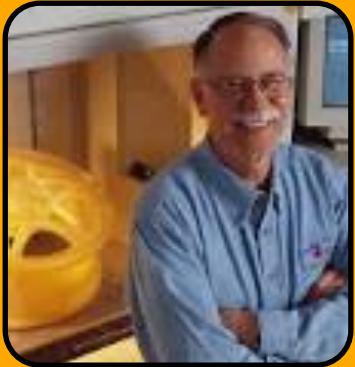


# 3D Printing Workshop

Margaret Mellinger  
Engineering librarian, OSU



# A Brief History



1984

- Charles Hull invented stereolithography, a printing process that makes a tangible 3D object from digital data



1990's

- First stereolithographic apparatus (SLA) produced by 3D systems

# A Brief History



## 1990's

- First use of 3D printing in organ transplant



## 2000's

- First 3D printed organ (kidney)

# A Brief History



2000's

- Open Source & 3D printing



2000's

- First SLS (selective laser sintering) machine

# A Brief History



2000's

- First self-replicating printer

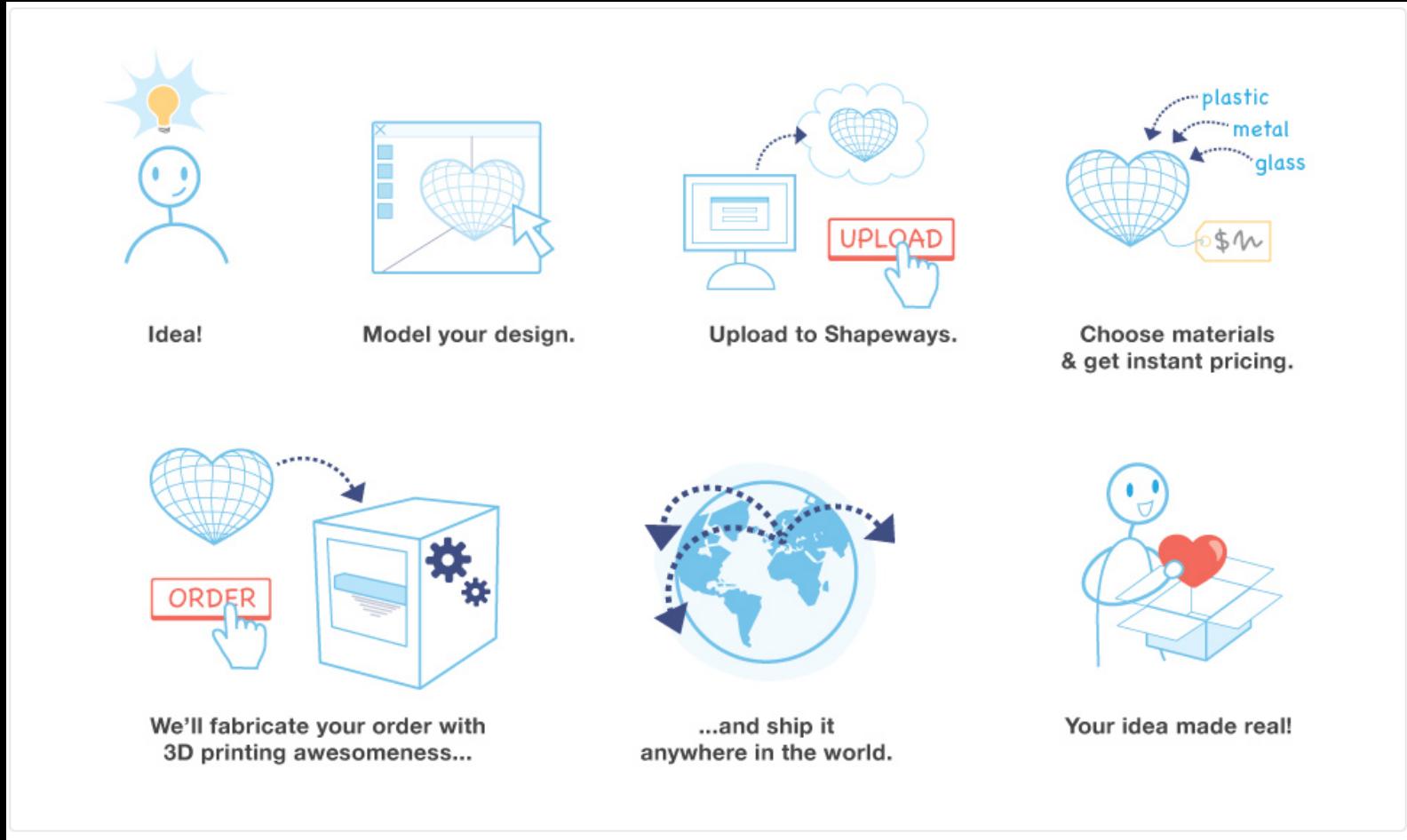


2000's

- DIY co-creation

 shapeways\*

# shapeways



# A Brief History



2000's

- 3D printed prosthetics take off



2000's

- DIY kits enter the market

# A Brief History



2010's

- 3D printed robotic aircraft



2010's

- First 3D printed car

# A Brief History



2010's

- 3D printed gold and silver



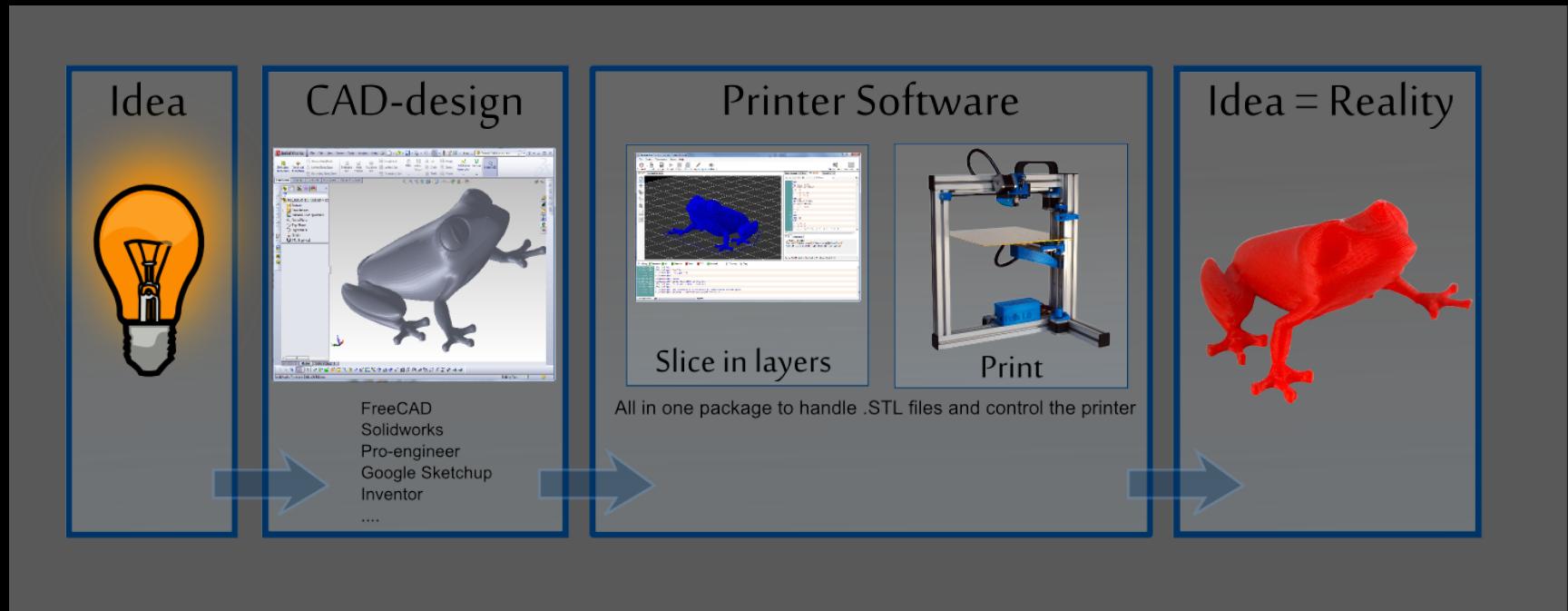
2010's

- First 3D printed jaw

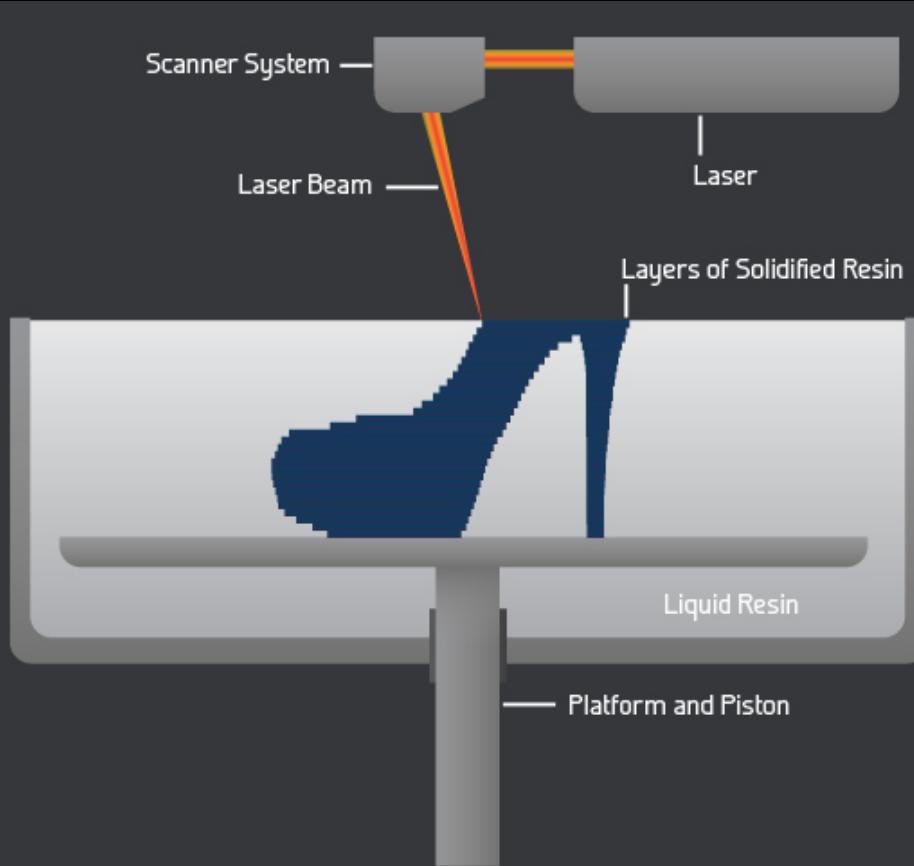
# Types of 3D printing

- Fused Deposition Modeling (FDM)
- Stereolithography (SLA)
