

# **Art of Fabricating Tangible Surfaces 2025**

# Introduction

Presentation of myself and summary of the docs

## About me

My name is Martin Gadet. I'm a French student in the first year of a Master's degree in Human-Computer Interaction (HCI) at Paris-Saclay University. I graduated with a Bachelor's degree in Computer Science from the IUT of Orsay. After my Master's, I would like to start working in the industry.

I'm passionate about music and I play the bass guitar and the drums. I'm also a climber and I practice bouldering.

# Week 1

First week work description

## Install softwares

After a short introduction to the course, the website, and the project, we had to install three pieces of software that we will use during the project:

- **xTool Creative Space**, which is used for the laser cutting machine
- **PrusaSlicer**, which is used for 3D printers
- **Autodesk Fusion 360**, which is a tool for creating 3D objects

## Introduction to Fusion 360

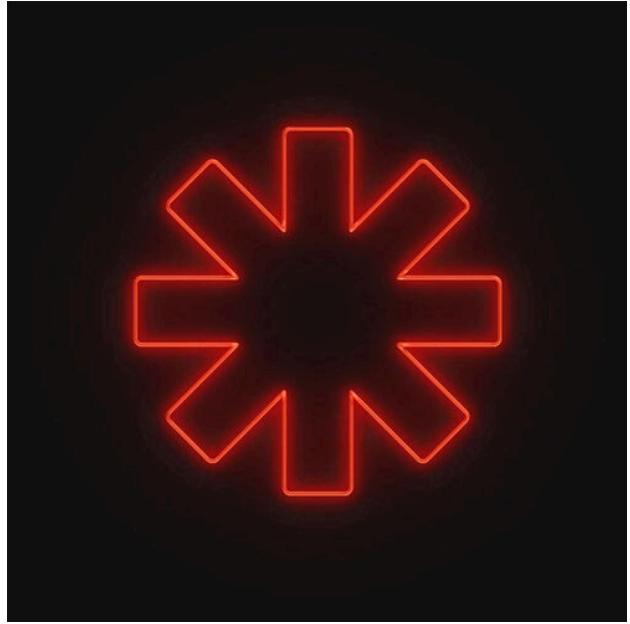
We started using Fusion 360 to test some basic features like "*Create a sketch*" and "*Merge sketches*." We also learned how to create simple shapes (circle, rectangle, lines) and how to repeat them in a circular or rectangular pattern.

## Pattern Idea

After that, we started thinking about our project. Based on previous examples and ideas given by the teacher, I came up with a pattern idea. As I said in the "*About Me*" section, I'm passionate about music, especially rock. My favorite rock band is the Red Hot Chili Peppers, and their logo could make an interesting pattern.



Red Hot Chili Peppers members



Red Hot Chili Peppers logo

So, my idea is to use their star logo to create a patterned surface by connecting several stars together. As a potential application for this patterned surface, I thought about designing a guitar strap or a ukulele case (a guitar case would be too large).



Guitar strap

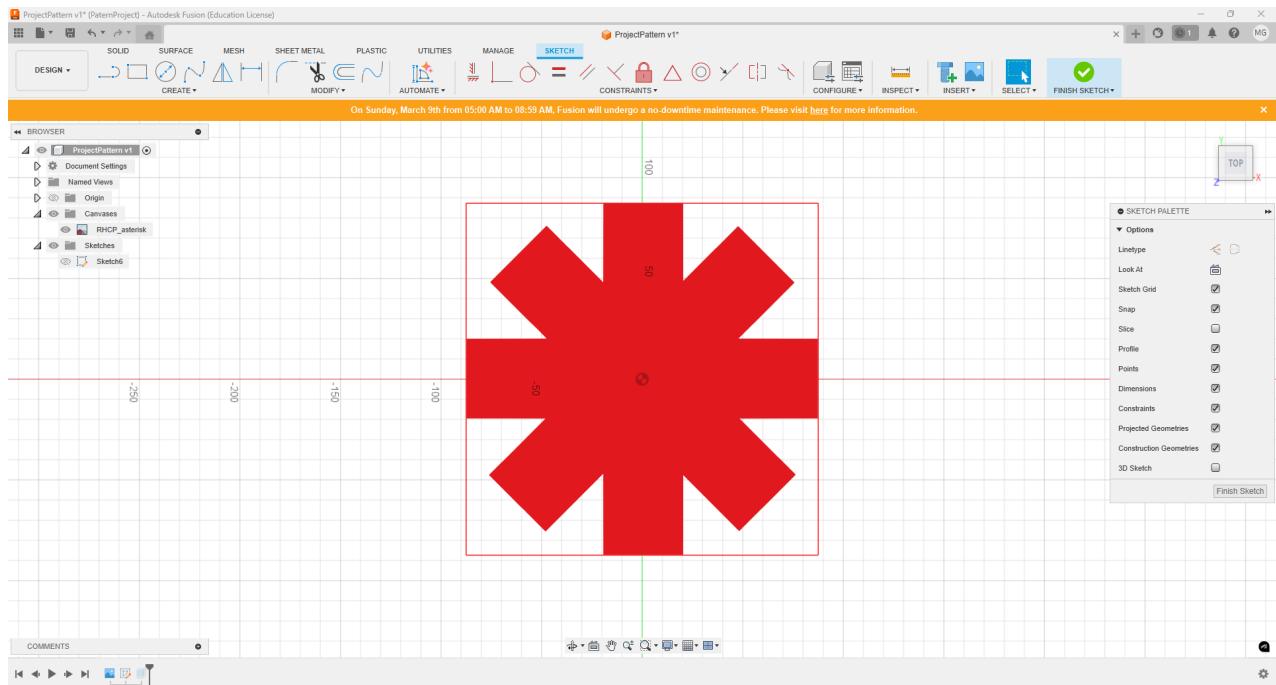


Ukulele case

# Start creating 3D star pattern with Fusion

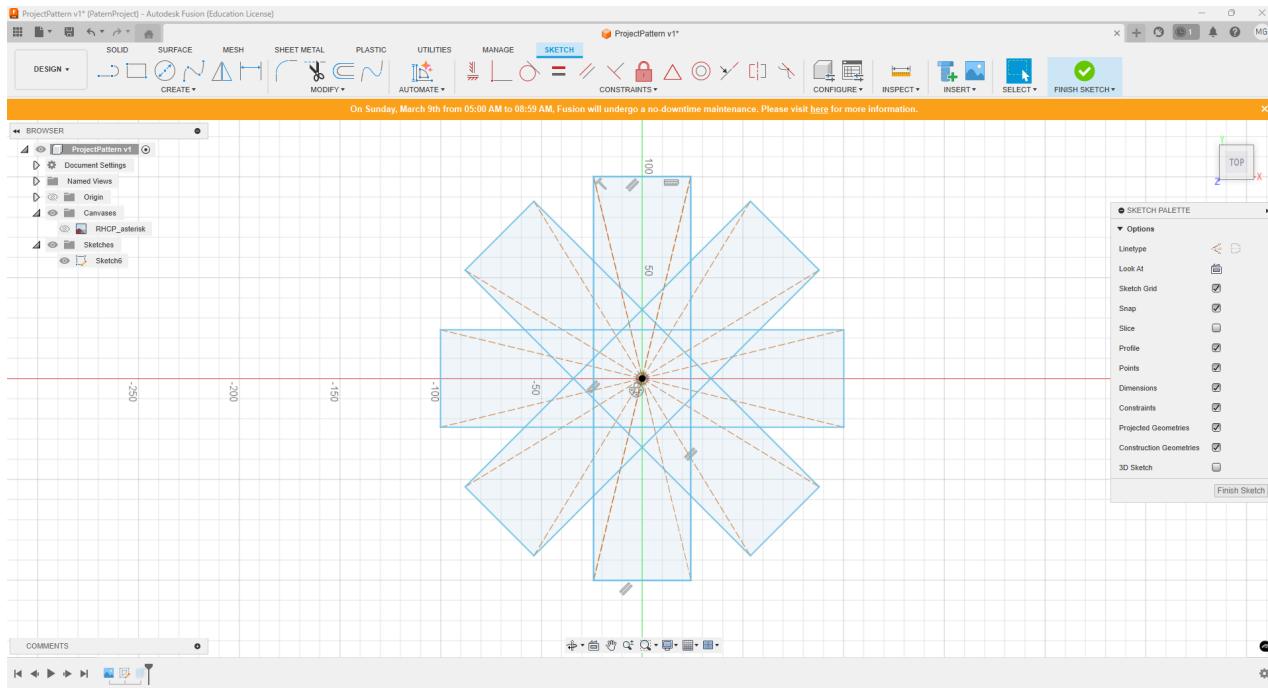
Following this idea, I started designing the logo in Fusion 360.

