



# LIQUID GESTURES

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# INTRODUCTION



## **How can design transform the body's invisible movements underwater into a tangible form?**

Today, contemporary design has expanded its vision to where art, technology, and digital manufacturing converge to generate new forms of creation in any field. Specifically in fashion and textiles, digital manufacturing has gained significant momentum due to the creative possibilities it offers and the development of unique projects that combine art, design, and science, revolutionizing the way things are made and redefining the concept of clothing, fashion and specifically in the significant of what personalized clothes mean.

In this context, human movement takes on new significance, evolving from a mere physical action into a source of information capable of generating data for visual structures, surfaces, and design systems. Building on these ideas, Liquid Gestures emerges as a project that explores the relationship between underwater body movement and how it is translated into textile elements using the digital tools offered by digital fabrication.

This project starts from the observation of the movements the body generates during immersion in an aquatic environment, particularly bodily gestures specifically those of the limbs: arms, legs, and torso.

Because underwater pressure and various factors alter the body's perception by generating resistance that produces more organic and continuous trajectories, creating patterns that function as a visual and bodily language. Based on this exploration, this project proposes the possibility of translating these gestures into parametric forms applicable to textile and clothes. Similarly, this exploration focuses on understanding how movements can be converted into design generating data through digital processes; furthermore, the project explores new possibilities for customization in garment design.

Similarly, the project is part of a contemporary discourse on the integration of the body and technology, drawing on computational design practices, generative systems, and experimental textile explorations. Thus, the proposal seeks not only to develop aesthetic objects but also to investigate new creative methodologies in which the body acts as a catalyst for formal and structural processes.

# CONCEPT

Liquid Gestures is a project that explores the translation of bodily movement in water into a visual and material language. Based on the analysis of trajectories, the project proposes a system in which bodily gestures become data, data becomes patterns, and patterns become structures applied to the body.

Beyond an aesthetic representation, the project aims for the pattern to function as an interface between movement, material, and body, demonstrating how computational design can materialize dynamic phenomena into tangible objects. Through the use of technical textiles, digital printing, and modules manufactured via 3D printing, a dialogue is established between flexibility, structure, and flow.

This project is also understood as a personal process of experimentation and learning. Throughout its development, parametric design has been used not only as a tool for formal generation but as a means to understand relationships between data, geometry, and material behavior. Similarly, the application of digital fabrication techniques has allowed these explorations to be brought into a physical context, confronting real-world decisions regarding scale, materiality, and assembly.



The research focuses on understanding how body movements can be transformed into design-generating data through digital processes. Through visual motion analysis, formal experimentation, and the use of parametric tools such as Grasshopper, a system of modules and surfaces inspired by the dynamics of the body underwater was developed. These elements were subsequently materialized using digital fabrication techniques such as 3D printing, laser cutting, and textile sublimation, and integrated into pieces such as a conceptual suit, cape and bag.

In addition to pursuing an aesthetic inspired by aquatic fluidity, the project explores new possibilities for personalization in garment design. Every body produces distinct movements; therefore, every gesture can become a unique source of formal generation. From this perspective, Liquid Gestures proposes an approach to design where body movement serves as input for the creation of personalized pieces, opening up future possibilities related to generative design, digital fashion, adaptive manufacturing, and reinforcing a solid user-product relationship.

The project proposes a way of designing in which the process, experimentation, and iteration are as relevant as the final object, establishing a foundation for future explorations within parametric design applied to the body and textiles, as well as personalization.



# Why, What, Who, When, Where?

The fashion and textile industry often prioritizes speed, novelty, and disposability, producing objects disconnected from the body and its lived experience. At the same time, the movements of the body especially underwater remain invisible and undervalued as sources of design.

Why

This project responds to the need for textiles that:

- Are deeply connected to the body that generates them
- Resist anonymity through personalization and embodied data

Value time, care, and long-term use

What

The project proposes a design system that:

- Interprets aquatic body movement (swimming styles) as a generative input
  - Translates movement into unique geometric and textile patterns
  - Materializes these patterns using durable biomaterials, hybrid textiles, and digital fabrication
  - Produces wearable or textile objects that register use, care, and time
- The final outcome is a personalized textile artifact that functions as a material record of movement and identity.

- Swimmers, Athletes, and individuals engaged in body-centered or aquatic sports.
- Users seeking long-term, meaningful relationships with their garments or wearables
- Designers and communities exploring slow fashion through technology and material innovation.

Who

When

- During the immersion
- During aquatic movement
- During data recording and translation
- Period from January to March

The project operates across multiple environments:

- In water, where movement originates
- On the body, where the object is worn, activated, and aged
- In the fabrication lab at IDIT Ibero Puebla, where patterns and materials are developed

Where

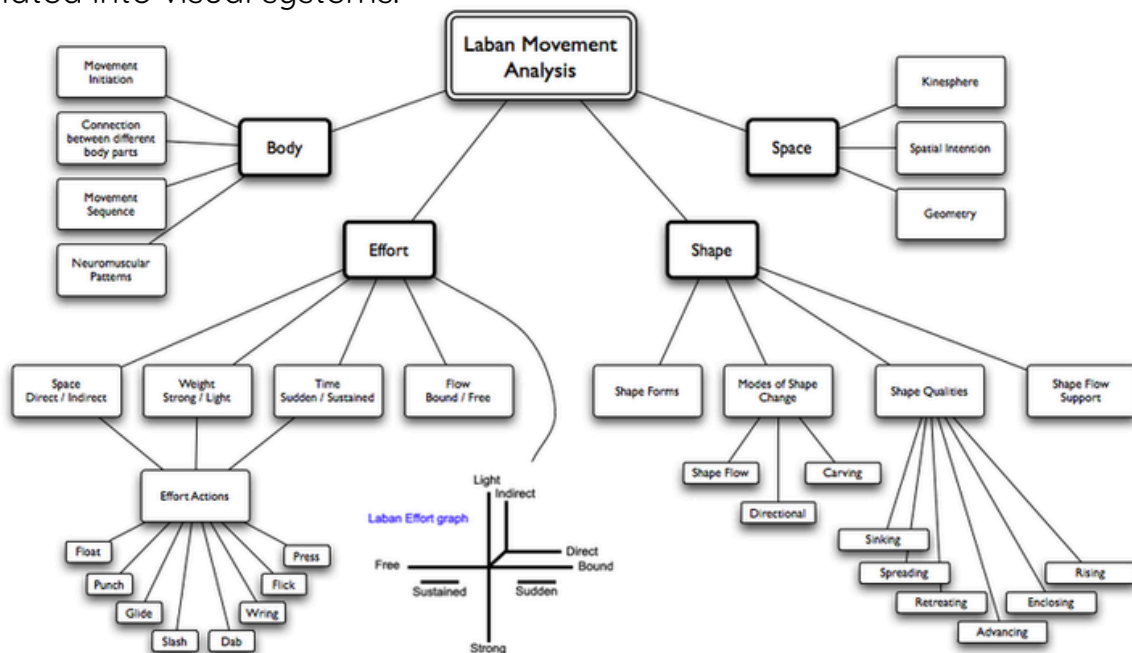
# RESEARCH

## MOVEMENT AND THE BODY

Movement is one of the most fundamental ways in which the body interacts with its environment, communicates information, and expresses emotions, intentions, and physical states. Beyond a just mechanical action, movement can be understood as an expression of physicality that reflects the relationship between perception, space, and experience. Every movement generates unique patterns, rhythms, and gestures that reveal how the body responds to different conditions and contexts.

One of the analysis that served as a reference for me in understanding exactly which underwater movements I wanted to analyze was Rudolf Laban's LMA system

(LMA) is an effective framework for observing, describing and understanding human movement and what it expresses. It is widely used in the fields of dance, theater, dance therapy, physical therapy, sports, and psychology. The part I found most interesting from his work was that he considered human movement as both a science and an art that embraces a continuum from nature to spirituality. I believe that this system aligns with my project on the study of movement in swimming as a structurable body language, as it provides a theoretical basis for the idea that movement can be analyzed, broken down, and translated into visual systems.



Picture Posted By: Ali Momeni

This methodology approaches the observation of movement from various perspectives that I consider valuable for the realization of this project and for gaining a broader understanding of movement observation in relation to the key aspects of this project, namely: body, effort, shape, and space.

## **BODY**

The category of body provides a terminology that distinguishes specific body parts and body part relationships, identifies sources of initiation of movement, and describes simultaneous or sequential phrasing of movement. It incorporates material known as Bartenieff Fundamentals, developed by Irmgard Bartenieff in the United States between 1940 and 1981. The concepts are based on highly specific anatomical and kinesiological principles and the exercises that comprise the fundamentals are designed to address the biomechanics of integration, coordination, and skill development. In application, these fundamentals enable actors to provide specific motor training to enhance the movement skills desired within a specific context.

## **EFFORT**

The effort category is a qualitative description of movement that provides a vocabulary for articulating the dynamic changes in movement expression. Effort addresses qualities of movement in terms of weight (light and heavy), space (direct and indirect), time (quick and sustained), and flow (free and bound). These eight effort elements combine to create configurations of multiple elements which he described as "states" and "drives." These effort configurations have moments of significant change which yields the limitless rhythmic variation that is apparent in the phrasing of human movement.

## **SHAPE**

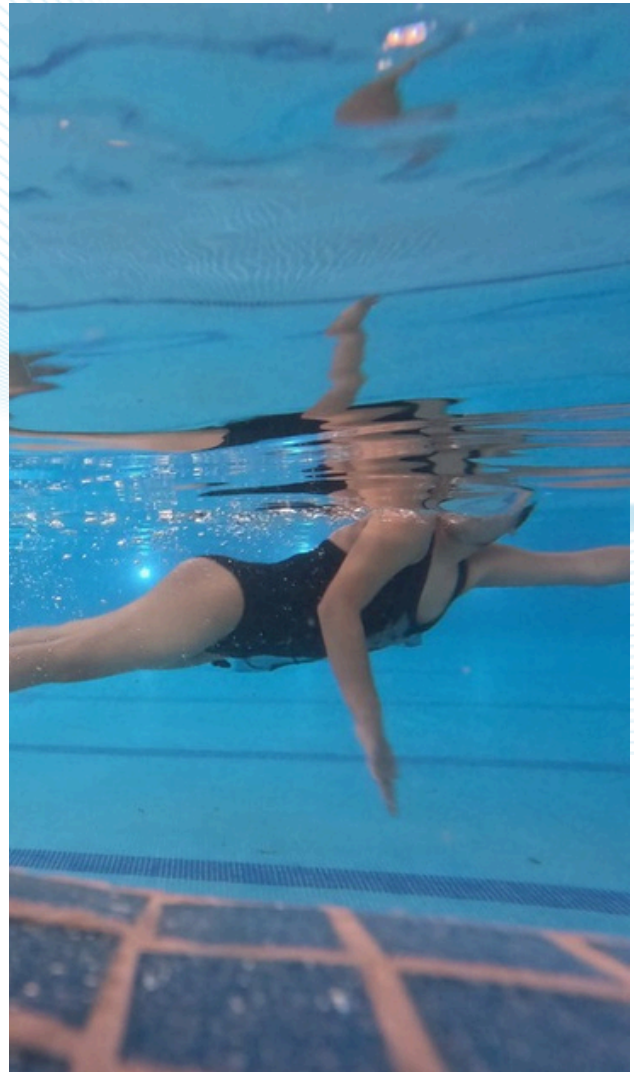
The category of space addresses issues of proximity, direction, pathway, location, and relationship. The relative distances between people or between a person and an object are the substance of much of the cultural choreography that is revealed in social behavior. Laban wanted to define three-dimensional space, therefore, he imagined a human being standing inside various geometric forms such as a sphere, cube, or octahedron and the vertices, edges, and facets of these geometric shapes provide a directional structuring of space.

## **SPACE**

The category of shape focuses on the capacity of the body to shape itself in space. This framework provides a way to describe the plasticity of the body, the forms it reveals, and the way in which its form constantly changes. Shape is viewed as a dynamic process because the outward change of shape creates a variety of inner attitudes. For example, a movement in which the individual is actively shaping the outer environment, as in walking your dog, appears differently than a change in the body shape that results from a deep sigh or another internally motivated action. This framework provides a way to describe the malleability of the body, the forms it reveals, and the way in which its form constantly changes.

# MOVEMENT UNDERWATER

The space in which the body moves directly influences the way its trajectories unfold and are perceived. One of the environments that most significantly alters bodily behavior is water, as its physical properties generate constant interaction between the body and the environment. The density and resistance of water condition every movement, producing more continuous, expansive, and organic movements than those performed on land. This interaction allows for a clearer observation of aspects such as the rhythm, cadence, power, and fluidity of bodily gestures.



Furthermore, the aquatic environment visually transforms the body's trajectories, generating undulations and smooth transitions that emphasize the continuity of movement. These characteristics make underwater movement a valuable source of information for analyzing gestural patterns and understanding how force, resistance, and fluidity manifest through the body.

# COMPUTATIONAL DESIGN

## **How does generative and parametric design influence this system?**

Generative design is a solution that, through the use of algorithms, automatically generates different design alternatives based on user-defined parameters. Unlike traditional product design methods, in which the designer manually creates iterations, this “algorithmic design” generates multiple and varied solutions in a short amount of time, using parameters that determine the design. Part of the essence of this project involves the use of generative design; however, while it offers many benefits such as time efficiency and feasibility, the goal of this project was to combine the innovation of generative design with traditional practices within the textile industry, creating a kind of ally rather than a replacement, since it is possible to humanize highly technical and technological processes by using personalized information.

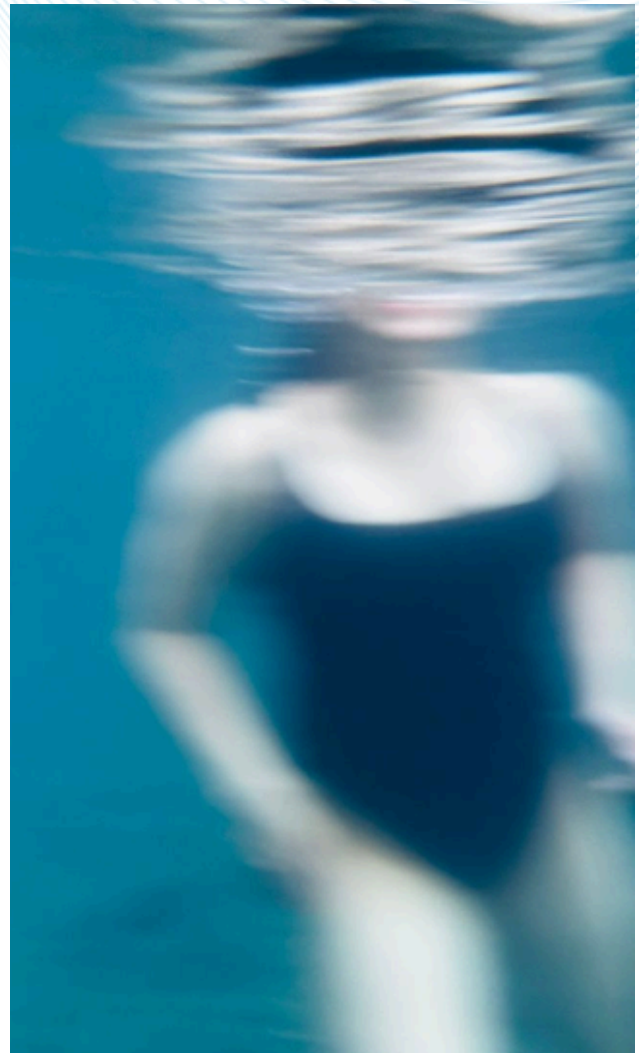
Leveraging digital fabrication to achieve our design objectives is an innovative design approach that allows us to explore various design possibilities while optimizing time and, in this case, generating customized designs that respond to specific movements, thereby creating unique and one-of-a-kind products, products with your personal footprint. Although Liquid Gestures is developed using parametric design tools, the system’s logic opens up future possibilities in generative design by allowing different motion data to produce unique and customized formal configurations.

