

[BOOTCAMP : 6 DAYS]

Digital Fabrication at the Green Fab Lab Barcelona

[How to make (almost) anything]

Part of the Fab City project Barcelona, a part of the Distributed Network of Fab Labs.
The bootcamp is based on the Fab Academy course from MIT.

Day 1 :

- > Introductory tour of the Green Fab Lab and facilities.
- > Review the week: Documentation and Description of objectives
- > Digital design - 2D (*Rhinoceros 3D*)

Day 2 :

- > 2D Subtractive fabrication (*Laser cutter & Vinyl cutter*)
- > 3D Scanning (*123d Catch + Kinect*)
- > Modelling in 3D (*Rhinoceros 3D*)

Day 3 :

- > Rhino 3D
- > Additive fabrication (*Ultimaker & Cura*)
- > 3D Milling (*Fab Modules*)
- > Robotic Demonstration.

Day 4 :

- > Numeric Control and GCode
- > Large format Milling (Shopbot)
- > Moulding and casting with Metals

Day 5 :

- > Physical computing (*Basics of Arduino Boards*)
- > Surface Mount Electronics (*Fabduino demonstration*)

Day 6 :

- > Finalizing Projects.
- > Product Expo and Cava Barbeque

What is the Bootcamp ?

The bootcamp is a practical and intensive one week training program and a broad reaching introduction to the Fab Lab environment. For groups of 5 to 15 participants, you will meet the machines, learn how to operate them and be introduced to the knowledge that will allow you to 'Make (almost) anything'.

The week provides the tools and skills for launching your ideas into the future of digital fabrication and distributed manufacturing. During the week we will rapid prototype a number of custom made objects, receive a library of open designs and software inventory.

Where is the Bootcamp?

The [Green Fab Lab](#) is situated in the estate of Can Valldaura, part of the Collserola park in the surrounding hills of Barcelona City. Only 15 minutes drive from the heart of the city the Green Fab Lab is part of the wider Fab City Network in Barcelona and operates as part of the Fab the [IAAC](#) school of architecture and [Fab Lab Barcelona](#).

Who is the Bootcamp for?

The Bootcamp program has been created to offer professionals interested in diversifying their design and making skills into the new arena of Digital Fabrication and customisation. It is also a program for young designers with a limited knowledge of machining and is also tailored to anyone who has an interest in the global maker movement



D1

> FAB LAB Protocols and FAB CITY Concepts

> Documentation

> Digital Design Tools

FAB 10 BARCELONA

The 10th International
Fab Lab Conference

2-8 JULY 2014

“ From fab labs to fab cities ”

info@fablabbcn.org ✉

Fab Lab Protocols and Fab City Concepts - An introduction to the Green Fab Lab and to the basics of digital fabrication. We will present the shared inventory and goals of the Fab Lab Network and set our objectives for a week of digital fabrication and local manufacturing. Some guidelines for developing a project in a fab lab, online resources and methods of documenting a project.

Documentation - Having access to relevant tutorials, design files and documentation is important when attempting to replicate, customise or innovate existing work. We will explore libraries and resources for distributed manufacturing and learn some protocols for managing your own design and fabrication projects and to convey your idea to others (or even yourself in the future!). Good documentation enriches the FabLab community and is very much a part of what makes this network different. We will present our Boot Camp project at the end of the week.

Digital Design 2D / 3D - We will end this first day by looking at a fundamental skill needed at the lab, the ability to transfer your design intentions into a CAD environment, be it in 3D (ideally) or in 2D. To do so, we will be using the Rhinoceros application, we have found to be a great compromise between power and ease of use, as well as providing a gentle learning curve. We will start working in 2D, as this is all that is necessary to start working with some of the simpler machinery in the lab, such as the laser and the vinyl cutters. We will then progress to 3D as needed and according to each person's abilities.

D2

> 2D Subtractive fabrication (*Laser cutter & Vinyl cutter*)

> 3D Scanning (123d Catch + Scannect)

> Rhino 3D



2D Subtractive Fabrication - We will then move on to working with the laser and vinyl cutters, which are the most versatile machines we have in the fab lab inventory. The laser cutter can be used to precisely cut a variety of materials from wood to a variety of polymers, to the point where a number of joints and fittings can be made to construct 3D objects from 2D files. The vinyl cutter can be used to cut, as the name implies, vinyl, for a variety of applications such as stencils and diagrams but more importantly, it can be used to cut thin copper into flexible and adhesive circuits. We will also take some time at the end of the day to create some silk screen patterns with the vinyl cutter which we will then use to print some custom T-Shirts.