My first attempt was to import a canvas of the logo to use as a reference.

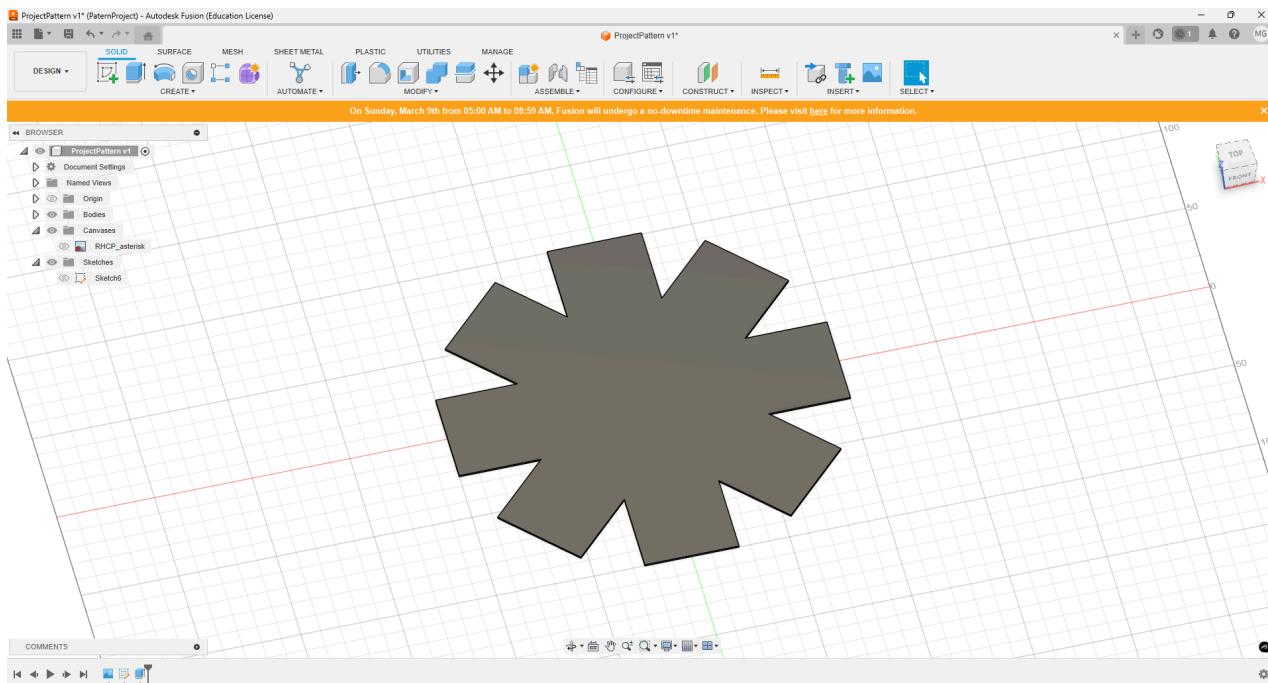


Logo Canvas

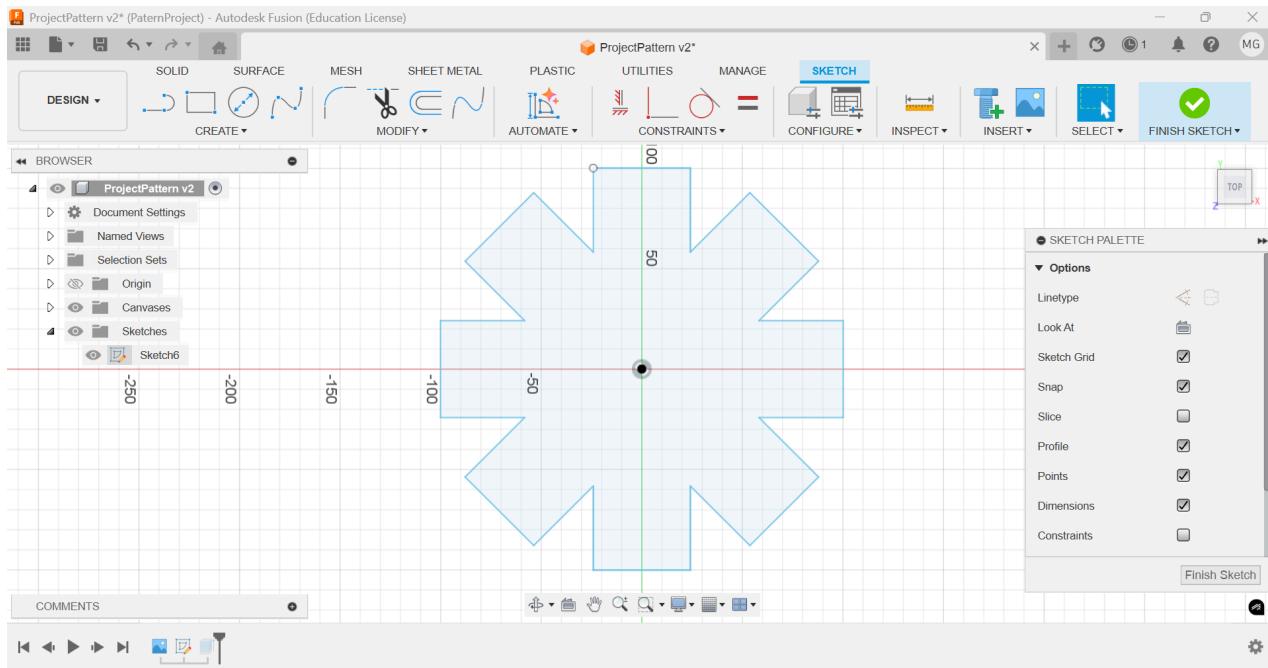
However, it was difficult to distinguish between my sketch and the canvas. After removing the canvas, I created a rectangle from the center and then used the circular pattern tool to duplicate it around the center. In the end, I had four rectangles forming the Red Hot Chili Peppers' star logo.