- Selective Laser Sintering (SLS)

# How 3D printing works: FDM



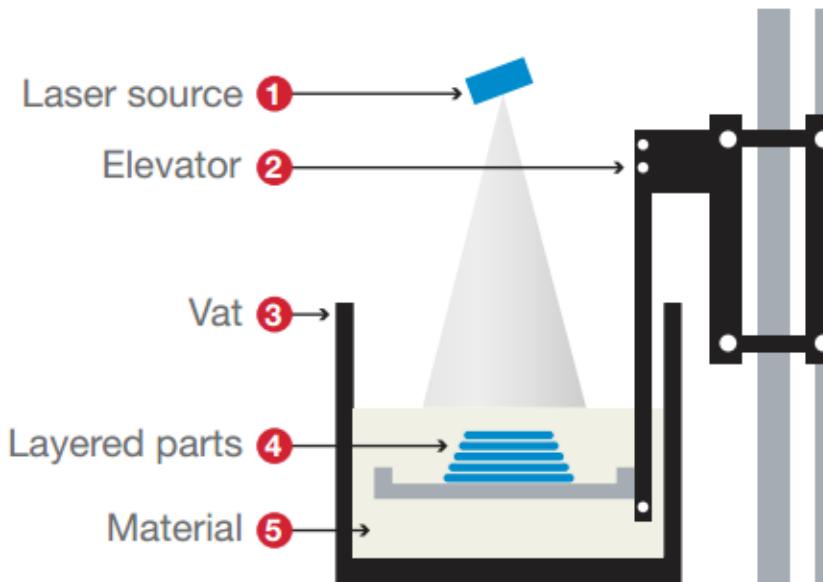
# How 3D Printing Works: SLA



# How 3D printing works: SLS

## HOW 3D PRINTING WORKS

3D printers work like inkjet printers. Instead of ink, 3D printers deposit the desired material in successive layers to create a physical object from a digital file.



- 1 A laser source sends a laser beam to solidify the material.
- 2 The elevator raises and lowers the platform to help lay the layers.
- 3 The vat contains the material used to create the 3D object.
- 4 The 3D object is created as parts are layered on top of each other.
- 5 Advanced 3D printers use one or more materials, including plastic, resin, titanium, polymers and even gold and silver.

# Types of Materials



**plastic**

 Strong & flexible

 1mm  
Min. wall thickness

 Details & texture

 \$\$\$\$\$  
Price

# Plastic (Nylon)

# Types of Materials



Plastic (PLA)

# Types of Materials



 Strong & flexible

 1mm  
Min. wall thickness

 Details & texture

 Price

# Plastic (ABS)

# Types of Materials



plastic

Variable Strengths & flexibilities

1mm Min. wall thickness

Details & texture