Another advantage of this design approach in the textile industry is the customization offered by generative design, as it is key to delivering more personalized products in a more efficient and sustainable way. This ranges from creating prints, patterns, and exclusive pieces for each customer or for specialized and specific products such as footwear to designing soles and insoles tailored specifically to each foot.

# BODY IDENTITY

Similarly, and as mentioned earlier, one of the key features of generative design is the customization of unique objects and products; this concept is essential to understanding the user's relationship with personalized products, as it enriches that relationship and enhances the user's sense of identity.

Bodily identity refers to the set of physical, perceptual, and expressive characteristics that enable each individual to relate to their own body and distinguish themselves from others. Beyond physical appearance, this identity is constructed through the way a person occupies space, moves, and interacts with their environment. Each body develops unique movement patterns influenced by factors such as experience, context, physical abilities, and habits acquired over time.



From this perspective, movement can be understood as a manifestation of bodily identity, since each gesture contains unique information about the person performing it. Trajectories, rhythms, speeds, and modes of movement generate a kind of language of their own that reveals individual characteristics that are difficult to replicate exactly. In the field of design, this uniqueness opens up the possibility of using movement as a data source capable of generating personalized proposals that respond to each person's particularities.

# STATE OF THE ART

In recent years, the fashion and design industry has seen a growing trend toward the personalization of products and experiences. Consumers no longer seek merely functional or aesthetically appealing garments, but also items that reflect aspects of their identity, lifestyle, and individual characteristics. This trend has driven the development of new design methodologies supported by digital tools, advanced manufacturing, and systems capable of generating solutions tailored to each user.

From a personal and familiar experience linked to sports, and particularly swimming, an interest emerged in exploring how body movements can become a source of information for the creation of unique objects. The observation that each person develops distinct movement patterns led to the question of whether these differences could be translated into personalized design elements. At the same time, this concern aligns with an increasingly evident demand among consumers, who value products that represent their own experiences, stories, or characteristics, beyond standardized production models.

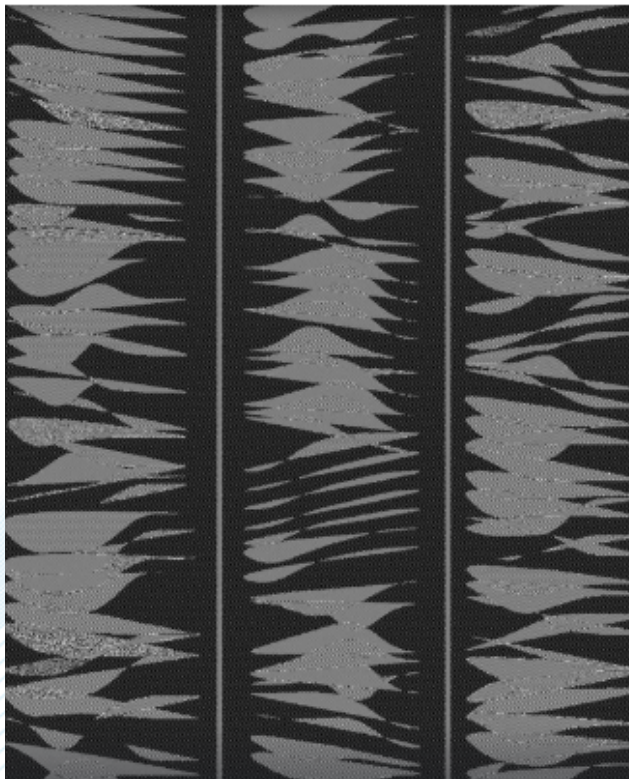
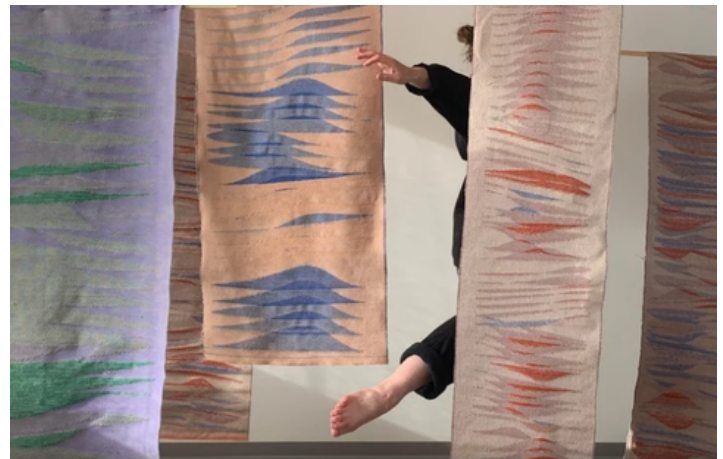
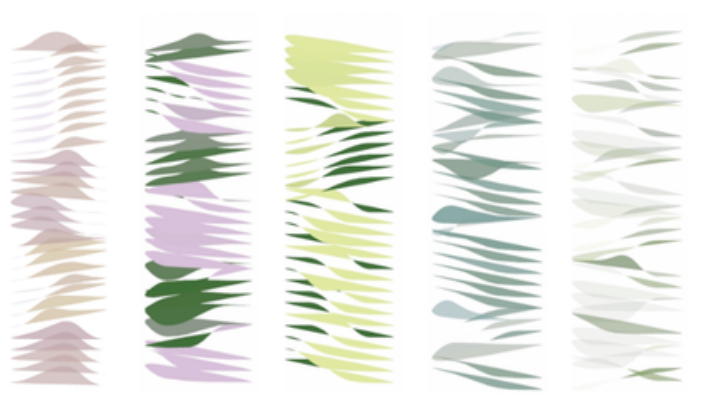


# MOVING SHAPES

By: Margrét Katrín Guttormsdóttir

One of the projects I drew inspiration from for this work was that of Margrét Katrín Guttormsdóttir, a collection of textiles created using patterns generated by body movement that evoke the sensation of dancing. Since the concept of movement is also central to my project, I considered this methodology a good precedent for the approach I could use to capture gestures and represent the intangible such as body movement in a tangible way with the help of parametric design.

The concept behind the “Moving Shapes” project is to capture the fluidity of dance movements and translate them into textile patterns that express the feeling of stress relief through dance and body movement.

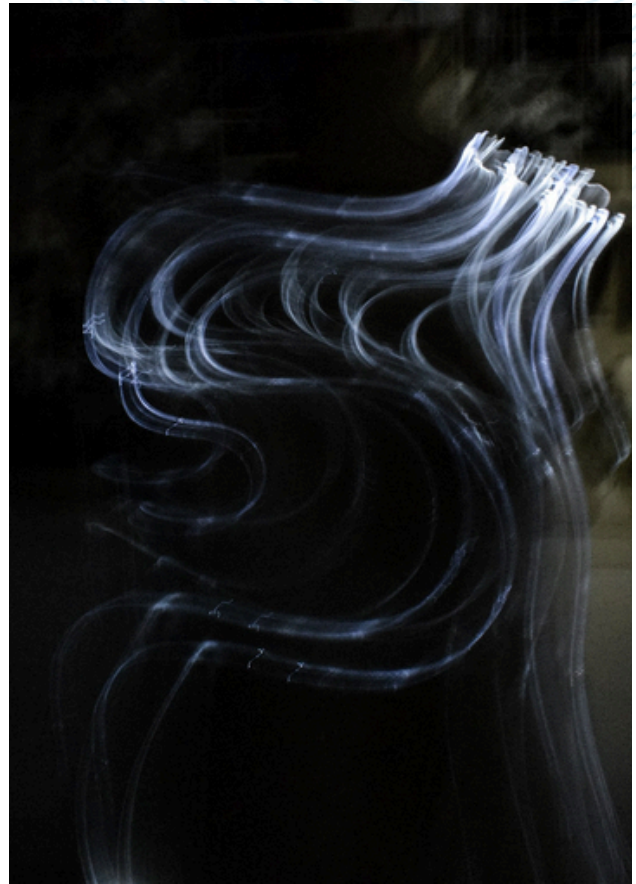


What makes this reference particularly relevant to Liquid Gestures is that the designer does not merely represent the shape of the body, but seeks to capture an intangible experience: the feeling of liberation and well-being that movement produces when dancing. She explored the relationship between parametric design and textiles, transforming bodily trajectories into patterns capable of communicating emotions and sensations through the material. I liked that this project proposes a constant transition between the physical and the digital: the body's movement is recorded, processed using computational tools, and subsequently translated into textile structures.

# MOVIMIENTO

By: Maite Sosa Methol

Maite Sosa Metholel's final Fabricademy project, "Movimiento," also served as a point of reference for Liquid Gestures due to the way she chose to interpret movement, exploring the relationship between the body, technology, and expression through a piece that combines interactive costumes, performance, and digital fabrication. The project integrates traditional textile techniques with contemporary tools such as e-textiles, motion sensors, programmable lighting, and digital programming, with the aim of amplifying the performer's physical expression and making visible what is normally ephemeral and intangible.



The importance of this project for Liquid Gestures focus on materializing invisible aspects of human movement. While "Movimiento" used light and interactivity to make characteristics such as intensity, speed, and bodily energy perceptible, Liquid Gestures wanted to translate movements performed underwater into textile patterns, modules, and structures through parametric design and digital fabrication. Both projects share the goal of capturing transient phenomenon of the body and transforming them into tangible elements capable of communicating information about movement and bodily experience.

# 3D SOUND PRINTED

Evette's Niche



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# FUTURECRAFT.STRUNG

Adidas

For Liquid Gestures, the concept behind the Adidas FUTURECRAFT.STRUNG custom shoe lies not only in the final product but also in the way it is made. Adidas proposes a design process based on data collected from athletes' bodies, using motion capture data as the source of information to determine the shoe's structure, material distribution, and functional performance. In this case, movement is no longer just a physical activity but becomes a set of data from which design decisions can be derived. This Adidas design and product proposal is directly related to that of Liquid Gestures, given that both projects use body movement as a starting point for formal creation and can offer us a glimpse into the future of Liquid Gestures.



While FUTURECRAFT.STRUNG analyzes the biomechanics of runners to optimize a shoe's performance through the strategic arrangement of fibers and materials, Liquid Gestures analyzes movements that occur underwater to translate the trajectories, rhythms, and patterns of these movements into modules, surfaces, and textile elements generated through the use of parametric design.

# PROJECT DEVELOPMENT

## WORKFLOW

After analyzing and evaluating the possible approaches and tools I could use to achieve this project, I decided to divide the development process into six phases, starting with observing the body underwater and understanding which movements I wanted to capture, then marking the points that would clearly define the trajectories and converting them into real data that Grasshopper could read, which would later be translated into curves that would generate shapes and repetitions, dictating the design. After successfully obtaining the curves (which was the most complicated part) the design process accelerated, and I moved on to the digital fabrication of the modules that would form the final design and I decided to keep the design of the items in a usable and functional way using regular fabrics for swimming items.

**Body in water**



**Trajectories**



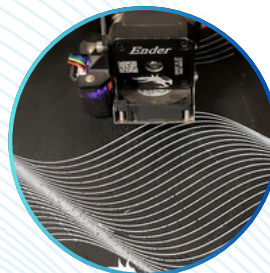
**Data**



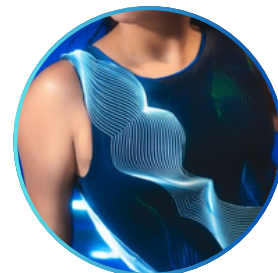
**Parametric System**



**Digital Fabrication**

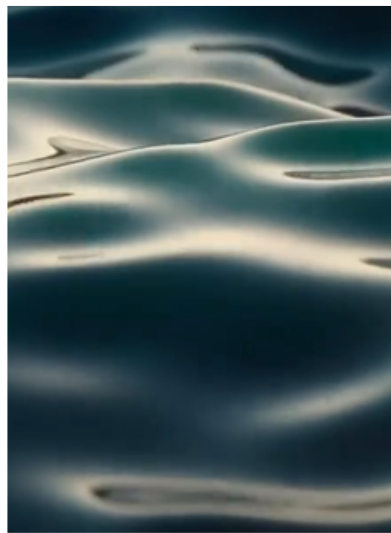
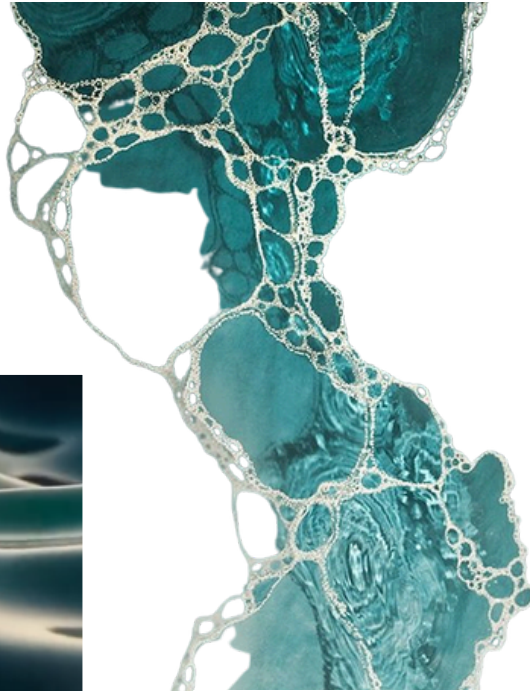
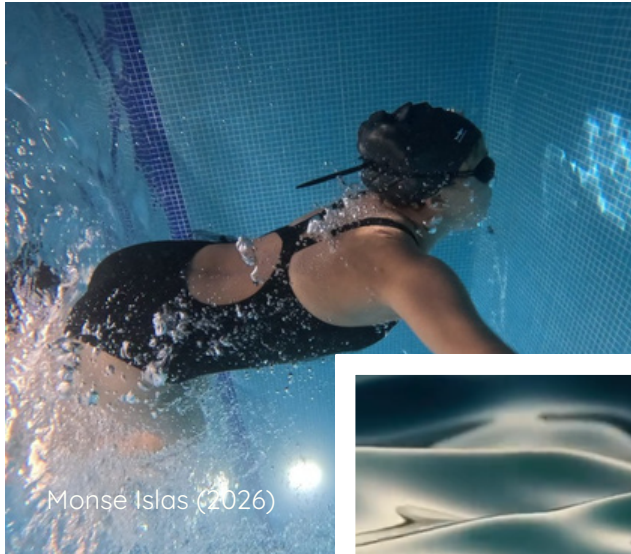


**Personalized Garment**



# INSPIRATION

Part of the inspiration for this project's aesthetic came from the fluidity and properties of water, specifically its color palette and forms, as well as the organic silhouettes it creates and the calm and peace that come from immersing oneself in it, but also from the power, strength, and rhythm generated by the body's movement.