Rectangles sketch

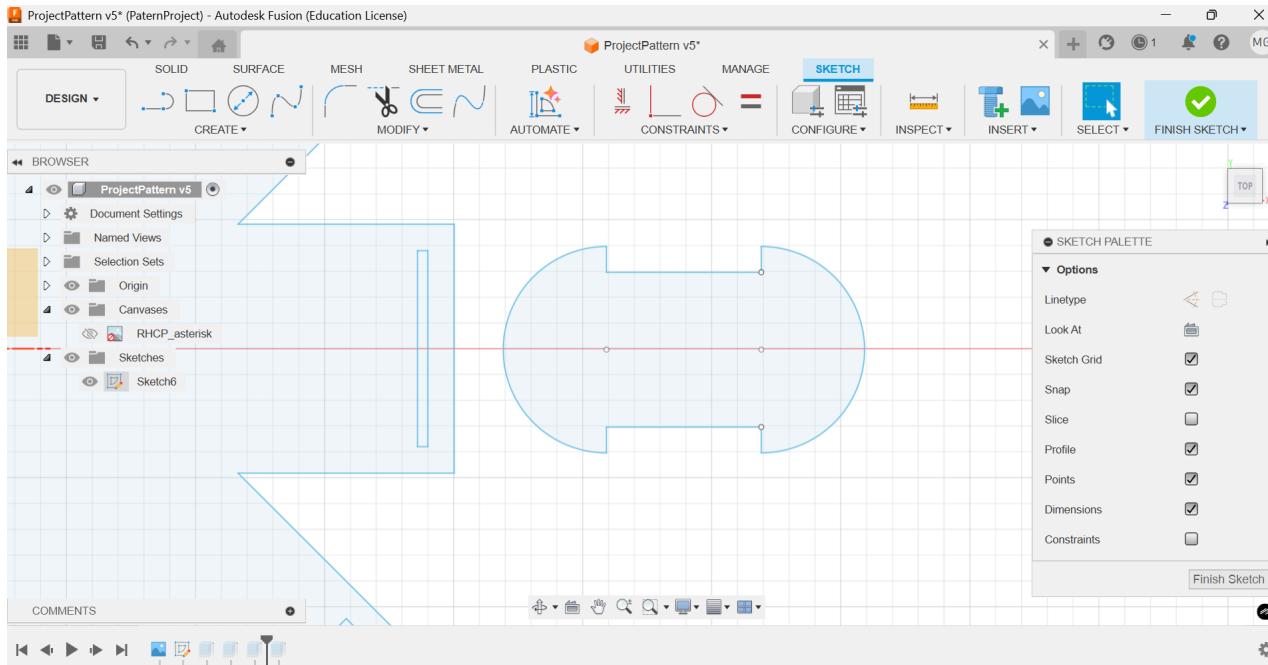


3D logo



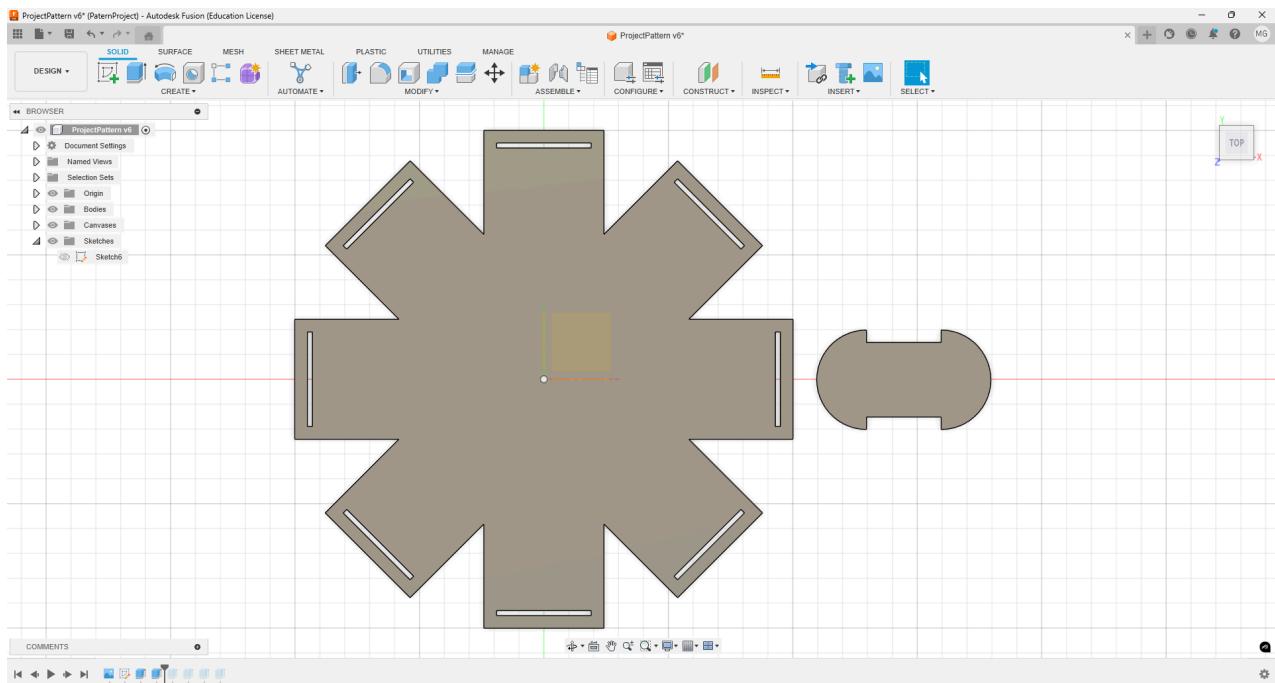
Sketch trimmed

To cut out the star shape, I had to modify the sketch. I used the *trim* tool to remove the inner lines and keep only the outer lines that define the star.



Hook to link stars

I also designed a way to connect the stars using a small hook. This hook fits into little rectangular holes, as shown in the picture above. I'm not sure if the size of the hook is correct, so I will try different sizes next week to test how strong they are.



Final result

Finally, I extruded the two pieces to make them 3D, ready for printing. This is my first draft, and I will try to cut it next week.

# Week 2

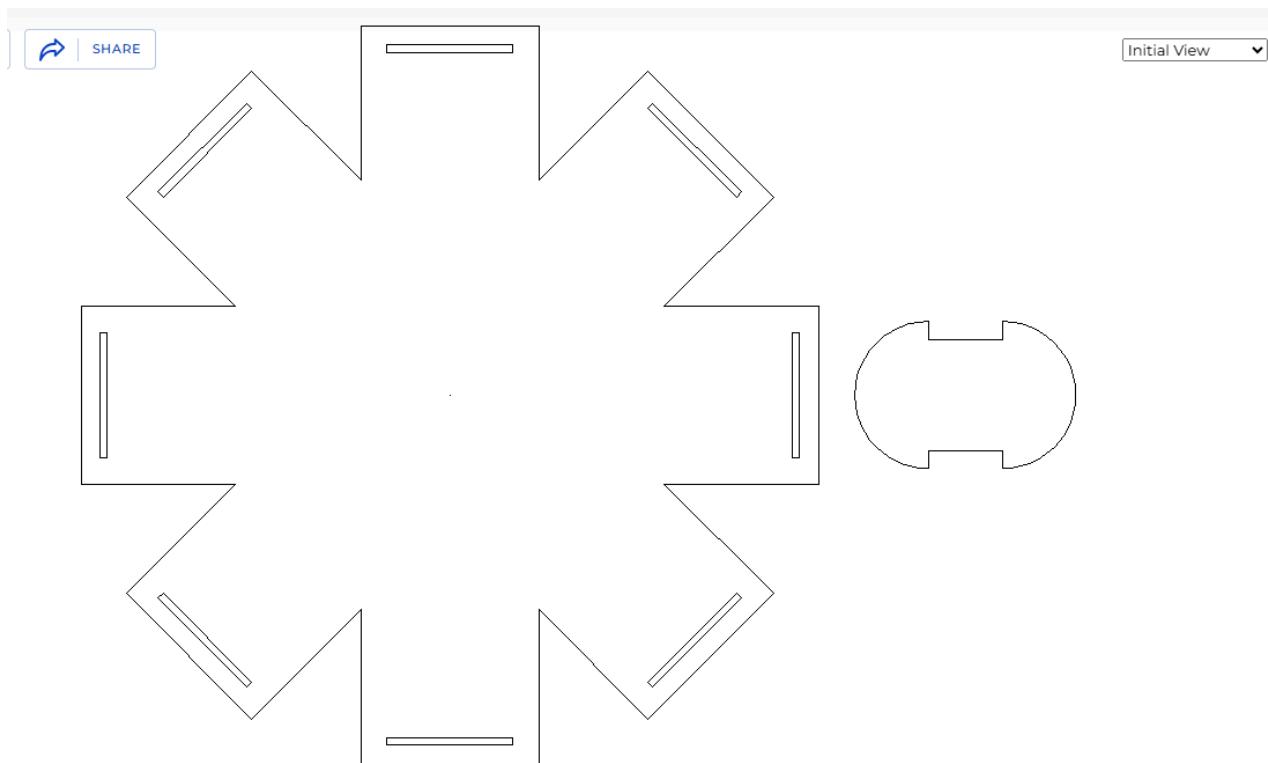
Second week work description

## Laser cutting

This week, I tested my design using paper and a laser cutting machine.

To use the laser cutter, I needed to export my sketch in **DXF format**.

After exporting, I used an online DXF viewer to check what the file looked like. I noticed that some extra lines appeared in the DXF file but were not visible in my sketch. I discovered that the diagonals from the rectangles that form the star were still there. After removing them, I re-exported the DXF file to prepare for the first laser cut.



DXF file view

The laser cutting machine works with **xTool Creative Space** software.

