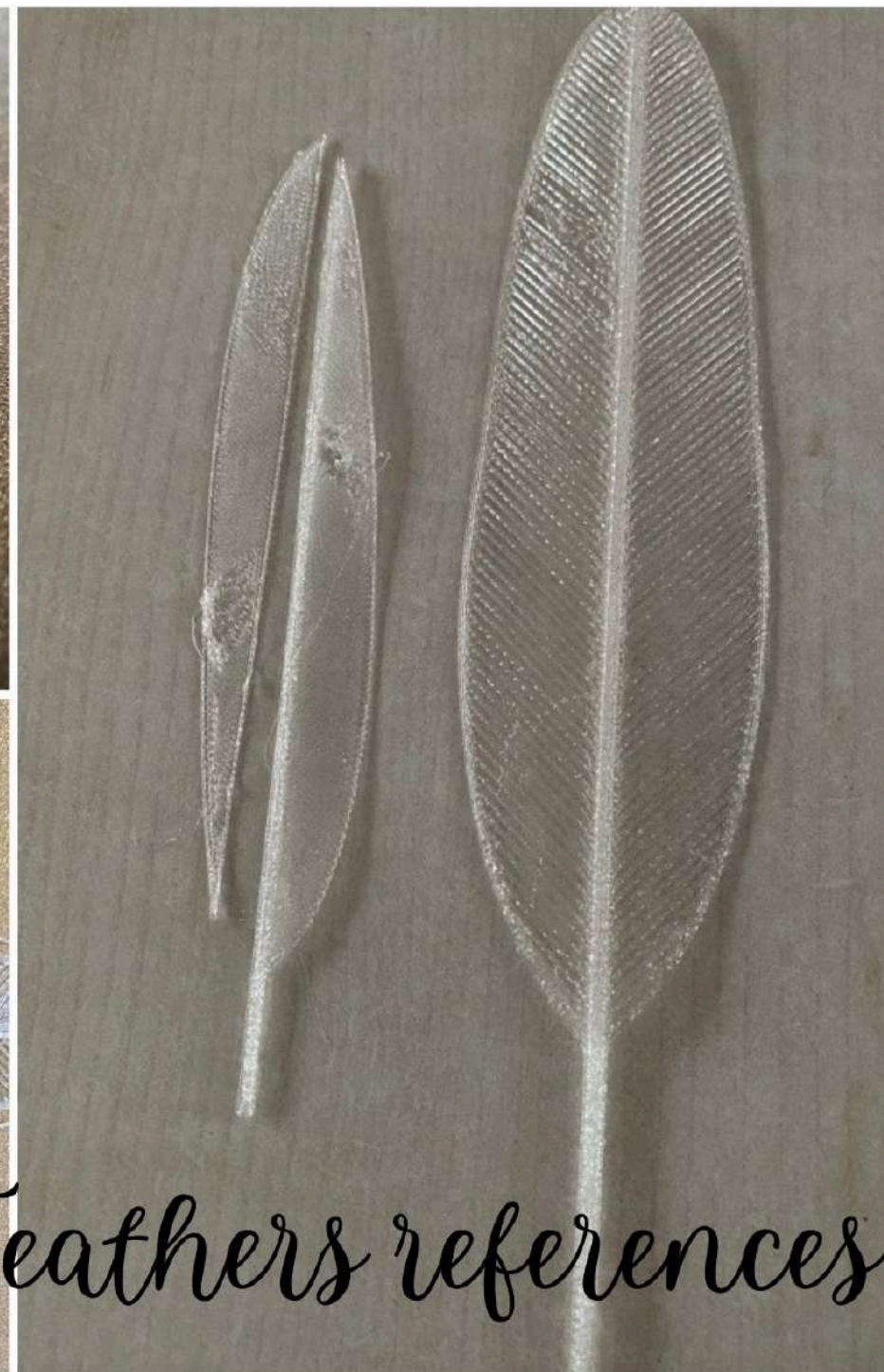


Florencia Moyano

<https://class.textile-academy.org/2022/florencia-moyano/finalproject/prefinal01/>

Hannah Eikens

<https://www.4tu.nl/du/projects/FabulousFeathers/>



Feathers references

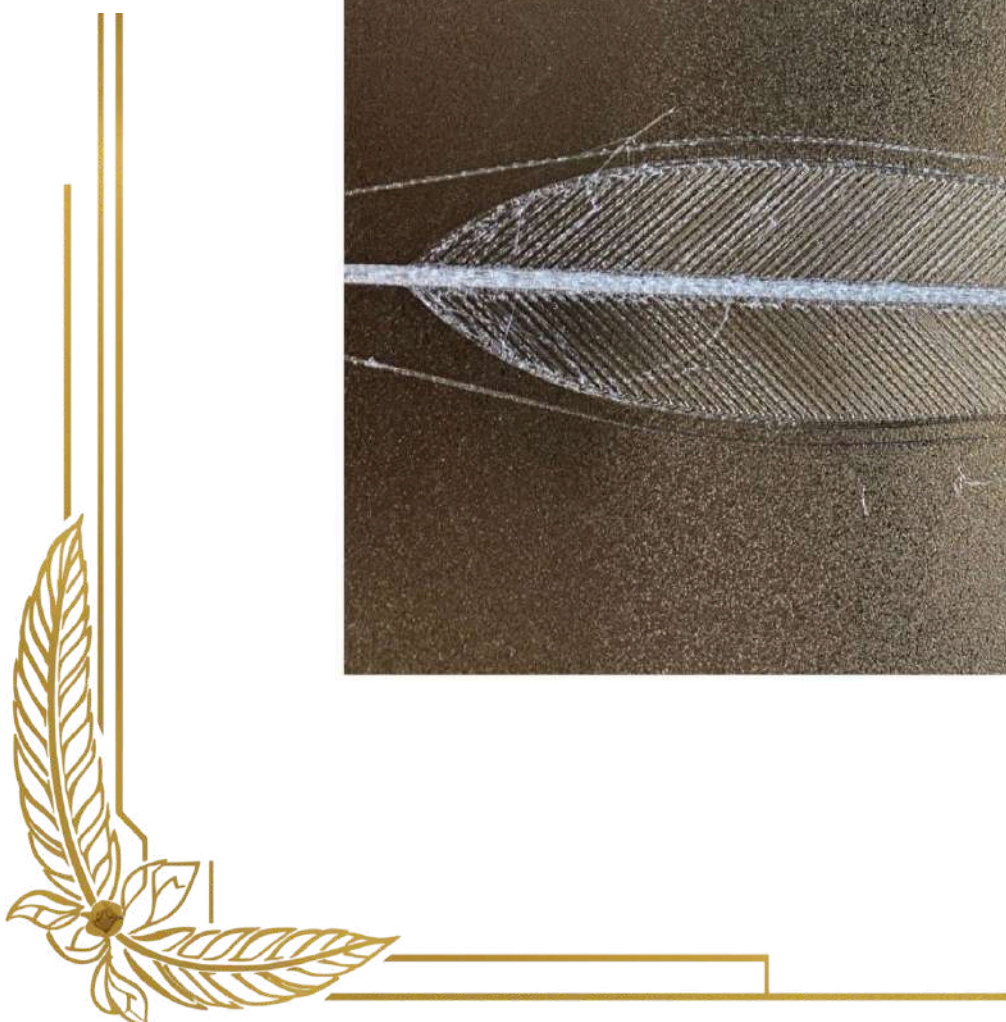


Billie Rubens

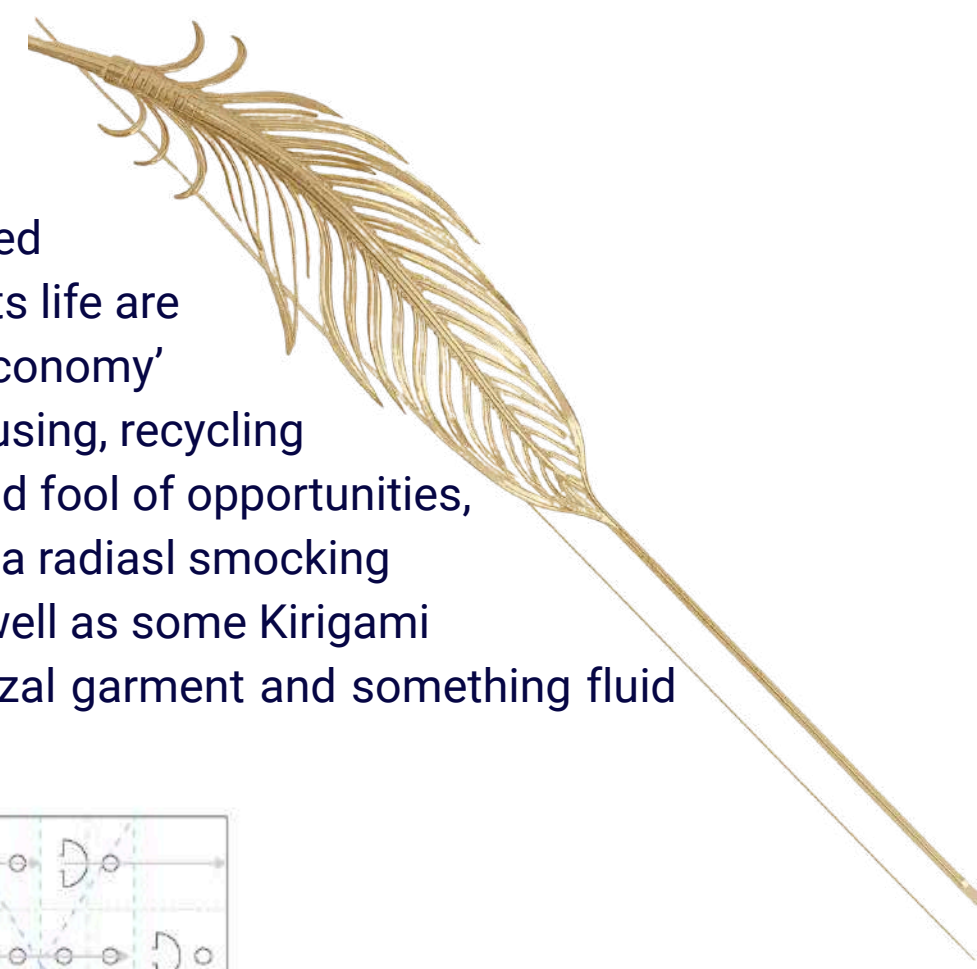
<https://www.printables.com/model/4875-4-realistic-3d-printed-feathers/files>

BarbMakes Things

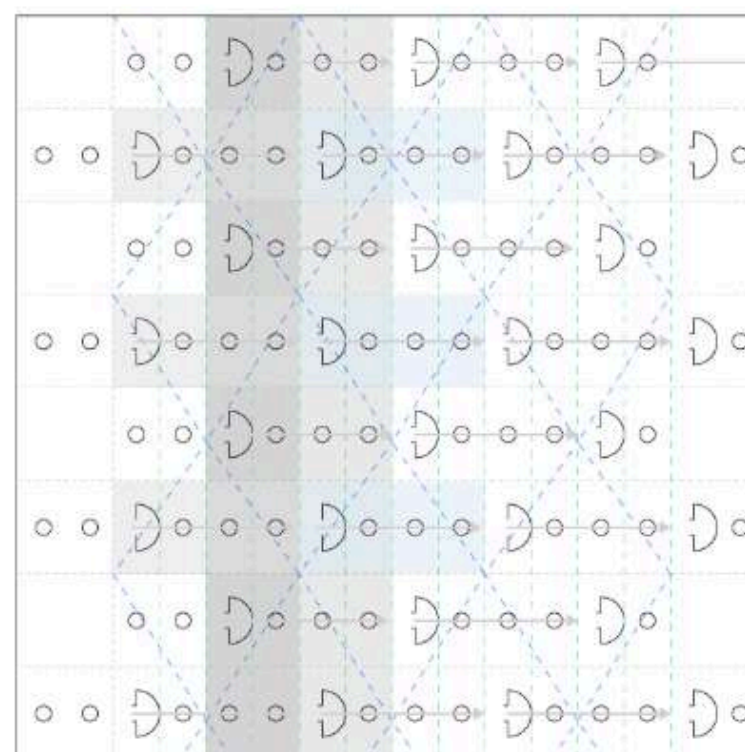
<https://www.instructables.com/Realistic-3D-Printed-Feathers/>



Circular Fashion is a system where our clothing and personal belongings are produced through a more considered model: where the production of an item and the end of its life are equally as important. Circular fashion comes from the intersection of the 'circular economy' —a model that exchanges the established cycle of make, use, dispose in favor of reusing, recycling and upcycling as much as possible—with sustainable and ethical fashion. It is a world full of opportunities, creativity and new challenges. Look through different projects to get inspired. I found a radial smocking design by Kim Winter and the interlocking system by Pattaraporn Kittisapakajon, as well as some Kirigami books trying to find something structural that resembled the snake for the Quetzal garment and something fluid and with movement for the Coatl garment.



Reference
Radial Smocking — design by Kim Winter



Design
Interlocking System — by Pattaraporn (Porpla) Kittisapakajon

During the Fabricademy course I learned a lot of new things and the biomaterials, sustainability and all the things around this was amazing, The fact that is a interdisciplinary manufacturing process that uses living cells, proteins, and biomaterials to generate complex biological system.

Biomaterials are substances derived from biological sources or engineered to interact with biological systems, initially for medical purposes

but increasingly applied in industries like fashion. In the context of textiles and apparel, biomaterials serve as sustainable alternatives to traditional, high-impact materials like petroleum-based synthetics or animal leather. Designer Neri Oxman has a Creativity Cycle, called the "Krebs Cycle of Creativity" (referencing the biological metabolic cycle), posits that creativity is a continuous, iterative loop where four distinct, but interconnected domains build upon and feed into one another. Laura Messing and David Cabrera are two designers with a long path. they experiment with new materials, new forms getting really nice results.