3D Scanning - The next module we will look at deals with turning atoms into bits - (recording physical information into a digital format.) This is an increasingly important aspect of digital fabrication as it allows for the customisation and manipulation of existing objects. We will use an Xbox Kinect scanner and Skannect software to record portraits of each participant. These digital files will help us inform the next modules.

Modelling in 3D - With our new 3D mesh files we will begin to use Rhinoceros 3D to manipulate our model. We will also learn some basic and creative tools for building new 3D solid models from the ground up. These models will then be fabricated later using a number of varied techniques.

D3

> Rhino 3D

> Additive fabrication (*Ultimaker & Cura*)

> 2.5D Milling (*Fab Modules*)

> Robotic Demonstration



3D Additive Fabrication - Printing in three dimensions and the processes we will look at on the third day are perhaps the most impressive of the technologies we have available. You will learn how to operate some 3D printers available at our Lab by yourself, including the 'Ultimaker 2' and 'Makerbot' machines. Whilst continuing to work with Rhinoceros software, we will learn some design rules when modeling for additive manufacturing, file processing and finally printing. We will repeat and run the machines throughout the week.

2.5D Milling- Subtractive Fabrication - During the afternoon we will focus on the Roland 'Modela' and 'MonoFab' machines, more specifically on their '2.5D' milling abilities, allowing us to create very precise 1 or 2 part molds. We will first go through the basics of mold design, and the few simple rules to remember when designing a mold, such as extraction angles and pour ports. Small 2.5D milling machines that allow us to cut small objects to a relatively high precision but they are relatively slow. Because of the time it takes to go through this process we be demonstrating and running several machines at the same time and exploring our own 'Fab Modules' software.

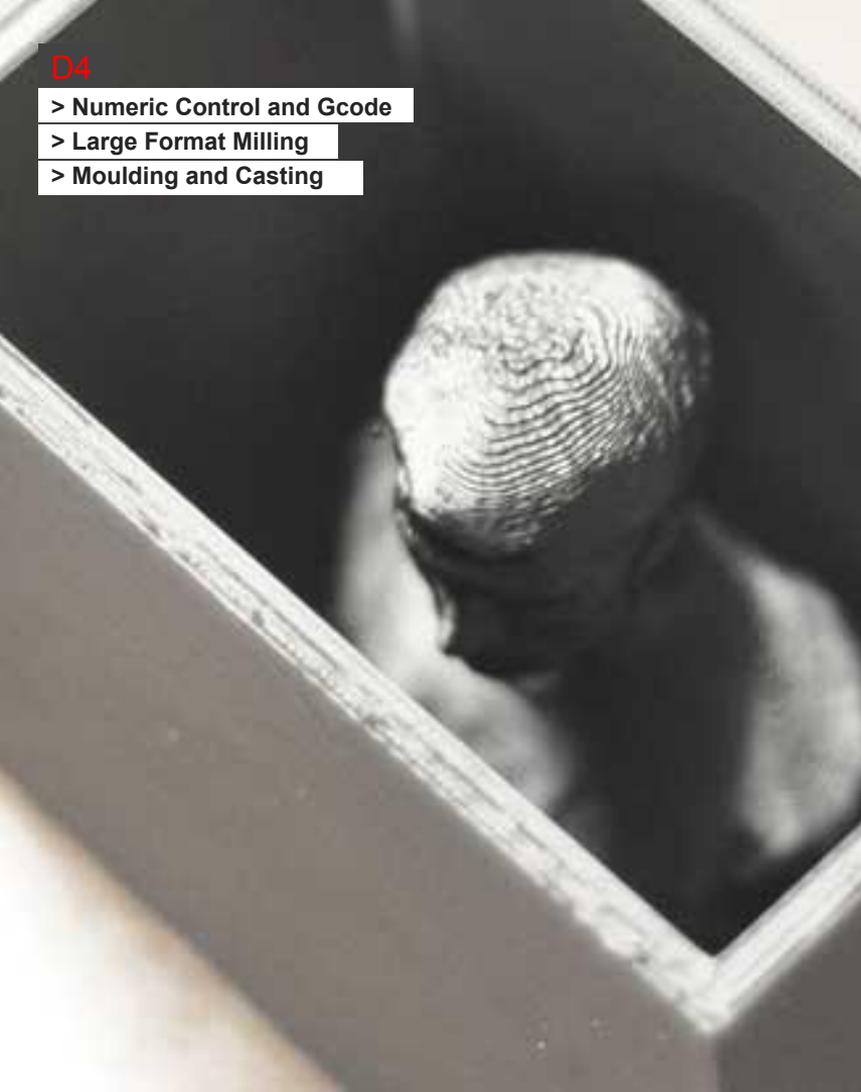
Six Axis Robotics Demo - Whilst the other machines are running we will have the chance to demonstrate the operation and abilities of the six axis robotic arm. This versatile and powerful machine can be programmed to perform a multitude of additive and subtractive functions. We will be take a broad overview of the Rhinoceros plugins available to program it and will set it off to perform a demonstration task.