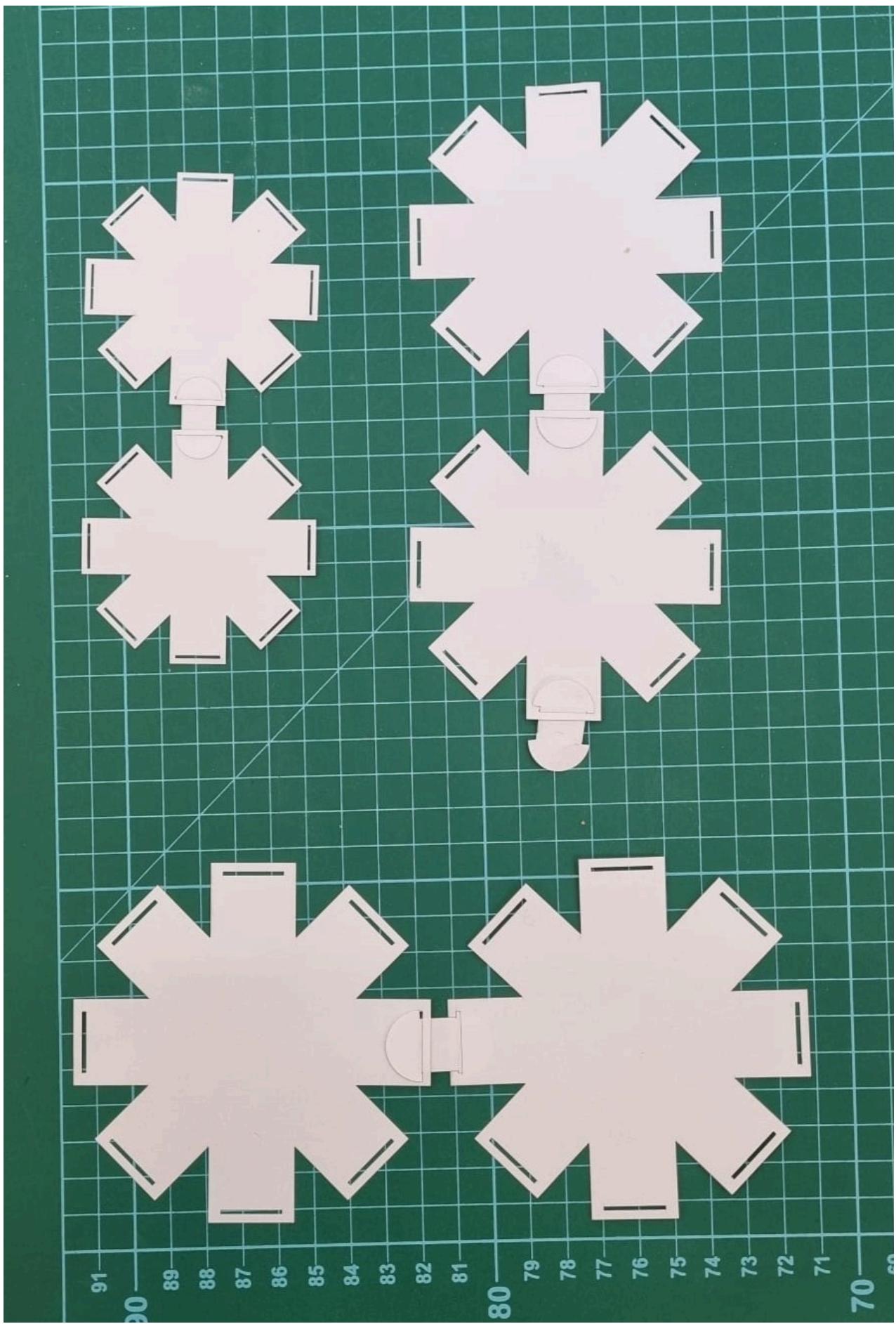
Here are the steps I followed to cut the paper:

1. Create a new project
2. Import the DXF file
3. Open the machine and place a sheet of paper in the corner
4. Place metal bars on the paper to keep it from moving
5. Update the background image to see where the paper is
6. Position the DXF design correctly on the screen
7. Set the cutting parameters (Power: 100, Speed: 50, Cut mode)
8. Start the cut in the software
9. Press the start button on the machine

After the first cut, I noticed that the holes where the hooks should go were too big. The stars couldn't stay connected and fell apart. To fix this, I reduced the hole size significantly.

Unfortunately, after the second cut, the holes were too small. So for the third and final cut, I slightly increased the hole size to find the perfect fit.

As you can see in the picture below, there are three test cuts — the final (and best) one is at the bottom.



### The 3 laser cutting tests

Using the xTool software was very easy. It's simple to position and resize pattern pieces on the paper. In the end, I created a clean and functional paper test for my pattern.

However, I faced a new problem I hadn't considered before:

**How can I attach a star to my guitar to make a guitar strap?**

With the current hole design, it's not possible to attach the star to the guitar. So I need to create **two stars with round holes** that can fit onto the guitar pins. These pins look like the ones in the picture below.



Guitar button for strap

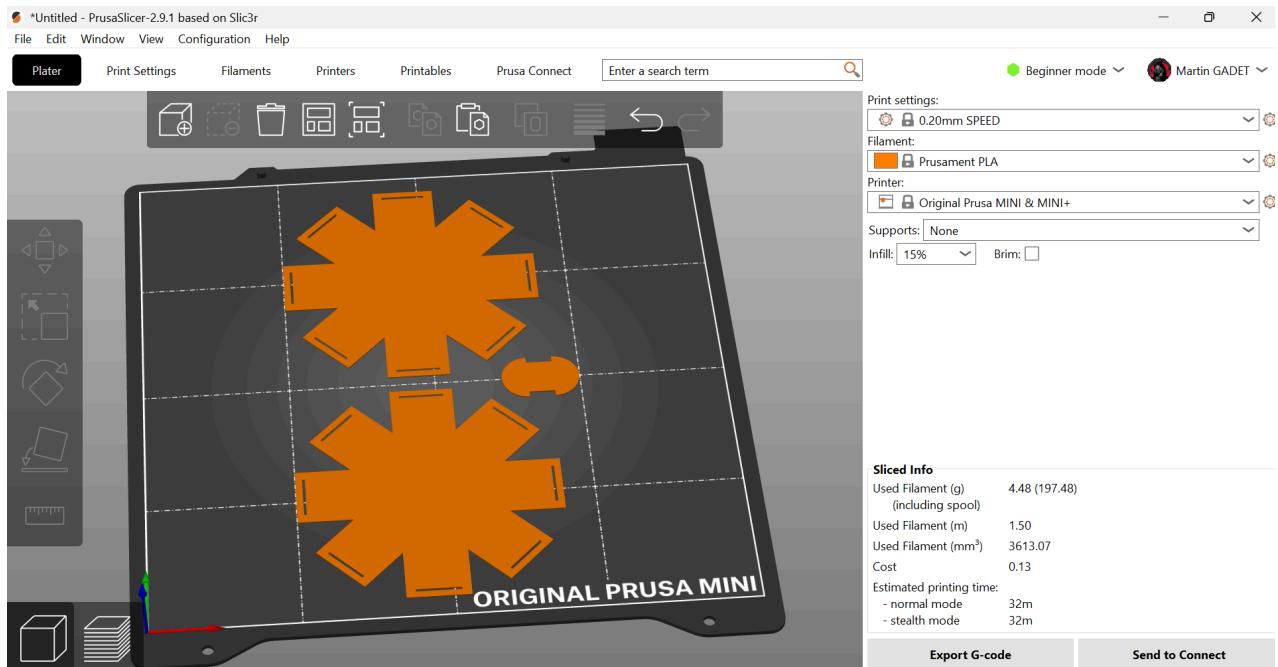
# Week 3

Third week work description

## 3D printing

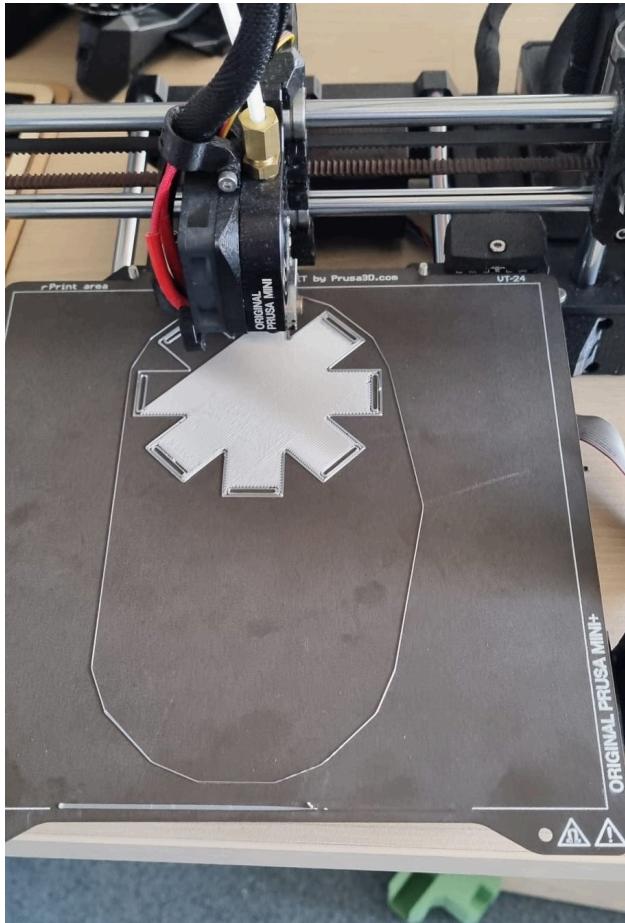
This week, I started 3D printing.

First, I needed to export my pieces from Fusion 360 in **3MF format**, and then import them into **PrusaSlicer**. I duplicated the star to test how well two stars could be connected using one hook. For my first test, I tried a thickness of **0.4 mm** (2 layers).