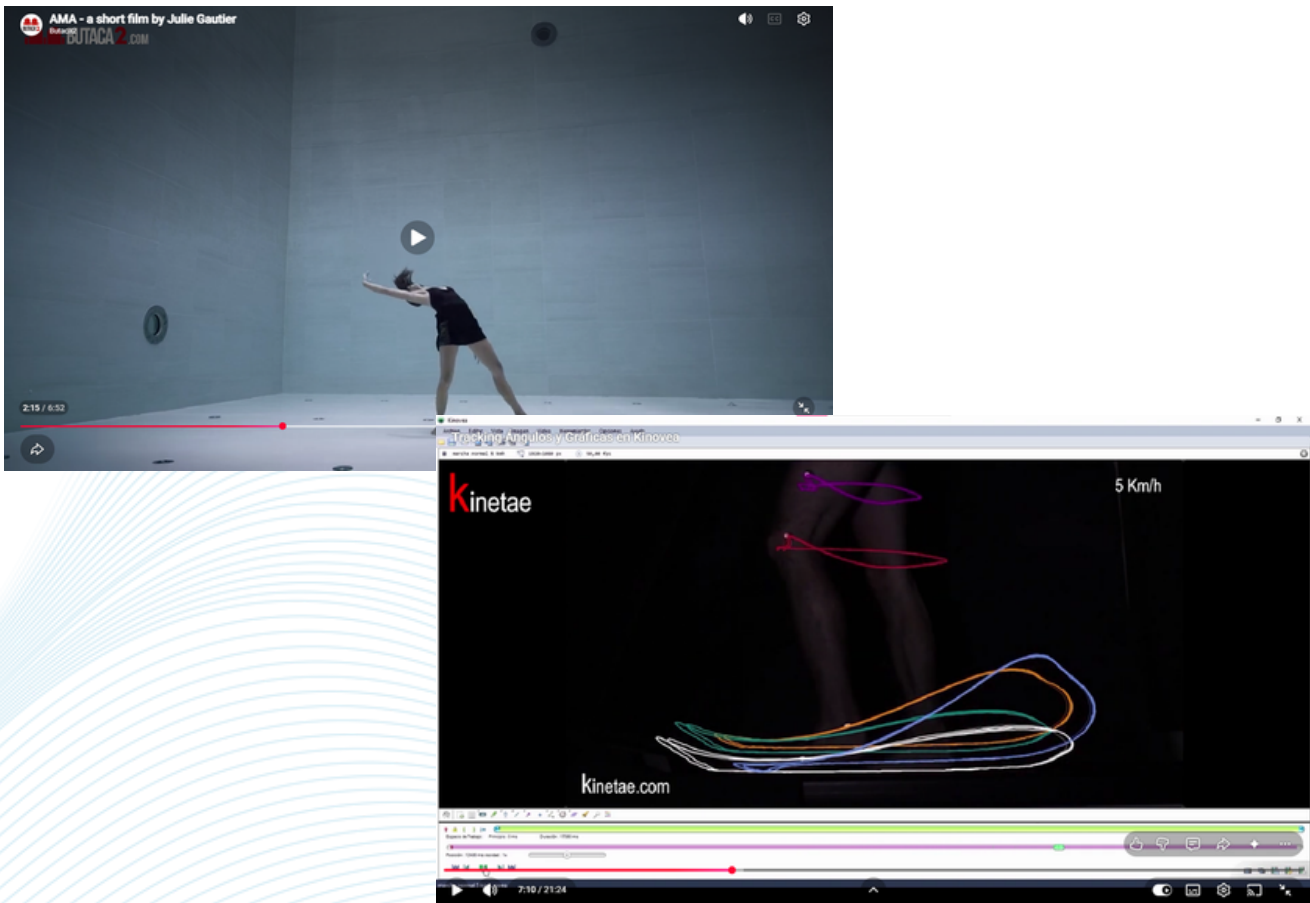
# TECHNICAL DEVELOPMENT AND EXPERIMENTATION

The first requirement I encountered in my project was how I was going to translate data to transfer it to Grasshopper and work with parametric design, and what were the best options for measuring it, as well as the best software to use. With one of my most direct references being Margrét Katrín Guttormsdóttir's "Moving Shapes" project, I realized that it was possible to do it from Grasshopper since that was the way that worked best for her.

However, I realized that this would not work for my project because it involves being live, and recording in an aqueous medium would result in a complexity that would prevent me from optimizing my time for parametric design.

I decided to work with a previous video to get the necessary data, this is an example of video to make the first test and also, this helped me to understand the best way to record a video, with contrast colors, clear background, clean environment, etc.

So I researched more thoroughly what tracking meant and how I could use it just to gather information. And I found the KINOVEA software that is useful for athletes who want to see the trajectory of their movements, which was very relevant to my project. So I decided to use this software, which is very easy to use, and with the help of videos, I was able to synthesize and clarify the data for Grasshopper.



# KINOVEA

## Data collection and translation

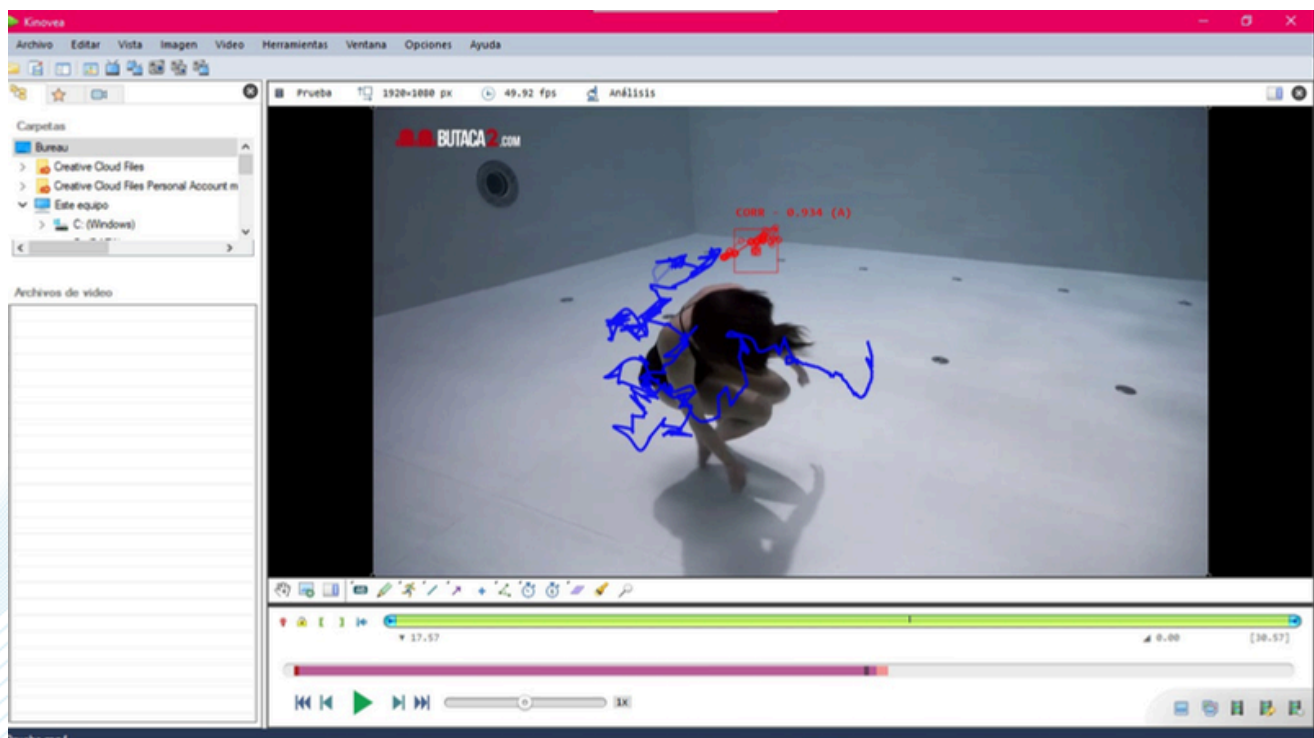
The tool that allowed me to convert swimming trajectories into data, as I mentioned earlier, was Kinovea, a free, opensource software program designed for the biomechanical analysis of movement using video. It enabled me to observe, measure, compare, and track movements frame by frame with great precision by tracking the trajectory of specific body points, primarily located on the limbs. I decided to focus on the body parts with the greatest mobility underwater, aiming to measure and analyze various factors to compare trajectories and verify whether there were indeed different flows.

For the first movement, three points were placed on the shoulder, elbow, and wrist to determine the trajectory of the arms as they moved, thereby analyzing flexibility and fluidity.

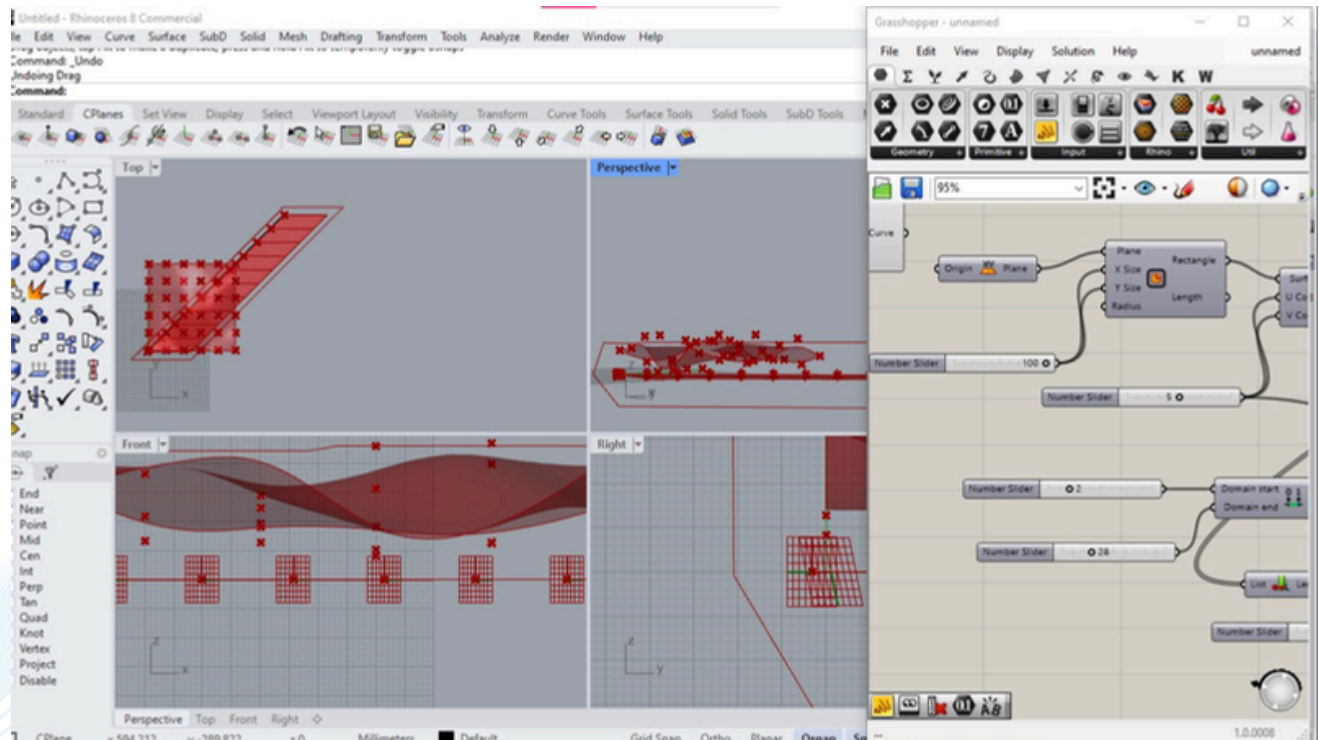
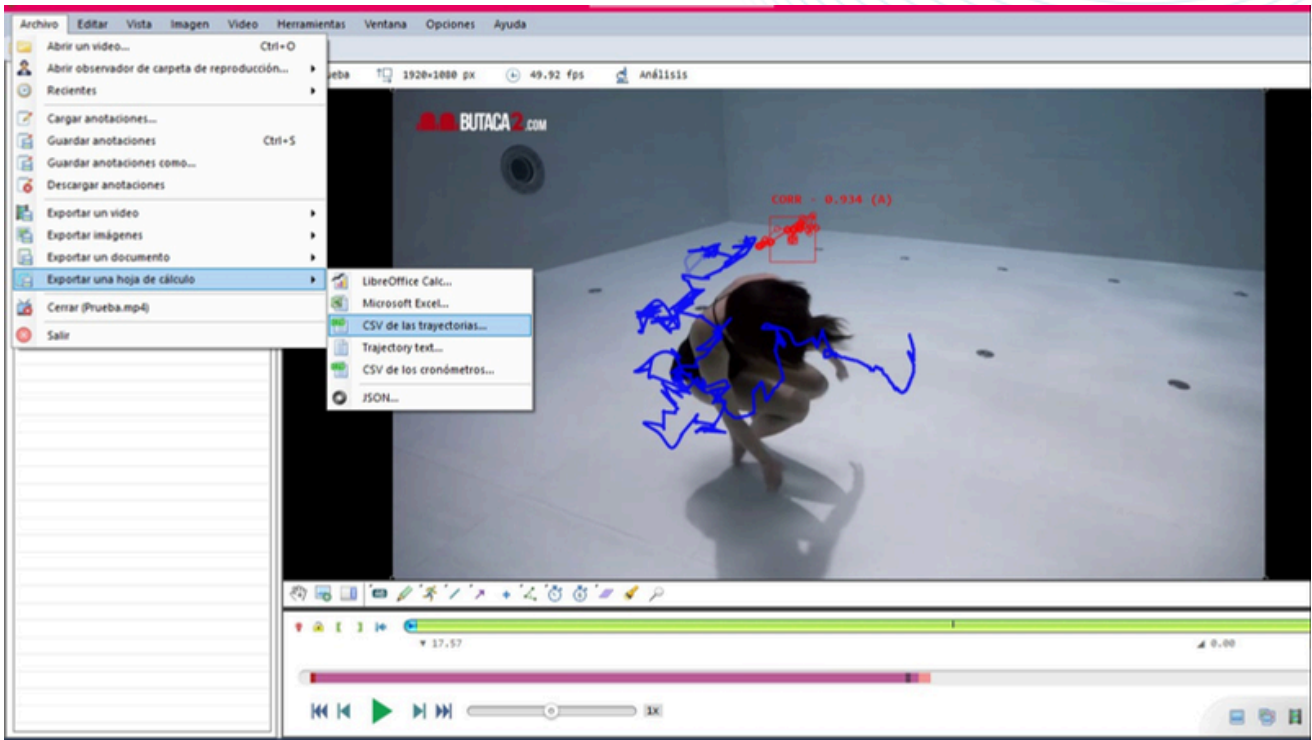
For the second movement, points were placed around the torso to analyze the body's intensity and power, since pressure differs inside and outside the water.

Finally, for the third movement, the structure and rhythm of leg movement were analyzed by placing points on the upper body, the knees, and the ankles.

Personally, I believe this software could be utilized more effectively, even to compare these sequences with one another and further streamline the process of interpreting the movements and reviewing the results it produces; however, for this stage of the project, obtaining the necessary data was sufficient.

