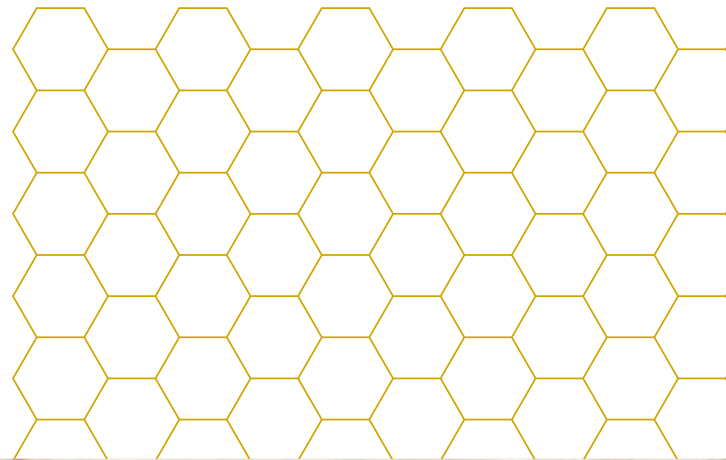# Setup to success: 3D printing for architects

Ultimaker

Setup to success: 3D printing for architects

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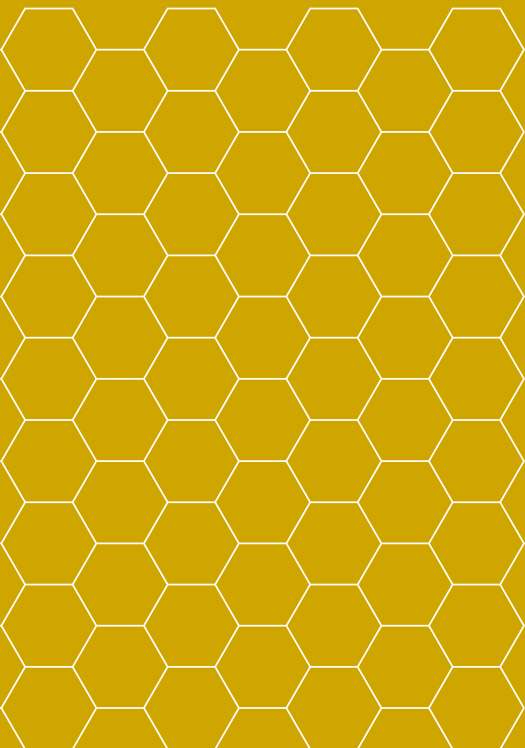
Introduction

From concept evaluation to winning business, 3D models are central to how architects design and communicate. Using an in-house fused filament fabrication (FFF) 3D printer reduces model-making time and enables you to print complex geometries that may not be possible using traditional methods.

What you will learn

This guide will help you achieve the benefits of 3D printing as quickly as possible. Using Ultimaker 3D printers as examples, we will look at:
- How to set up your printer and optimize your workspace
- How to implement a 3D printing workflow
- How to make the most of 3D printing, with application ideas

This guide has been created by Ultimaker's 3D printing experts. It also features examples from real-life architects, so you can learn from those already using 3D printing to reduce production time and costs.

Setup

To start using your 3D printer as quickly as possible, you should consider a few things in advance. How is it installed? Where will it be located? Who will use it?

Unboxing

Before your 3D printer arrives, visit ultimaker.com for useful resources, or watch one of our videos to help you understand your printer's features and guide you through setup (e.g. the features explained and unboxing videos for the Ultimaker S5).

Each Ultimaker printer comes with a quick-start guide detailing how to unpack and install the printer and start your first print. The first time you turn your printer on, it will ask you to complete simple setup actions: choose the language, install the build plate and print cores, load material, connect to a network (optional), and check for the latest firmware.

Unboxing the Ultimaker S5 printer

Location

Desktop 3D printers are considered clean and safe for an office environment, depending on the material being printed, and are quiet enough to be placed on a desk. But if a single 3D printer serves multiple users or you have a multi-3D printer setup, it may be best to create a central 3D printing area.

As Ultimaker 3D printers do not exceed a maximum noise level of 50dB, noise isn't usually a problem when running a single printer. But when running multiple 3D printers it is better to place them in a separate area to reduce overall noise levels.