Laura Messing
<https://bio-materia.com/sobre-laura-messing/>



David Cabrera



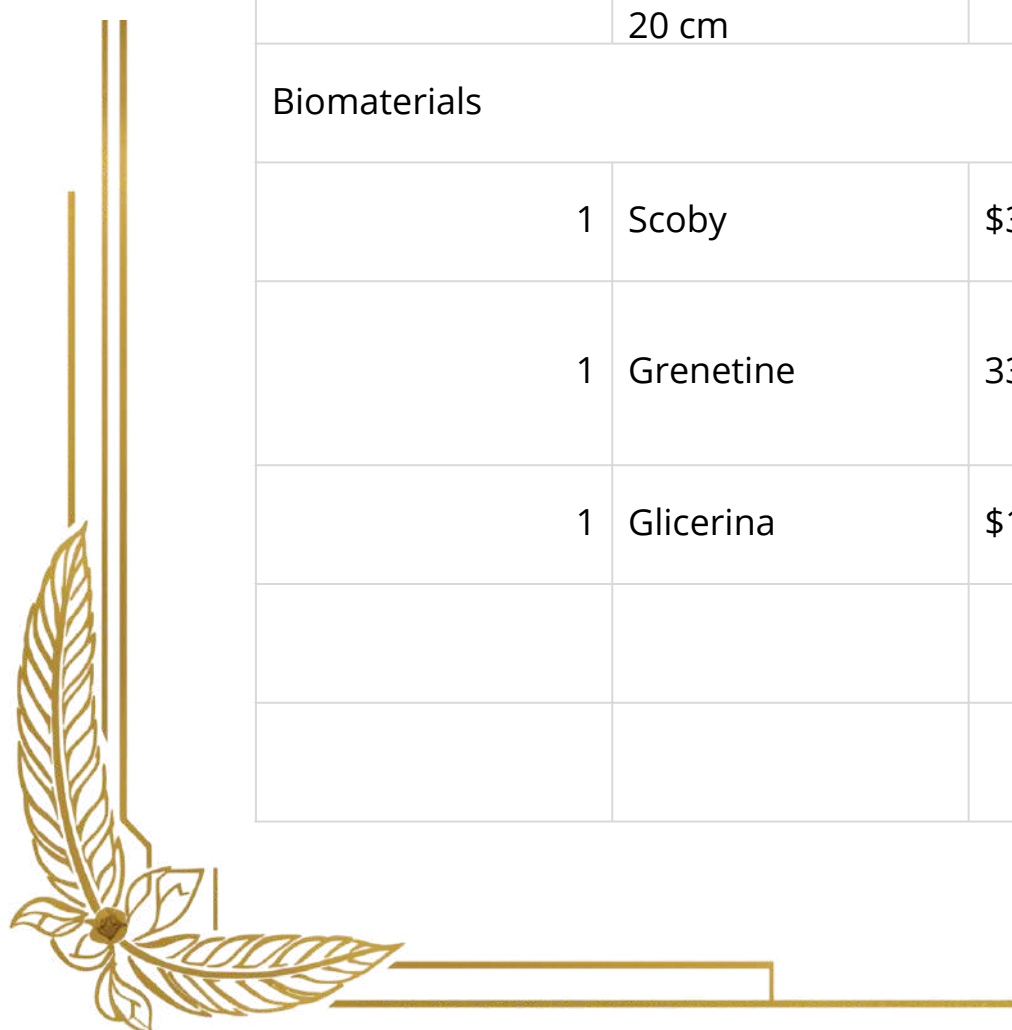
BILL OF MATERIALS

BOM



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QTY	Description	Price	Link	Functional link	Notes
Textile materials					
20 p	Clothes second hand/table cloth	\$400.00 MXN	https://www.2ganga.com/	Ver Producto	Pieces on a bazar
1/2/2026	Natural wool Tread	\$650.00 MXN	https://www.amazon.com.mx/Ovillo-lana-merino-Revolution-	Ver Producto	5mm thick
6	Cotton embroidery tread	\$516.00 MXN	https://www.amazon.com.mx/Hilo-para-Macrame-Colgadores-	Ver Producto	They sell the box with 12
5	Cones of thread for sewing	\$329.00 MXN	https://www.amazon.com.mx/AK-TRADING-CO-multiusos-	Ver Producto	Different colors
4	Dye pigment	\$32.00 MXN	https://colorantesmariposa.mx/	Ver Producto	Black
Design software and 3D					
1	Rhino 8 Software	995.00 USD	www.rhino3d.com	Ver Producto	Account
1	PLA for 3D printer	\$599.00 MXN	https://www.amazon.com.mx/SUNLU-PLA-3D-Filamento-dimensional/dp/B0F6T8LF46/	Ver Producto	Tri-Color coextrusion 1.75 mm Diferent
1	TPU for 3D Printer	\$599.78 MXN	https://www.amazon.com.mx/ELEGOO-Transparente-Filamentos-	Ver Producto	Color to be define.
1	PLA for 3D printer	\$389.00 MXN	https://www.amazon.com.mx/ELEGOO-Filamento-dimensional-	Ver Producto	Black 1kg 0.02mm
Electronics					
1	Arduino UNO	\$1,049.00 MXN	https://www.amazon.com.mx/Arduino-Org-A000066-R3-	Ver Producto	
1	FabriXIAO			Ver Producto	
1	XIAO NRF52840 Sense BLE con IMU	\$336.00 MXN	https://www.amazon.com.mx/Seeed-Studio-XIAO-ESP32S3-	Ver Producto	
20	Leds RGB Flash Lento/ Rápido 5mm 2 pines	\$2.00 MXN	https://www.amazon.com.mx/Emisores-Multicolor-Redondos-Difusores-	Ver Producto	
20	Neopixels RGB 5x5 mm SMD WS2812B-B	\$ 6.00 MXN	https://www.amazon.com.mx/stores/page/1599FED2-B2D2-4A2D-9CE1-533FCE166EFE	Ver Producto	
8	battery AA	\$175.00 MXN	https://www.amazon.com.mx/Energizer-ENEPLUSAA4-Alcalina-Color-	Ver Producto	2 packages
1	Cables de alambre de estaño 24 AWG 20 cm	\$ 45.00 MXN	https://www.amazon.com.mx/TUOFENG-alambre-carretes-diferentes-colores/dp/B07V1D82HM/	Ver Producto	
Biomaterials					
1	Scoby	\$380.00 MXN	https://www.amazon.com.mx/Kombucha-Conservado-Personalizada-	Ver Producto	
1	Grenetine	332.59 MXN	https://www.amazon.com.mx/Grenetina-Duche-1Kg-Bloom-Sabor/dp/B098PQGJ8C/	Ver Producto	Ver Producto
1	Glicerina	\$179.00 MXN	https://www.amazon.com.mx/Glicerina-Corona-Multiusos-Personal-	Ver Producto	



TOOLS

For this project Tonalli, a Tribute to the ultimate teacher: Quetzalcoatl we used different tools, that help us develop this capsule collection

- Rhinoceros software
- 3D printing machine
- Laser cutting machine
- Grenetine
- Glycerine
- Natural dye
- Recycle demin
- Recycle linen
- Recycle PVC
- Batteries AA
- Ultrasonic sensors
- Microcontrollers
- Cables
- Embroidery and normal threads
- Sewing machines
- Scissors
- PLA and TPU filaments



MOODBOARDS



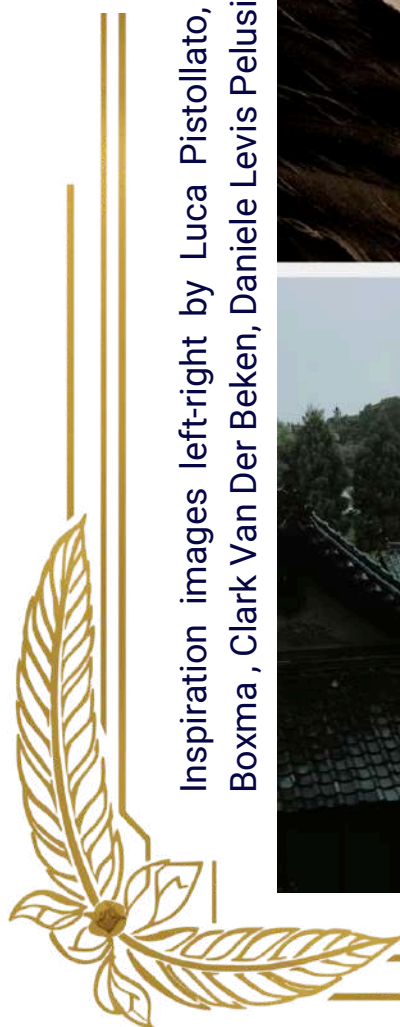
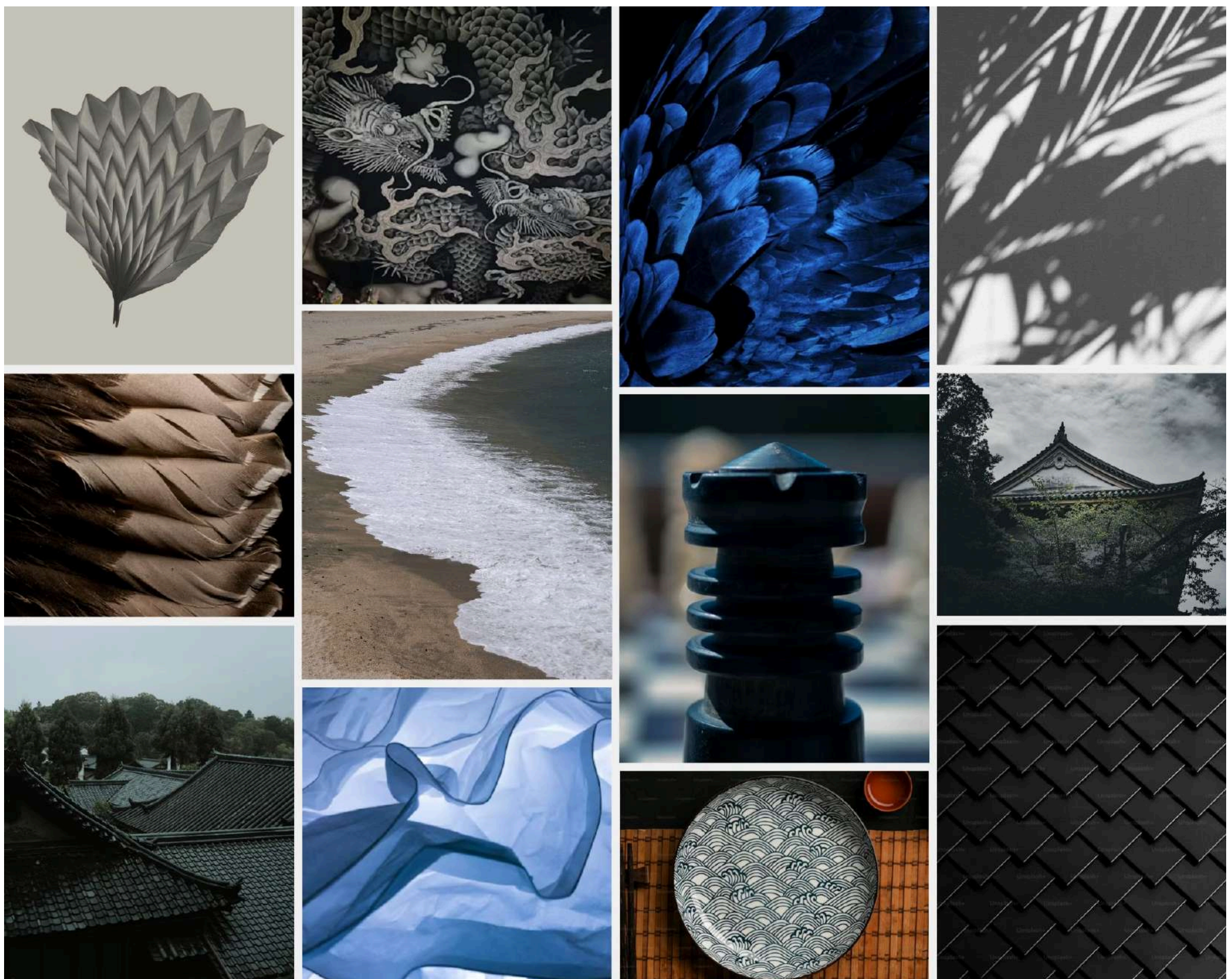
INSPIRATION

Inspiration images left-right by Leo Barada, British Museum, Se. Tsuchiya, Zdeněk Macháček, Oleksandr Sushko, r/TopCharacterDesigns, Baramee2554, Creative commons.org-Eddo