\$\$\$\$ Price

# Plastic (Resin)

# Types of Materials



**metal**

**TINKER CAD**

**Strong & rigid**

**3mm**  
Min. wall thickness

**Details & texture**

**\$\$\$\$\$**  
Price

# Metal (Stainless Steel)

# Types of Materials

metal

i.materialise

i.materialise

Strong & rigid

0.5mm  
Min. wall thickness

Details & texture

\$\$\$\$\$  
Price

# Metal (Gold & Silver)

# Types of Materials

The image shows a comparison card for 3D printing materials from i.materialise. It features two main sections: one for 'metal' (Titanium) and one for 'Flexible Plastic'.  
**Metal (Titanium) Section:**  
- **Image:** A hand holding a metallic, textured ring, with a blue 'metal' ribbon in the top left corner.  
- **Brand:** i.materialise  
- **Icon:** A dumbbell icon.  
- **Text:** Strong & rigid  
- **Icon:** A wavy line icon labeled '0.2mm'.  
- **Text:** Min. wall thickness  
- **Icon:** A series of circles and dots.  
- **Text:** Details & texture  
- **Icon:** Four dollar signs (\$\$\$\$).  
- **Text:** Price  
**Flexible Plastic Section:**  
- **Image:** A black, flexible, segmented plastic strip bent into a U-shape.  
- **Brand:** i.materialise  
- **Icon:** None shown.