Ventilation should be considered when using materials with safety requirements, or which produce an unpleasant odor. You could also consider an air management accessory, such as the Ultimaker S5 Air Manager, which removes up to 95% of ultrafine particles (UFPs). Ultimaker provides safety data sheets for every Ultimaker material, so you can identify each materials' safety requirements.

Operation

Ultimaker 3D printers are designed to ensure reliability and maximum uptime, and are certified for safe unattended use. This means that you can leave your printers to run unattended, for maximum efficiency.

Files can be uploaded to the 3D printer via USB or a network connection. With Ultimaker Connect and Ultimaker Cloud, you can start and manage print jobs remotely, access print analytics, and save your print settings to the cloud for remote access.

Personnel

Ultimaker 3D printers are designed to be simple to use, so you're unlikely to need specialist training, or a new team member to use them. You may, however, need a dedicated operator when running more than 10 printers.
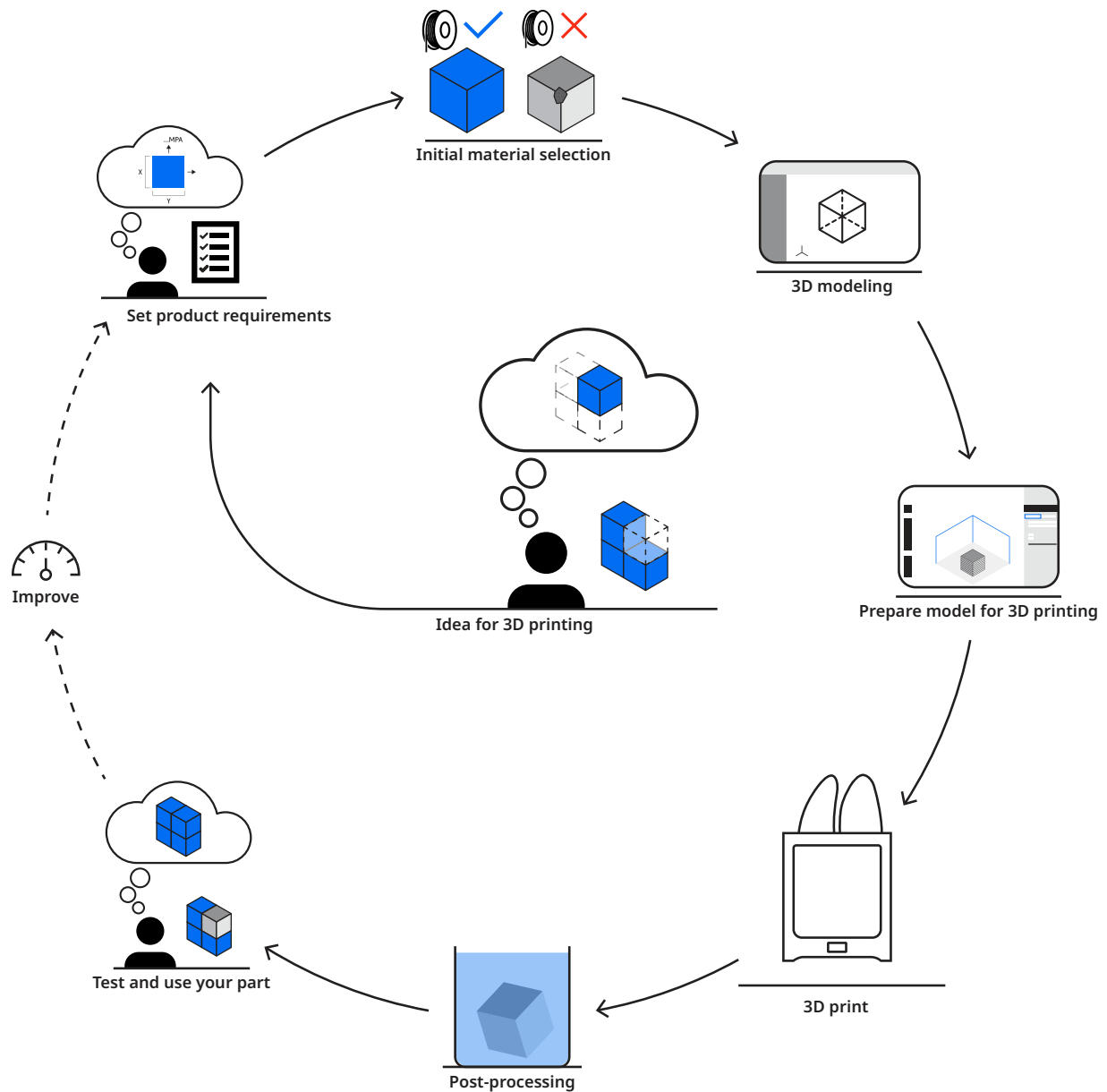
To optimize results, staff should be trained to design for additive manufacturing (DfAM). A good introduction to this concept is our free 'How to design for FFF 3D printing' guide. Your reseller may offer more in-depth training.