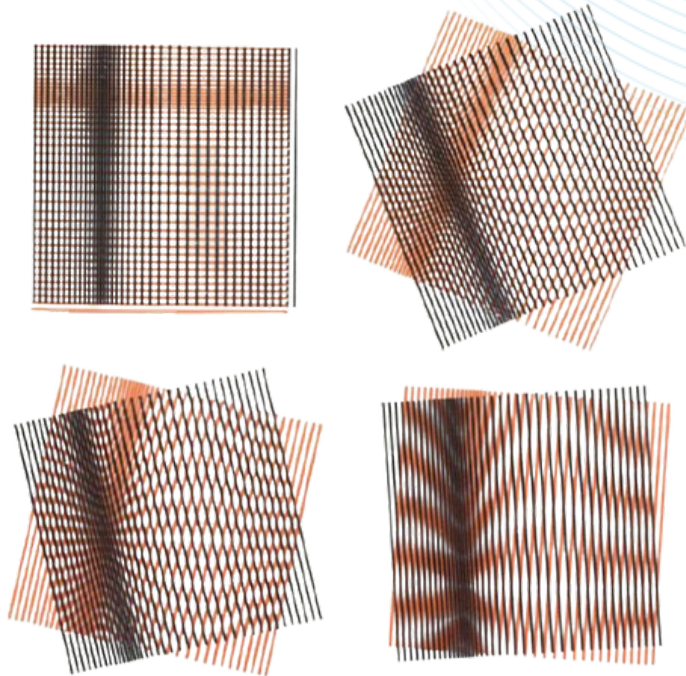


First, using a test video, I was able to track the person's path in the water and generate some curves using a Grasshopper definition; however, I still couldn't figure out how to get Grasshopper to read the data, but this was the best plan to understand how grasshopper and cvs reader data worked.

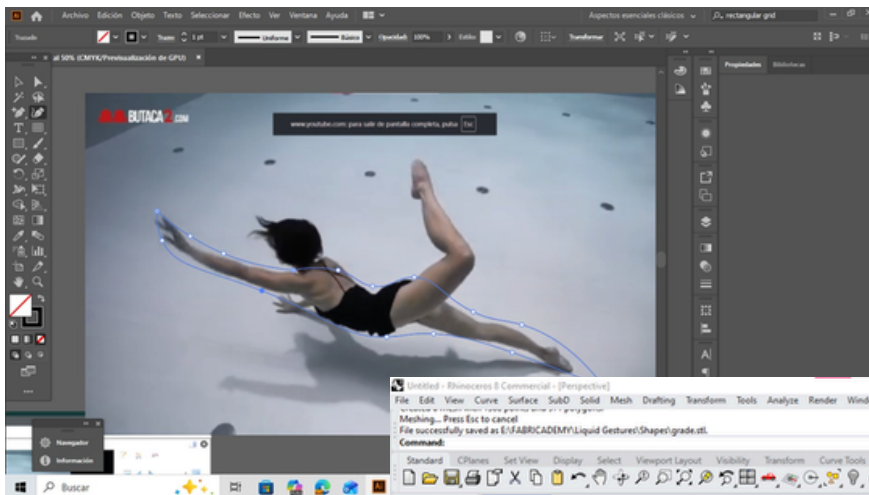


At the same time, this allowed me to conduct initial 3D printing tests with different materials, including filaments and the best fabrics compatible with those filaments. And at the same time I understood how the X, Y and Z axis worked to make figures and curves, so I decided to seek for making a kind of optical illusion for make the pieces more interesting and create a motion effect on the items.

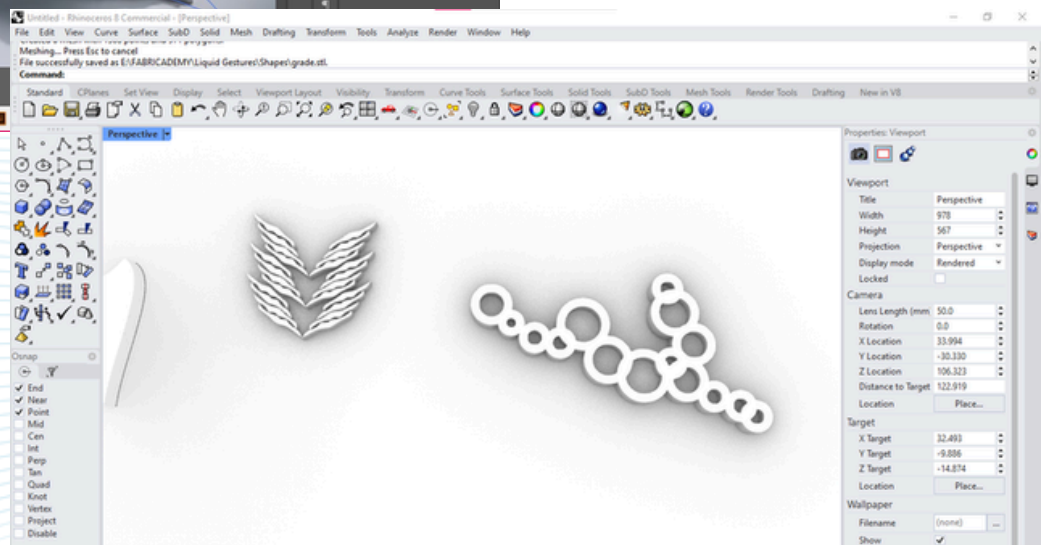
X



Y

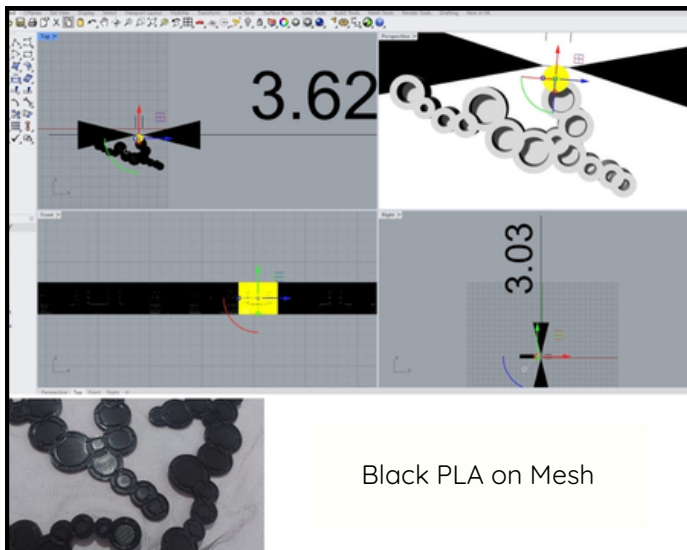


A gesture is defined as an intentional, repeatable, and measurable bodily action that functions as a generator of data for the construction of material structure.



## 3D printing

While I was figuring out the best way to translate the data, create curves, and achieve the optical illusion I was aiming for, it was also important to find the best match between filament and fabric to ensure the design was durable and capable of withstanding underwater conditions, as well as having minimal water resistance so as not to hinder the body's natural movement underwater.



### Printing parameters

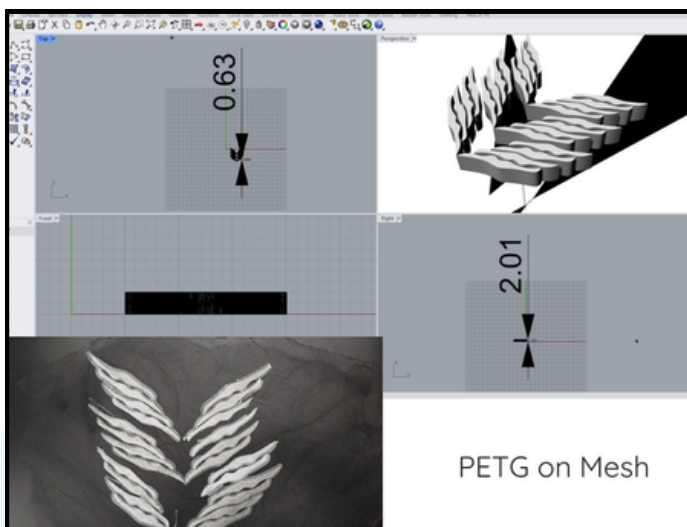
Nozzle temperature:  
210°C

Bed temperature:  
60°C

Moderate speed  
100 mm/s

Comments: The figure is very stiff and doesn't conform to the body, making fluid movement impossible

The first attempts were a pattern created from the silhouette of the body swimming underwater, printed in PETG on a non-stretch flat fabric mesh and PLA printed also on rigid mesh. Although this first test used a lightweight filament, it was rigid, which could be somewhat cumbersome for the user.



### Printing parameters

Nozzle temperature:  
240°C

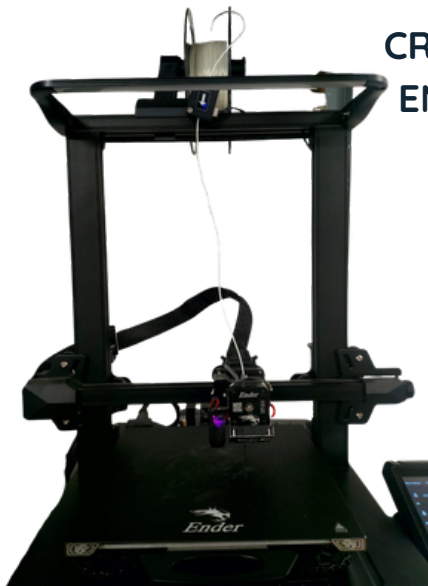
Bed temperature:  
70°C

Moderate speed  
60 mm/s

Comments: The figure is very stiff and doesn't conform to the body, making fluid movement impossible

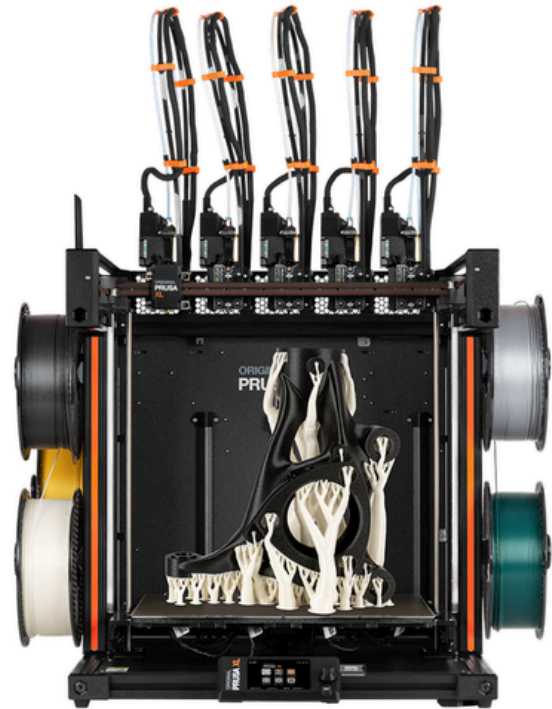
In these initial tests, it was also important to determine the thickness and dimensions of the part to be printed. In this case, they were set to 2 mm, but for this material, the result was too rigid, making it not the best option

## Machines



**CREALITY  
ENDER-3**

To print my pieces I used the Creality Ender-3 and the Original Prusa XL 3D printer with 5 heads



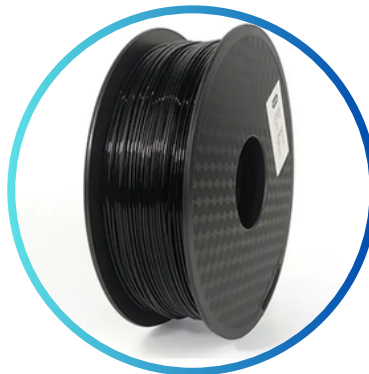
## Materials

**PETG**



Resistance to water and humidity, moderate flexibility, can be bent slightly without breaking and less brittle and more flexible

**PLA**



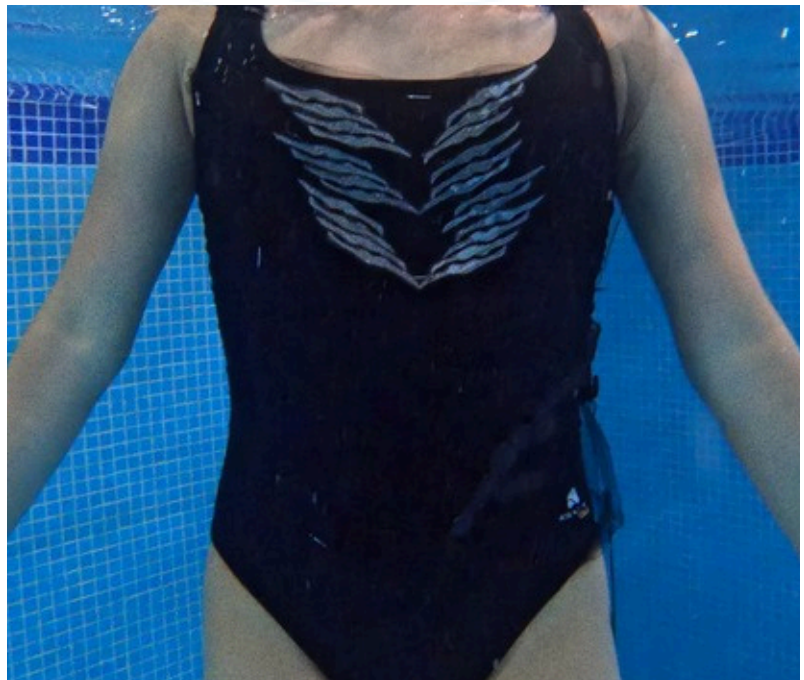
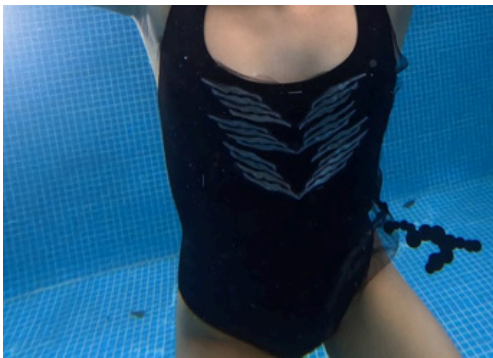
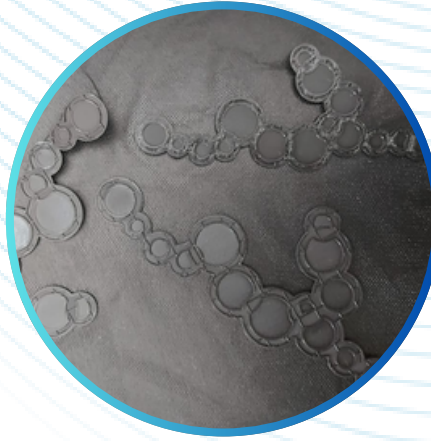
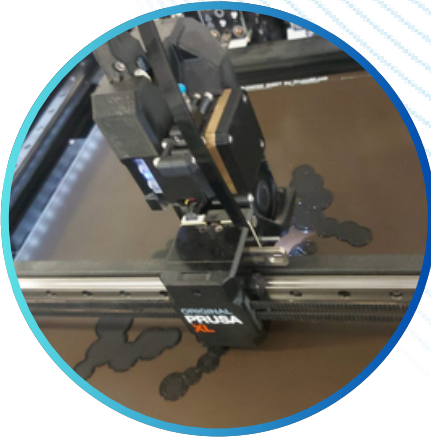
High Stiffness, Low flexibility, low to medium impact resistance and high hardness