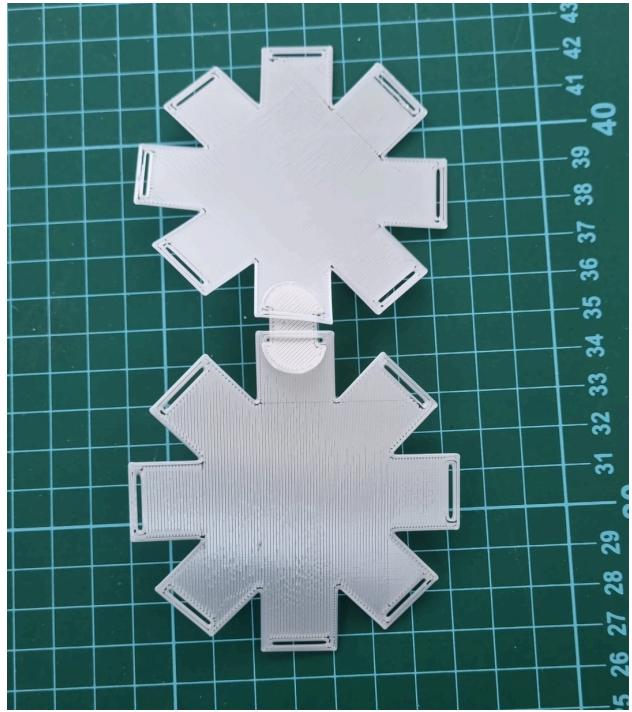


PrusaSlicer view of V1

I also reduced the original size of the star using the "**Object Manipulation**" panel in PrusaSlicer, so I could fit two stars on the printer's platform. I scaled the design down to **40%** of the original size, which gave me a star of about **8 cm**.



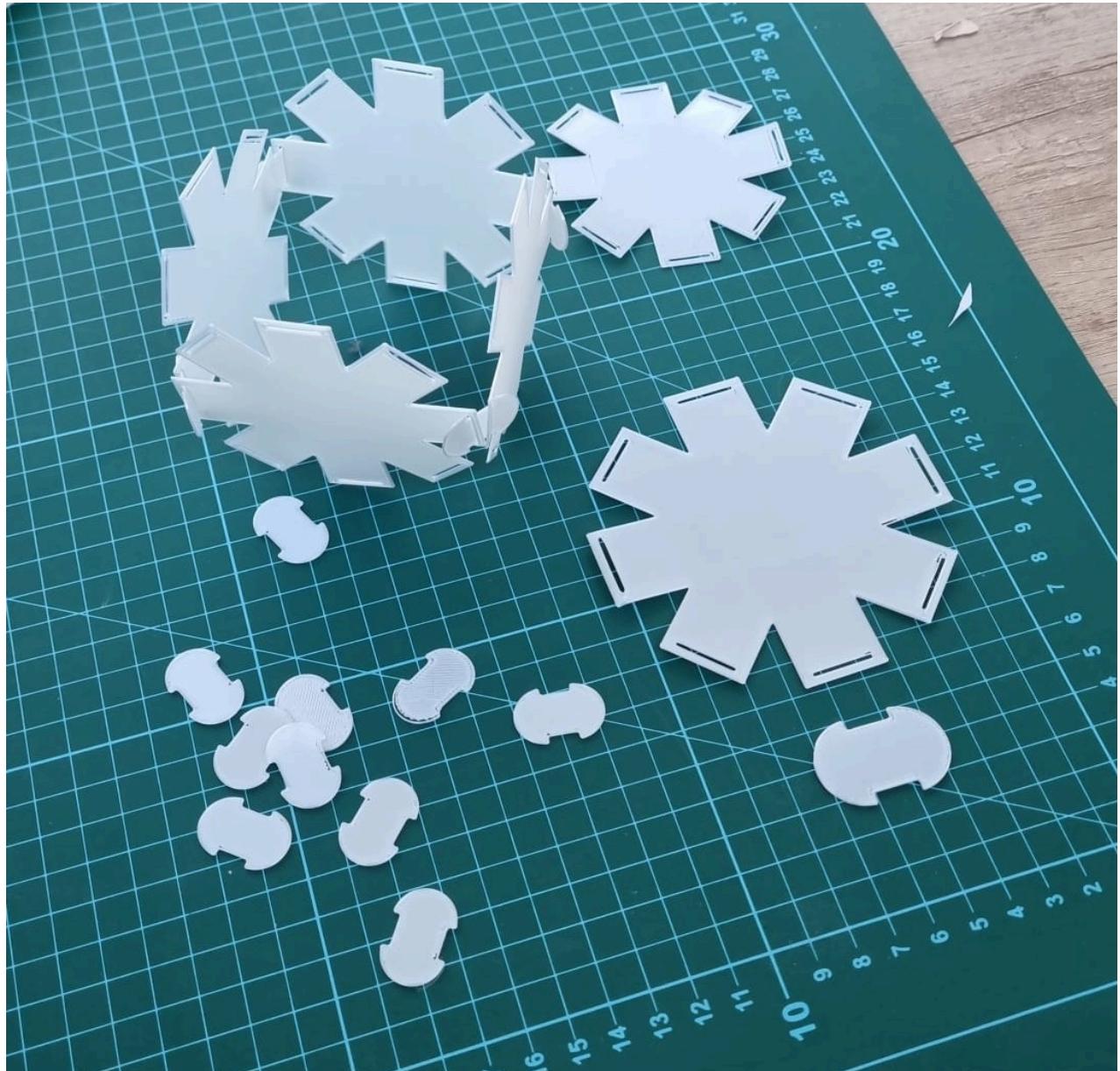
V1 during printing



V1 attached

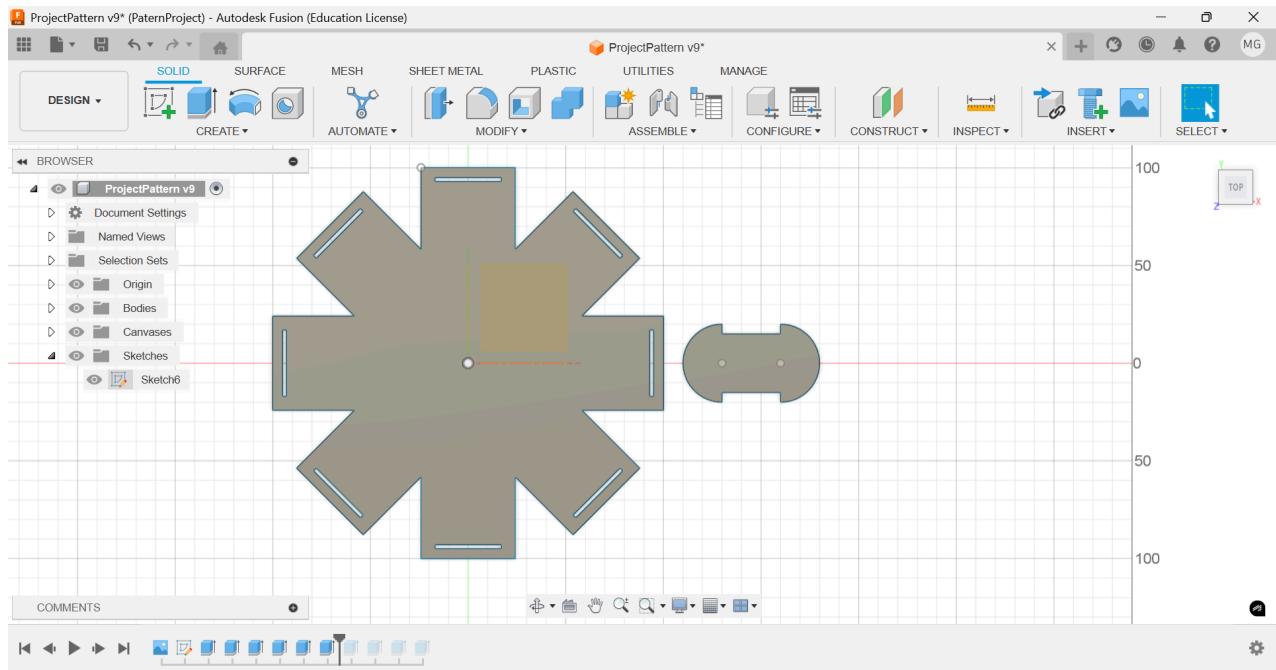
After printing version 1, I realized that **0.4 mm** was too thin, and the parts were not strong enough. So, I increased the thickness directly in PrusaSlicer to **0.6 mm** to make the pieces more solid.

In the next picture, you can see a construction test where I tried to create a 3D shape with my pattern. Here, I made a kind of cube using four stars.