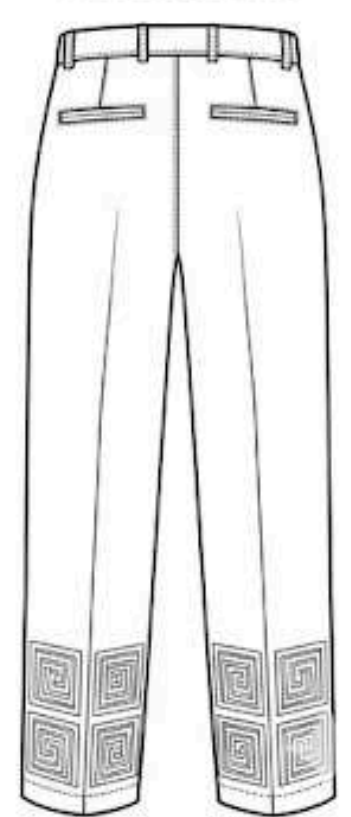
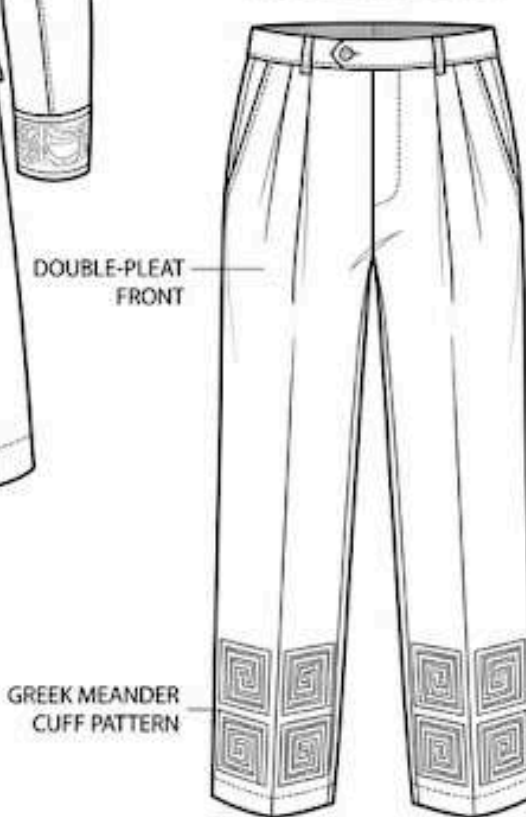
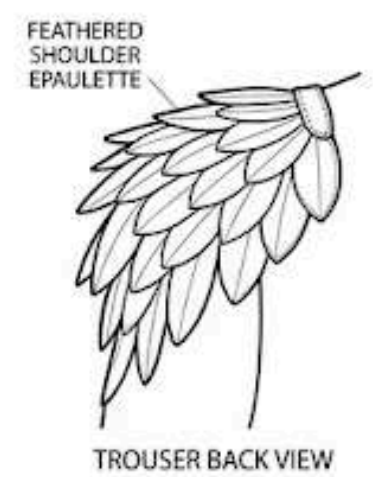
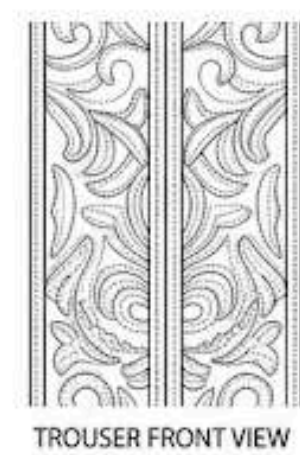
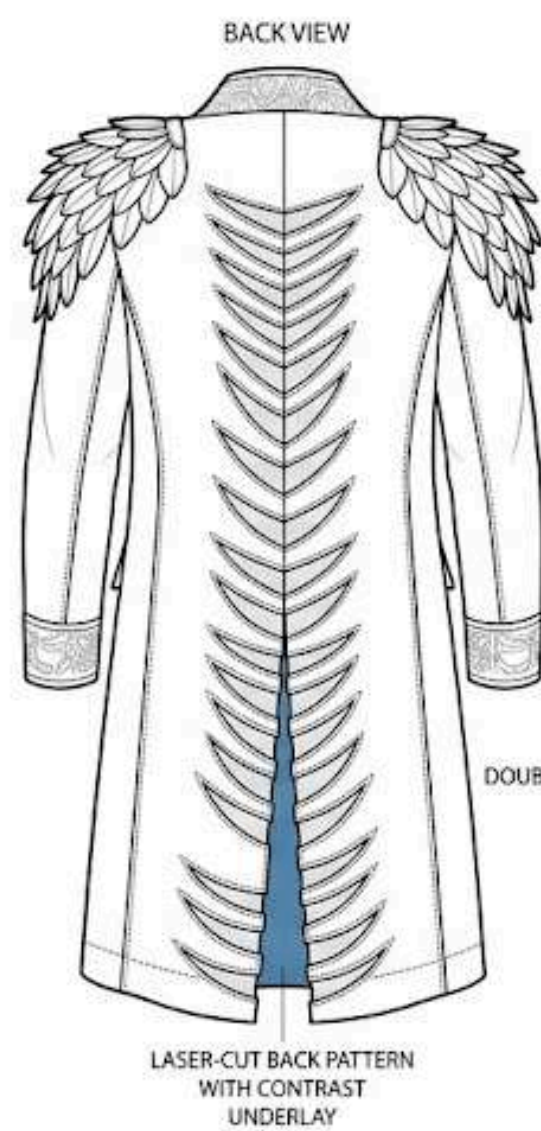
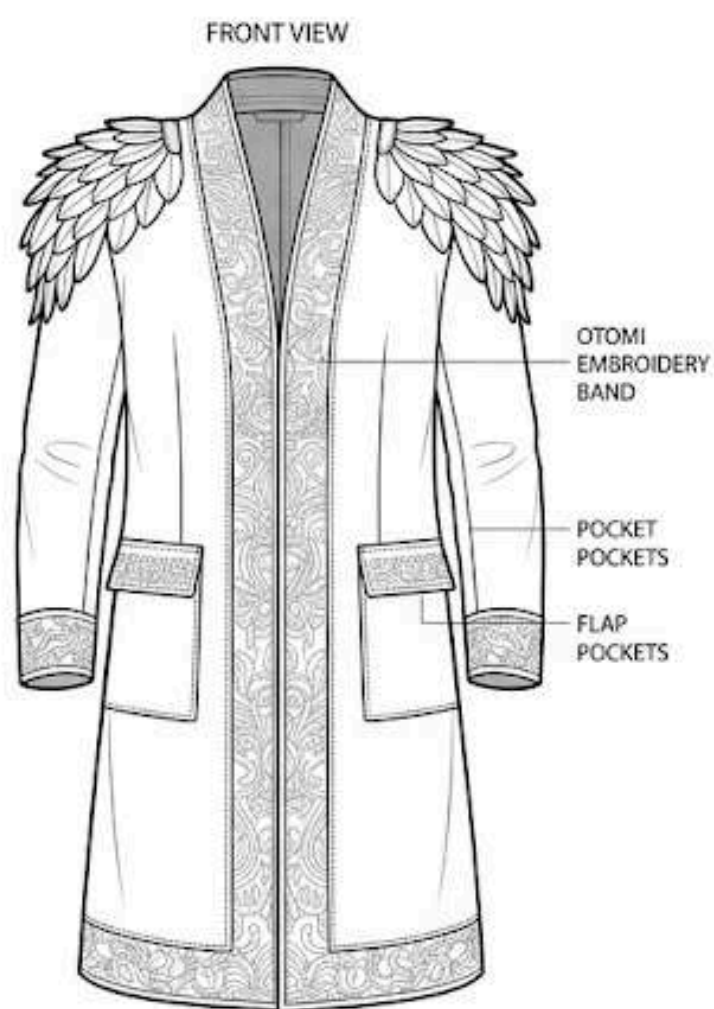


COLOR

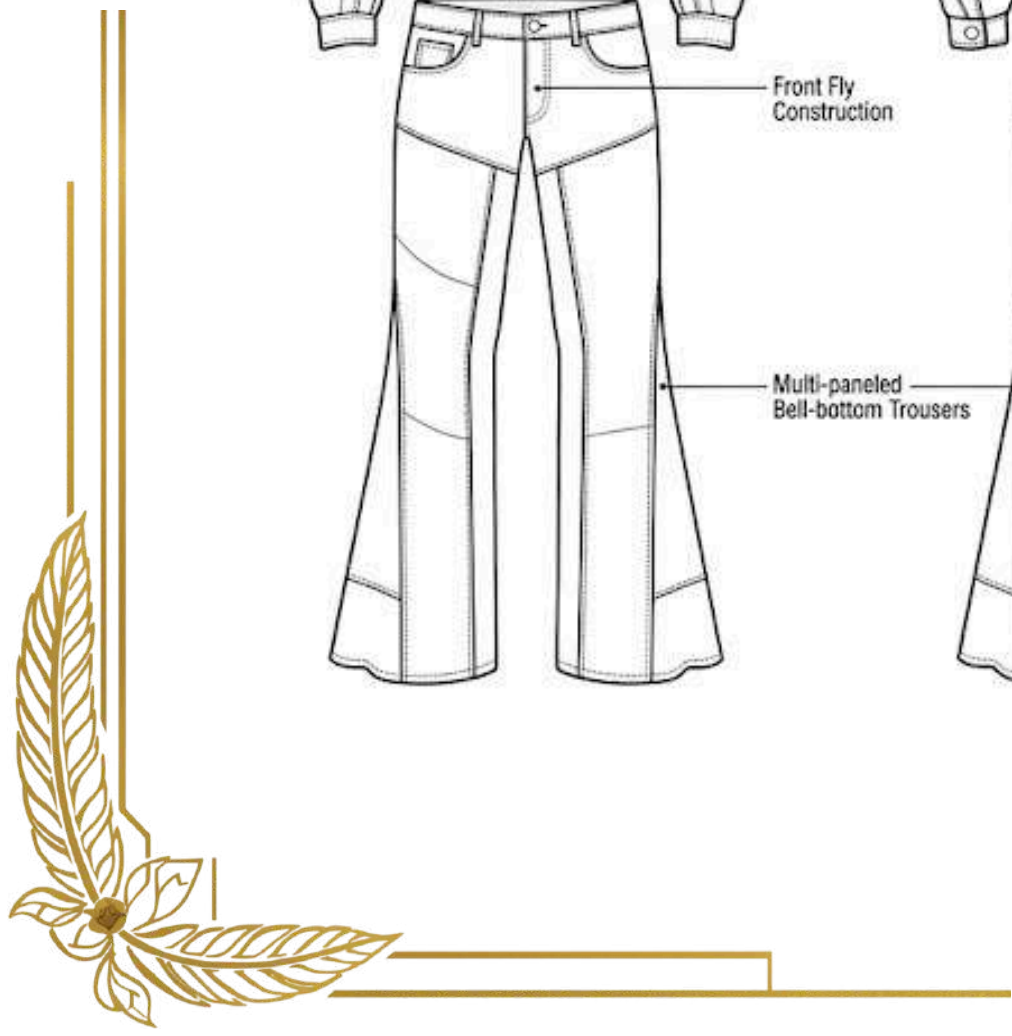
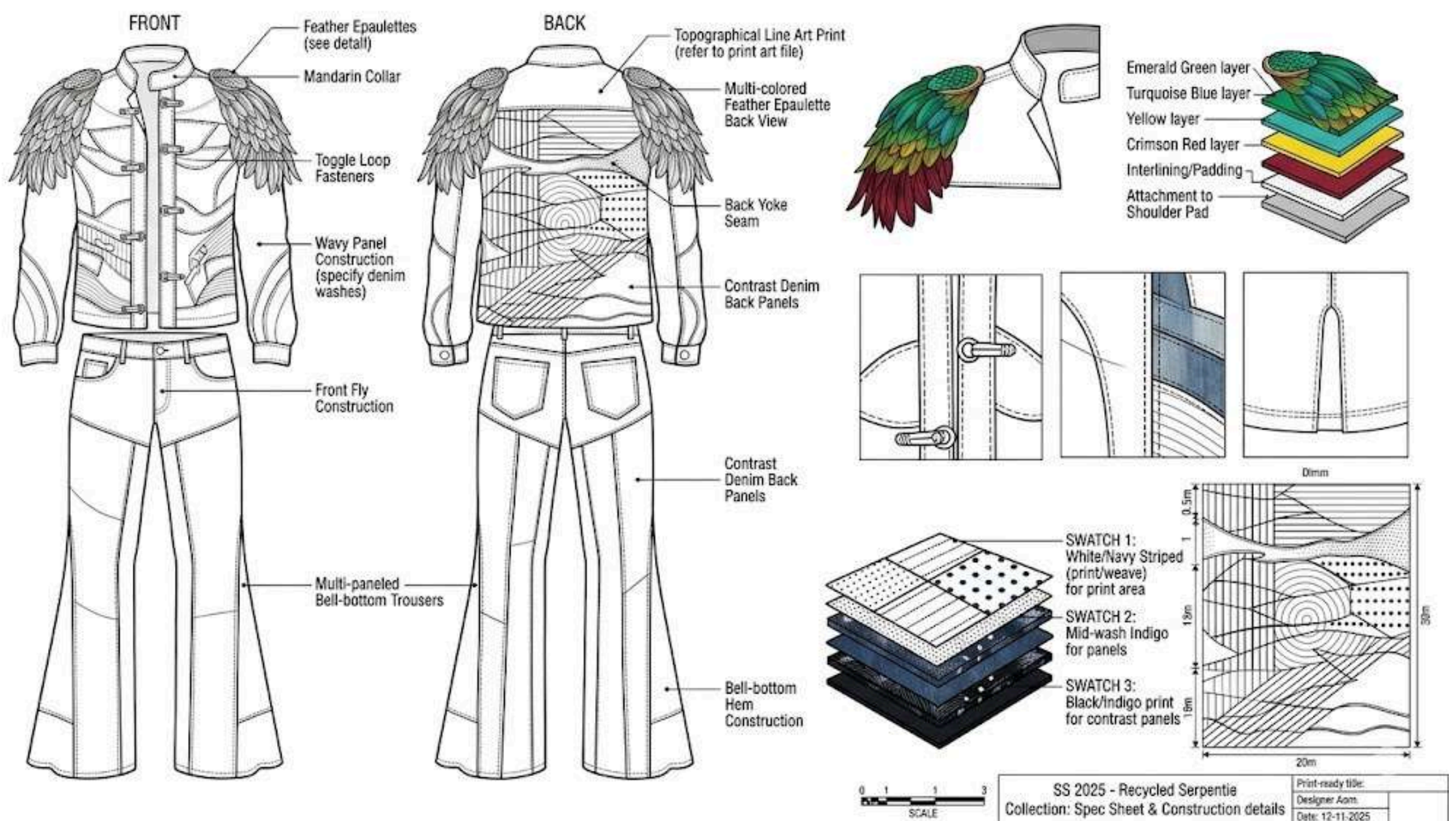
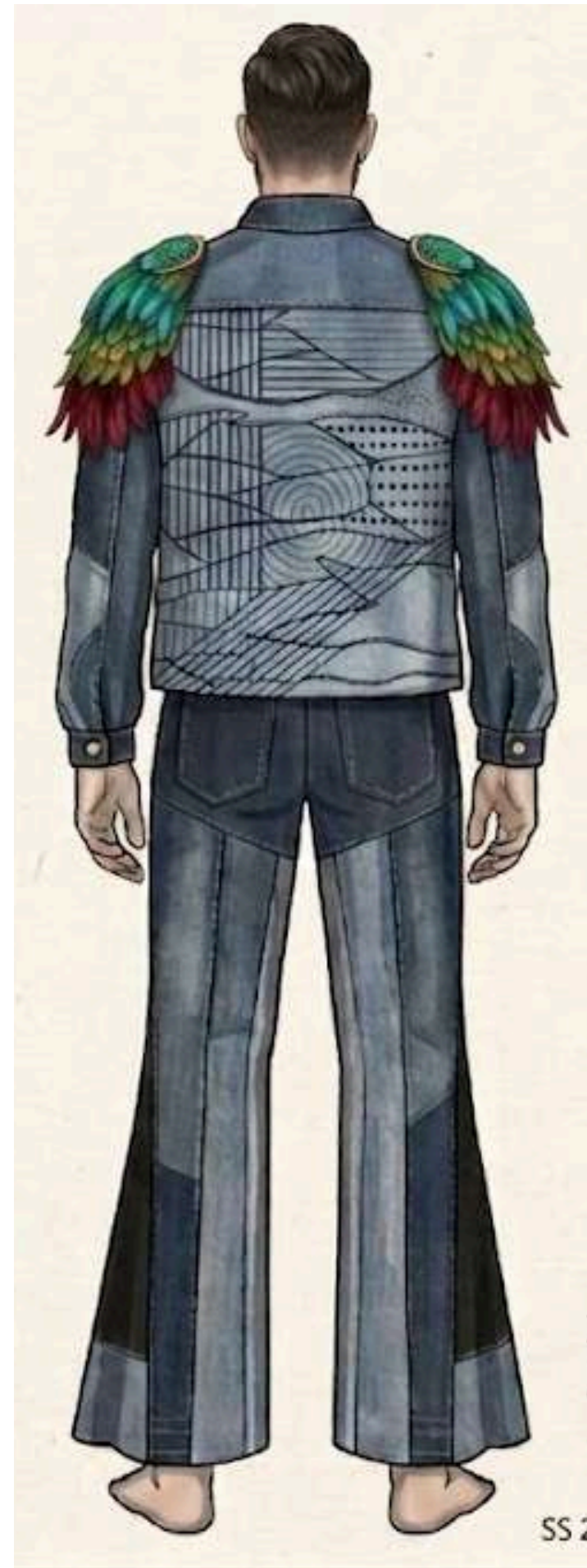
Inspiration images left-right by Luca Pistollato, Leo Barada, Daniel Olah, Iara Sillion, Thomas Boxma, Clark Van Der Beken, Daniele Levis Pelusi, Alexa Accuardi