D4

> Numeric Control and Gcode

> Large Format Milling

> Moulding and Casting



Numeric Control and Gcode : Accompanying a knowledge of design and machine operation we will briefly introduce some of background knowledge of computing, numeric control and an understanding of Gcode for the specific machines we run in the Lab.

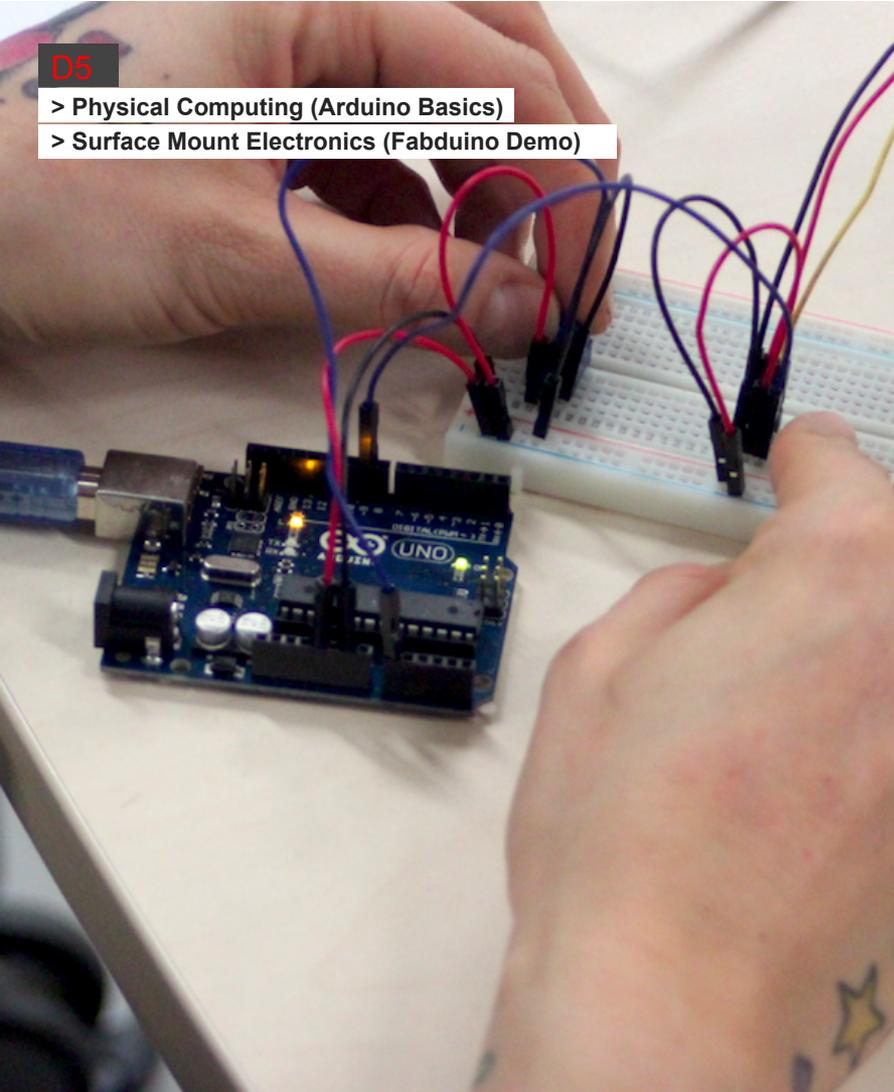
Large Format Milling : With our new knowledge of code we will move on to designing for large scale objects using Computer Aided Manufacturing (CAM) software, this time in conjunction with the RhinoCAM milling plugin and Shopbots own Vcarve Pro software. The Shopbot milling machine allows us to cut large sheets of material (up to 240cm by 140cm). We will explore some of the joints, fittings and techniques used to create 3D objects from 2D drawings and flat material stock. Finally we will make some furniture for the lab and construct the pieces together. The Shopbot can also mill 2.5D shapes into thicker material stock such as foam or solid wood. This allows us to create complex surfaces, topographies as well as molds for casting resins and other materials, just as we have done with the Modela but in a larger scale.

