Digital Transformation for Leaders

simplilearn

3D Printing

Learning Objectives

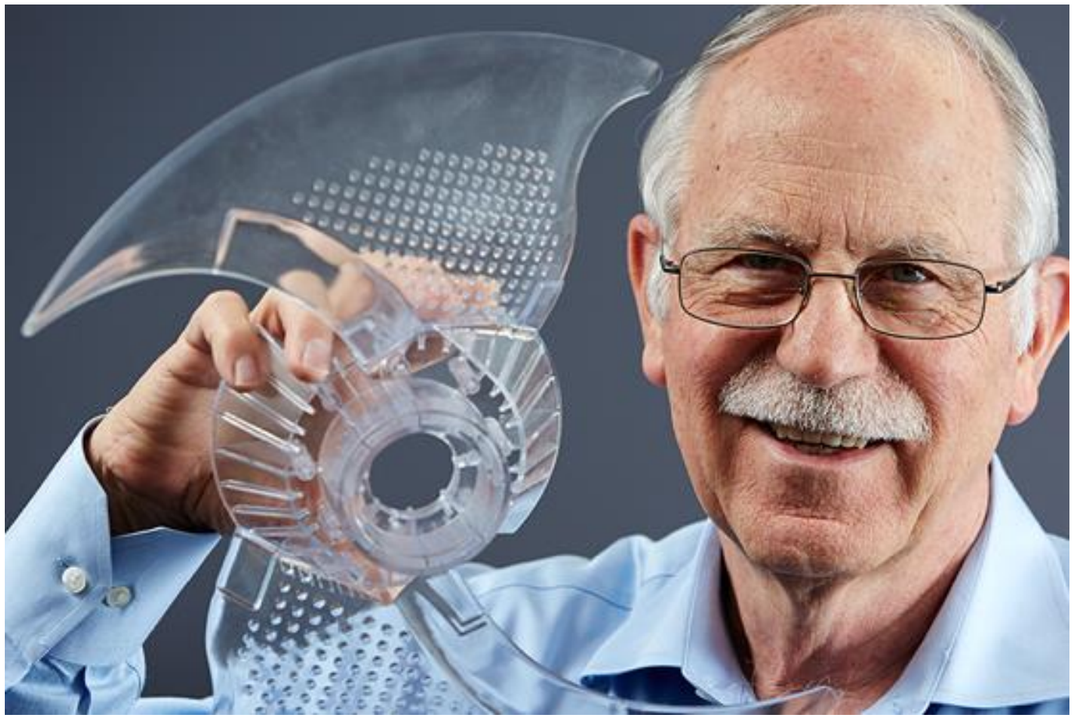
By this end of this, you will be able to:

- Define 3D printing
- Identify the applications of 3D printing
- List the pros and cons of 3D printing
- Learn how 3D printing helped companies improve quality and save cost
- Gain an understanding about the future scope of 3D printing

Overview of 3D Printing

3D Printing: Origin

Chuck Hull is known as the father of 3D printing.