**REGULAR BLACK MESH  
(Rigid)**



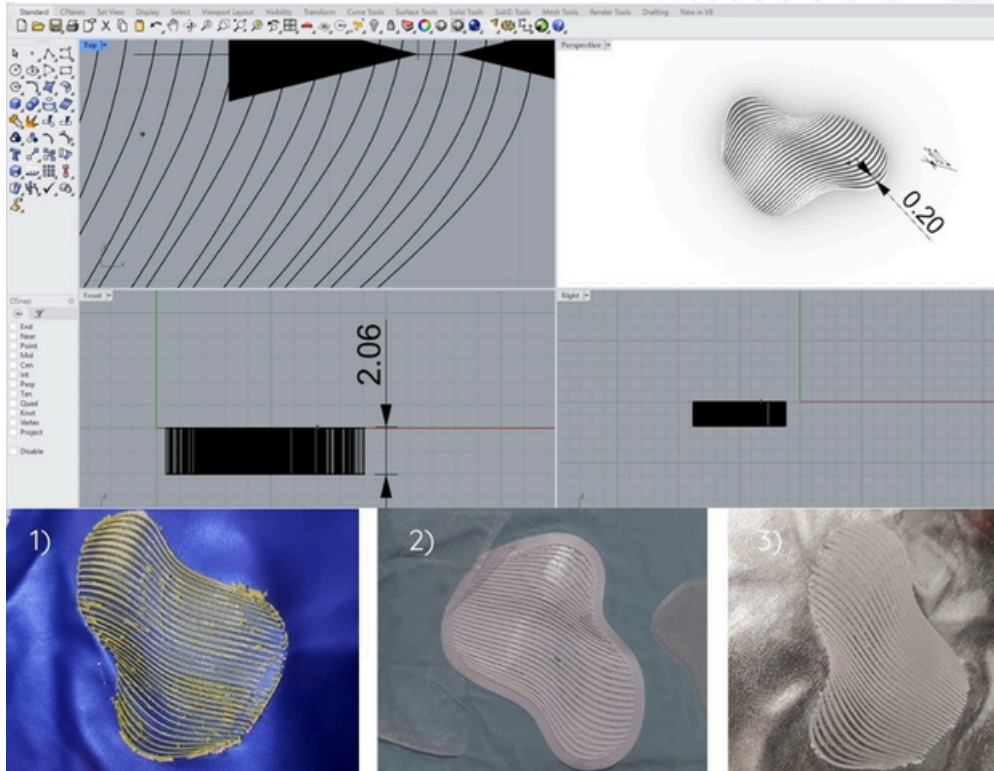
Structural rigidity, transparency, lightness, ability to create tridimensional forms

## First Prototypes



These early prototypes were crucial in selecting new materials and continuing the experimentation to find the best fit, since for 3D printing in TPU, the printed modules were very rigid despite being 2 mm thick; PETG showed greater flexibility but was not comfortable for the user. Likewise, although the mesh's openwork allowed water to pass through, it did not dry completely, leaving water trapped between the holes; however, this gave me the insight that the design needed to be more fluid and feature thinner lines.

As the project was taking shape, while searching for the ideal fabric, I realized it was important for the fabric to be mostly polyester; the most successful initial tests were conducted on durable fabrics such as neoprene, spandex, and Lycra. For the 3D printing the best filament was TPU because it was more flexible and moldable, despite being one of the most difficult to work with



1. Neoprene + tpu filament

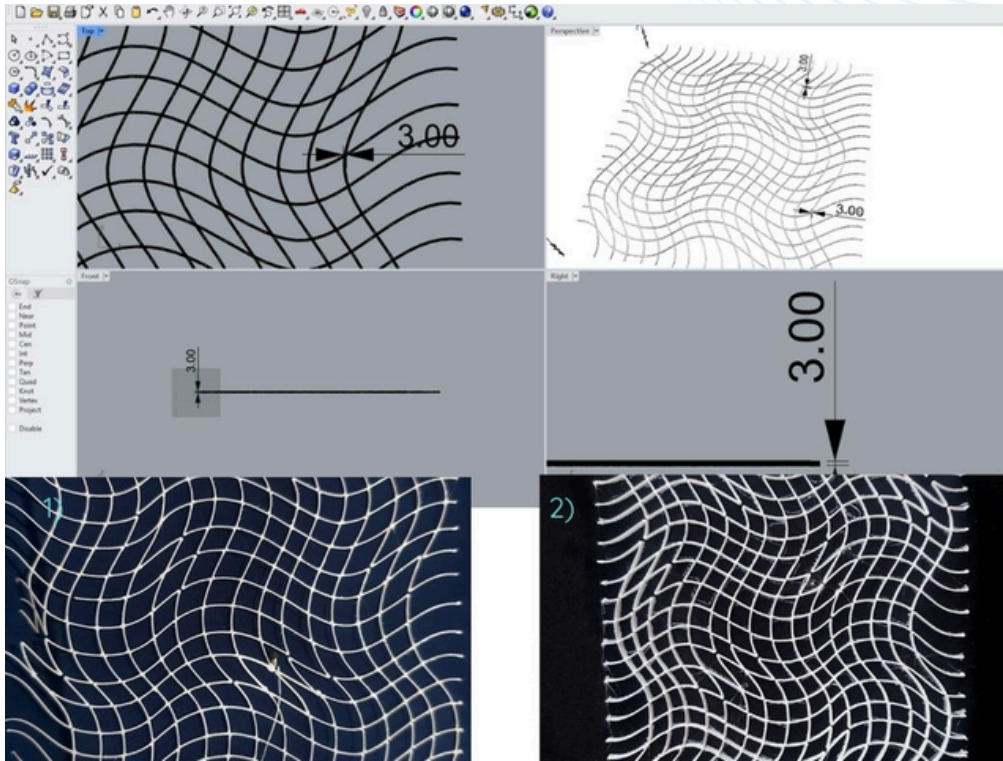
2. Lycra + tpu filament

3. Metallic Lycra + PETG filament

Printing parameters			Printing parameters			Printing parameters		
Nozzle temperature: 230°C	Bed temperature: 70°C	Moderate speed 50 mm/s	Nozzle temperature: 230°C	Bed temperature: 65°C	Moderate speed 50 mm/s	Nozzle temperature: 260°C	Bed temperature: 70°C	Moderate speed 60 mm/s
Notes: The neoprene used for this sample was too plastic-like, so during the printing process, the nozzle burned the fabric, resulting in a smudged print.			Notes: In this spandex, the filament adhered better because both materials are elastic			Notes: I decided to try again with PETG since it's a lightweight filament and adhered well to the metallic spandex; it also had a bit of flexibility thanks to the thickness of the lines and the spacing between them, which allowed me to stretch the fabric without affecting the print		

## Best 3D printing- Fine lines

This was the best printing option for a 50% spandex, 50% polyester fabric with TPU filament, using a line width of 2 mm and an extrusion thickness of 2-3 mm.



50% spandex, 50% polyester fabric with TPU filament

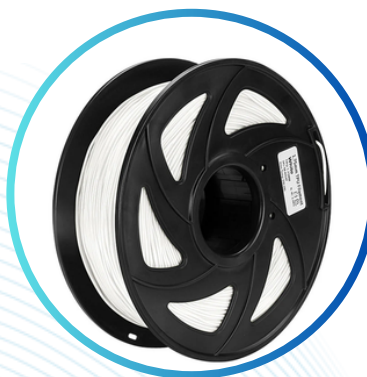
TPU

Poliester

### Printing parameters

Nozzle temperature: 210°C	Bed temperature: 60°C	Moderate speed 63 mm/s
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Notes: This was the best option for creating an optical illusion with very thin yet sturdy lines that adhere to the fabric and stay firmly in place.



High flexibility, elasticity, and impact resistance allow for the creation of adaptable and dynamic parts



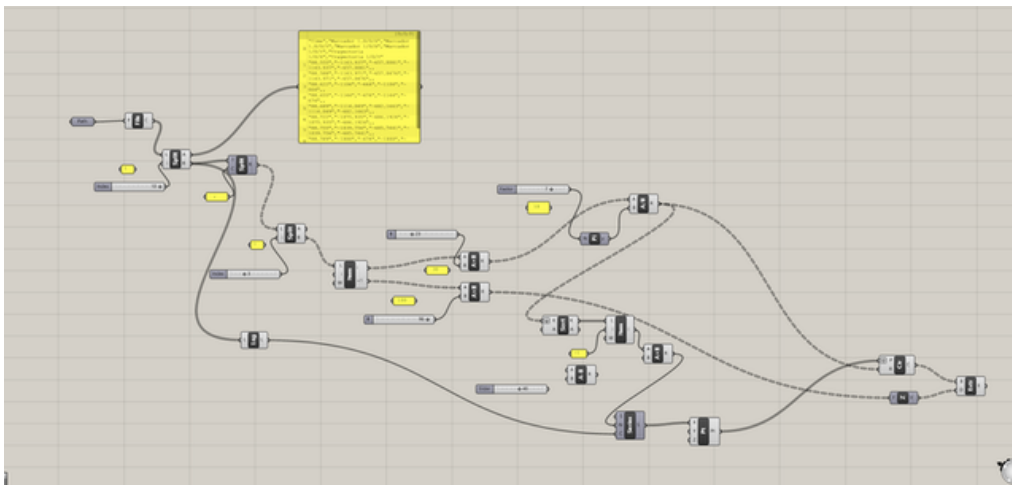
High elasticity, anatomical fit, water resistance

Although the spandex used in this project was not selected based on sustainability criteria as I would have liked, its elasticity, body-hugging fit, and resistance to aquatic environments proved essential to meeting the design objectives.

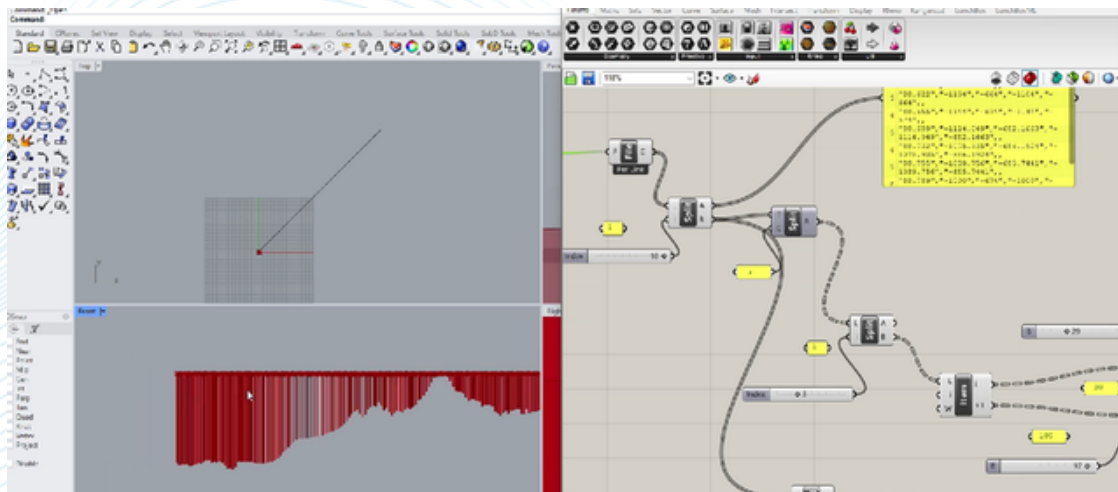
# FINAL DESIGN DEVELOPMENT

## Grasshopper definition exploration

Taking all of the above into account, I was finally able to figure out the best ways to translate the CSV data provided by the motion analysis software so I could begin bringing the final products to life. The other first way to read data from a CSV file in Grasshopper was one that visually, the data only looks like a graph, and what I was looking for were more fluid, curved shapes to create smooth trajectory effects and thereby generate a kind of optical illusion to give the pieces more depth, dimension, and fluidity.



In this part, you can also play with the thickness and dimension of the data, generating more elongated or narrower shapes

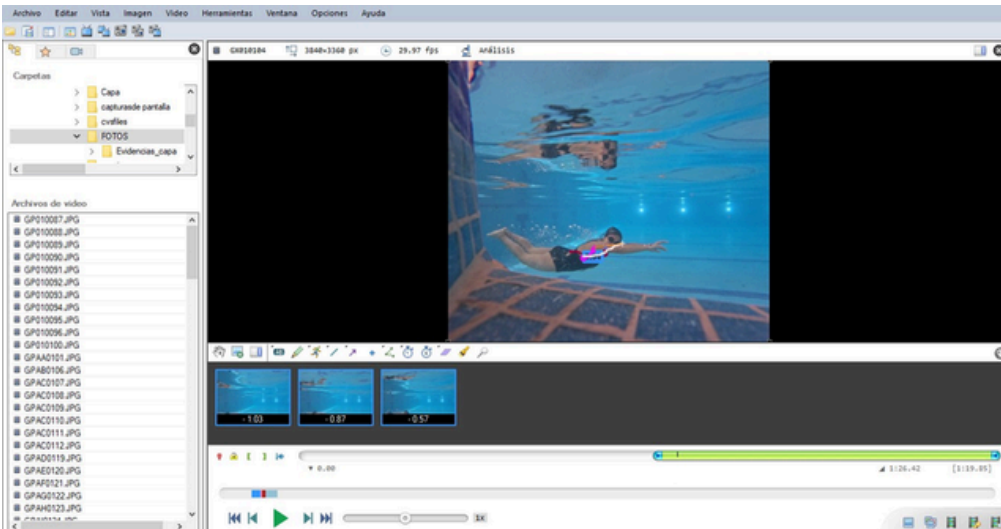




# UPPER GESTURE:

Flexibility and flow

For the first piece, the goal was to create a design with a simple silhouette that captures the fluidity and flexibility of the body in water; the piece is intended to appear as a direct extension of the body in motion, where skin and water become one and the same language. This choice stems from the need to work with a garment that allows for the observation and translation of the fluidity, adaptation, and continuity of bodily movements without structural interruptions.