Moulding and Casting : By this time all participants should have designed and fabricated their own mold or 3D model. We will use these objects to cast more pieces using either soft silicone or a liquid plastic compound. These positive and negative casts can then be used to replicate our original pieces multiple times using differing materials.
(Metal / Wax / Plastic / Chocolate)

D5

> Physical Computing (Arduino Basics)

> Surface Mount Electronics (Fabduino Demo)



Physical Computing - From this point on we will move away from the mechanical side of the projects and into the electronics side of things. You will learn how to translate the functions and behaviors of your intended project or object into a series of simple inputs and outputs. We will be using the Arduino prototyping platform for the hardware side as it is a tested platform which also has a lot of information, support and plugins available online through their network at arduino.cc. This platform also provides an easy to use software component, Processing.

In this sense, an input can be almost anything, such as a database on a computer, a joystick or a temperature sensor. We will show you how to program your electronics to behave in the fashion desired. For those with limited or no programming language, don't worry, it's easier than it appears.

Surface Mount Electronics - You will be provided with a schematic of our own customized version of Arduino, which you will be edit and modify according to your needs using Eagle software. We will mill and the board using Fab Modules and the Roland Modela. In this afternoon you will learn how to solder components to the board and populate it with the necessary components. We will work mostly with sensors such as temperature, humidity, light, pressure as well as some user controlled inputs such as buttons. As far as outputs are concerned we will be working mainly with simple outputs such as LEDs (lights) several types of motors such as DC and stepper motors and some other simple actuators.

D6

> Finalizing Projects

> Product Expo



Finalizing Projects : During the final day you will have time to put all that you have learned in the previous days together, and to use and produce whatever elements of your final designs that have not yet been completed. This is also a chance to go deeper into particular aspects of the digital fabrication skills you have learned and will be able to make free use of all of the machines and processes you have trained on during the week. Again we will be there to assist you and troubleshoot any problems you may encounter.

This will also be a chance to consult with the Fab Lab staff about your future ideas for projects, pitch your ideas and access our networks for launching new projects and other Fabrication Laboratories.

Project Archive and Software Library : As part of the maker movement and Network of Fab Labs you will always be able to access the latest open designs and software. On the last day you will be given archives and libraries of supporting documentation, and tutorials to help you continue into the future.

Exhibition : Cava and BBQ : To finish the week we will bring all of the products that you have made together to present and celebrating them. There will be a Cava and BBQ to say thank you and send off to complete the week of digital fabrication.

Bootcamp Budget : 6 Days

Estimate for 10 participants

Morning Sessions 10:00 - 14:00

Afternoon Sessions 15:00 - 19:00

Tuition :
1 x Full time tutor six days
2 x Full time support staff six days

Outcomes: Participants will make their own products
Access to expert training for digital fabrication
Access to Fab Lab nodes and network
Software and hardware / installations
Learn design tools and CAD / CAM processes
Machine training and operation x10 machines
Product customisation and fabrication.
Electronics design and circuit production
GCode and Programing Languages

Manufacturing consultations
Product development, strategic planning

Business models and startup consultation
Setting up a Fab Lab

€ 1200 euros (per participant)

Optional Accommodation :

Located onsite at the [Masia Can Valldaura](#)

Terraces and Swimming pool
Access to Kitchen at all times
Breakfast and lunch included as part of the workshop.

Option 1: **50 euros** (per night / en suite room)

Locked double room
Shower and Toilet

Option 2 : **30 euros** (per night / dormitory room)

Communal dormitory
Shared shower and toilets

Optional Lunch / Dinners : 25 euros

Contact Details :

For further information please contact:

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[Map Location](#)