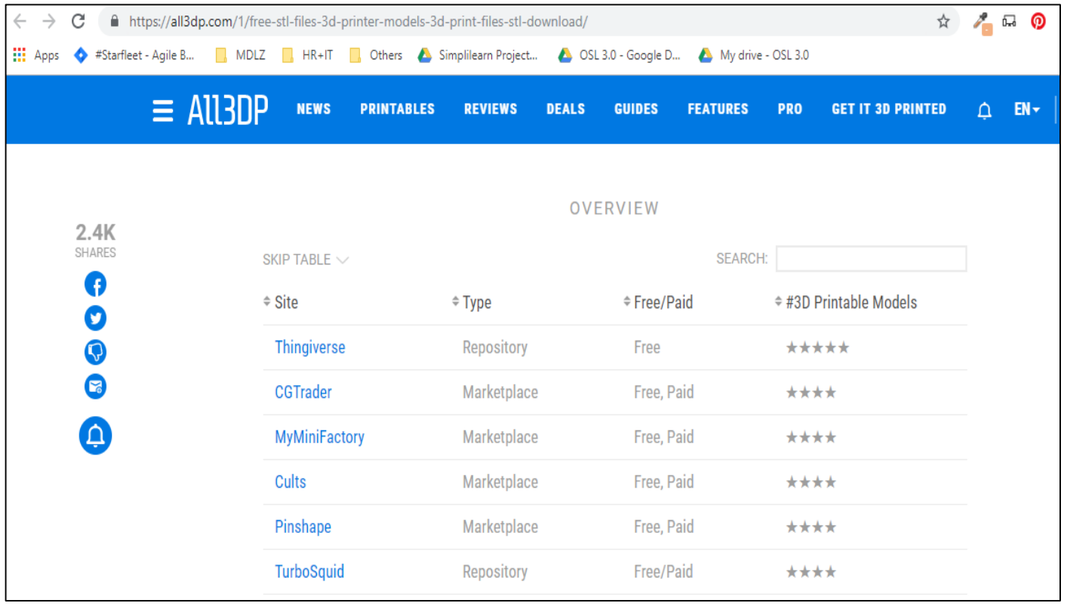
3D Printing: Definition

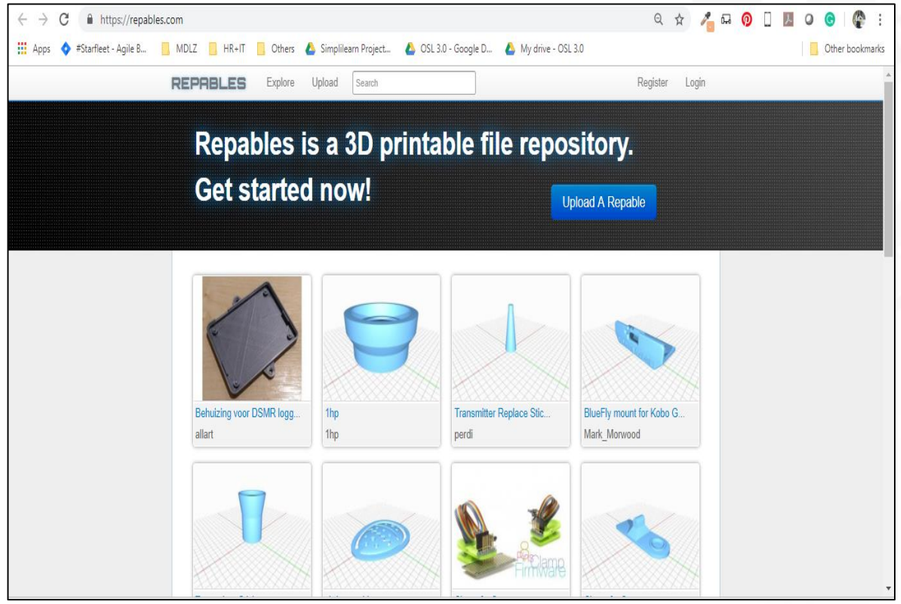
- The process of making a physical object from a three-dimensional digital model.
- 3D printing is also called additive manufacturing.

3D Printers

3D Printing: Cost

- A simple home-based 3D printer is about $300, while the commercial ones can cost tens of thousands of dollars.
- There are numerous sites where 3D models, along with files and instructions, are available for free or at a small cost.





3D Printing: Prosthetics

- 3D printing changes the lives of people by providing them with affordable prosthetics: hands, limbs, and arms.
- 10 percent of medical devices are 3D printed and nearly 100 percent of hearing-aid devices are made from 3D printing.

- Non-profit organizations like E-NABLE is empowering volunteers to create and print affordable prosthetics.

Applications of 3D Printing

3D Printing: Raw Materials

Plastic is the most commonly used raw material 3D printing.

However, a wide range of materials can be used for different applications.

3D printers can print delicious and unique Belgium chocolates

3D Printing: Low-Volume Manufacturing

- In low-volume manufacturing, 3D printing helps produce products more frequently and easily.
- Businesses will be able to overcome the restraints that come with traditional methods.

- 3D printing empowers an agile development process for producing physical parts and accelerates the production and time to market.