## Metal (Titanium)

# Types of Materials



others

 Rigid & delicate

 3mm  
Min. wall thickness

 Details

 Price

# Ceramic

# Types of Materials

others

Rigid & delicate



2mm  
Min. wall thickness



Details & texture



\$\$\$\$\$

Price

*i.materialise*

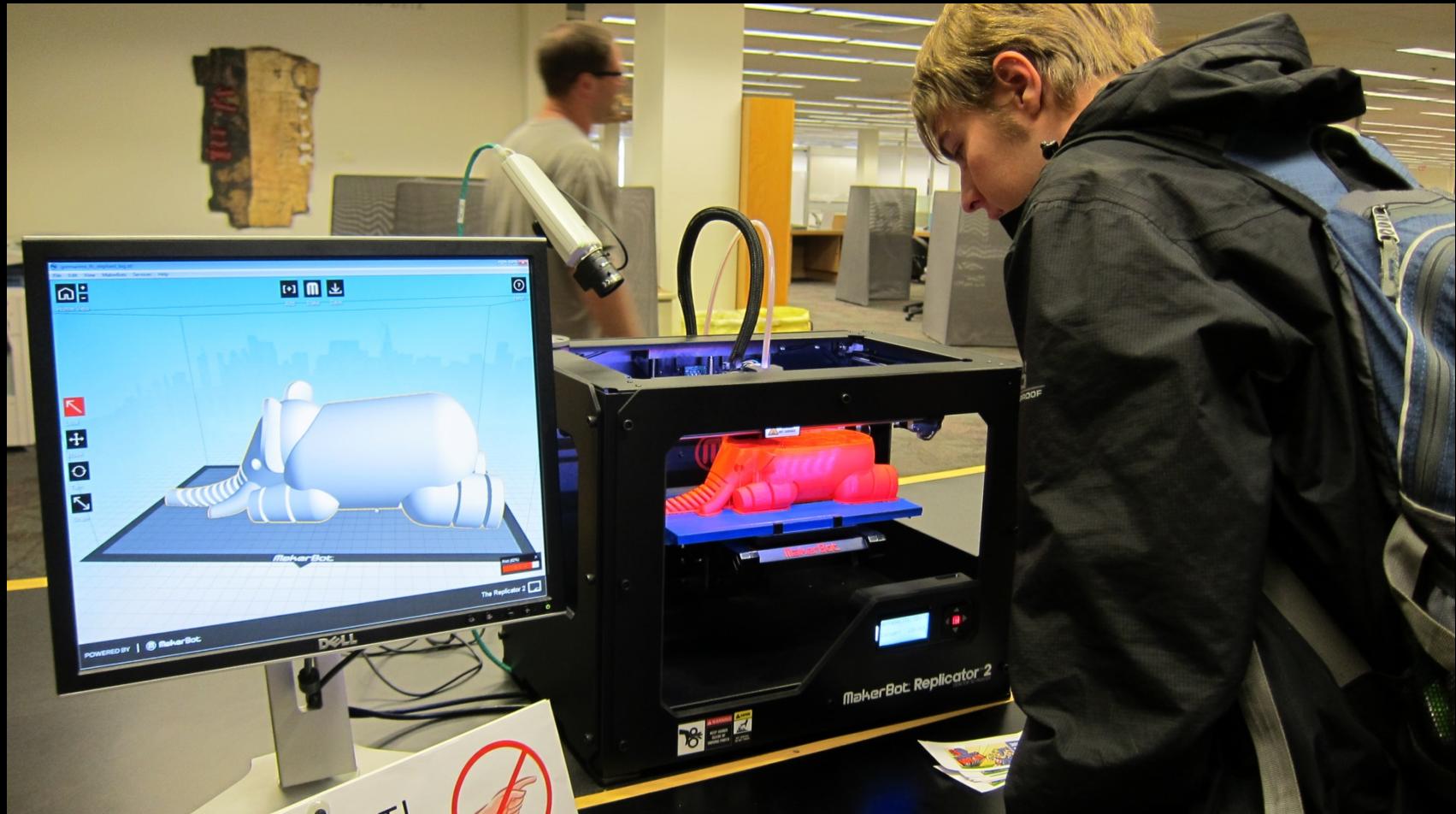
# Gypsum

# Software for creating files

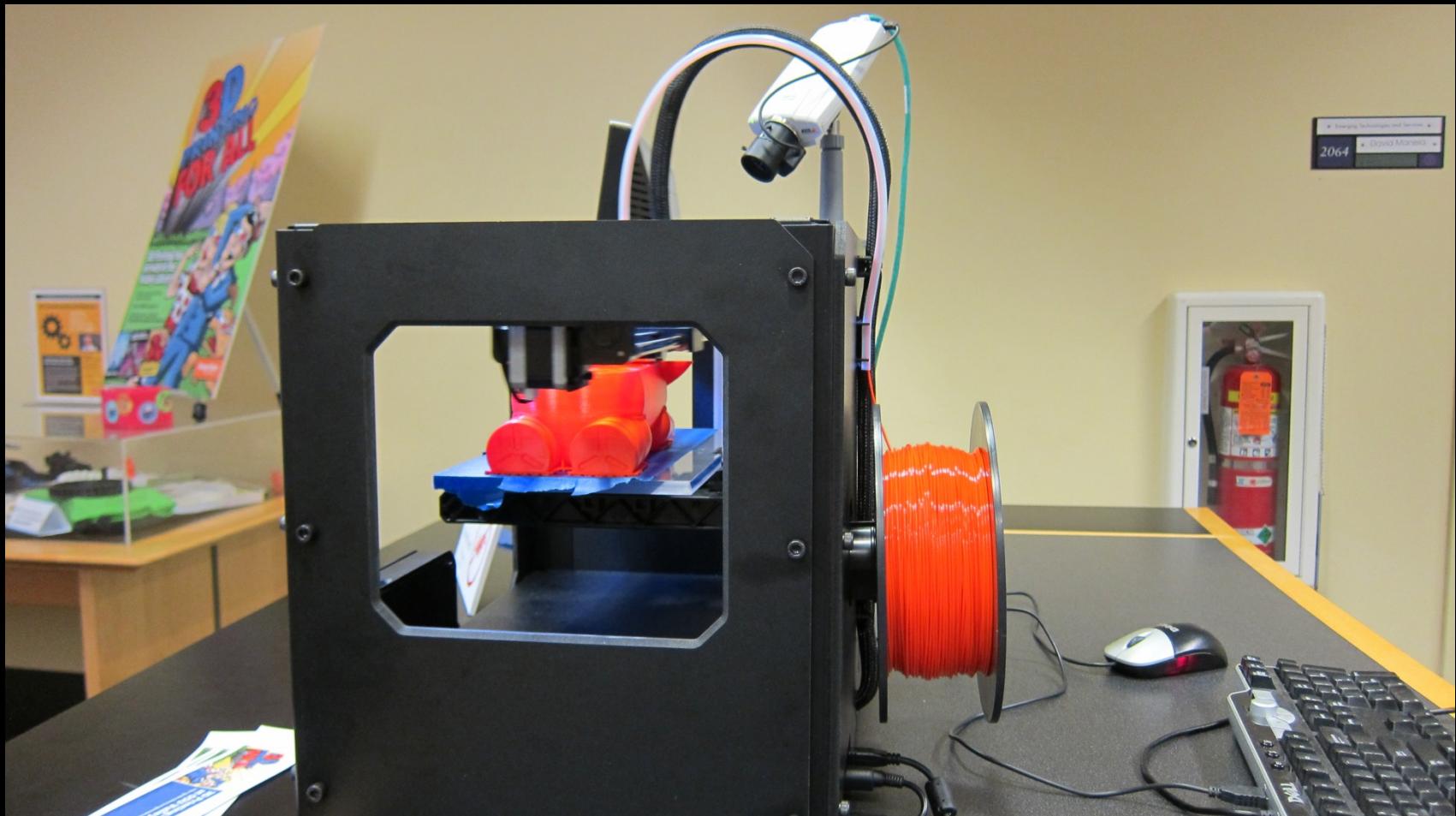
# Makerbot Replicator 2

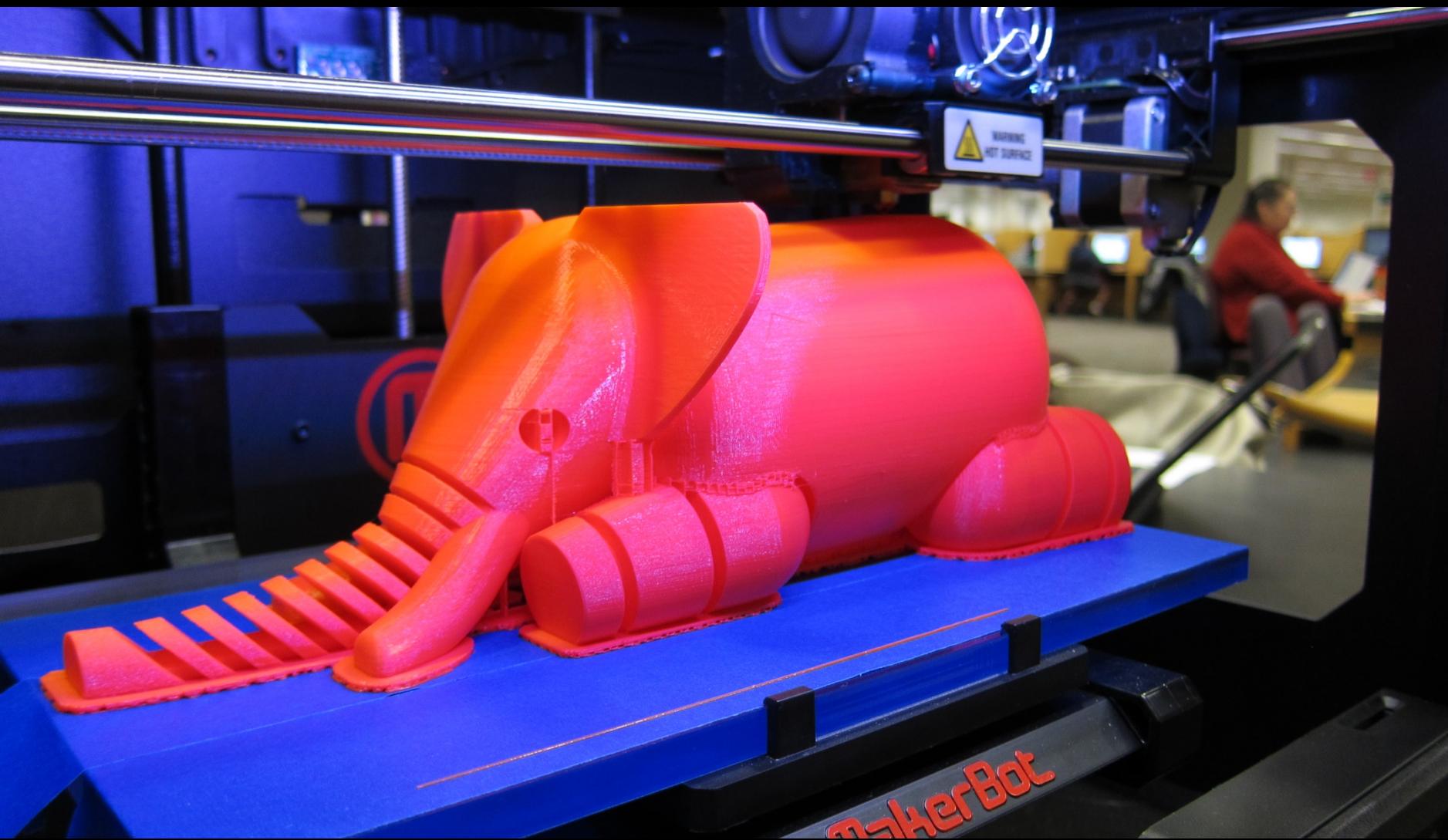


# Printer Launched 3/31/14



# In the space that we have





# Guide to 3D Printing

3D printing  
A guide about where to find 3D printers and training at OSU.

Home   3D Modeling Software   Free 3D models   Valley 3D Printing Request   Printer Policy   Training & Workshops

**3D printers on campus**

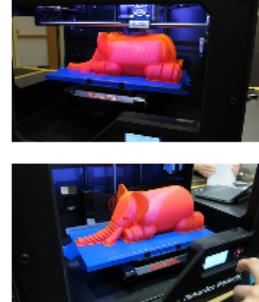
**Announcements**

3D Printing launched at the Valley Library on 3/31/2014. No tuition money was used to purchase this printer. During the Spring Term 2014 pilot phase, your first print job is free. Because of demand, we can print only one project per student during this time.

Announcement: 4/9/2014 The cooling fan is broken on the printer. It's fixed :) - we want to catch up a bit with the printing, so we'll open the print request form again on Monday 4/14.