V2 construction try

After version 2, I noticed that the connectors were **too short**. I slightly increased their length in Fusion 360 and re-exported everything.



Last Fusion version file

For my final test, I increased the size to **50%**, making the star **10 cm** wide. This is because I need a large enough star to create a hole big enough for the **guitar pin**.

### Object manipulation

Name: **Body11**

**x**  **y**  **z**

Position:    mm

Rotate (relative):    °

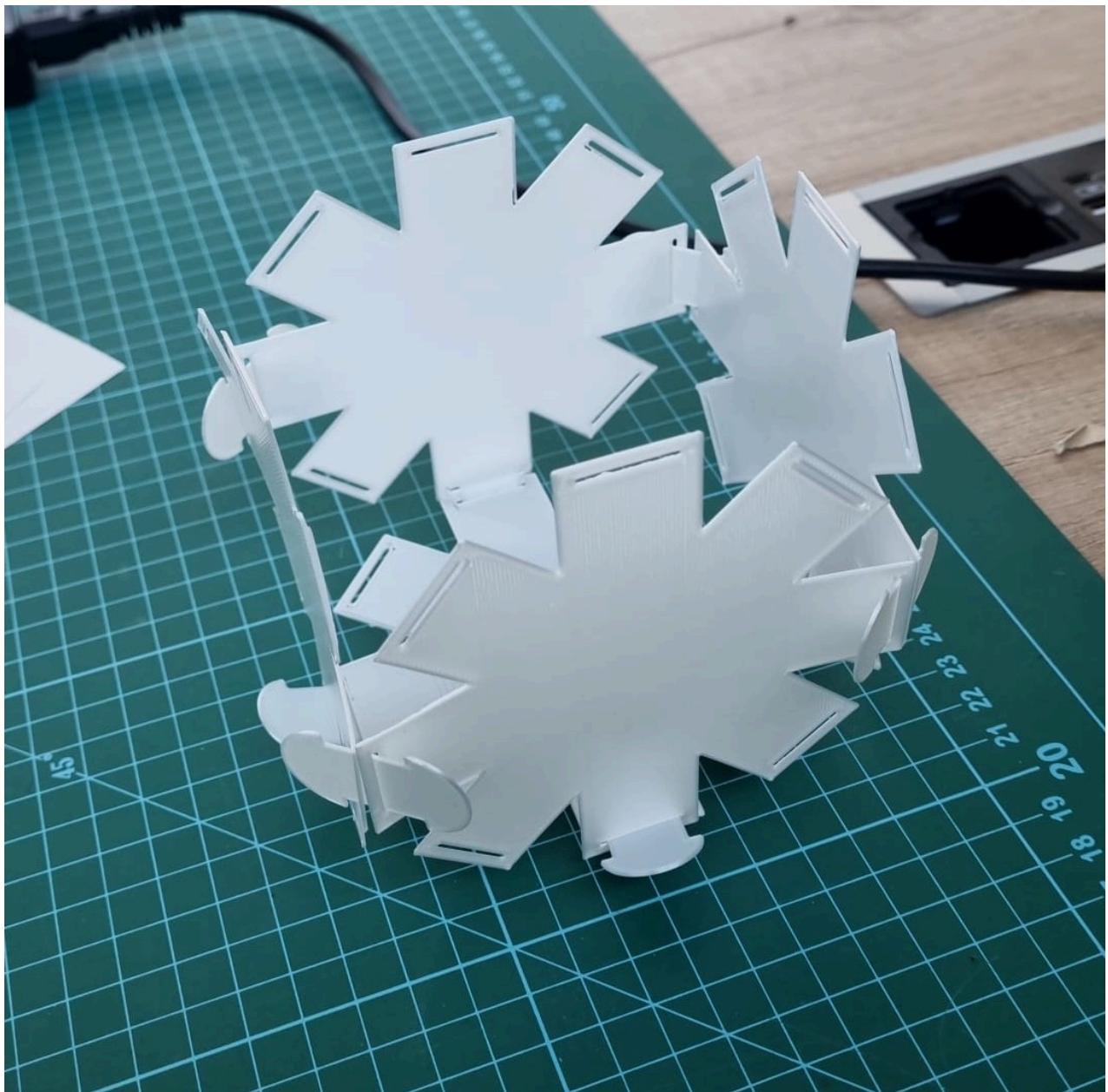


Scale factors:    %

Size [World]:    mm

Inches

Final "Object Manipulation" panel



Start building the Ukulele case

I also started building the **ukulele case**, and I will continue printing more parts since the project isn't finished yet.

## Filament changing

To finish, I wanted to test a different filament. So, I learned how to change it: You just need to go to the **Filament menu** and choose "**Change Filament**". Then, follow the steps to unload the old filament and load the new one.

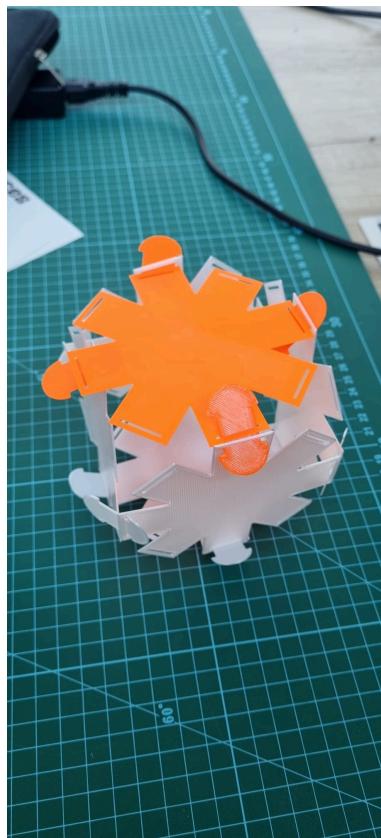


Main menu



Filament menu

For this test, I used **orange PETG filament**. This filament requires a **higher temperature** to melt. It is **more solid and less flexible** than the one I used before.



Final construction for the week 3

# Week 4

Fourth week work description

## Mass production

This week, I continued printing my pattern again and again until I complete the required 1 square meter surface.

# Week 5

Fifth week work description

## Printing problem solving

This week, I solved a problem I've been facing since the beginning: I could only print **one star at a time**, and each print took **37 minutes**. That was too long for just one piece.

So, I tried creating a new print file using a classmate's computer. On their version of **PrusaSlicer**, I was able to place **two stars** on the plate, and the total print time was only **27 minutes**. I'm not sure what caused the issue with my version, but now the problem is solved, and I can print more stars faster.

## Building ukulélé case

This week, I also finished building my **ukulele case**. To place the ukulele inside, you can open the three stars on the side closest to you in the picture. After placing the instrument inside, you can close the case and carry your ukulele anywhere you want.

I don't own a ukulele, so I will make a **life-size cardboard model** to check if it fits inside the case.



