



Podogo

- Step foward -

Annie Ferlatte -2021 -

Use accessible fabrication technologies and softwares to digitize your feet and build an ultra-personalized sole design for your body shape and needs.

Different shape of feet mean different shape of shoes. Everybody has the right to have access to shoes that fit their feet even if the shape is not considered standard. Avoid waste creation by buying unadapted shoes. Instead, create your own pair that can be personalized, reused, upgraded, repaired and modified.

This guide will show you step by step a process to digitize your feet with a 3D scanner and build an ultra-personalized sole so it can fulfill your specific needs. This workshop is also a good way to use different fab lab technologies and increase your skills. Produce with local material and share your work to contribute to the communs.



Equipements

- 3D scanner
- 3D printer and TPU filament 85A
- Laser cutter
- Embroidery machine (depending of your design)
- Leather needle
- Precision pliers
- Computer with the softwares: Meshmixer, Fusion 360, Inkscape

Materials

- Vegetal leather
- Thick cotton wax rope
- Local fabric (Upcycle or biodegradable)

A to Z steps 3D scanning

Don't forget, this is only a process. Personalized your sole and shoe to fulfill your needs and style. Make it yours!

Make your 3D scanning set up and scan

Your feet change dimension depending its position. When you put weight on your feet, they become larger.

- Find a place bright with no direct light.
- Put an acrylique flat on 2 banches.
- Start 3D scanning with the help of a friend.

This project was made with the phone application Scandy Pro, but don't hesitate to take your fab lab 3D scanner.

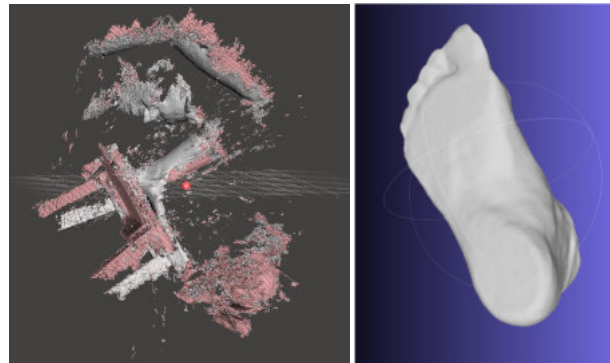
Clean your 3D scan with Meshmixer

When your scan will be done, it will look like this (picture to your left) and we want an end result like the picture to your right.

- Export from your 3D scanner display a file in .obj and mm unit if possible
- Open the file in Meshmixer and **select** a part that you want to keep. **Invert** your selection and **discard** everything that is not touching to the zone you select.
- **Fill** the holes if any and use the action tools **Plane cut** to create a clean finish. Last step is to **Remesh** your scan to lower the triangulation so the file will be lighter. Save in .STL

Action tools -- Keyboard shortcut

- Selection -- S
- Invert -- I
- Discard -- X
- Fill (holes) -- F



A to Z steps 3D modeling

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Import your scan into Fusion 360

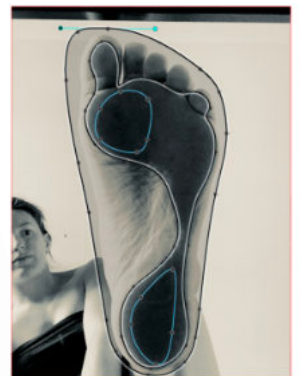
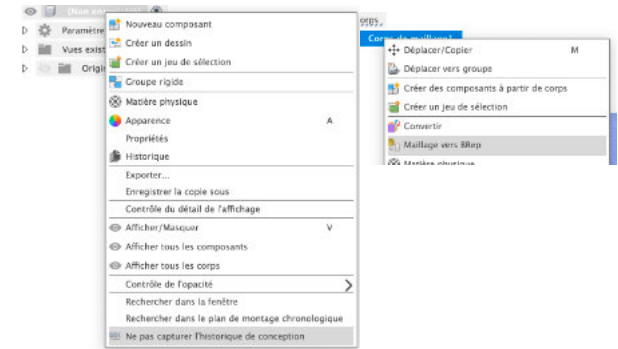
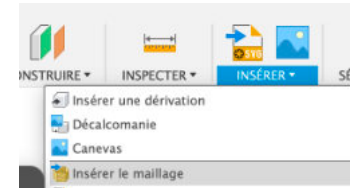
- In the menu **Insert**, click on **Insert a mesh file** and select your .stl file of your 3D scan. Make sure the select unit dimension is good.
- Stop the history of your file and transform your mesh (in the body section) into a Brep.
- Save this new Fusion 360 file.

Modify the Fusion 360 file

In this pre-made file, the history of the actions are all preserved. Go back at the beginning and replace the 3D scan file by yours.

- Take a picture of your underfeet, increase the contrast and put it black and white. Insert it in Fusion.
- Place it directly under your feet objects and size it to match the feet.
- Go in each box of the history line of and modify the lines to match your shapes.
If you need more holes to sew, make sure to have an unpair number.