3D Printing: High-Volume Manufacturing

- For high volume manufacturing, a production line is set up for 3D printing.
- Improvements to machinery, adjustments to the print speed, or a change of product can be done instantly.

AON-M2 2020

3D Printing: Constructing Houses

- Creative use of 3D printing concept is leveraged for large endeavors.
- Homes can now be built in less than 24 hours at a cost of only $4,000.

Gaia made with soil and agricultural waste

3D Printing: Constructing Bridges

- 3D printing is being used in civil engineering and architecture.
- It reduces cost, provides superior engineering characteristics, and removes physical constraints.

MX3D is replacing the layering process

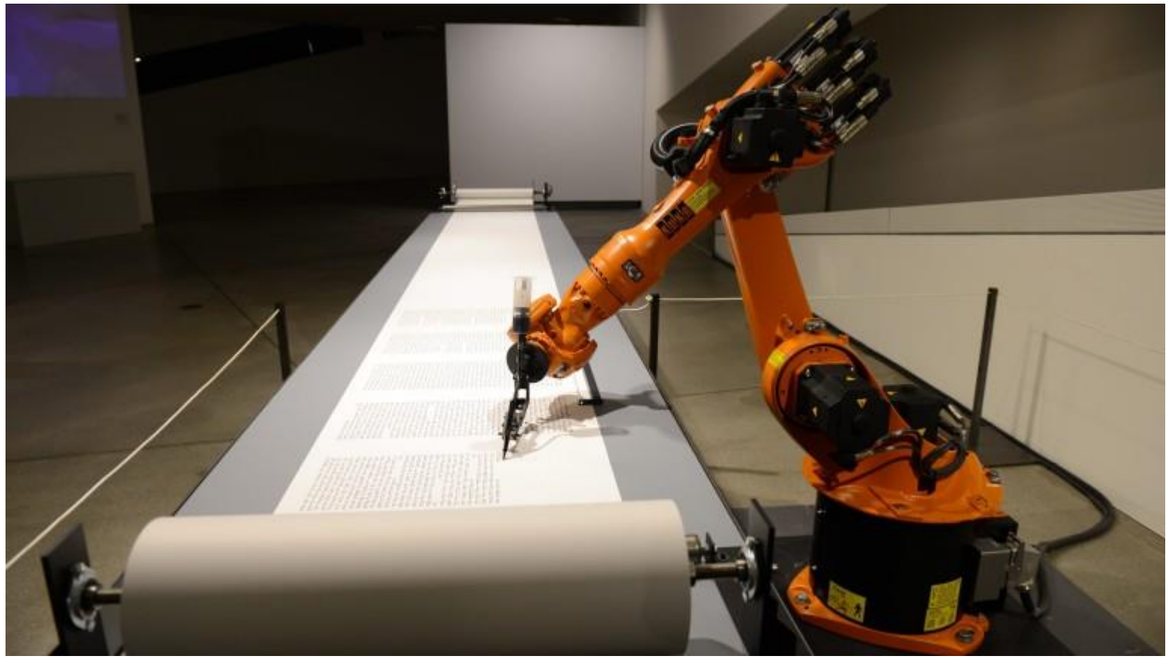
3D Printing: Scanners

3D scanning is the process of analyzing a real-world object or environment to collect the data on its shape.

EinScan SP 3D Scanner

3D Printing: Robotics

- Robotics is involved to create large, complex products.
- 3D printers can create robotic arms.



Writing robotic arm

3D Printing: Eliminates Physical Barrier

- In traditional production, multiple parts are produced and combined later.
- 3D printing removes these physical barriers.
- It fuels the creativity to solve problems and enables agile processes.

VELO3D breaking barriers in metal additive manufacturing with support-free 3D printing

Case Study: Volkswagen

- Volkswagen's Portugal plant saved $377,000 in a year by 3D printing wheel assembly jigs and fixtures.
- Jigs and fixtures are parts that hold and guide tools in a machinery.