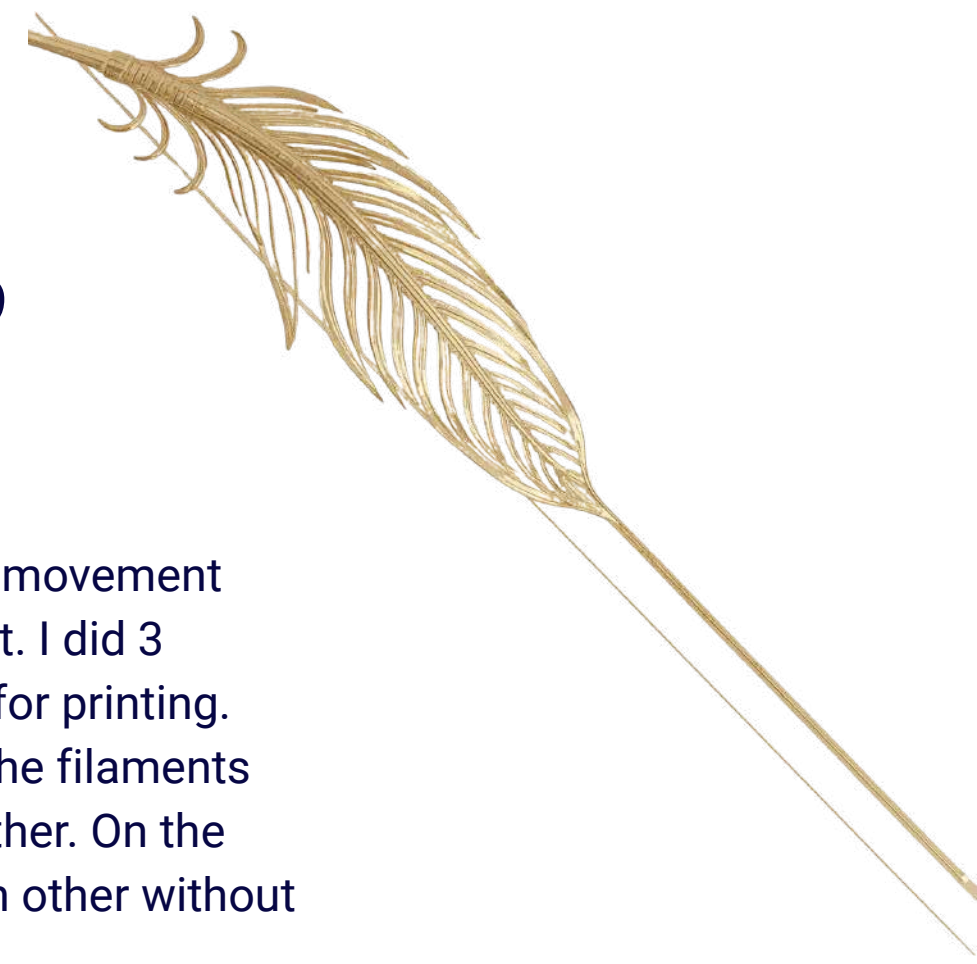
SKETCHES



SKETCHES



CREATIVE PROCESS



FEATHERS

I drew each filament by itself because I wanted them to have its own shape, movement and personality. It took me a lot of time but at the same time I enjoyed it a lot. I did 3 different versions. The first, left one, is the one I downloaded, but it was not for printing. The second one from left to right, I made it, but I saturated it too much and the filaments looked nice, but in the moment that we printed the feather they glue all together. On the third one, I placed the filaments more separated and trying not to touch each other without placing to many.

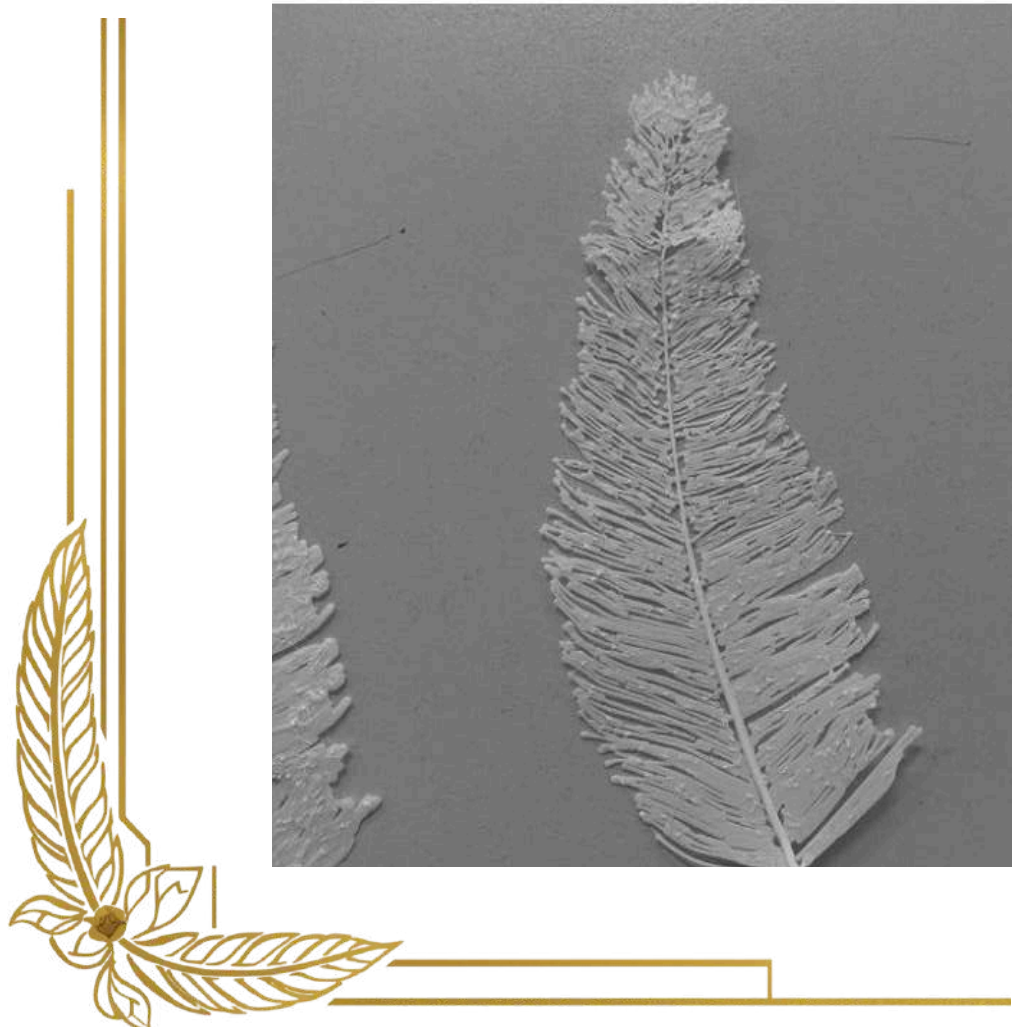
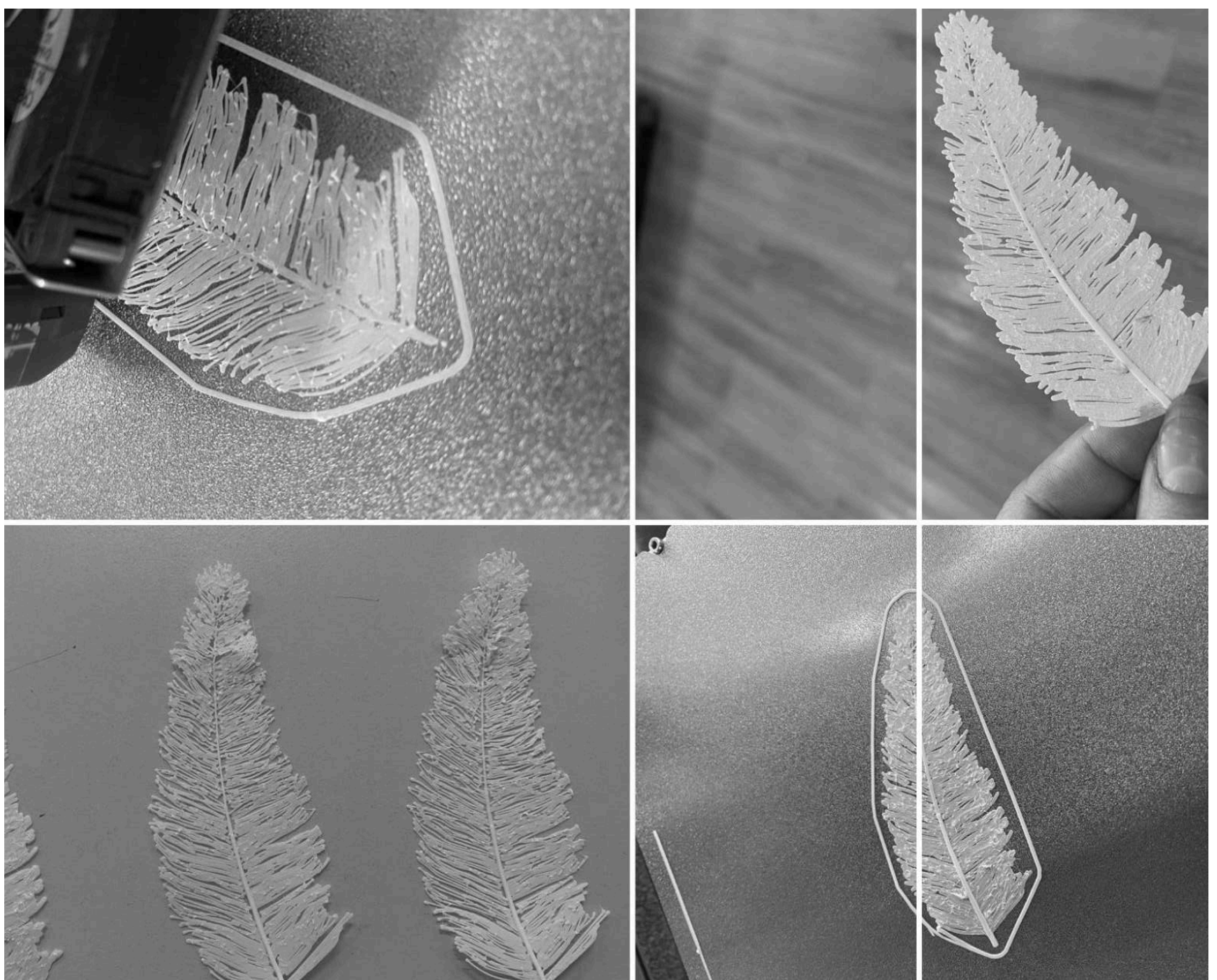
Then I selected them all, except the center, and used the pipe command to make them thicker, but some of them got together and some not. After that I had to join the filaments with the center. I tried transforming the pipes into meshes and then by using the Boolean command try to join them but the program said that the command had failed. I send them to the printer, to see how they looked. The first ones were printed in PLA.

With the help of Luis Hernández from the FabLab, we manage to model it on grasshopper and change some of the parameters and it work much better, so we printed a bigger feather with PLA and the result was very good, flexible, thin and with movement, but the problems was still that the filament joined together.

We decided to change some parameters on GrassHopper. Together we started to think about different improvements, like to reduce the number of filaments, leaving more space between them once more. When we thought we had finished, we found out there was an error on the top of the feather, but still, we send it to print to se the result, but this time with used transparent TPU.

The parameters we used where:

Total Filament: 2,51 g
Model Filament: 0.84 m
Printing: 41m
Time: 31s



After looking at all the alternatives found, I continue modelling the feathers. It was a challenge, but I manage to do it and the result was amazing. I printed them in PLA first, but even though they were flexible, I wanted them to be even more flexible and the look of them more natural and irregular, so I printed them in transparent TPU. Not all the printed feathers had a favorable result, but as we had to print a lot, we try different things, like drying the TPU to avoid the irregular printing and the difficulty to get it out of the printing table.



The feathers needed to be full of color, due to the inspiration on the Quetzal bird that represent the feathers of Quetzalcoatl. They need to be emerald green, blue, with a bit of red. For that several dying tries were made, some were painted with acrylic, some with chartpac markers and some with natural dye like cochinele and pericón.