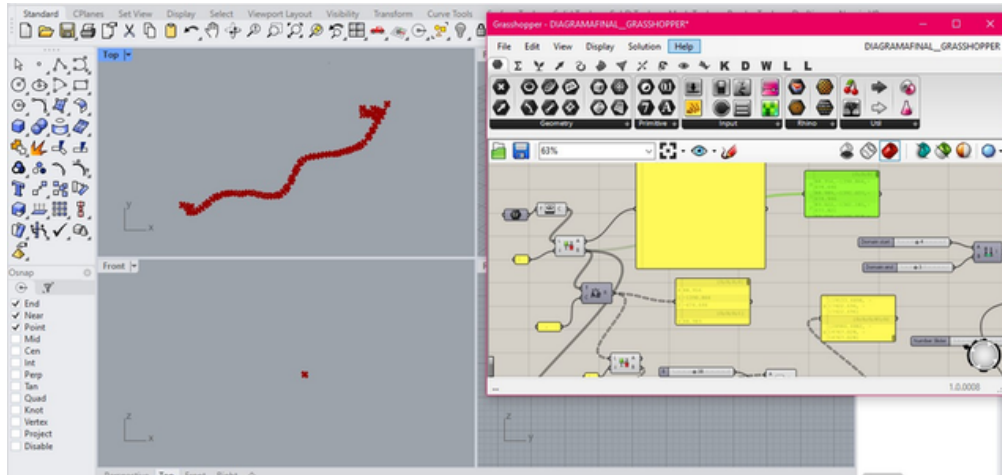
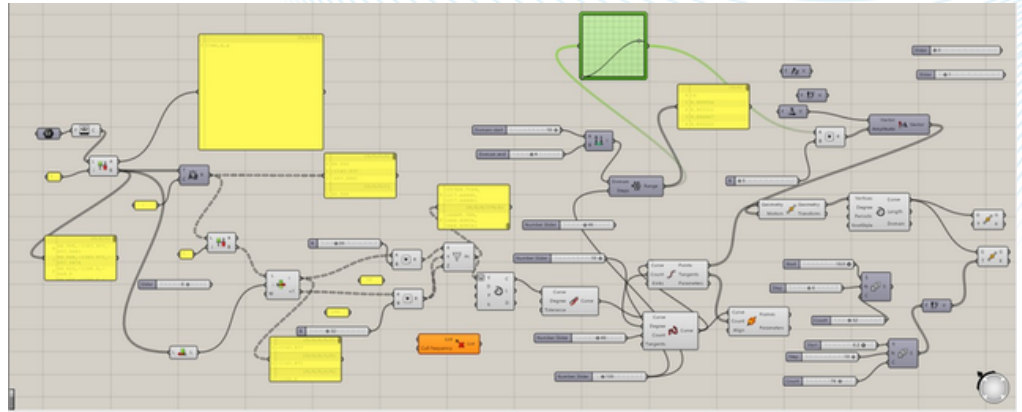


I focused on the arm as an extension of the body, since it is one of the most frequently used limbs underwater. Once the movement was identified and the trajectories were obtained, the data was exported into CSV files so that Grasshopper could interpret them as curves

To make the data provided by the software easier to read, it is important to remove the unnecessary columns, leaving only the first four, which define the coordinates of the curves at actual size

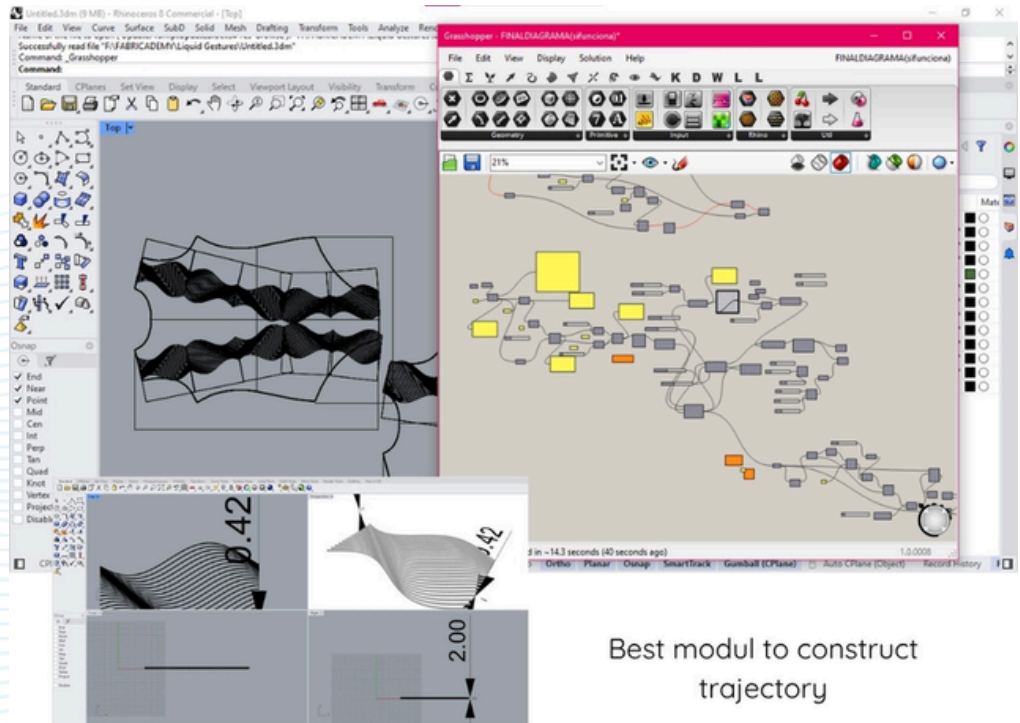
Time	Marcador 1	Marcador 1	Marcador 1	Marcador 1	Marcador 1	Marcador 1	Marcador 1	Marcador 1	Marcador 1	Marcador 1	Marcador 1	Marcador 1	Marcador 1	Marcador 1	Marcador 1	Marcador 1	Marcador 1	Marcador 1	Marcador 1	
2	88.555	-1143.937	-657.0081	-1143.937	-657.0081															
3	88.588	-1143.971	-657.0476	-1143.971	-657.0476															
4	88.622	-1144	-664	-1144	-664															
5	88.655	-1144	-674	-1144	-674															
6	88.689	-1114.049	-682.1663	-1114.049	-682.1663															
7	88.722	-1075.935	-686.1924	-1075.935	-686.1924															
8	88.755	-1039.756	-685.7441	-1039.756	-685.7441															
9	88.789	-1000	-674	-1000	-674															
10	88.822	-968.0366	-667.6936	-968.0366	-667.6936															
11	88.855	-928	-658	-928	-658															
12	88.889	-891.9203	-676.0271	-891.9203	-676.0271															
13	88.922	-859.561	-670.0049	-859.561	-670.0049															
14	88.956	-818.3301	-665.7966	-818.3301	-665.7966															
15	88.989	-855.6693	-672.0427	-855.6693	-672.0427															
16	89.022	-868.2844	-681.7395	-868.2844	-681.7395															
17	89.056	-865.5089	-677.9697	-865.5089	-677.9697															
18	89.089	-851.7983	-669.9966	-851.7983	-669.9966															
19	89.122	-832.183	-659.7122	-832.183	-659.7122															
20	89.156	-802	-664	-802	-664															
21	89.189	-832	-652	-832	-652															
22	89.222	-845.1941	-640.1223	-845.1941	-640.1223															
23	89.256	-819.5278	-642.063	-819.5278	-642.063															
24	89.289	-815.5183	-660.2261	-815.5183	-660.2261															
25	89.322	-776	-654	-776	-654															
26	89.356	-776.6306	-657.937	-776.6306	-657.937															
27	89.389	-817	-646	-817	-646															
28	89.423	-778.6014	-657.9641	-778.6014	-657.9641															
29	89.456	-779.1785	-677.6829	-779.1785	-677.6829															

This was the definition with the components that allowed me to construct curves to transform into optical ilusional pieces



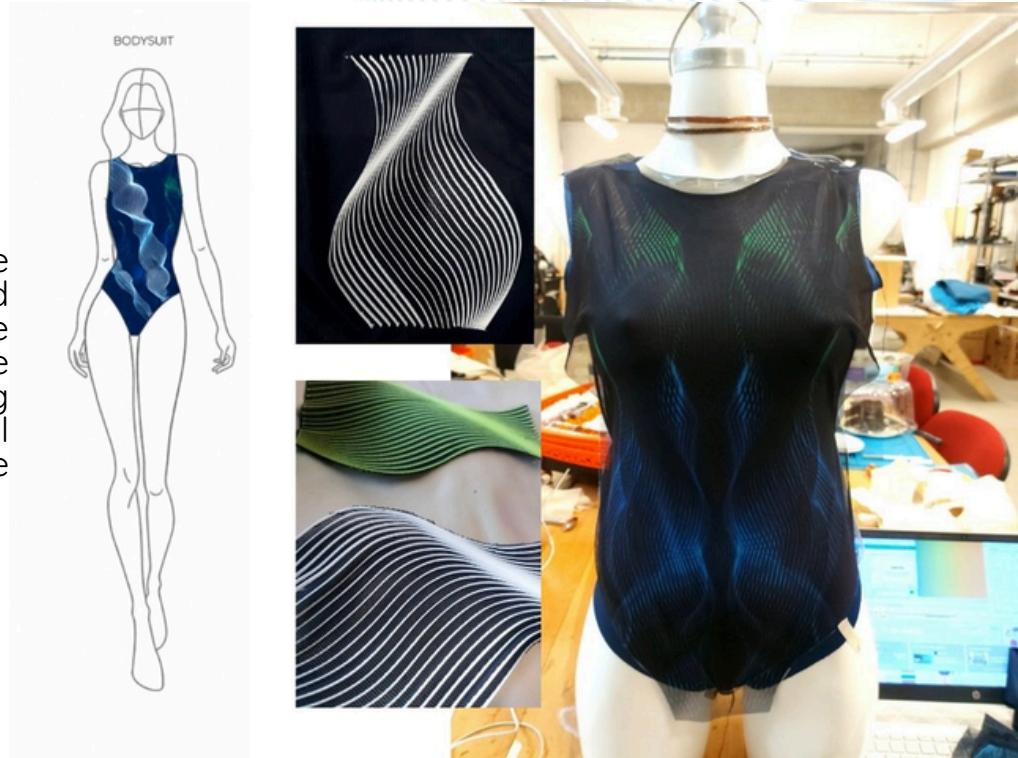
Finally I could generate a curve in grasshopper that construct the base to the design. You can play with the parameters to add more curves infinity in X and Y axis, and you can also control espases between every line

With the curves and parameters defined, I was able to adapt these paths to the suit's pattern in order to scale and adjust the trajectory



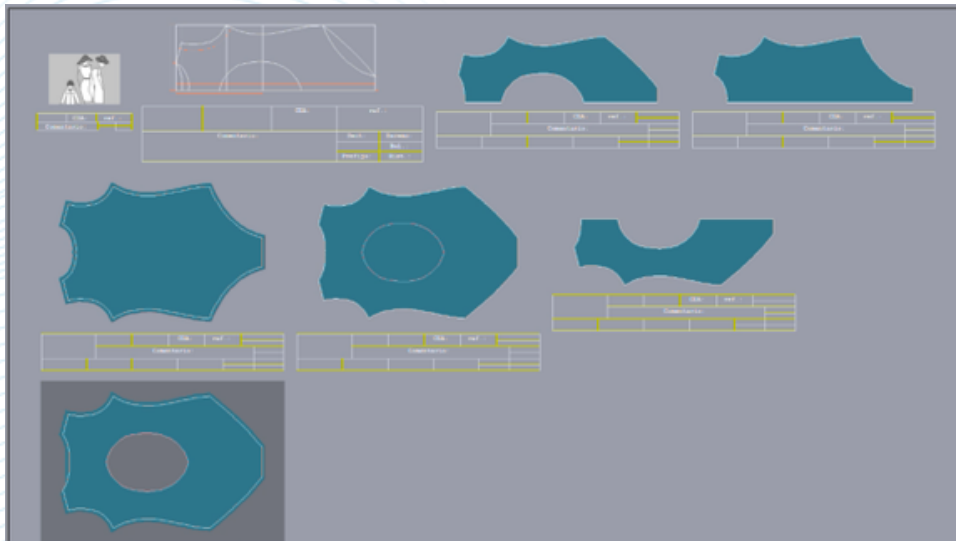
Best modul to construct trajectory

Finally with the curves obtained and all the tests made previously, I got the final design making a kind of optical ilusion, this was the final piece sketch.



## Pattern Making - Modaris Lectra

Lectra Modaris is software specialized in digital patternmaking used for creating, modifying, and scaling garment patterns. It enables the development of precise patterns, optimizes fitting processes, and facilitates the transition from design to production. Within Liquid Gestures, this tool contributed to the technical development of the garment, enabling the generation and adaptation of the patterns needed to integrate the textile and structural elements derived from the parametric design process. Its use enhanced precision in the garment's construction and the preparation of digital files for subsequent laser cutting and manufacturing.



## Laser cutting

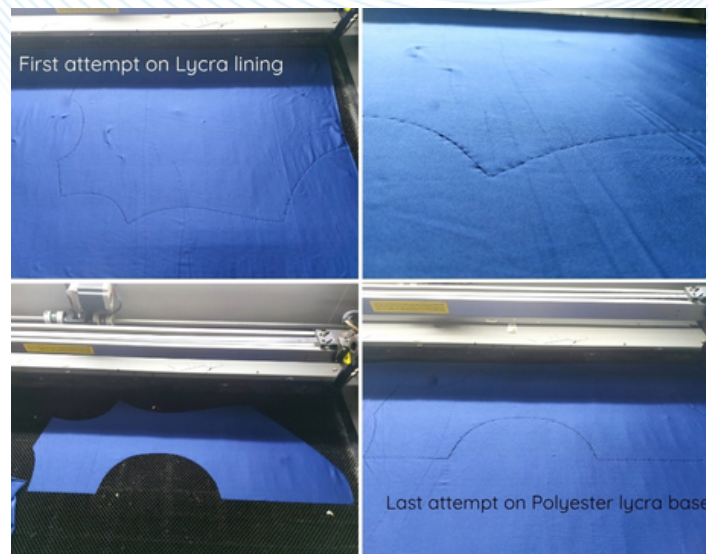
Once I had the digital patterns, I decided to cut a test piece out of Lycra since I had never worked with this fabric using a laser cutter before.

The settings were:

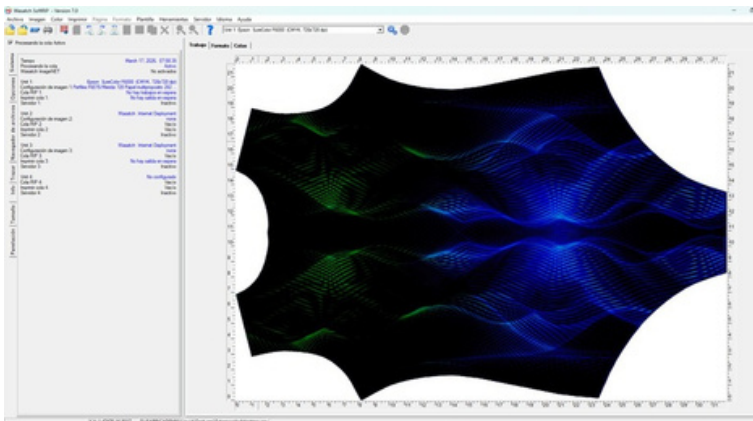
- **Speed: 40 mm/s**
- **Power: Max. 40, Min. 30**

Synthetic fabrics like polyester or Lycra require low power because they melt easily, so I had to adjust to a faster speed and less power and that has a clean cutting.

- **Speed: 180 mm/s**
- **Power: Max. 30, Min. 20**



## Sublimate

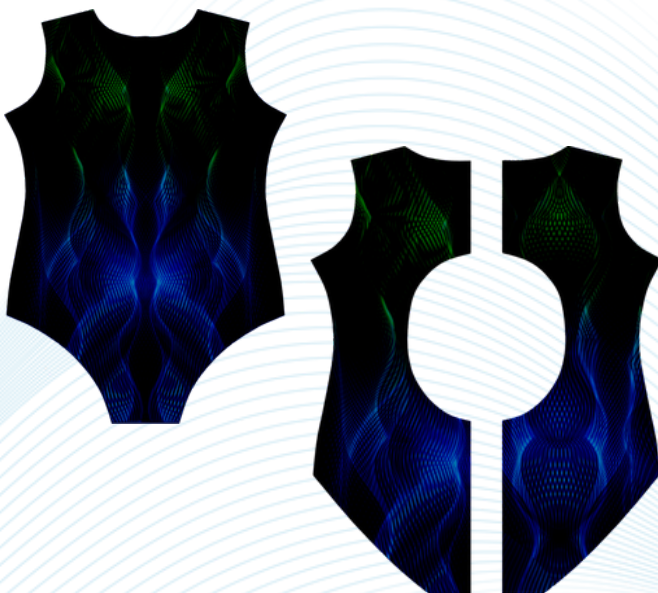


For the sublimation, I wanted to respect the flow of the paths while creating a design guided by them, with a mirror effect to achieve a sporty style with an optical illusion.

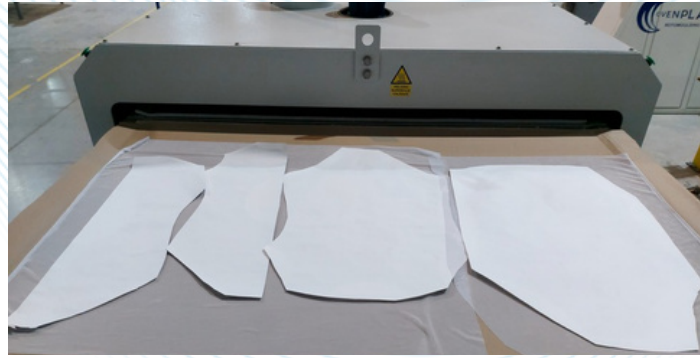
I used **Wasatch's SOFTRIP software**, where you first import the file (AI, PDF, PNG, etc.) into the program.