**3D printed objects**

- The orange elephant debuted on our webcam



**3D Printer Webcam**

OSU Oregon State UNIVERSITY

OSU Webcams - Valley Lib:  
Valley Library 3D Printer 2014-04-15 08:38:15 PM



**What is 3D printing?**

3D printers use digital models to fabricate three-dimensional objects, a layer at a time. The process of 3D printing - called additive manufacturing or rapid prototyping in engineering and commercial settings - has been around for almost 30 years. Low cost 3D printers, do-it-yourself kits and open source software are

**Librarian**



Margaret Mellinger

**Contact Info**  
Office Hours: Call or email for appointment  
Office Location: The Valley Library, 4th Floor  
541.737.9642  
[Send Email](#)

**Links:**  
[Profile & Guides](#)

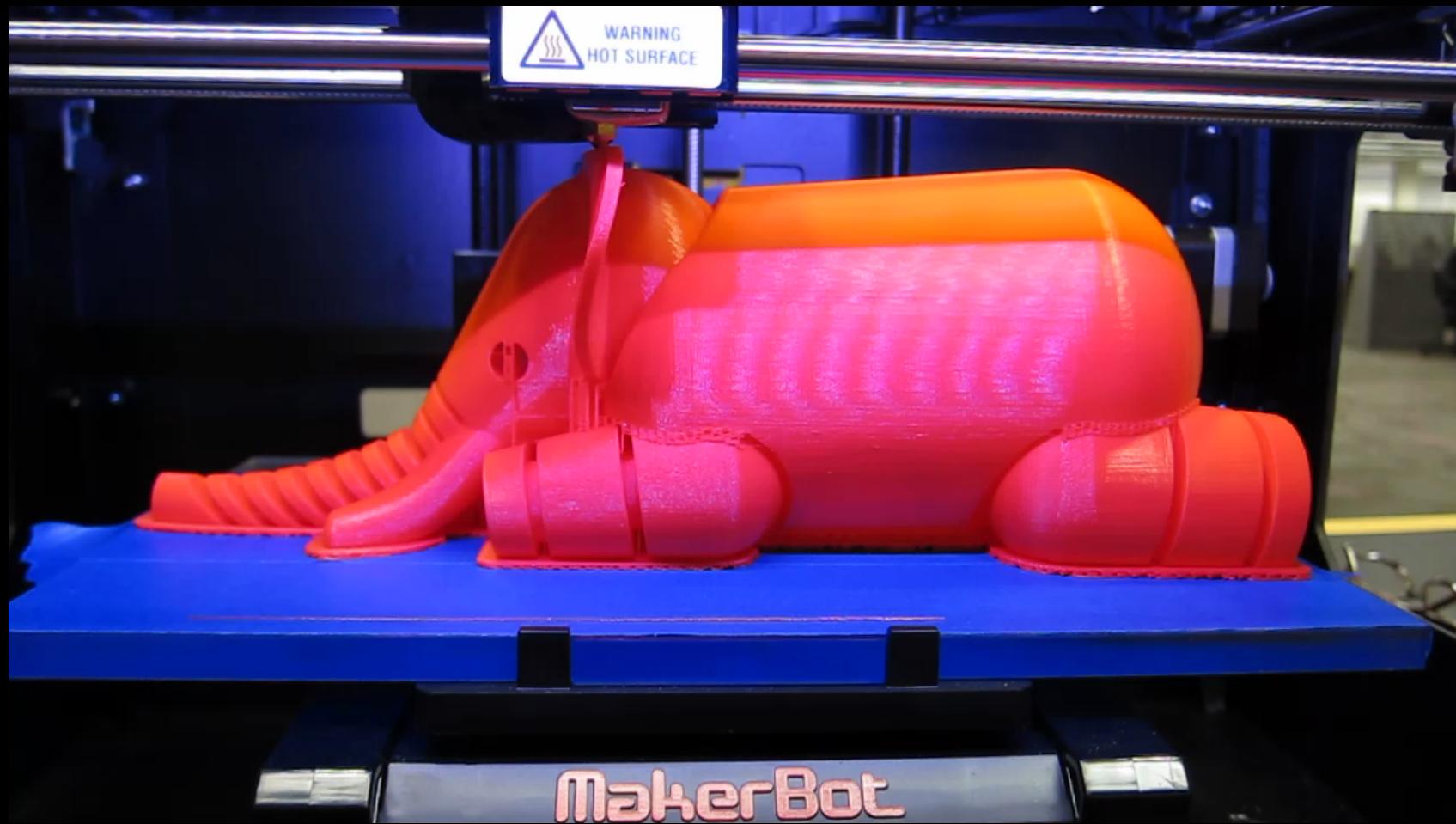
**Librarian**



# Printing Policy

Purpose	Policy
<p>The Valley Library desires to offer the OSU community access to emerging technologies such as 3D printers to inspire interest in design and help students bring their creations to life. This policy establishes how and under what circumstances the OSU community may use the Library's 3D printer.</p> <p>Policy adapted from Sacramento Public Library</p>	<p>The Valley Library's 3D printer is available to OSU students, faculty and staff to make three-dimensional objects in plastic using a design that is uploaded from a digital computer file.</p> <p>I. The Valley Library's 3D printer may be used only for lawful purposes. No one will be permitted to use the Library's 3D printer to create material that is:</p> <ul style="list-style-type: none"><li>a. Prohibited by local, state or federal law.</li><li>b. Unsafe, harmful, dangerous or poses an immediate threat to the well-being of others. (Such use may violate the terms of use of the manufacturer.)</li><li>c. Obscene or otherwise inappropriate for the Library environment.