Case Study: Volkswagen

John Kawola
Former North American President
Ultimaker (Volkswagen Vendor)

"It used to be if they wanted one of these parts, it would cost $200 to get the part, and it would take a couple of weeks. Now they can print it in a couple hours and cost $20"

Case Study: GE Additive

- GE Additive, a subsidiary of General Electric, offers machines that harness Electron Beam Melting and Laser Additive Technology.
- With 3D printing, it began producing metal fuel nozzle for GE Aviation LEAP engine in 2015.

Case Study: GE Additive

3D printing helped the company:

- Eliminate the welding and brazing process
- Increase the strength of metal nozzles by five times
- Reduce the weight by 25 percent

Metal Fuel Nozzle

Pros and Cons of 3D Printing

3D Printing: Constraints

The three main constraints to 3D printing are:

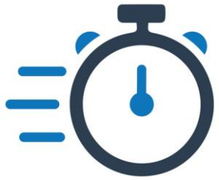
01	**Speed**	3D printers are slow when compared to the other methods.
02	**Size**	Printing large objects is complex and expensive.
03	**Material**	Plastic is not suitable for all types of work.

3D Printing: Advantages

Cheaper than traditional methods

Reduction in errors, material wastage , time, and money

No machinery problems or human errors



Develop ideas at a faster pace

Iterative products development

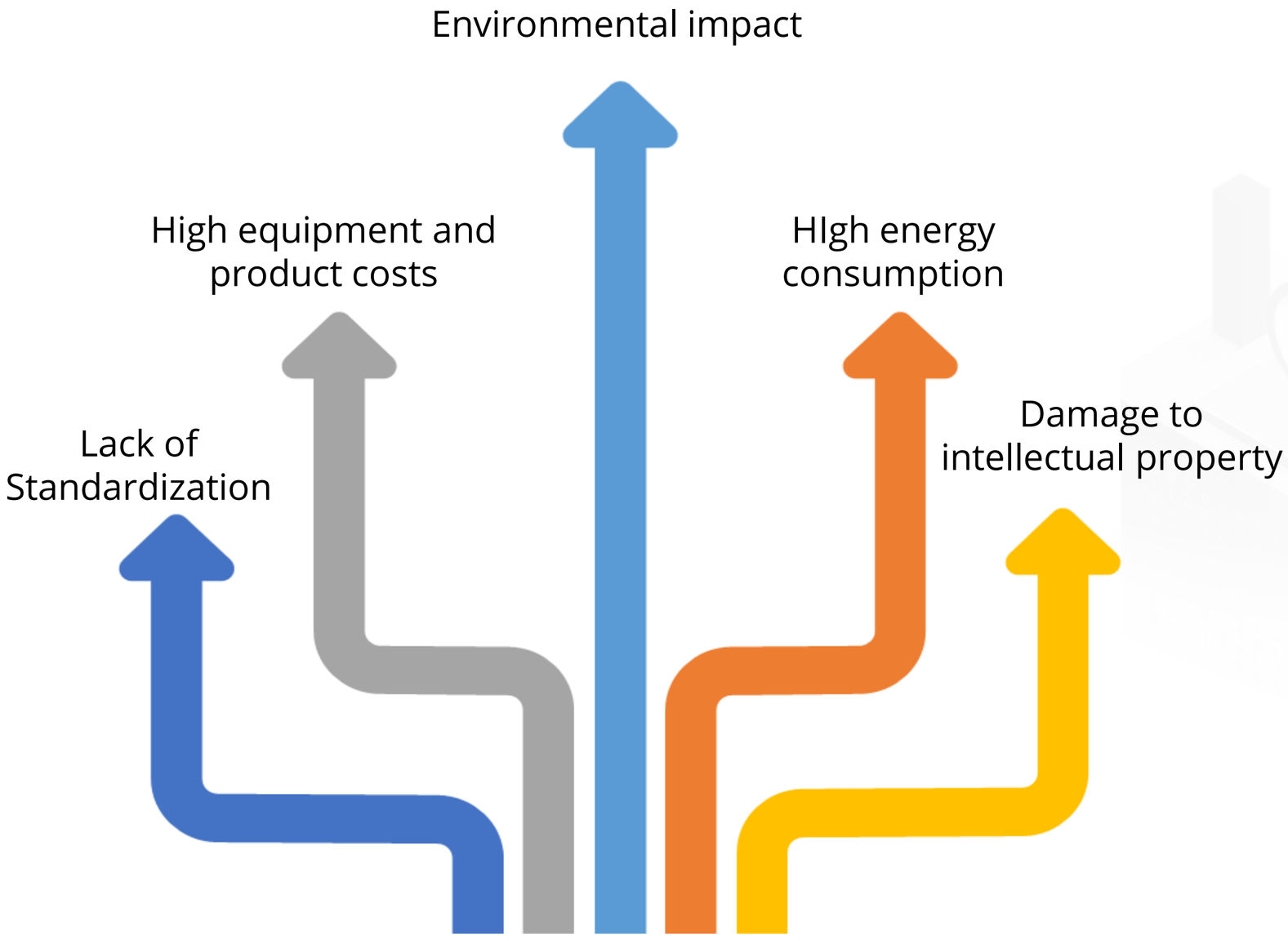
Ease in developing complex products

Decrease in cost over time

Minimal waste

Production on demand

3D Printing: Challenges



Case Study of 3D Printing

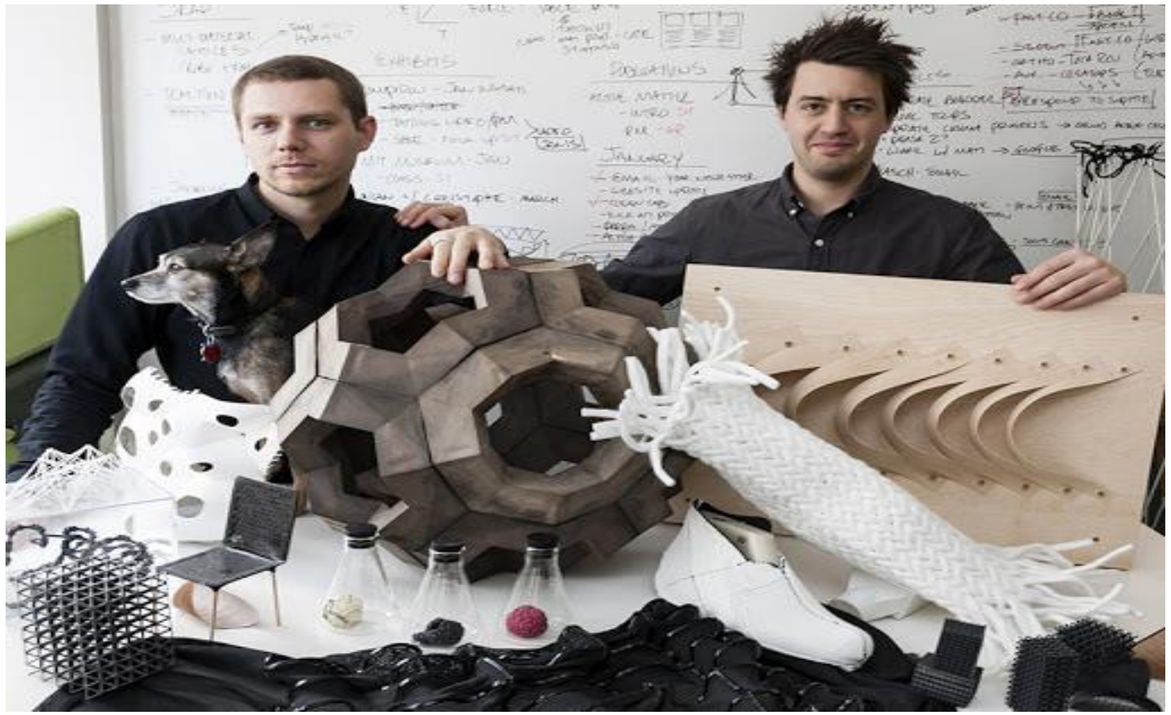
Steelcase MIT Rapid Liquid Printing Furniture: Case Study

- People are rejecting the stereotype, monolithic office.
- Organizations are rethinking about their workplace to deliver a more human-centered experience.
- Work environments that allow furniture customization can increase a person's sense of belonging, promote self-expression, and authenticity.