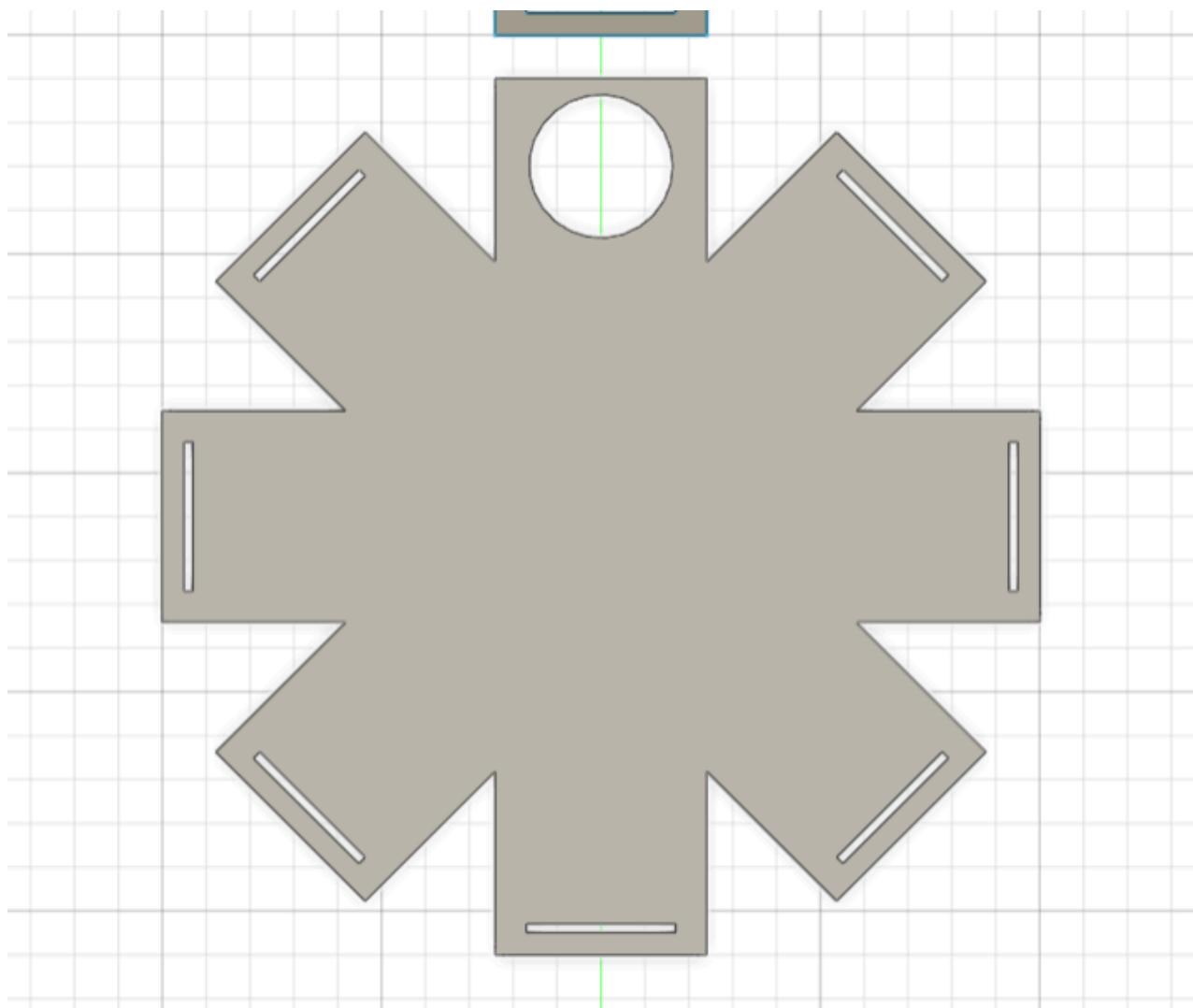
Ukulélé case

## Finishing printing

I also finished printing my pattern. In the end, I printed **85 stars** measuring **10×10 cm**, along with some connectors. These stars represent a surface of **85 square decimeters**, and when you include the spaces between the stars connected by the hooks, the total area reaches **1 square meter**, as required.

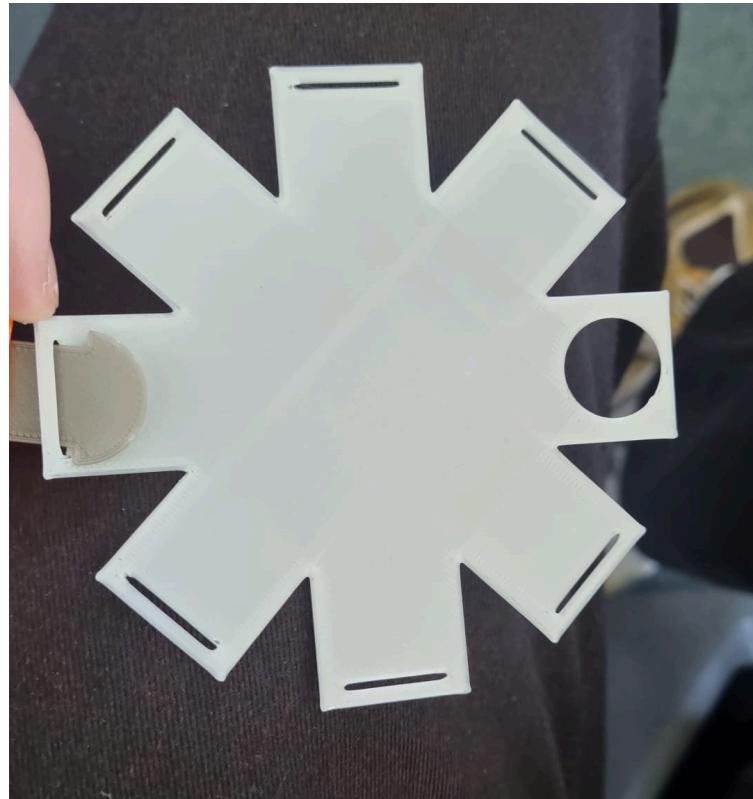
## Pattern with round hole for the guitar strap

After finishing the ukulele case, I started creating the **guitar strap**. To do this, I needed to design a **star with a round hole** for the **guitar pin**.



Star with round hole on Fusion

In **Fusion 360**, I duplicated the original star and replaced one of the connector holes with a round one. Then I exported the design and printed **two stars** with round holes in **PrusaSlicer**.



Printed star with round hole

In the end, I had stars ready to attach to the guitar pins, and I could finally build the strap.

## Build the guitar strap

To build it, I started with one **white star** and then attached the others **one by one** until the length felt comfortable. To adjust the size, you can simply remove or add stars.



Guitar strap around me

## Build a tote bag

With the extra pattern pieces I had left, I built a **tote bag** to carry things like **guitar pedals**.



Tote bag

# Week 6

Final week work description

## Laser cutting of cardboard guitar and ukulélé

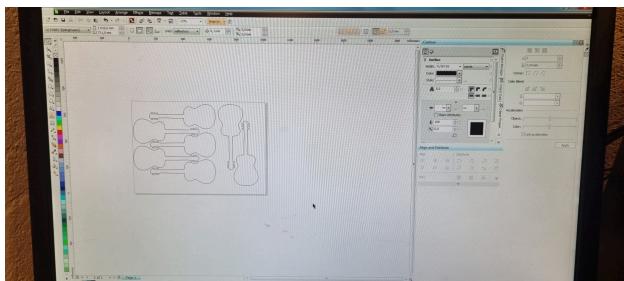
This week, I started working on materials to **present my project**. I planned to **laser cut a guitar** to display the **guitar strap**, and a **ukulele** to present the **ukulele case**.

To do this, I searched online for **DXF or CDR files** that looked like a guitar or a ukulele. I found two files that matched what I was looking for on <https://3axis.co>. This website gathers files from different creators who share their **laser cut designs**.

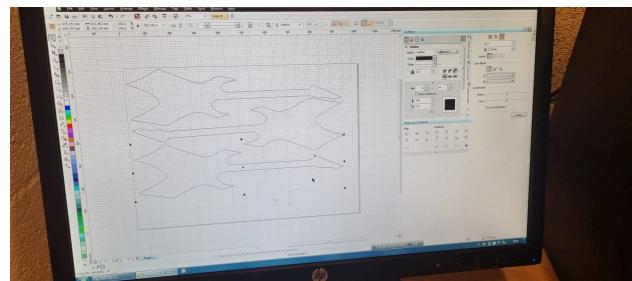
Then, I opened the two DXF files in **CorelDraw** to check their appearance and prepare them for laser cutting.

Using the **large laser cutting machine** is more complex than the smaller one. First, we had to cut a large piece of cardboard to fit into the machine. Then, we needed to **calibrate the laser**, **turn on the smoke evacuator**, and finally **press the start button** to begin cutting.

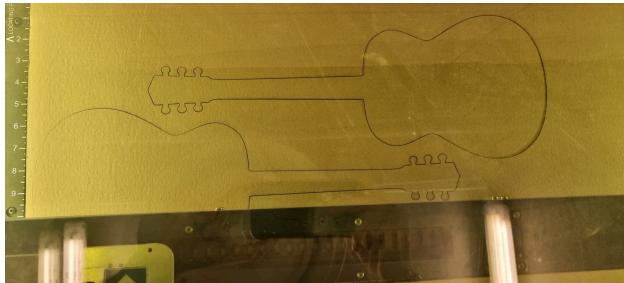
In the following pictures, you can see how the guitar and ukulele were cut. I chose to cut **several parts**, which I will assemble later using glue.



Ukulélé cdr file



Guitar cdr file



Ukulélé durring cutting



Guitar during cutting

Here are some images of the **cutting process** for the different pieces.