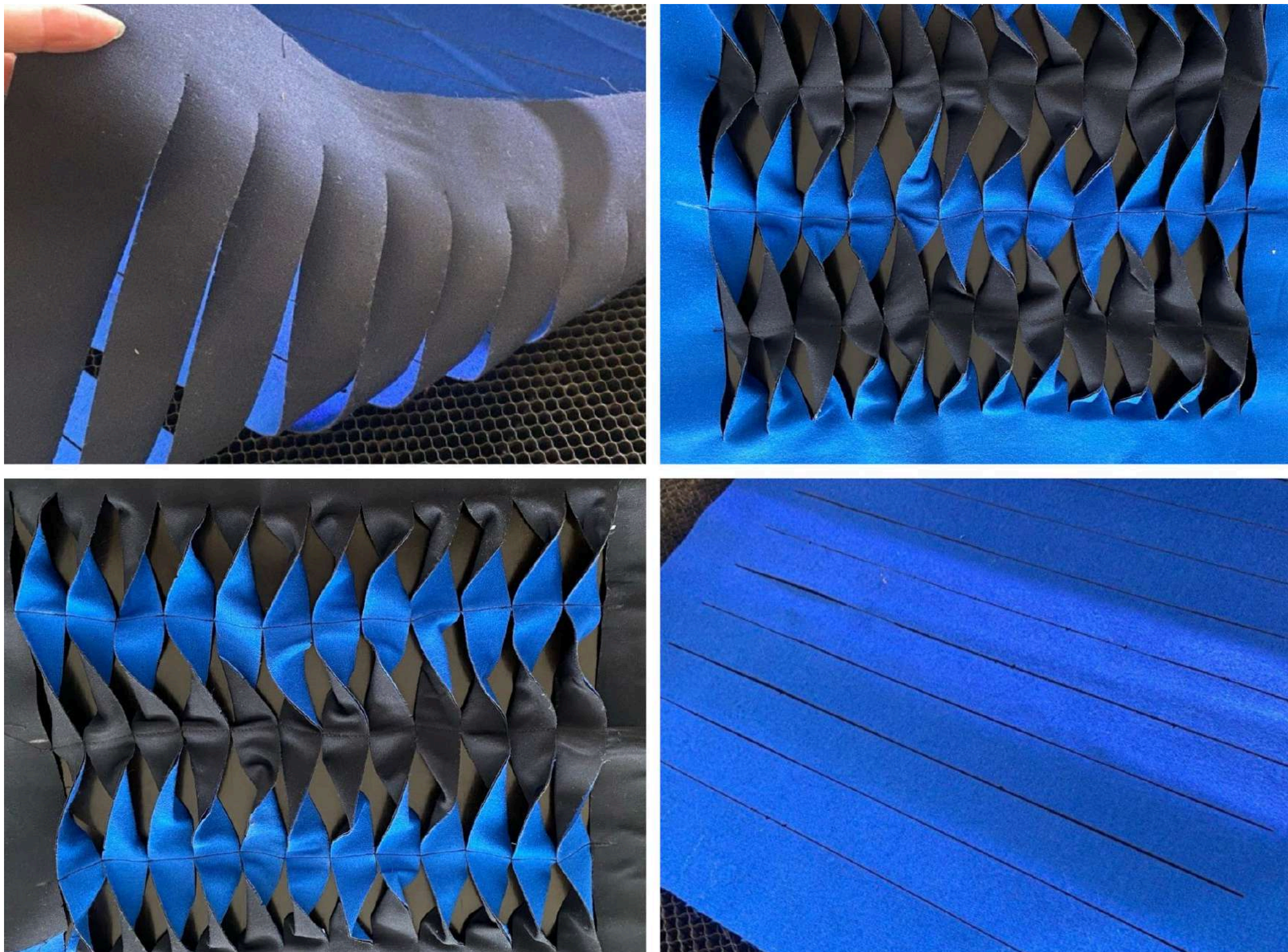
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OS CIRCULAR FASHION

The technique called Kirigami is a variation of origami, the Japanese art of folding paper. The difference is that in Kirigami, the paper is cut as well as being folded, resulting in a three-dimensional design.

Both garments of the capsule collection will have kirigami in different forms. "Quetzal", the black structured one with the double colored textile with stripes folded at the back and sew for resistance, representing the earth and the "Coatl", the blue recycling denim garment with Kirigami on the front and back, representing the wind and movement.



Stripes folded to create a serpent texture for one garment



Modules cut in recycle denim to be assembled together to form the look of the denim jacket



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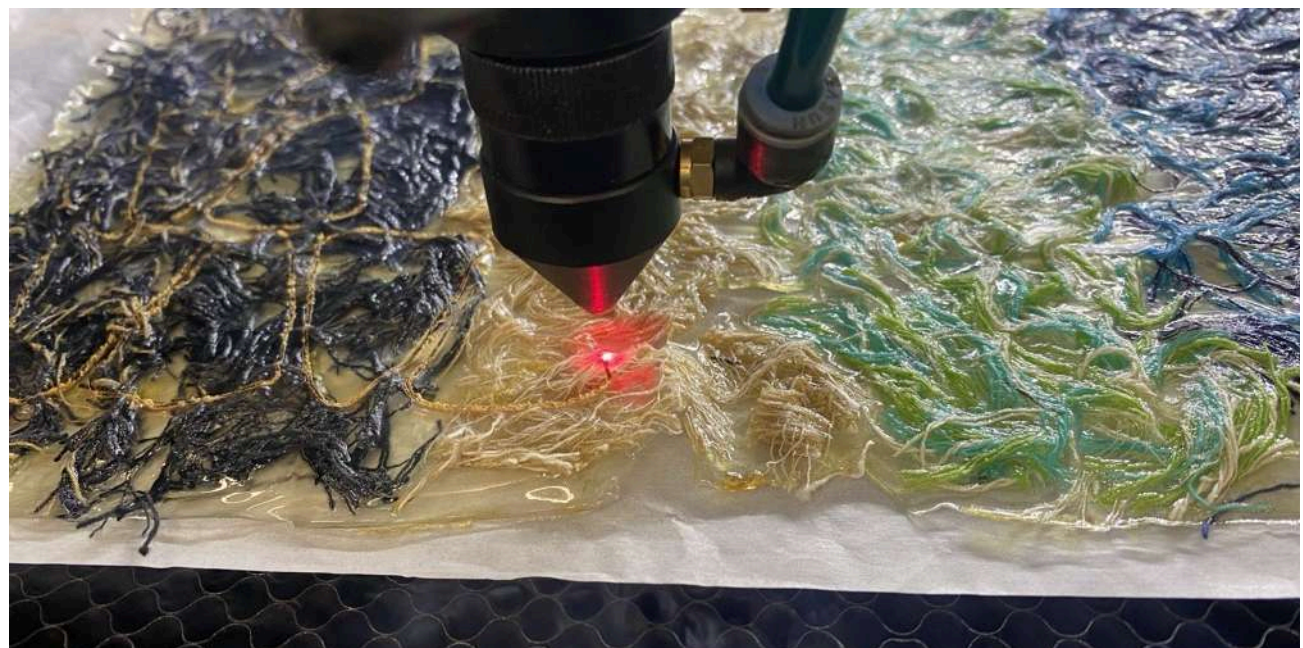
BIOFABRICATION

As all the project is meant for the students to get an approach to different techniques, Biofabrication is one of them, therefore we decided to make the scales with bio-resin. The Bio-Resin are polymers from renewable, natural sources like plants, vegetables, oil, starches or waste. They are sustainable, biodegradable alternatives to conventional plastics and designed to lower the carbon footprints and minimize the environmental impact.

For the scales we used this recipe:

- 48 gms Grenetine
- 8 ml Glycerine
- 240 ml Water
- Pieces of natural cotton threads of different colors

We made the recipe, placed it into an aluminium tray with wax paper and left it to dry. After the night we cut it on the laser machine to form the scales. We used a speed of 1000mm/min and a power of 45%.



<https://gitlab.fabcloud.org/academany/fabricademy/2026/students/patricia-vizcaya/-/tree/7f0e7ac17785611e3bbde978809d211cdc8e4062/docs/files/Development/Scales>



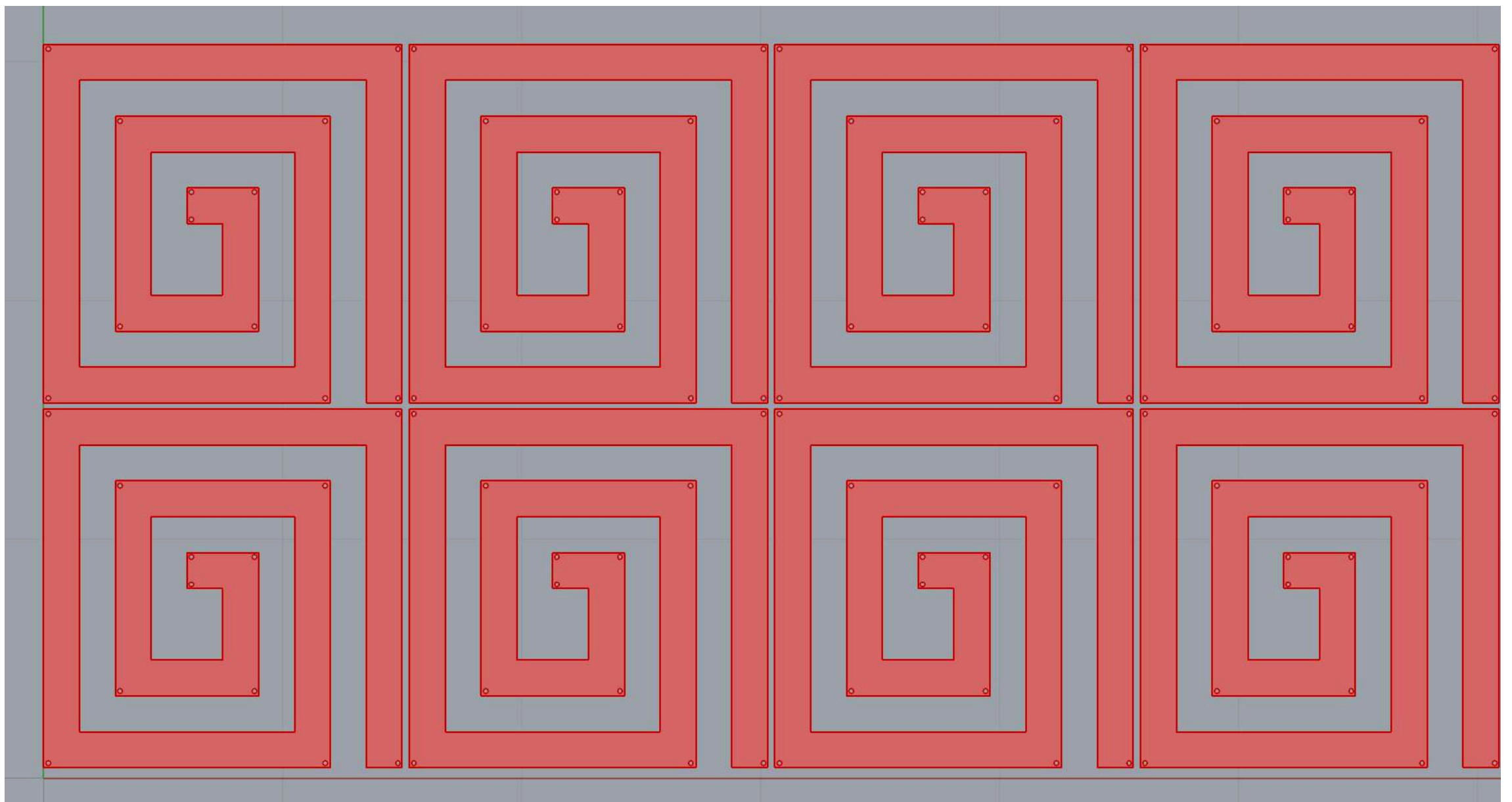
SHOULDER PADS & FRETS

The shoulder pads were termoformed with a heat pistol over the shoulders of the manequin. After that were saw on he shoulders of boths garments ones all the electronic was added and place on place.