This project was made with Fusion 360 because it's free for hobbyist, but you can achieve all these steps in your favorite software. This section is inspired by the project Gensole. They show another way to do it, but it achieves the same goal at the end.

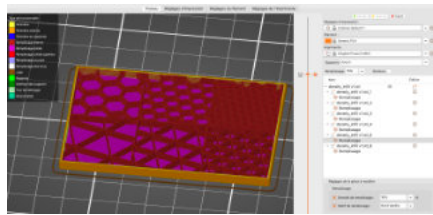
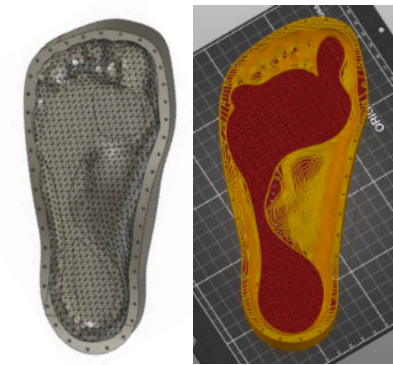


A to Z steps 3D printing

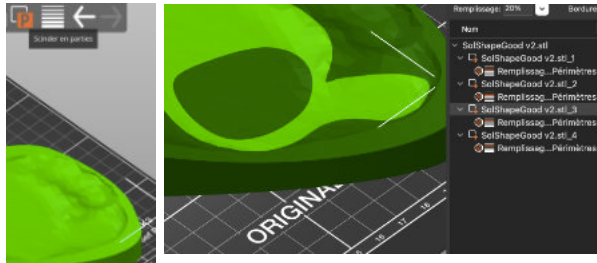
Don't forget, this is only a process. Personalized your sole and shoe to fulfill your needs and style. Make it yours!

3D print your sole

- The first picture is the final result from your modeling; one sole composed with multiple bodies. (One for each different density zone).
- Test your desire infill density. If you are not sure, create 6 cubes bodies that you can import in the Prussa Slicer and split the parts. Attribute different densities and settings for each parts. For this exemple, the sole needed to be breadable, so it was printed without horizontale layer at the bottom and on the top.
- When you find good settings with small samples, import your sole model and set up your favorite setting.
- Divide your model in two between the layers who delimitate the geometry of the foot and the rest of it.



Time to print! Every filament needs different settings. For this project I use the basic integrated settings for the flex material with 0.2mm layer thickness. The temperature is set to 240 deg celcius and the ambient temperature needs to be stable. Make sure to do a first layer calibration and to clean your printer nozzle.



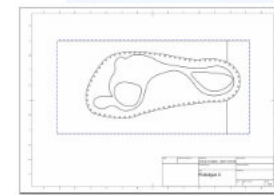
The sole in contact with the ground

This sole is made in 3 main sections. You just printed both pieces in the middle of the picture (the red ones). This middle part is the structural one. It will hold your arch and absorb some chocs. Next, focus on the layer to your left (the beige one). This one needs to be completely biodegradable so when you will scratch the surface it will create biodegradable microparticles. Choose a natural material, locally produced. Here is a vegetal leather that you can soak before laser cutting it. To prepare your files, export the PDF drawing from your 3D model.

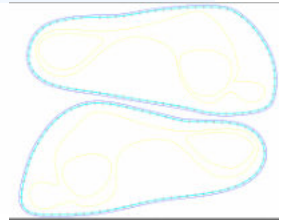
Your can also create this sole in macrame with double half hitch knot. Make sure you take a nice twisted natural fibers that is more likely to resist abrasion. Yucca or yute are good exemples, sadly not local here. You can refer to the documentation of this project on Fabricademy student 2021, Annie Ferlatte to have more informations to create macrame or braided sole.

A to Z steps The sole on the ground

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PDF drawing
Scale 1:1



Inkscape sole file
Ready for laser



Macrame sole



Vegetal leather sole

A to Z steps

The top sole and the assembly

Don't forget, this is only a process. Personalized your sole and shoe to fulfill your needs and style. Make it yours!

The top sole

Think about the properties that you need. This top sole will be in contact with your skin, find something that is adapted to you. Does it need to be breathable, warm, moist resistant etc. Then upcycle this material from clothes or furnitures. If it's similar to felt or suede, you can laser cut it. If it's woven for example, import your drawing into an embroidery machine and make a zig zag stitch on your drawing lines to cut it and have a nice finish.



The assembly

- Sew with a leather needle the layer in contact with ground (the vegetal leather here) and the first layer 3D printed
- Sew one hole offset from the previous step the layer that is touching the skin and the other 3d printed one. (the one with the foot geometry)
- Last step, add your shoe design in the middle and sew all layer together like the the picture.



Congratulation, you made it!

#podogo



<https://class.textile-academy.org/2021/annie.ferlatte/finalproject.html>

<http://gensole.com/instructions/>

<http://www.gyrobot.co.uk/blog/gensole-is-live-hello-world>