Guitar after cutting



Ukulélé being assembled with glue



Assembled cardboard guitar and ukulélé

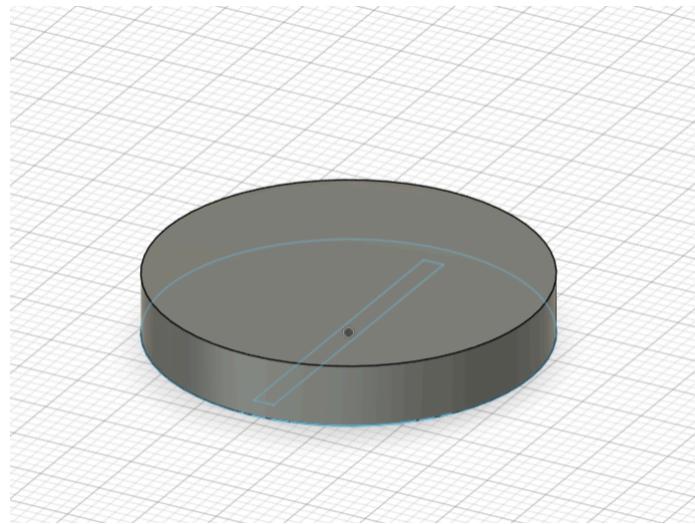


Cardboard ukulélé inside the case

## Building of guitar pins for the strap

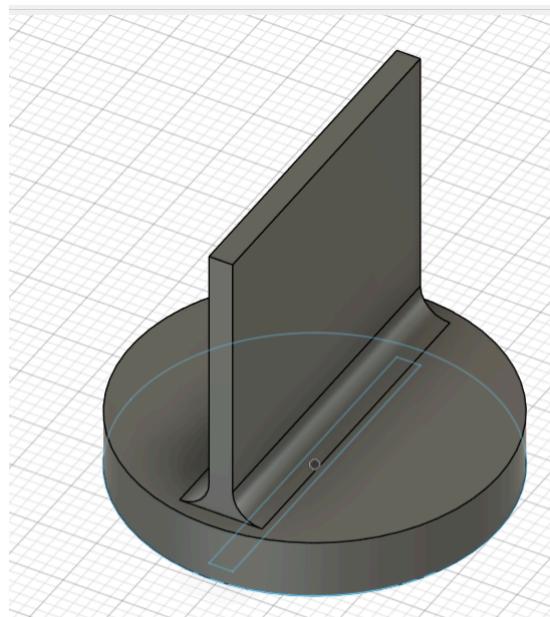
To use the guitar strap correctly, I needed **pins** to attach it. At first, I tried to make them out of cardboard, but I wasn't satisfied with the result—they weren't strong enough.

So, I decided to **3D print the pins** instead. This way, they would be **stronger and more precise**.



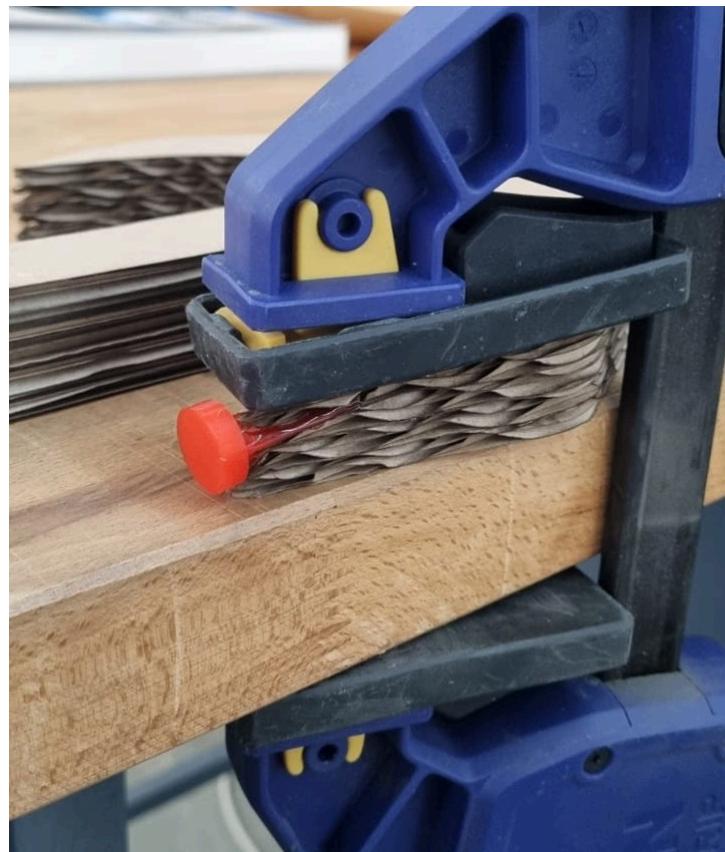
First version of pin in Fusion 360

After printing the first version, I realized it was difficult to **glue them onto the cardboard guitar**. So, I went back to **Fusion 360** and created a **second version** of the pin.



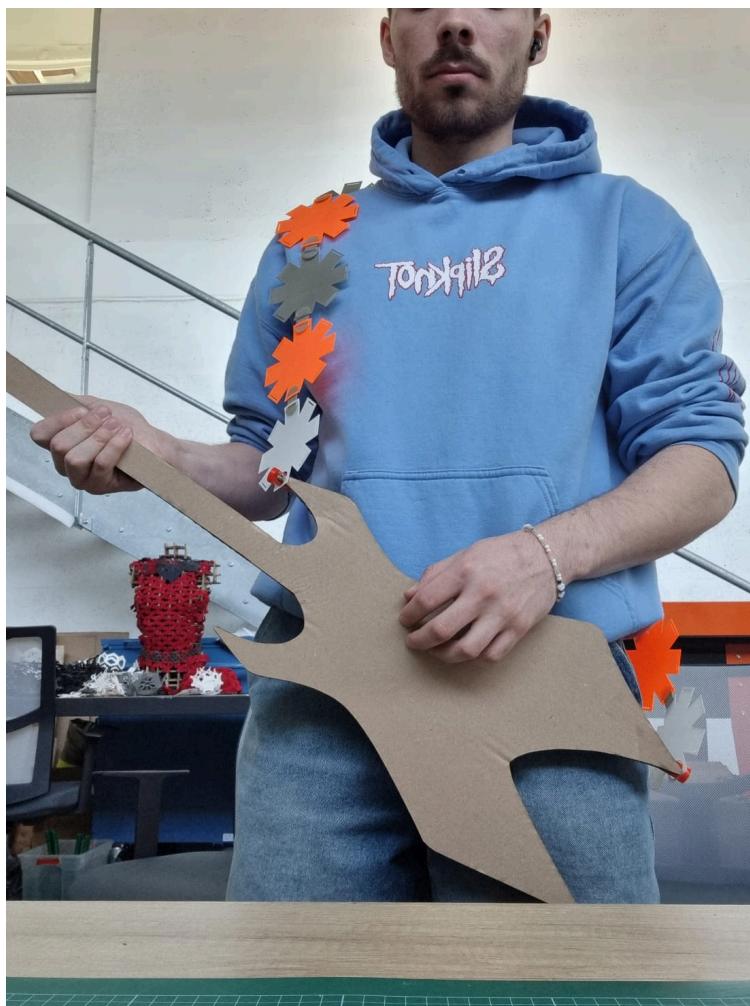
Second version of the pin in Fusion

Finally, after printing the pin, I glued it onto the guitar and used pliers to hold it in place while the glue dried.



Pin inside the guitar

After the glue drying, I was able to attach the strap to the guitar and wear it like a real one.



Guitar with the strap

# Week 7

Exhibition !!!

During the week 7 we set up the exhibition with our final creations. We also add a cartel that explain briefly our work. We all got the same template created by Sergei on Figma.

The cartel features a teal background. In the top left corner is a QR code with the text "SCAN ME" below it. In the bottom left, the name "Martin GADET" is printed. The central title "RED HOT 3D printed music accessories" is displayed in large, white, sans-serif font. Below the title, a paragraph explains the project's origin: "This project was born from my passion for music, especially rock music and my desire to create something usable and useful." It then describes the design process: "The goal was to create a 3D-printed tangible surface based on a repetitive pattern. I chose the Red Hot Chili Peppers logo as pattern, because their music has had a strong impact on me. This surface was then used to design and prototype real objects related to music, including: 🎸 a guitar strap, 🎤 a tote bag, 🎵 a ukulele case". A note at the bottom states: "To make this stuff, I had to use different techniques like laser cutting, 3D printing and 3D design." To the right of the text area, there is a large, white, 3D-printed model of a guitar strap with a repeating grid pattern, resting against a blue background with a similar grid texture.

Cartel



Exhibition stand

At the end we also present our work in front of the whole class to explain the goal of the project and its inspirations.

# Conclusion

In this project, I tried to show one of my hobby which is music by representing the logo of my favourite band as a pattern. This group is the Red Hot Chili Peppers (the best band in the world). With 3D printed tangible surface, I was able to create stuff and accessories that can help me in making music and playing instrument.



Guitar strap



Pedal board tote bag



Ukulélé transport case

At the end I printed 85 patterns of 10x10cm, which represent 850 square centimeter. If we take into account the space between patterns due to the connectors , we have the mandatory 1 square meters.

My goal was to share my passion for music and for this band with others and also make stuff that I will be proud.