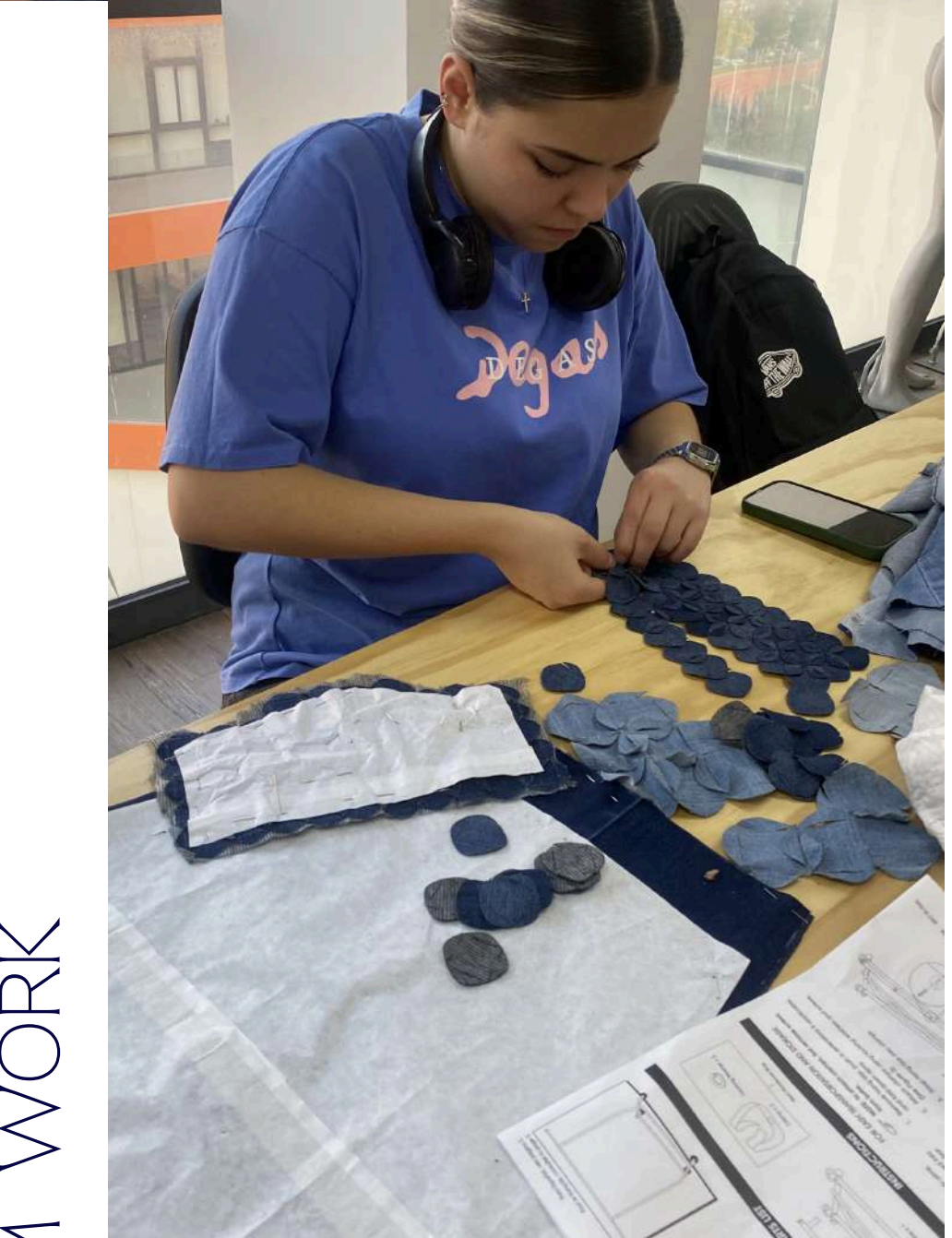


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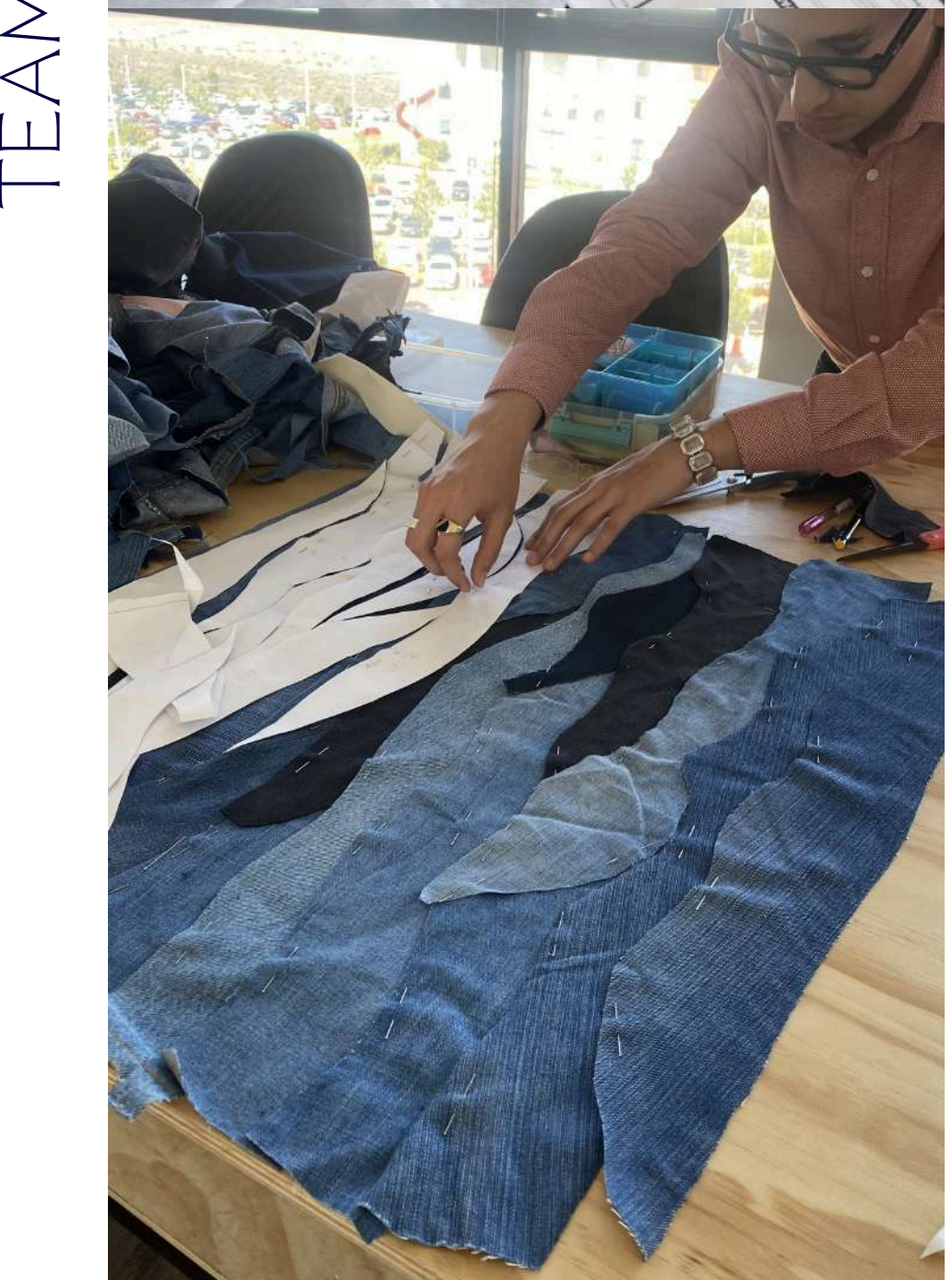
The frets were meant to be of biomaterial at first but I could not get the right flexibility, so then I decided to made them of bals wood, but at the end we cut them on battery card and cut in the laser machine.



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TEAM WORK

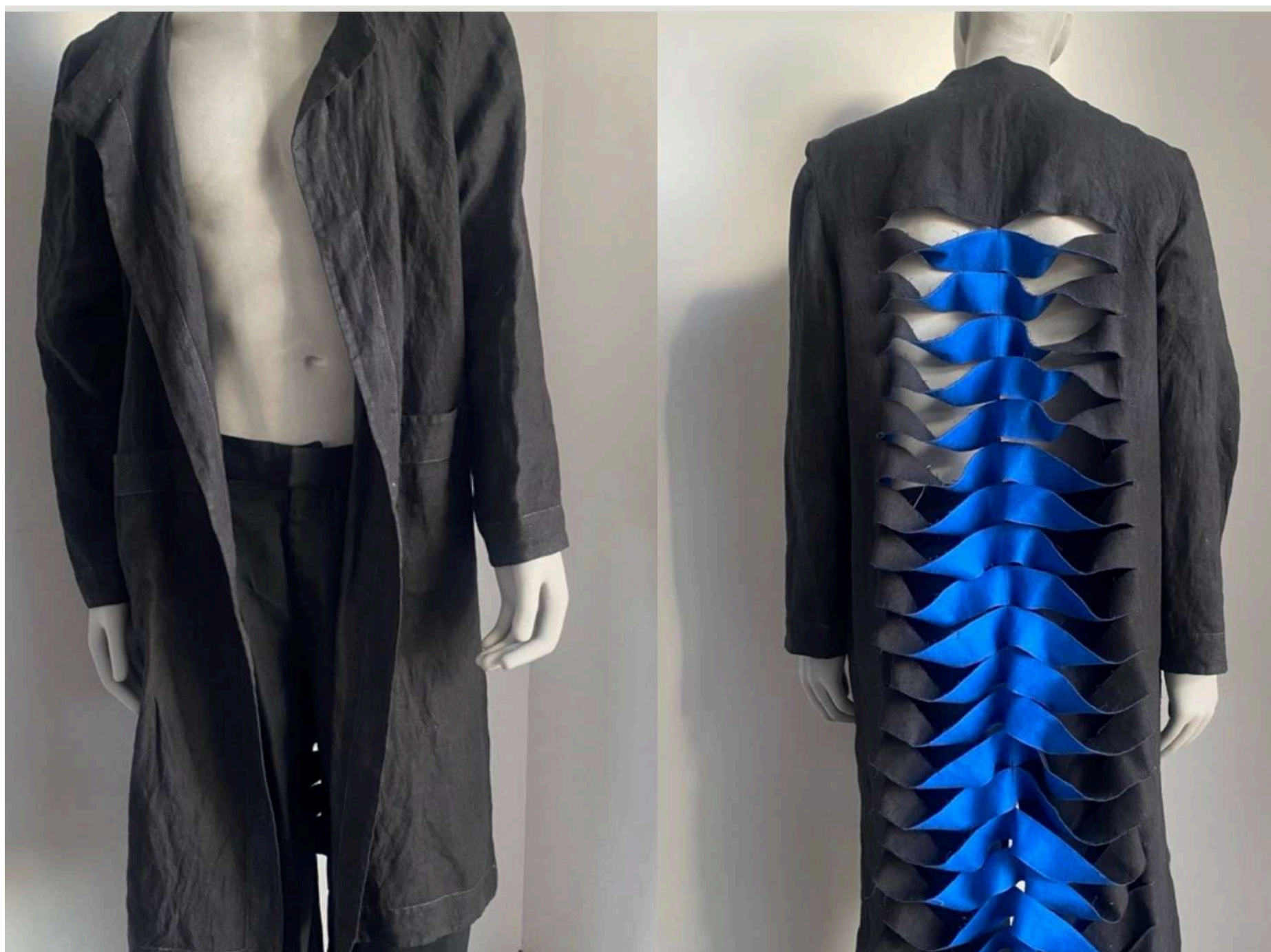


CONSTRUCTION & EMBROIDERY

There were many challenges working with all the students, scheduling days, and times for us to be together, to be able to work as a group, apporting ideas, doing the work and as well delegating activities. It was an amazing experience. We worked together students from Graphic Design, Industrial Design, Multimedia Desing and Fashion Design.

The journey began gathering all the recycle clothes, selecting them by colors and density of the demin and as well the dying table cloth that someone donated. All the material was cut trying to use as much as possible. We cut at the laser cutter the Kirigami pieces, assemble them and began embroidering both garments.

The **“Quetzal Garment”** represent the earth, the roots, the structure



The **“Coalt Garment”** represent the wind, the sky, movement, fluidity



EMBROIDERY

All the embroidery was made by hand, all the students working together, teaching each other the technique and learning from each other. In the Quetzal garment we did the Otomies embroidery, adding colors presented un the quetzal bird -different kind of greens, blues, yellow and red-.



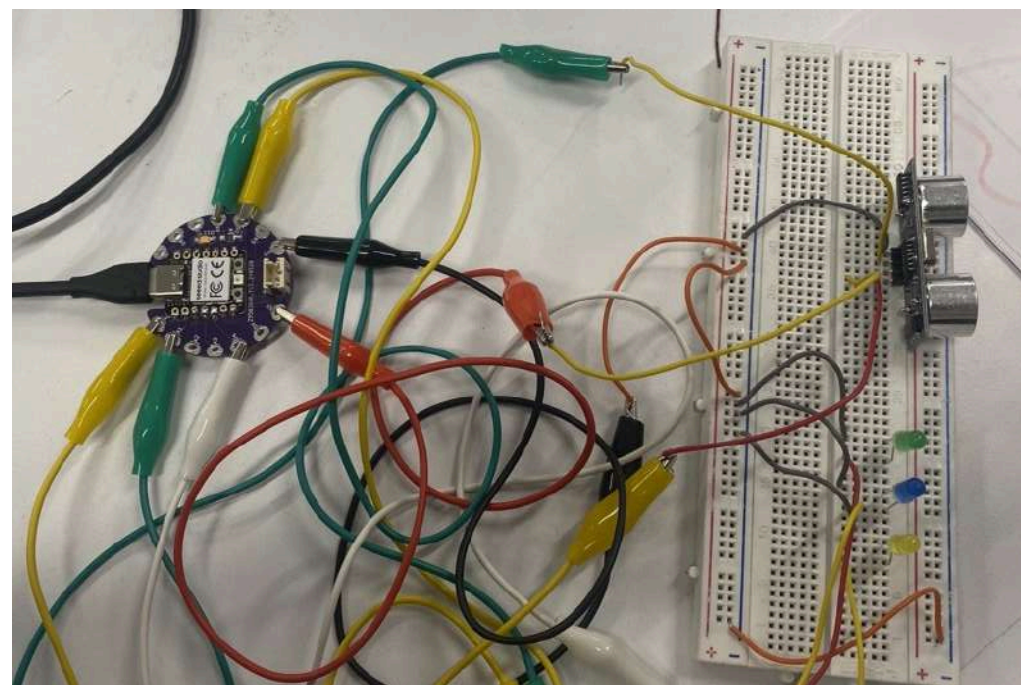
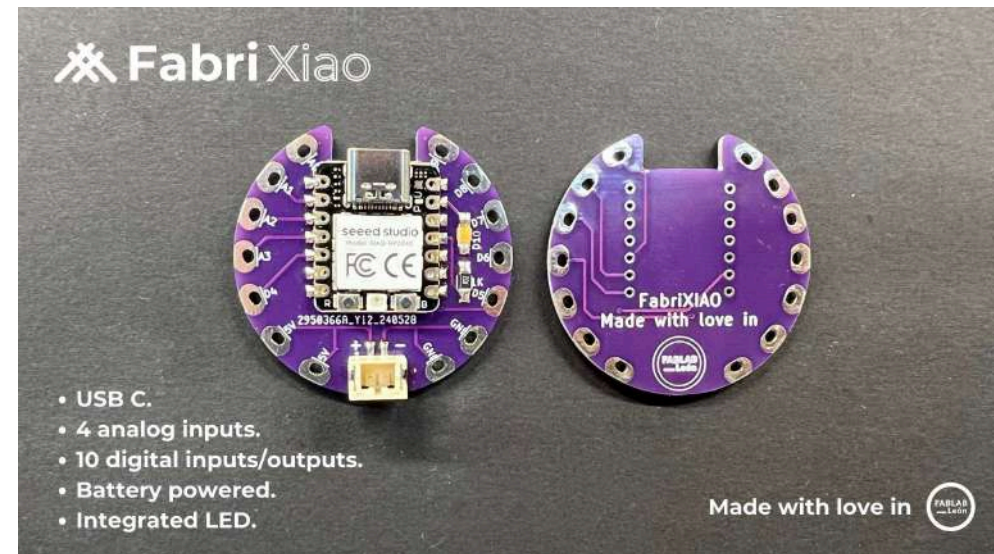
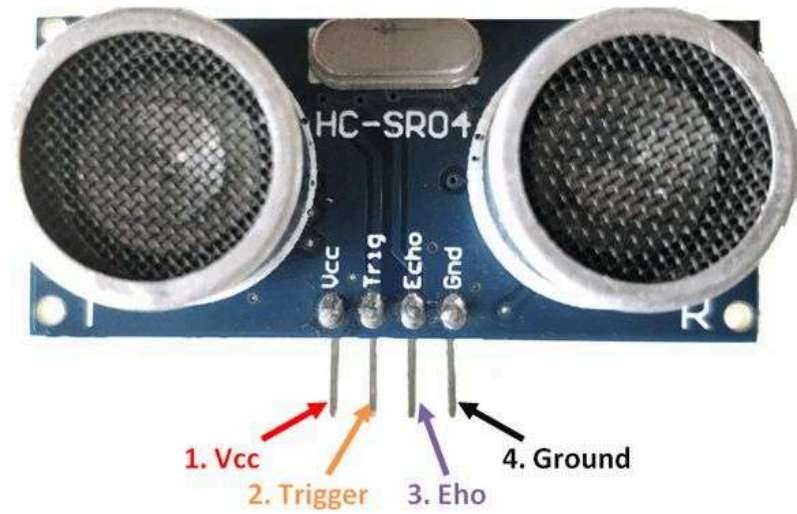
For the "Coatl" garment we used the ancestral technique from japan called Boro and Sashiko, but as the work was made by the students it was difficult to get the perfection needed, but the result was great and they were happy.