Whit this program you can set:

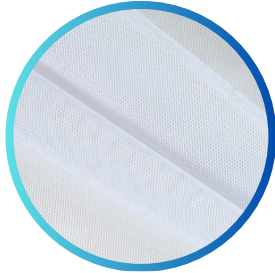
- **Actual print size**
- **Resolution**
- **Color profiles (very important for color accuracy on fabric; I recommend running a color test, as results may vary depending on the color profile you're using)**



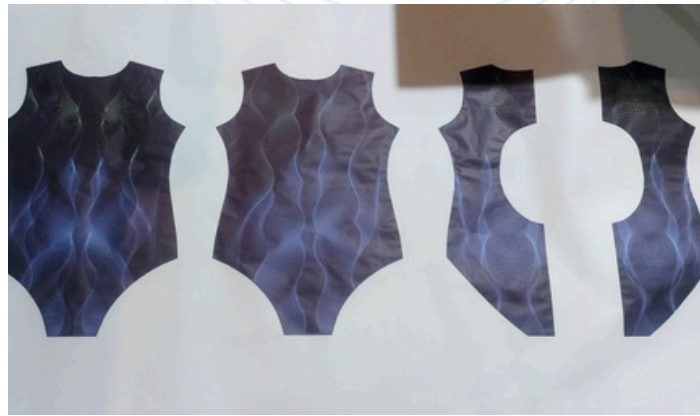
Once the design has been printed on paper, the paper is placed on the fabric. To ensure a better finish and better adhesion of the design to the fabric, it is important to use fabrics made primarily of synthetic materials (**usually polyester/lycra**). Apply heat (**≈180-200°C**) and pressure. The ink transitions from a solid to a gas and bonds to the fiber.



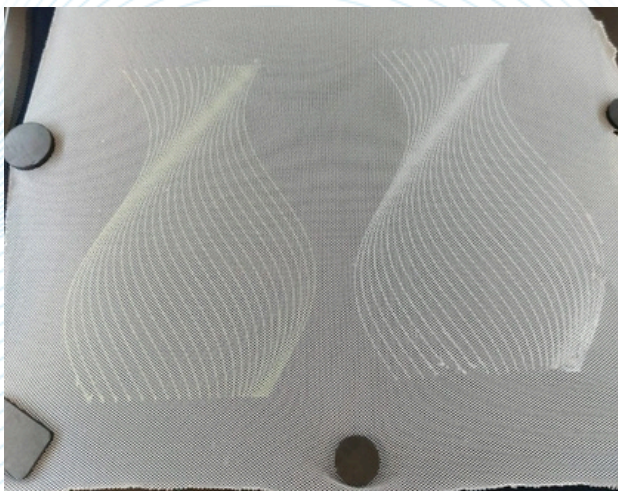
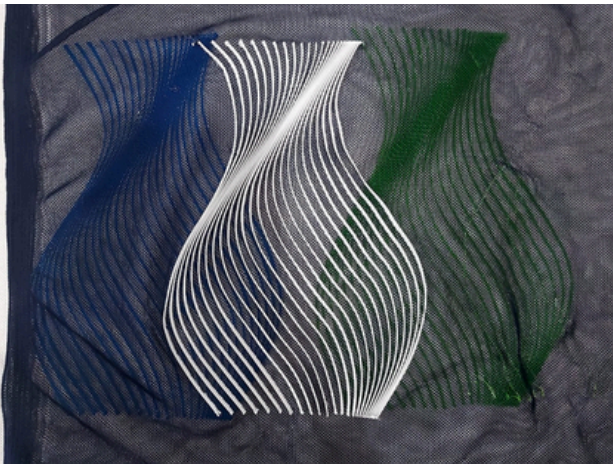
### Power mesh fabric



A lightweight, breathable, flexible, and stretchy mesh fabric that allows for freedom of movement and conforms to the body. Ideal for athletic wear



### 3D Printing



#### Printing parameters

Nozzle temperature: 210°C	Bed temperature: 60°C	Moderate speed 63 mm/s
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Thin lines on mesh to maintain the flexibility of the fabrics that mold to the body

This ensured the print had sufficient flexibility and stretch so it wouldn't feel restrictive on the body

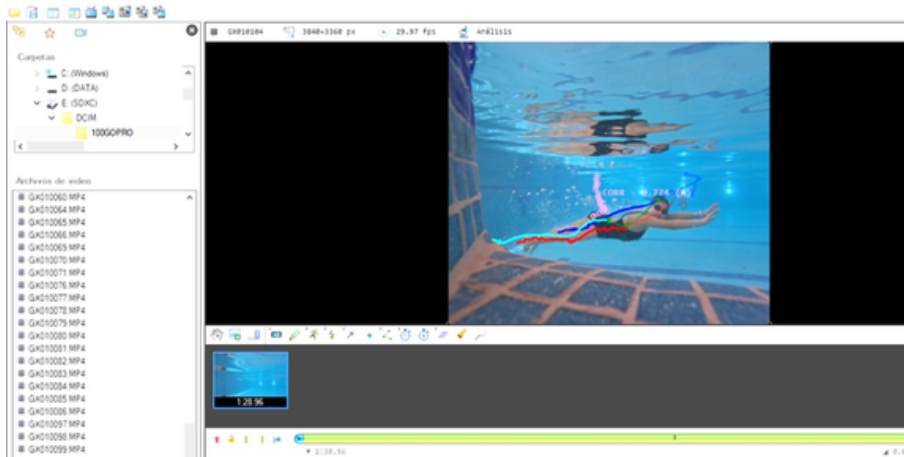
Blue power mesh



# MIDLE GESTURE

## Intensity/Power

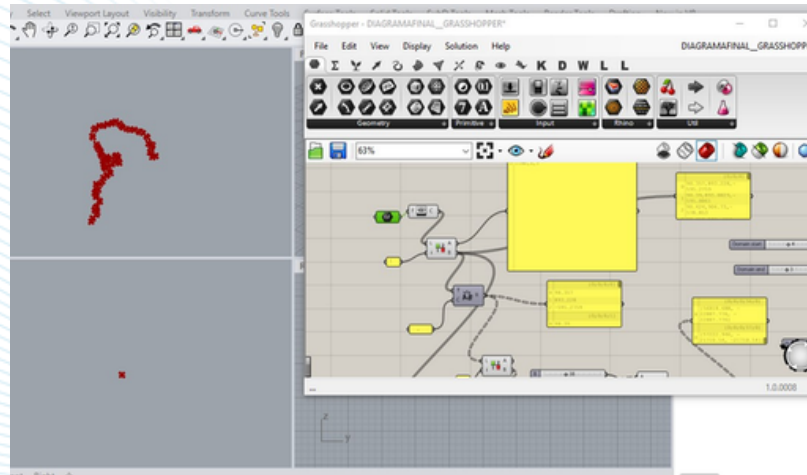
A lightweight cape that extends body movement, exploring the intensity and power of underwater gestures through fluid, shifting forms. This piece represents the body's central gesture, the torso. The second key point of the body for generating movement. I wanted to make the piece an extension of the body that plays with the intensity and power of underwater movement, exploring how the force of the gesture transforms form. Therefore, the cape is not merely an accessory, but a device that translates the gesture into volume, time, and presence

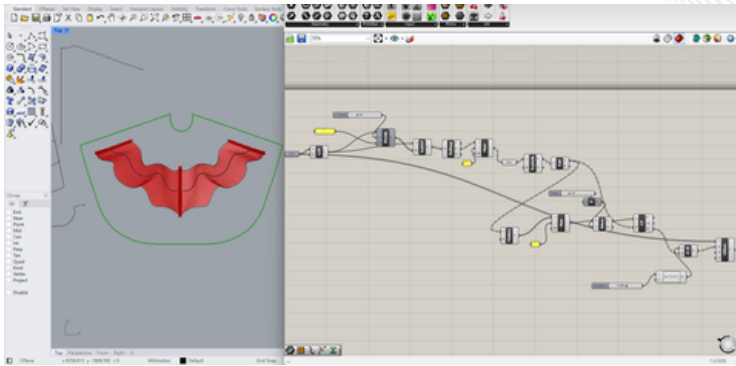


As in the first piece, the first step is to generate the curve. To do this, new trajectories had to be created, this time for the torso, which generates new data and a new CSV file that needs to be converted using the definition created in Grasshopper.

For this piece, I decided to experiment with the power, parameters, and settings to achieve an engraving on neoprene, as well as cuts that add depth to the piece.

What is interesting about these pieces is that they are unique, since each movement records different data, so the curves, shapes, and repetitions will always be unique.





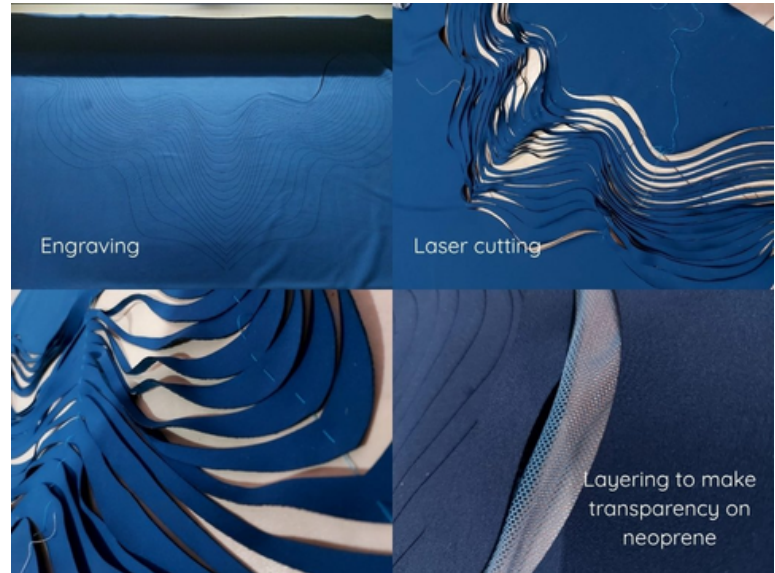
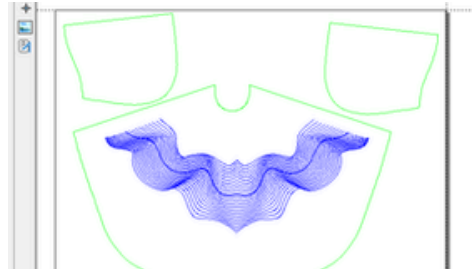
For the mold of the piece, I chose to use a Grasshopper definition that would adapt the shape to the mold. Once I had the curves with the initial definition in Grasshopper, the curves were extracted, aligned, and modified to be included in a new Grasshopper definition that would adapt to the shape of the cape

## Laser Engraving

For the front of the cape, I chose a fabric pattern featuring these repeating motifs created by the body's contours

The settings were:

- **Speed: 350 mm/s**
- **Power: Max. 30, Min. 25**

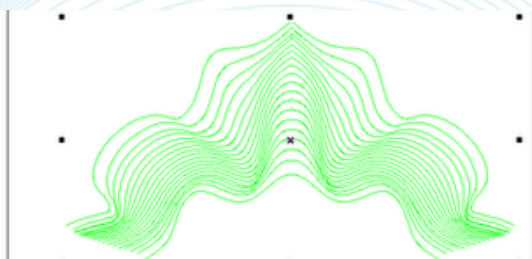


## Laser cutting

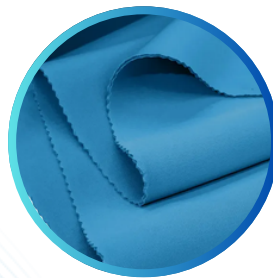
For the back panel, a cut was chosen to add dimension to the back; these measurements were ideal to ensure the fabric wouldn't burn and that the cut would remain defined on the panel, since the lines were very close together and there was a risk they wouldn't show up or would merge together and burn.

The settings were:

- **Speed: 80 mm/s**
- **Power: Max. 40, Min. 25**



## Neoprene



This material is widely used in water based and sports related activities. Its structural properties allow for the creation of surfaces with greater volume, which facilitates laser cutting and engraving. It is characterized by thermal insulation, water resistance, functional flexibility, and structural stability.

**SmartCarve** was the software used to adjust and prepare the digital files used in the laser cutting of various materials, ensuring precision and efficiency throughout the manufacturing process.

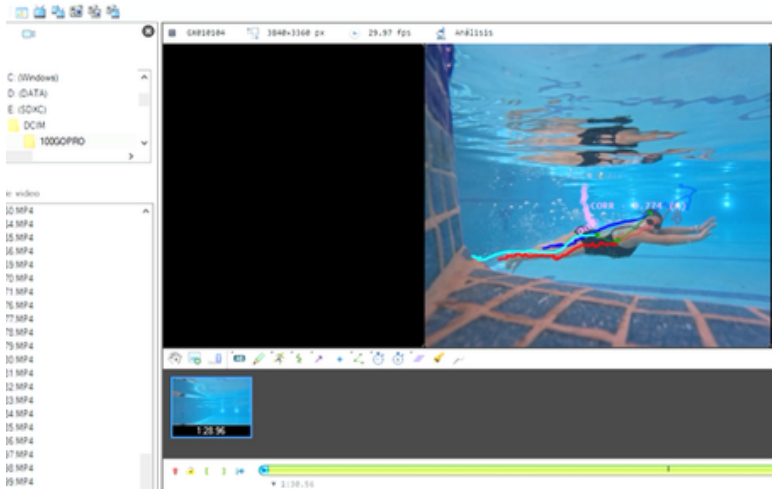
# LOW GESTURE

## Structure and rhythm

The bag in Liquid Gestures emerges as a translation of the movement of the legs, particularly in an aquatic environment. Unlike pieces that explore the upper body, this design focuses on the power, rhythm, and repetition generated by the legs as they move underwater. The modules that make up the bag represent this rhythmic structure: patterns that evoke the cadence, endurance, and continuity of movement

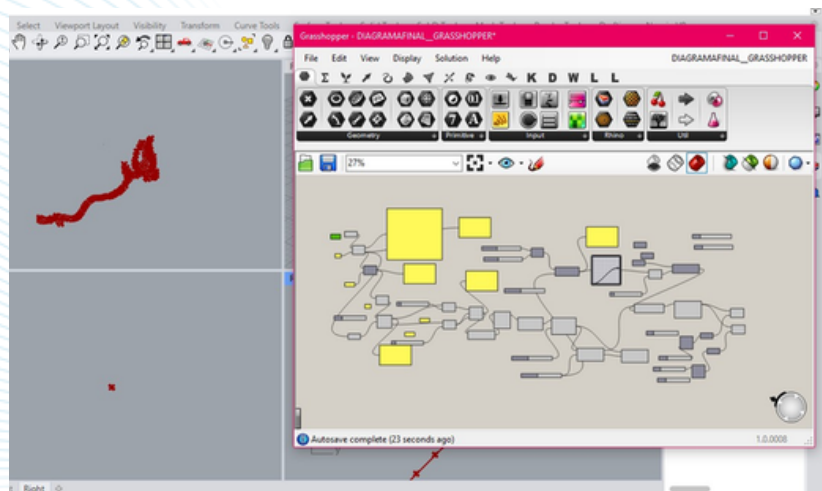


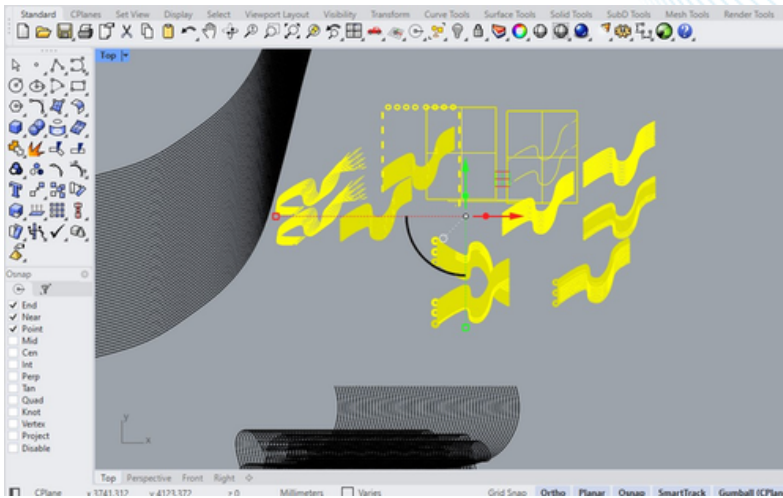
For the bag, I wanted it to be a simple design with plenty of open spaces so that, when in use, water could drain out and air could circulate inside, allowing the items inside to dry more effectively; thus, the bag's shape was defined by the movement itself



The method for creating the curves in this piece was the same as in the previous ones; however, for this piece, I experimented with the orientation of the modules to create a compatible module that could be assembled and disassembled. Holes were added to serve as the module joints and form the bag.