Once your team and workspace are ready for 3D printing, it's time to implement a workflow that streamlines efficiency.

Workflow

An efficient workflow will improve the quality of your 3D prints and reduce the time it takes to achieve a return on investment.

To help get you started, we have provided a typical 3D printing workflow below:

Initial material selection

3D modeling

Set product requirements

Idea for 3D printing

Prepare model for 3D printing

Improve

Test and use your part

Post-processing

3D print

Material selection

Material selection is critical to a successful 3D print. Ultimaker 3D printers are optimized to use the Ultimaker range of materials, but can also use third-party materials. Many material manufacturers provide print profiles for their filaments in Ultimaker Cura, for optimal print results.

Here are a few of the most popular materials:
- **PLA** prints quickly and reliably, reproducing surface details with precision. Ideal for high-resolution architectural models for evaluation or presentation
- **Wood, ceramic, carbon fiber**, and other composite materials can be printed for a range of effects
- **PVA** support material dissolves in water, so you can print complex geometries, such as models of intricate facades or fixtures

More information on choosing the right material can be found on the Ultimaker website.

3D modeling

When designing for 3D printing, there are seven key considerations based on the geometry and features of your part:
1. **Nozzle size.** Consider the diameter of the nozzle you use. The minimum wall thickness of your part should be equal to or larger than your nozzle's diameter
2. **Bottom layer.** The bottom layer is the foundation of your 3D print. The larger its surface area, the better its adhesion to the printer build plate. Use chamfers instead of fillets for edges that touch the build plate, as rounded corners are more effective than sharp ones
3. **Support material**. Dual extrusion printers can print support material within overhangs or cavities to enable more complex geometries. This does, however, increase print and material costs. Limit the use of support material by creating overhangs with an angle greater than 45-degrees
4. **Small details.** For designs featuring small details, use a smaller nozzle. Ensure that small details have time to cool before the next layer is printed
5. **Tolerances.** Plastic polymers shrink when heated and then cooled. This needs to be considered when designing parts with specific size requirements. With some materials (such as PLA), this is usually unnoticeable, but some filaments may require test printing
6. **Fast printing**. If print speed is important, you can reduce the thickness of the bottom or the walls of your print, or choose a larger nozzle diameter
7. **Modularity.** FFF 3D printers are only able to print parts that fit within their build volume, but this doesn't make them unsuitable for producing large objects. Instead, use a modular design, consisting of multiple components, that can be printed more rapidly

Preparing your 3D model for printing

Once you have a 3D design file, you can transfer it to print preparation software that will turn it into instructions for your 3D printer.

Ultimaker Cura is the most widely used 3D printing software in the world, with millions of users, and is [free to download from our website](#).

In Ultimaker Cura's Recommended mode, printing is as easy as loading your model design, choosing key settings (layer height and infill density), and starting your print. You can also switch to Custom mode and tweak multiple settings for highly customized results.

With Ultimaker Cura you benefit from the open and integrated Ultimaker ecosystem. Here you will find:

- Preconfigured material profiles from leading filament producers, including BASF, Clariant, DSM, DuPont, and Owens Corning
- 'Print from CAD' integration with free plugins for SolidWorks, Autodesk Inventor, and Siemens NX
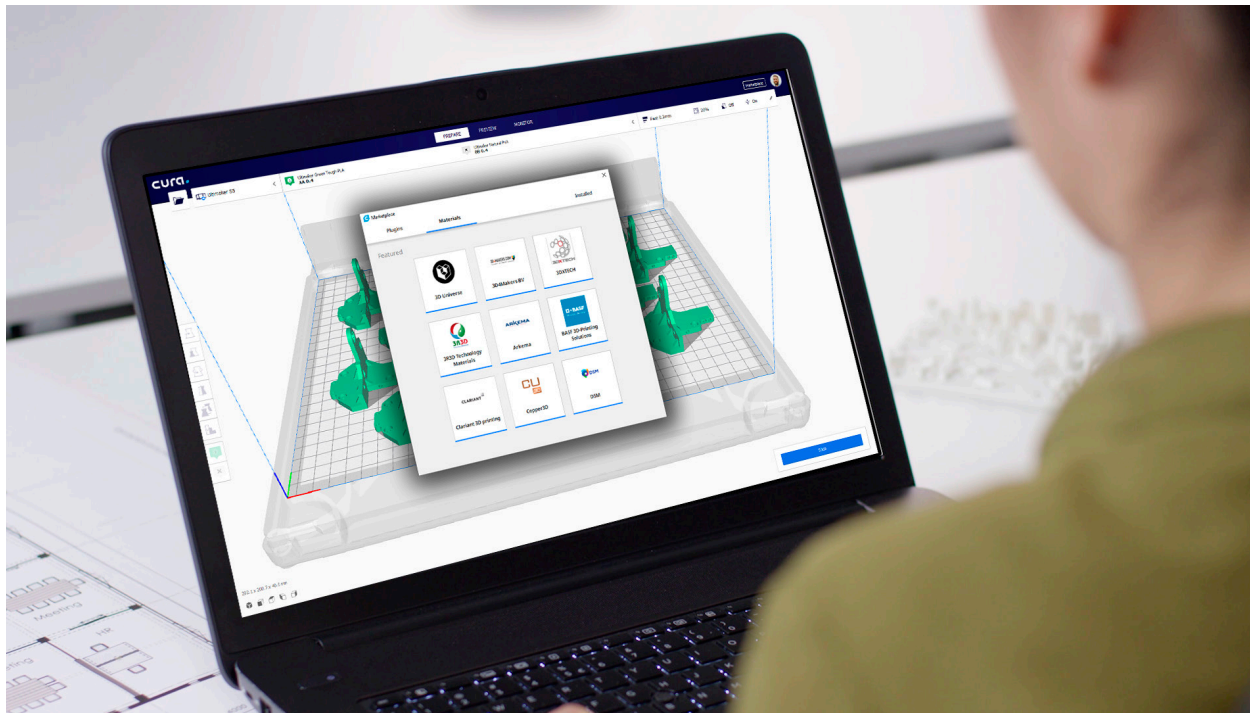
Extra print profiles and software integration can be downloaded in Ultimaker Cura

Printer operation

When you have prepared your print in Ultimaker Cura, you can save it to USB or print via a network.

Ultimaker Connect is a network print management tool that enables you to queue multiple print jobs, monitor print progress, and track maintenance and printing analytics from your desktop.

This is particularly effective if you have multiple 3D printers. You can create groups of printers for use by different teams, or with a frequently used configuration. Queued print jobs will start automatically when a printer with a matching configuration becomes available.

And with the Teams feature in Ultimaker Cloud, your 3D printers are accessible to all team members – regardless of where they are, or the network they're on.

Post-processing

When your print finishes, wait for the build plate to cool, then remove the part. If it sticks, use a spatula to free it from the build plate.

Often, the only post-processing needed is to remove the thin brim added to your print for optimal adhesion. This can be done by hand or with a small modeling or hobby knife.

If you used water-soluble support material such as Ultimaker PVA, you will need to dissolve it before you can use your print. Manually detachable supports, such as Ultimaker Breakaway, can be removed with a pair of pliers.