WEARABLES

For the wearables we wanted to adapt a sensor circuit in both garments for them to light up when they got together and light out when they were apart.

As the project is in collaboration with the students and they did not know about electronics, we teach them the basics for them to understand the complexity of it and the precision needed. In collaboration with a professor from Multimedia Design, Mel Cano, helped us step by step. We started with simple circuits, first using a proximeter sensor and second using an ultrasonic sensor.



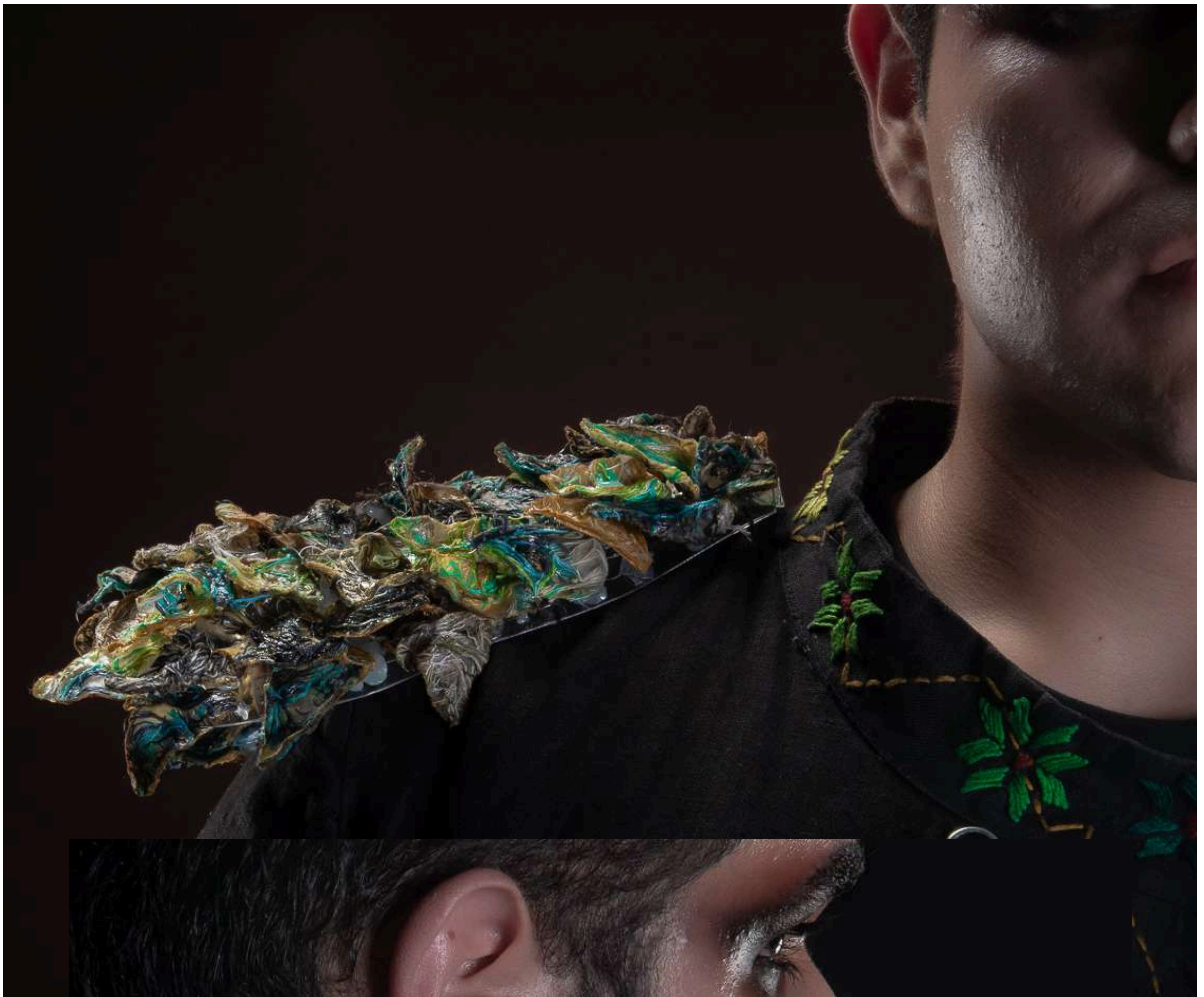
We tried different codes, because we wanted the neopixel to lighten up as they approach and the inverse motion when they got apart. First we manage to get that effect but did not fade, so we tried it several times. Finally we were able to place the neopixels on the shoulder pads of the garments. Once the circuit worked we continue with the soldering of all the cables to the neopixels, the Ultrasonic sensor and the FabricXIOA..

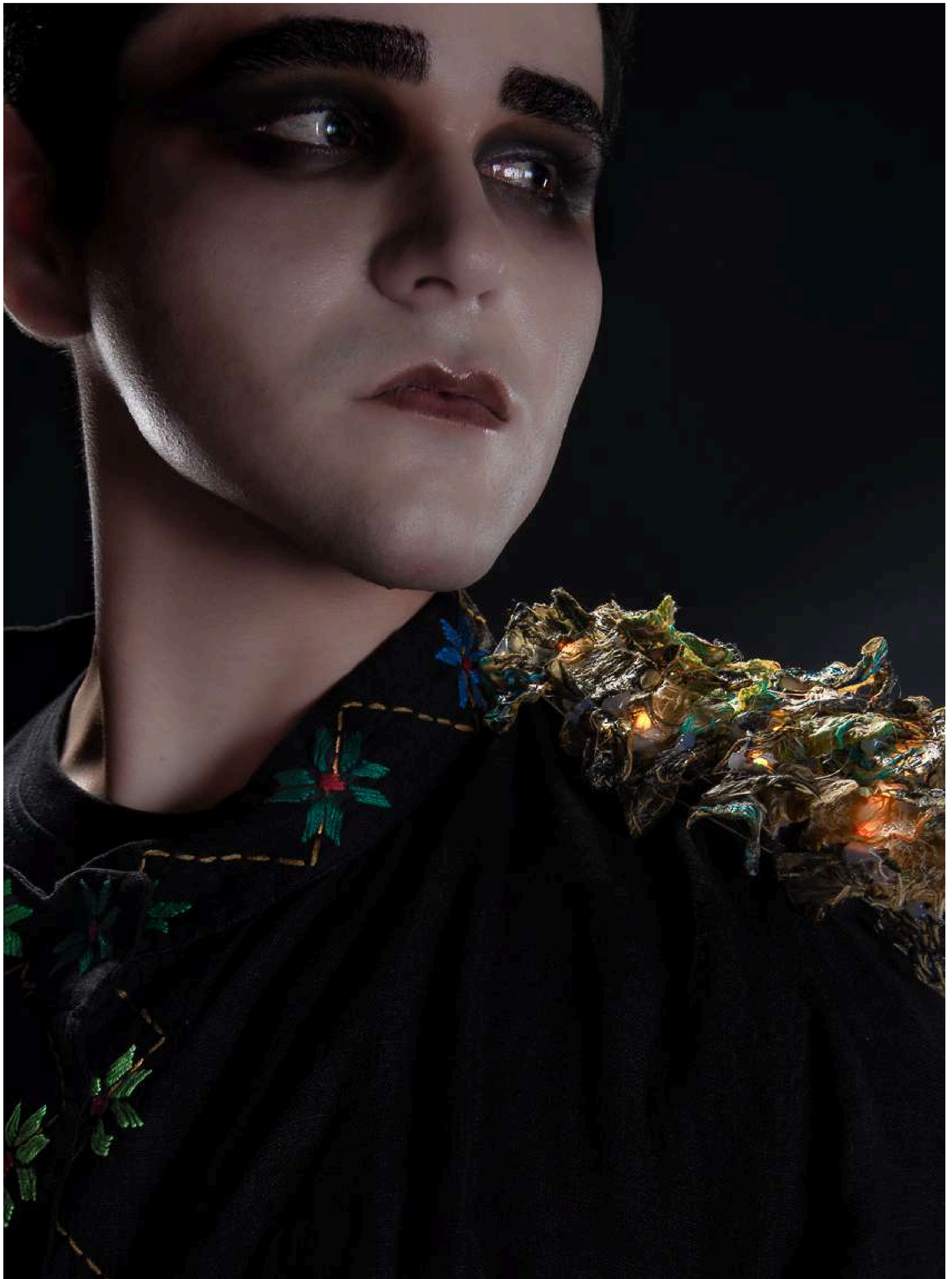


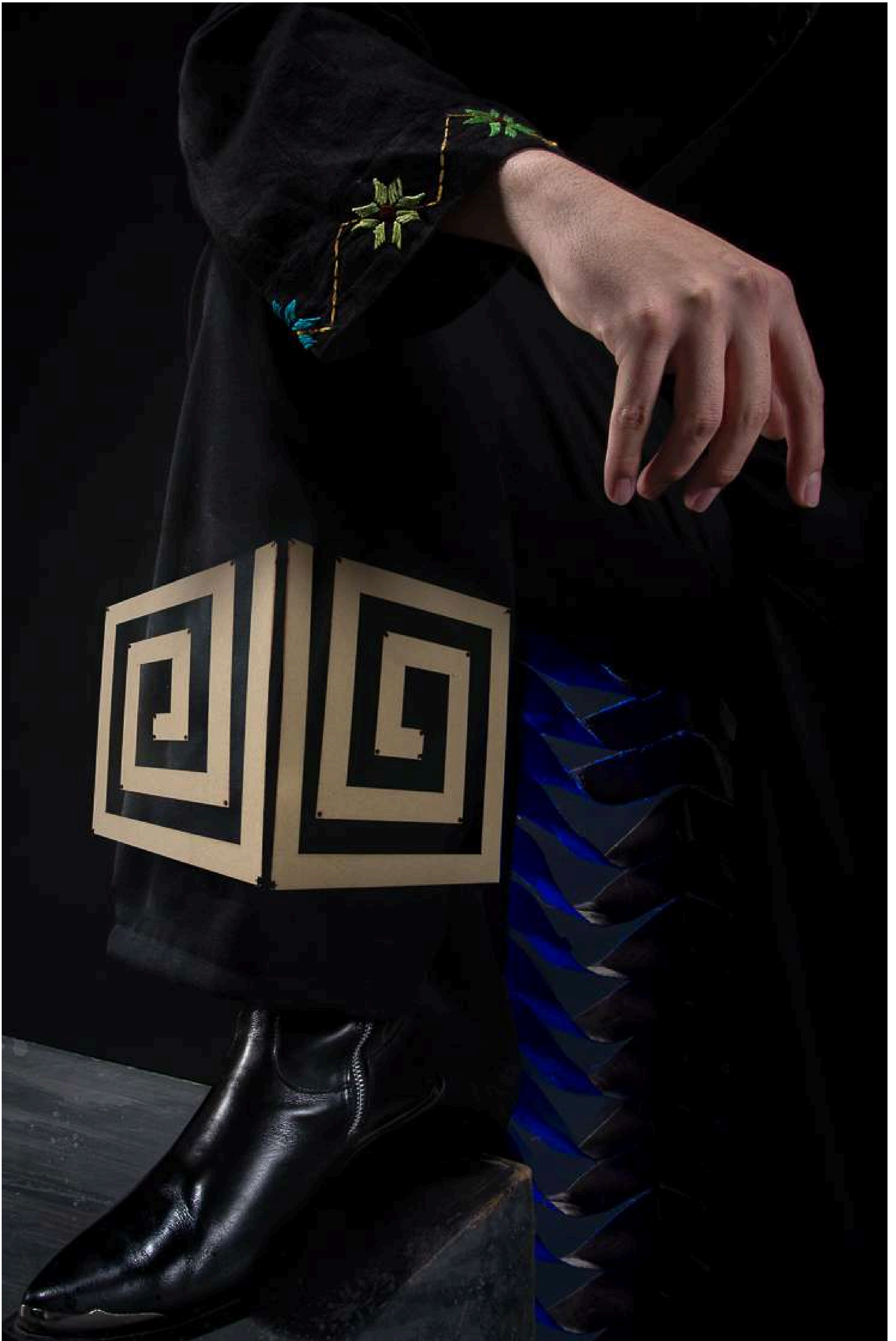
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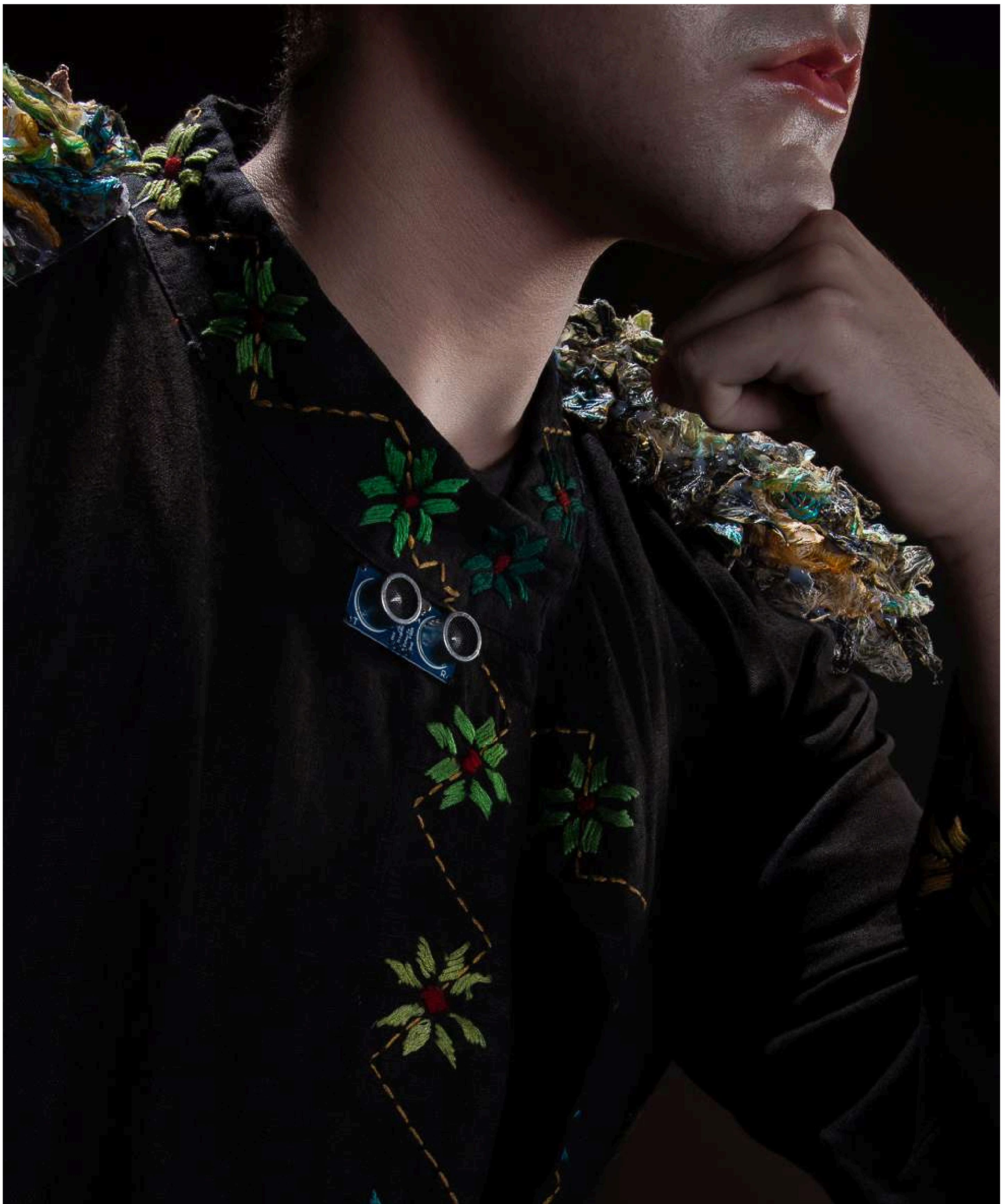
FINAL OUTCOME

