Turnstone (Steelcase brand)

Steelcase MIT Rapid Liquid Printing Furniture: Case Study

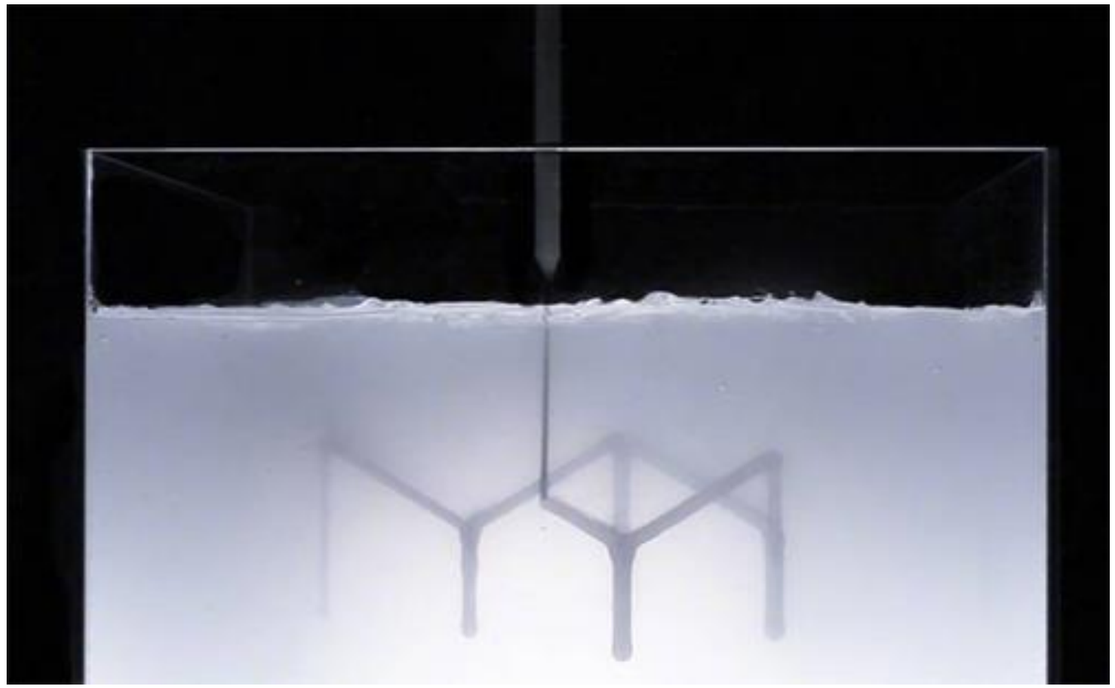
- The three dimensional printing has been around for decades, but it comes with certain limits.
- The Self-Assembly Lab, founded by MIT assistant professor Skylar Tibbits and co-directed by Jared Laucks, aimed to create a new process with improved speed, size, and quality.



Skylar Tibbits and Jared Laucks

Steelcase MIT Rapid Liquid Printing Furniture: Case Study

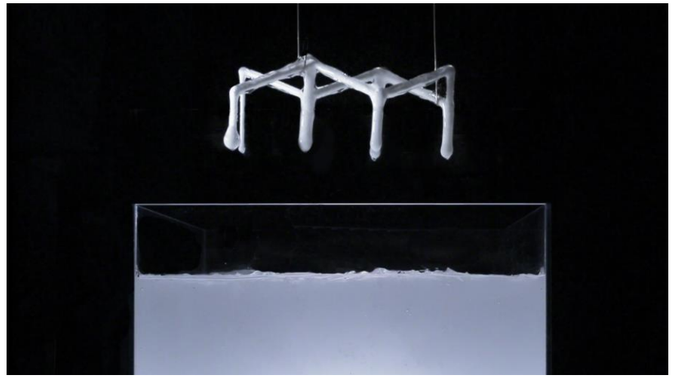
- An innovative new technique emerged after months of working on the project with Steelcase.
- The process prints inside of a gel, allowing a product designer to draw in 3D space without the limitations of gravity.
- A two-part mixing process allows the material to be chemically cured.
- The technique mixes, extrudes, and cures.