Once supports are removed, you can start additional post-processing options, such as:
- Sanding, for a smooth surface finish
- Polishing with a plastic polish compound
- Gluing modular parts together using a modeling or industrial adhesive
- Painting your print, using a primer and separate top coat
- Screw threading

Not all post-processing techniques are suitable for all materials, so be sure to research and test your chosen method before trying it on your final part. Follow the manufacturer's guidelines for any off-the-shelf products you use in post-processing.
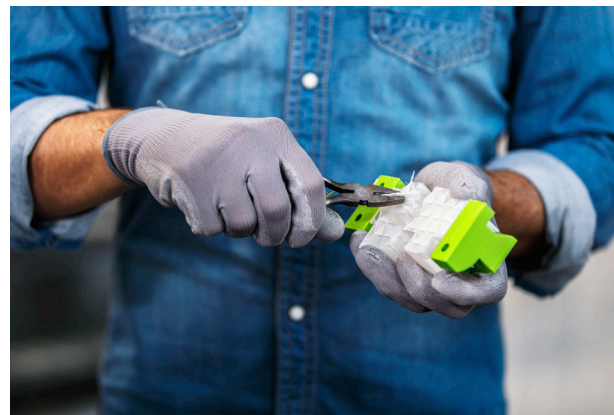
*Removing PVA (left) and Breakaway (right) support material*

Application ideas

3D printing gives architects a powerful competitive edge – avoiding outsourcing and other model making techniques. With Ultimaker's fast and reliable 3D printers, you can shrink model-making times from months to days, and print complex geometries that couldn't otherwise be created.

But how do you ensure that you are maximizing your return on investment? This list of application ideas will help you make the most of your 3D printer.

Concept models

Print rough models of early designs to decide on the project's direction. 3D prints can be used to evaluate an entire project in miniature, or individual fittings or details.
Tip: Network multiple Ultimaker printers with Ultimaker Connect and print your concepts all at once, then compare for maximum impact.
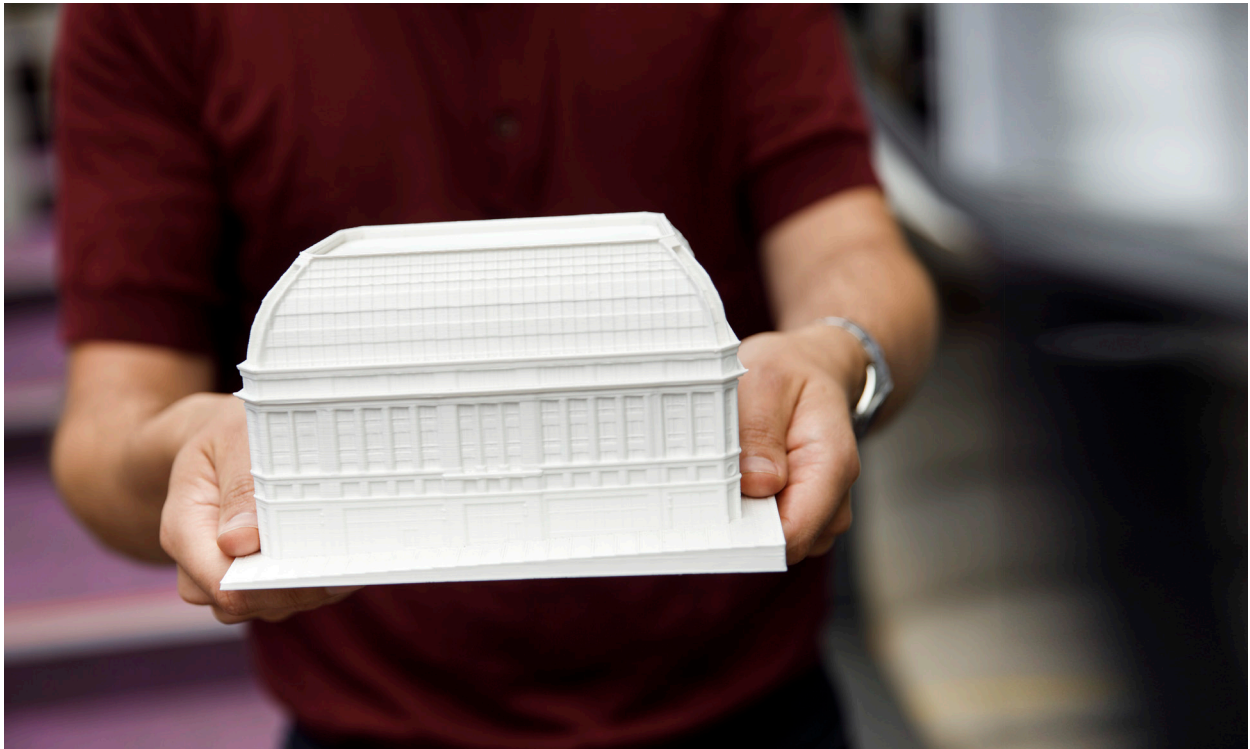
Client presentations

3D printing can be combined with other techniques to create a striking representation of your project.
Tip: Take advantage of Ultimaker's open filament system to use exotic materials, such as ceramic or wood, for an eye-catching or realistic finish to your model.