For this piece, the gesture I wanted take was from the movements of the legs underwater; as the third most important limb when interacting underwater, the legs require a lot of rhythm and constant movement to keep the body afloat.

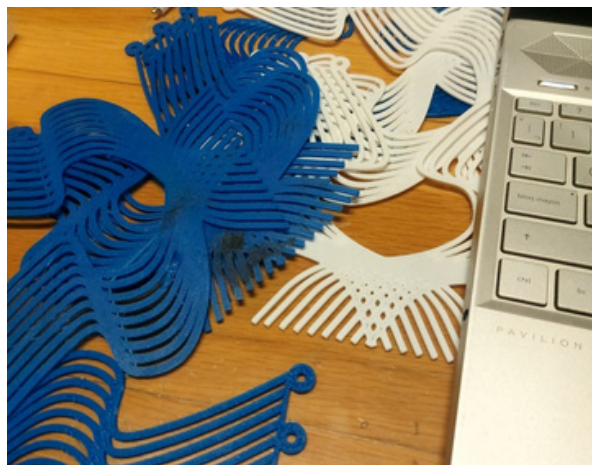
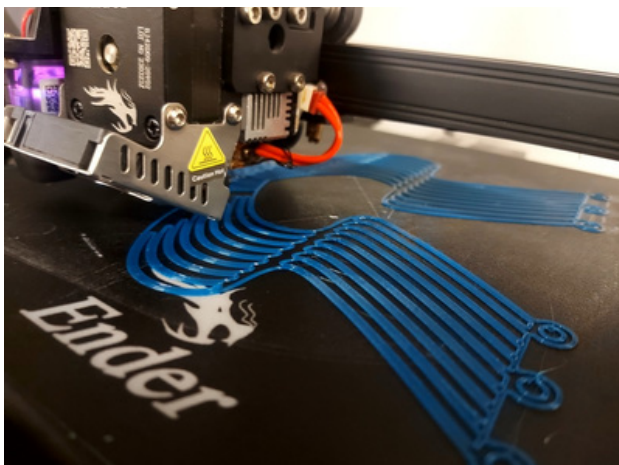




I decided to reduce the size of the curve without losing the original shape of this piece, and I arranged them to create a repetition among the curves and achieve the optical illusion effect I was seeking

### 3D Printing

Due to the size of the print bed, I chose to split the module in two and then join them using heat. It is very important that the soldering iron be set to medium heat, since at high temperatures the pieces tend to melt and burn, altering not only their appearance but also their shape, and they become difficult to bond.



#### Printing parameters

Nozzle temperature: 230°C	Bed temperature: 65°C	Moderate speed 30 mm/s
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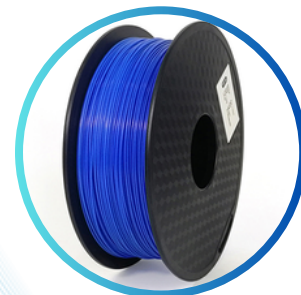
White and blue TPU filaments were used, highlighting the importance of the part's thickness, an extrusion width of 5–7 mm is recommended to provide both structural support and flexibility.

White TPU



High flexibility, elasticity, and impact resistance allow for the creation of adaptable and dynamic parts

Blue TPU

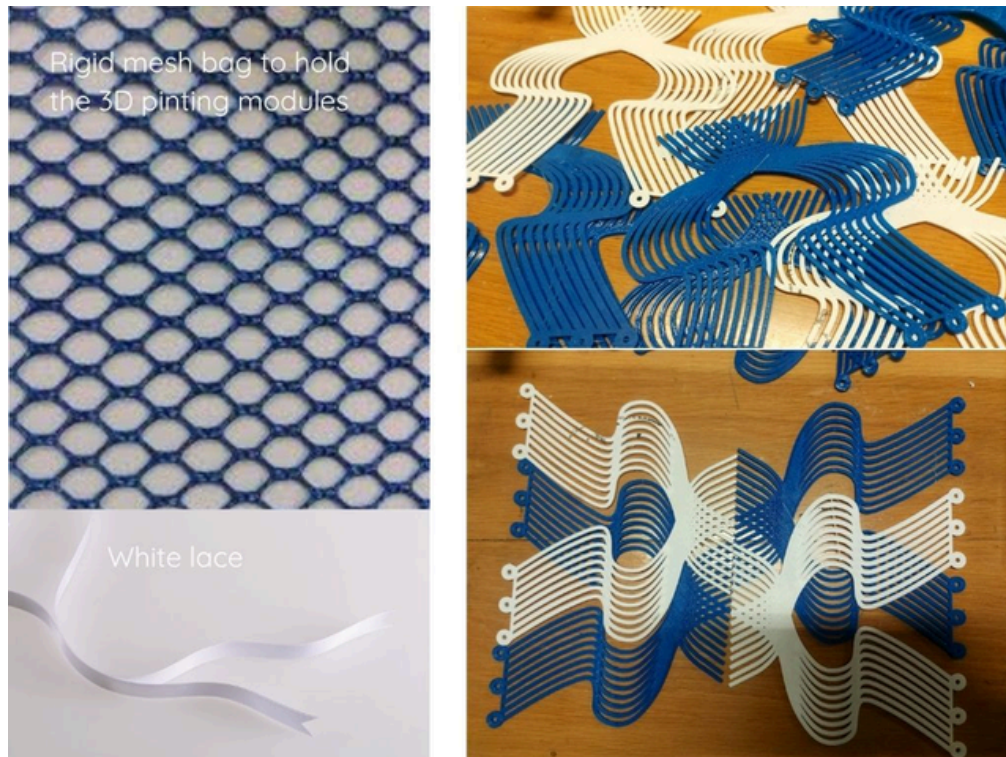


High flexibility, elasticity, and impact resistance allow for the creation of adaptable and dynamic parts

## Assembly

With a medium temperature and a slight retraction, it will be possible to join the modules and maintain a clean appearance; always remember to remove excess material from the nozzle so it doesn't contaminate the part with leftover material.

After printing the necessary modules, they were simply joined with a silk ribbon; you can add as many modules as you want to create different dimensions of the final piece.



# FUTURE AND POSIBILITIES

The future of Liquid Gestures, more than the products themselves, is envisioned as a system capable of generating an identity that can be replicated in any activity, sport, or form of movement seeking to be translated and transferred to any piece, garment, or personalized product that represents the user, creating a user-product relationship as well as a new way of transforming the sense of belonging and/or the relationship between a natural element and the body.

Likewise, a broader exploration of materials and filaments is intended; that is, I believe there is still a vast area for experimentation regarding the reaction of different types of filaments and their adhesion to specialized sports fabrics. Personally, I see a vast opportunity for the future of garment customization. In the future, the use of recycled textiles or alternatives with a lower environmental impact that retain similar properties of elasticity and durability could be explored, thereby maintaining the functional qualities required by the project.

## CONCLUSION

Liquid Gestures allowed us to explore the relationship between body, movement, and technology by translating aquatic gestures into tangible design elements. The project demonstrated that movement can function as a generator of information capable of producing patterns, modules, and structures using parametric design tools and digital fabrication. It also highlighted the potential of these methodologies to develop more personalized proposals centered on the bodily experience, opening new possibilities for future research in textile design, computational fashion, and personalization based on motion data.

While there are still areas for growth, it is a solid basis for concluding that this project helped me recognize that: Movement can become a design tool; it is possible to make the intangible tangible; we can create connections between innovative practices and traditional processes, humanizing technology; we can partner with parametric and generative design for new forms of creation; digital fabrication undoubtedly expands the possibilities of textile design and fashion; every movement is unique and unrepeatable and possesses unique potential.

# ACKNOWLEDGEMENT

For me, Fabricademy represents a very important milestone in my life, both professionally and personally. Having the opportunity to learn more about digital fabrication as it applies to textiles has been incredibly enriching and instrumental in helping me continue on the path that has led me to the field of fashion and textile design, specifically, textile innovation.

I would like to express my deepest gratitude to everyone involved who made my participation and progress during this period possible. To the local instructors at FAB LAB IBERO PUEBLA for sharing their knowledge with me, especially my local instructor Raúl Babines for his commitment and dedication in guiding me throughout my Fabricademy experience, for his willingness to help, and for always encouraging me to explore new paths in the realm of design and experimentation. To my classmates Laura, Sam, Dani, and Beto for sharing the classroom and always being willing to help and collaborate.

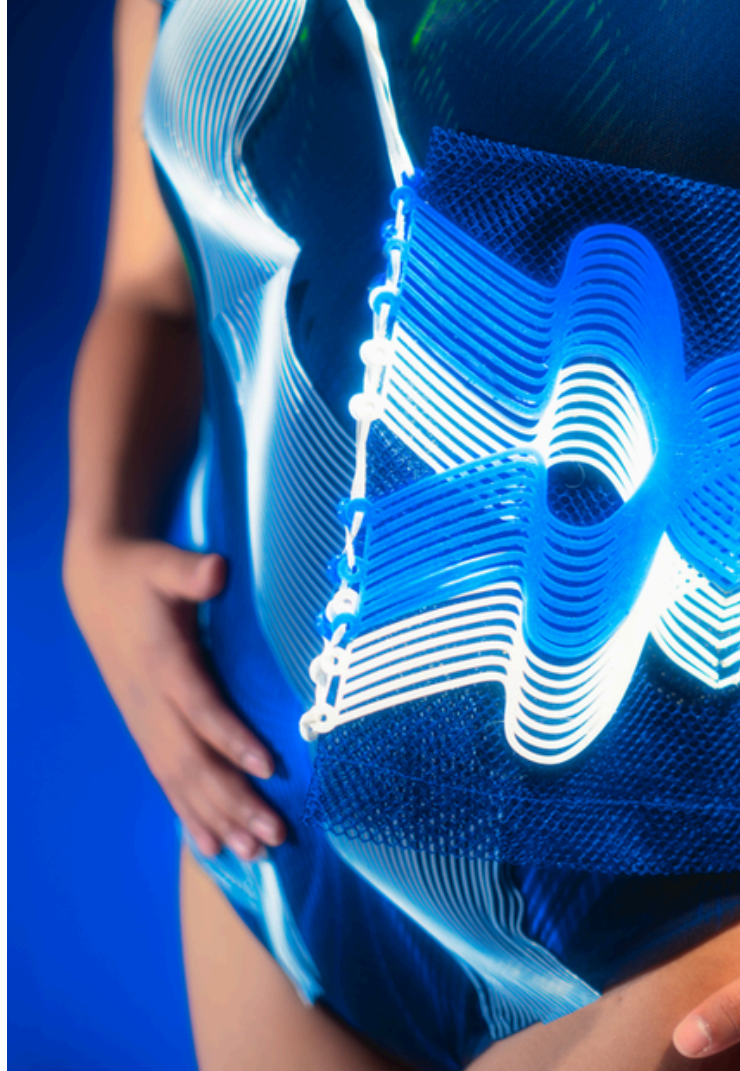
To my global instructors for their support and guidance throughout my journey, and to everyone who was directly or indirectly involved and willing to collaborate so that I could complete this course, because success isn't achieved alone, and without them, this wouldn't have been possible.

For now, I'm left with a great feeling and a desire to keep learning more about the latest innovations in design and art so that I can grow in this field and share everything I've learned and all my knowledge.

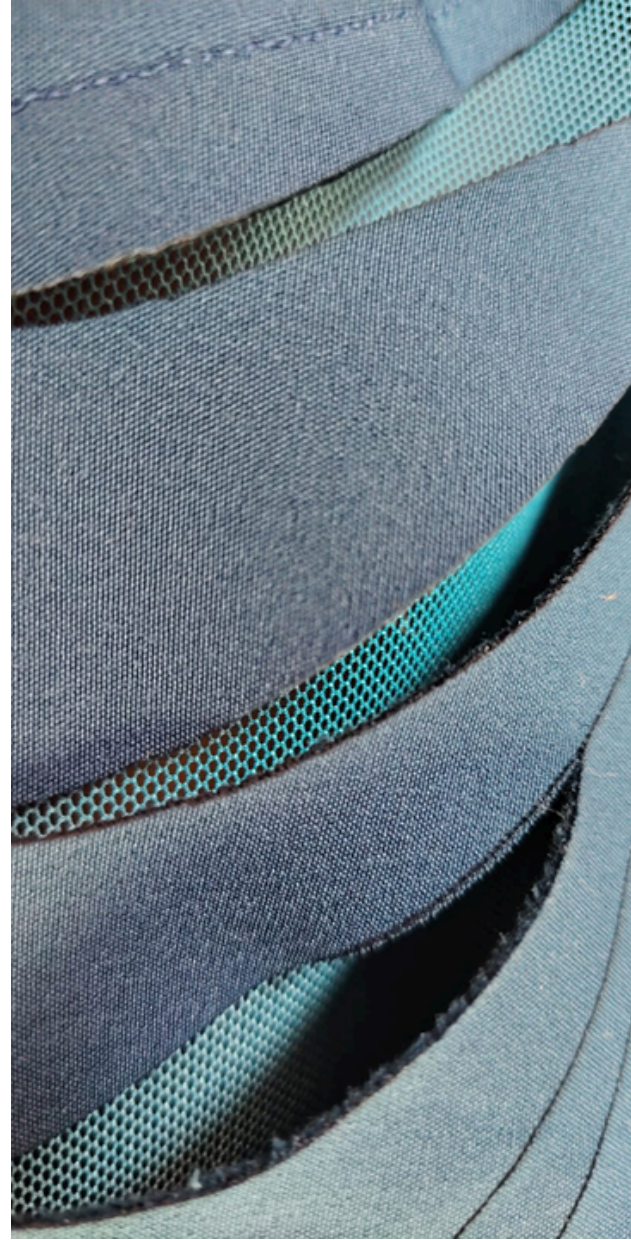
# GALLERY











**Model:**  
Fatima Islas  
**Photographer:**  
Jesús Rafael JR  
**Styling:**  
Monse Islas

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