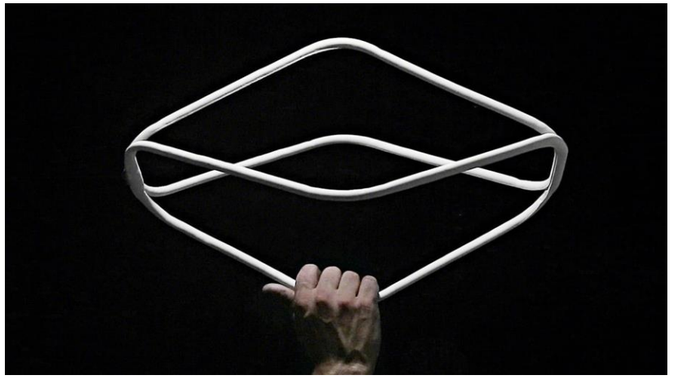
Rapid Liquid Printing

Steelcase MIT Rapid Liquid Printing Furniture: Case Study

Rapid Liquid Printing physically draws in 3d space within a gel suspension.

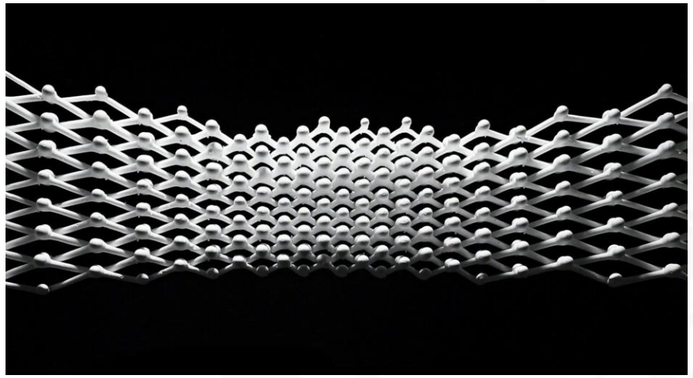


Enables the creation of large scale, customized products with materials.



Addresses three limitations:

- Slow speed
- Small scale
- Low quality material



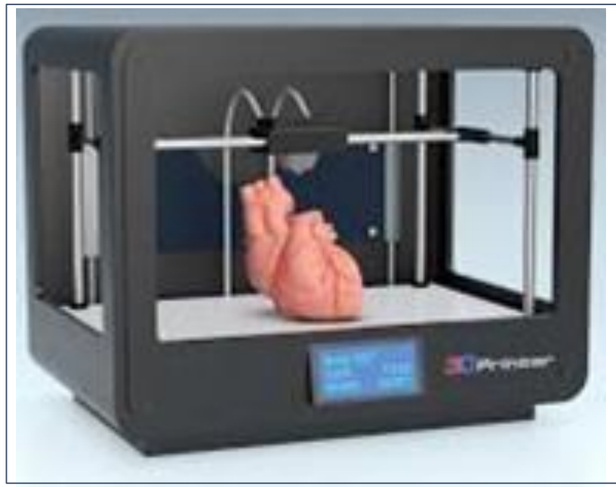
Materials used, size of the object, and intricacy of the design affect the speed of the Rapid Liquid Printing process.

Future of 3D Printing

3D Printing: New Approach

3D printing is expected to expand to many areas in the future.

Most promising areas include:



Medical application: Future of heart transplant

Custom part replacement: Serial production

Customized consumer products: Food

3D Printing: Accessibility

3D printing is becoming more accessible.

You can get your own 3D printer at home.

3D Printing: Opportunity

3D printing is evolving and producing consumer products more effectively than traditional business processes.

3D printing is evolving at a fast pace.

3D printing is an enabler to rethink many aspects of an organization.

3D printing enables an agile development cycle.

Key Takeaways

- 3D printing solutions are expensive to implement for engineering and industrial purposes.
- 3D printing involves other concepts such as 3D scanning and robotics.
- 3D printing uses a wide range of materials for custom or mass production.
- 3D printing is a technology that fuels creativity. However, you need to think holistically about its uses to design impactful solutions.