Massing studies

See a building or development within context, and quickly scale up a model with modular parts.
Tip: Make the most of the many material colors available, and use different tones to highlight key structures.

Master plans

3D printing provides both fine detail and large volume for planning scale-models that can be used for you own evaluation or for public display.
Tip: Split a large 3D city model into multiple parts that fit on your printer's build plate and assemble the segments for huge savings compared to traditional large-scale model making.

Case study: Make Architects

Make Architects is an award-winning London practice, founded by Ken Shuttleworth. Its Ultimaker 3D printers support the studio's democratic design culture, enabling model-makers and designers to print thousands of models each year. Staff find 3D printing so easy to use that it is embedded into each project's workflow – from conceptual design to client presentation.

"Ultimaker 3D printers haven't just sped up model production and saved costs. By automating the production of additional context models, they allow our model-makers to focus more creative attention on the site's actual design."

Paul Miles, Modelshop Manager, Make Architects

Make Architects previously relied on traditional model-making methods, including hand-cutting concept and massing models. This was a labor-intensive, noisy, and messy process. Some models were outsourced to a 3D printing service for overnight fabrication, but were fragile and expensive.

After purchasing their first Ultimaker 3D printer, the modelshop quickly scaled their production. Today, 14 Ultimaker 3D printers operate in the modelshop. After just a 30-minute induction, each employee can 3D print with confidence.

For a typical 1:1000 scale concept model, they were able to achieve considerable cost and time savings.

	Outsourcing	Ultimaker 3D printers
Cost	$100	$1.25
Time	24 hours	3-5 hours

Take the next step to success

Build your 3D printing knowledge with industry leaders and experts, or request a quote, on the Ultimaker website.

**Request a quote
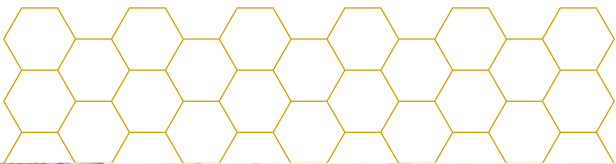from Ultimaker**

**Learn more
about
3D printing**
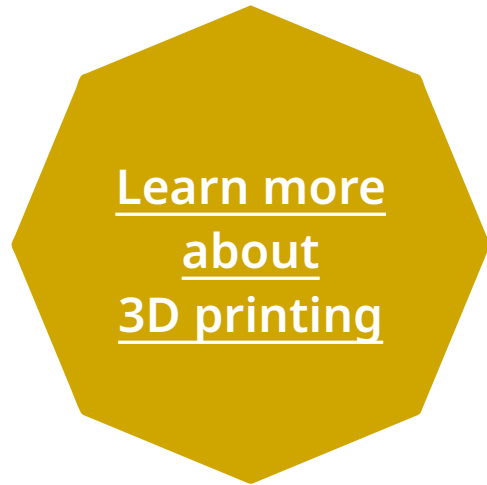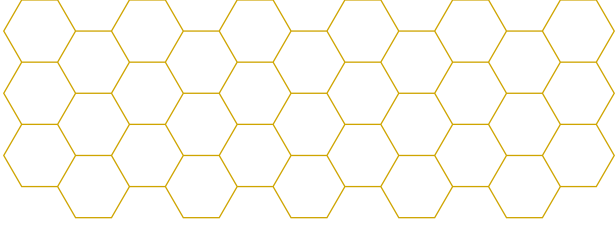
About Ultimaker

Since 2011, Ultimaker has built an open and easy-to-use solution of 3D printers, software, and materials that enables professional designers and engineers to innovate every day. Today, Ultimaker is the market leader in desktop 3D printing. From offices in the Netherlands, New York, Boston, and Singapore – plus production facilities in Europe and the US – its global team of over 400 employees work together to accelerate the world's transition to local, digital manufacturing.

ultimaker.com

General inquiries: info@ultimaker.com
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