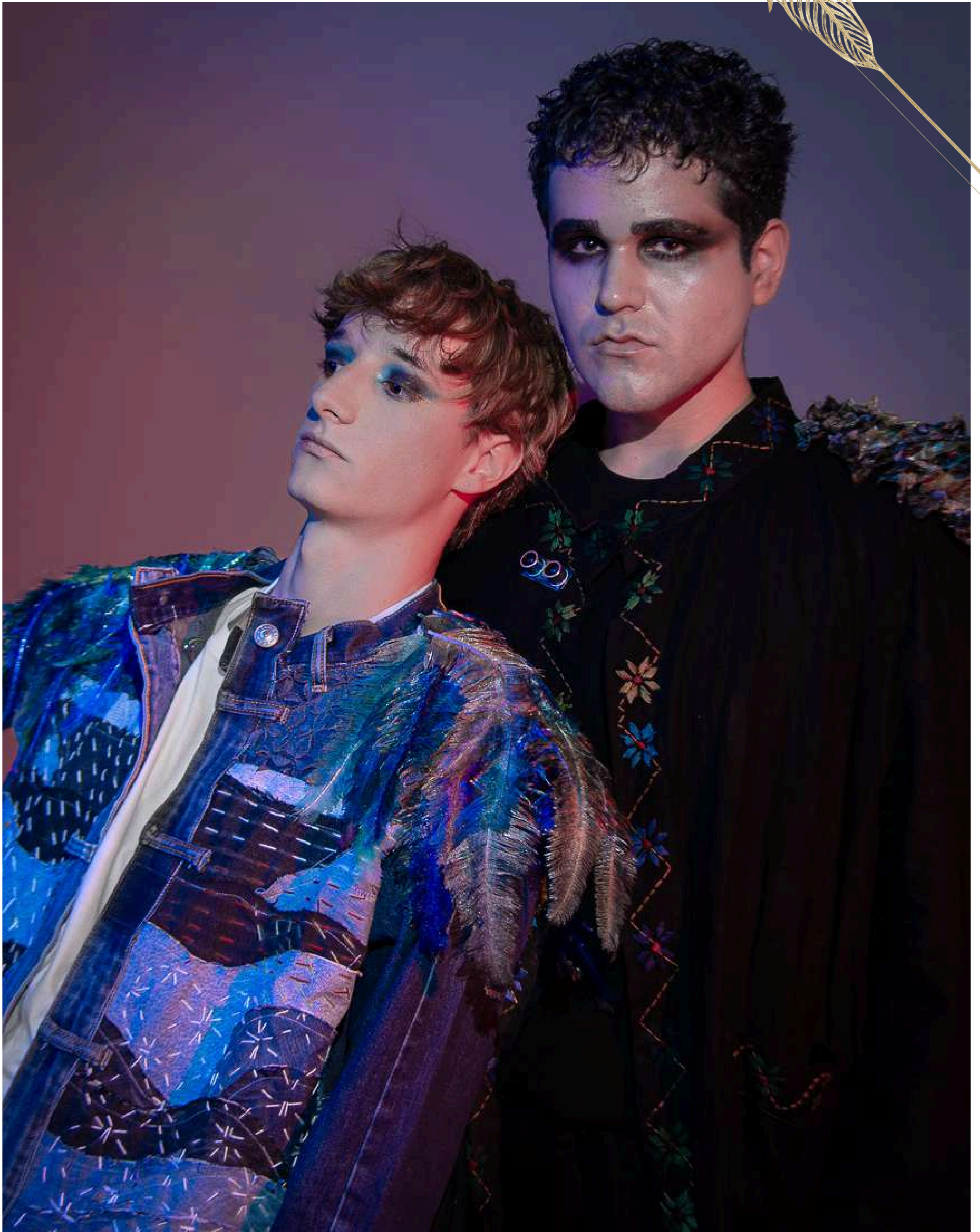
















CONCLUSION



The development of Tonalli, stands as a testament to the profound potential when heritage and digital fabrication are unified as a creative language and not treated as opposite forces. Tonalli, help us explore an iconographic and spiritual duality represented on the Mesoamerican serpent feathered Quetzalcoatl. This capsule collection materialized the invisible concept of Tonalli, this internal transforming internal energy in a tangible, responsive and embodied narrative.

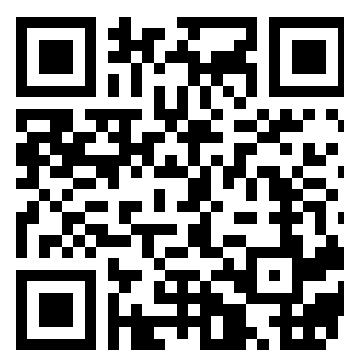
This project helped to built a bridge to close the gap between manual artisanal wisdom and digital manufacturing. The final garments demonstrate that advanced technologies like 3D printing flexible TPU, laser-cut kirigami geometries and organic bimaternal materials can coexist in harmony with the handcraft and uncycled textiles.

Tonalli was an unforgettable project. I had the opportunity to get out of my comfort zone, to experiment new outcomes, to challenge myself doing things I wouldn't thought about. I know there is a lot more to accomplish, several boundaries were identified that offer opportunities for further refinement. The most important things is that this was one of many more interdisciplinary projects where different expertises join together to create something astonish.

A project were the students can learn new things, get to use machines that did not know exist or thought where to difficult. To establish standards one unreachable. There is so much one can do in three months, but at the same time was really difficult because even though I have a Fablab in my place, there were no peers near to encourage you or help you.

I think that Tonalli, opens several exciting pathways for future exploration within both Fashion Design and academic education. Future interactions, like integrating active electronic components in the bio-resin that protect the circuitry from moisture. Use the parametric design tools in a dynamic way generating laser-cutting patterns directly responding to a wearer's biometric data, creating truly customized, digital artisan garments. It is a great framework to teach the students how to balance traditional patternmaking and heritage preservation with modern physical computing and sustainable fabrication tools.

Ultimately, Tonalli proves that the future of fashion does not lie in the complete automation of the design process, but in the intentional creation of a "wisdom duality." By honoring the human hand while mastering the digital machine, we can create interactive garments that carry deep cultural souls into the smart textile landscapes of tomorrow. We developed a video as the result of all the worked made as a collaboration of knowledge, expertise and new expectations that resemble the importance of this duality.



TONALLI video





REFERENCES

- 
- Briceno, R. (2024). The multifaceted applications of origami. *International Journal for Research in Applied Science and Engineering Technology (IJRASET)*, 12(6), 4050–4056. <https://doi.org/10.22214/ijraset.2024.64050>
 - Japan Avenue Magazine. (s.f.). Japanese animals in myths and legends. <https://japan-avenue.com/blogs/japan/japanese-animals>
 - Tenko.fr. (s.f.). Le dragon japonais: Mythe, légendes et signification profonde [El dragón japonés: Mito, leyendas y significado profundo]. <https://tenko.fr/en/blogs/infos/le-dragon-japonais-mythe-legendes-et-signification-profonde>
 - Accademia Education. (s.f.). The Dragon and the Serpent: The Lóng of China, the Quetzalcoatl myth cycle, and Serpent Archetype introduction – Some notes on culture, language, and myth. Academia.edu. https://www.academia.edu/61721238/The_Dragon_and_the_Serpent_The_L%C3%B3ng_of_China_the_Quetzalcoatl_Myth_cycle_and_Serpent_Archetype_Introduction_Some_notes_on_culture_language_and_myth
 - Encyclopædia Britannica. (s.f.). Quetzalcoatl: Aztec deity. <https://www.britannica.com/topic/Quetzalcoatl>
 - Orozco, C. (2025, 28 de mayo). Topiltzin/Quetzalcoatl/Kukulcan. *MayaIncaAztec*. <https://www.mayaincaaztec.com/kings-and-emperors/topiltzin-quetzalcoatl-kukulcan>
 - Reddit. (2024). Aztec color symbolism in architecture and design [Hilo de comunidad]. *r/aztecreconstruction*. https://www.reddit.com/r/aztecreconstruction/comments/1ai1lur/aztec_color_symbolism/
 - Petlevych, N. (s.f.). Quetzalcoatl: The Feathered Serpent in myth and history. *The Collector*. <https://www.thecollector.com/quetzalcoatl-feathered-serpent-myth-history>
 - Sparrow Finds in Japan. (2025, 24 de julio). Dragon in Japanese myths, legends, kanji, and history. <https://sparrowfindsfromjapan.com/2025/07/24/dragon-in-japanese-myths-legends-kanji-and-history/>
 - Kaklamani, G., Kazlauskas, A., & Grogan, M. (2022). Properties of Sodium Alginate hydrogels crosslinked with Calcium Chloride for bio-textile applications. *Journal of Biomedical Material Research*, 110(4), 854-866.
 - Fabricademy Class Archive. (2019). BioFabricating Materials: Formulating Pine Resins and Gelatin Composites. *Textile Academy Open Source Repository*.
 - Grimmelsmann, N., Martens, Y., Schlingman, P., & Ehrmann, A. (2019). Mechanical properties of 3D printed polymer structures on textile substrates. *Technological Innovations in Fashion and Textiles*, 14(2), 112-121.
 - Buechley, L., & Eisenberg, M. (2018). The LilyPad Arduino ecosystem: Designing embedded physical computing without sacrificing textile drape. *IEEE Pervasive Computing*, 17(2), 40-47.
 - Buechley, L., & Eisenberg, M. (2018). The LilyPad Arduino ecosystem: Designing embedded physical computing without sacrificing textile drape. *IEEE Pervasive Computing*, 17(2), 40-47.
 - Al-Ghamdi, S. M. (2026). Digital heritage and fashion: Preserving cultural identity through AI and virtual archives. *Digital Scholarship in the Humanities*, advance article. <https://doi.org/10.1093/llc/fqag008>
 - Brisson, Y., & L Dubrovski, E. (2024). Flatfold3D: 3D printing structures on fabric to facilitate folding of pattern into wearable shoes. *Proceedings of DRS*, Article 226. <https://doi.org/10.21606/drs.2024.226>
 - Chai-Arayalert, S. (2026). A crowdsourcing-based digital storytelling platform for preserving intangible cultural heritage: A case study of Southern Thai textiles. *Heritage*, 9(5), 160. <https://doi.org/10.3390/2571-9408/9/5/160>
 - Huang, X., Kettley, S., Lycouris, S., & Yao, Y. (2023). Autobiographical design for emotional durability through digital transformable fashion and textiles. *Sustainability*, 15(5), 4451. <https://doi.org/10.3390/su15054451> Cited by: 20
 - Varisco, A. (2025). "Digital craftsmanship" as a methodology for fashion research. *European Journal of Cultural Management and Policy*, advance publication. Cited by: 2
 - Zhao, W., He, P., Ling, K., Gao, C., Wang, K., Wu, L., & Yang, J. (2025). Printed graphene/CNTs/TPU-fabric wearable strain sensor for healthcare monitoring. *Soft Science*, Article 2024.61. <https://doi.org/10.20517/ss.2024.61> Cited by: 18
 - Ellen MacArthur Foundation. (2020, October 20). New video tells the story behind the Jeans Redesign. <https://www.ellenmacarthurfoundation.org/news/new-video-tells-the-story-behind-the-jeans-redesign>
 - A. A., & Author, B. B. (2025). Sustainable treatments in denim fabric: A systematic review. *Sustainability*, 17(23), Article 10469.
 - Berzowska, J. (2023). Soft circuits and somatic storytelling: Using proximity inputs for non-verbal garment narrative communication. *International Journal of Fashion Design, Technology and Education*, 16(1), 74–83. <https://doi.org/10.1080/17543266.2022.2110432>
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