</li><li>d. In violation of another's intellectual property rights. For example, the printer will not be used to reproduce material subject to copyright, patent or trademark protection.</li></ul> <p>II. The Library reserves the right to refuse any 3D print request.</p> <p>III. Cost: Your first 3D print at the Library is free until 6/30/2014. After that time, there will be a charge of 10 cents per gram of filament used in the printing process. 3D printing costs will be charged to ONID accounts.</p> <p>IV. Items printed from the Library 3D printer not picked up within 7 days after being printed become the property of the Library. Items must be picked up by the individual who printed them, using an OSU ID.</p> <p>V. Only designated Library staff and volunteers will have hands-on access to the 3D printer.</p>

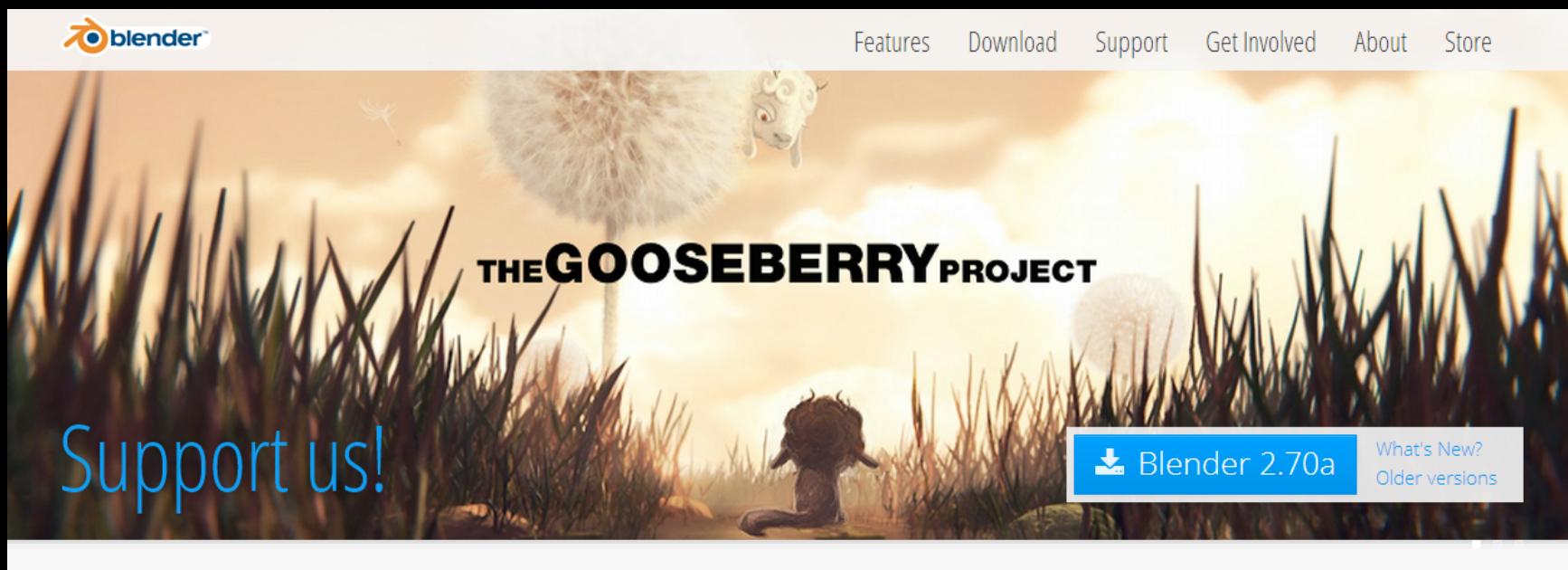
# Web Cam!



# 3D Printing Club



# Blender Learning Community



The image shows the Blender website's main page. At the top left is the Blender logo. To its right are navigation links: Features, Download, Support, Get Involved, About, and Store. The central part of the page features a large, artistic photograph of a white sheep with a large, fluffy coat standing in a field of tall grass under a warm, golden sky. A single dandelion seed is captured in mid-air above the sheep. Overlaid on this image is the text "THE GOOSEBERRY PROJECT" in a bold, black, sans-serif font. In the bottom left corner of the image, the text "Support us!" is written in a large, blue, sans-serif font. In the bottom right corner of the image, there is a blue button with a white download icon and the text "Blender 2.70a". Below this button, smaller text links say "What's New?" and "Older versions".

blender

Features   Download   Support   Get Involved   About   Store

THE GOOSEBERRY PROJECT

Support us!

Blender 2.70a

What's New?  
Older versions

T. Rowe Price. A Brief History of 3D printing.

[http://individual.troweprice.com/staticFiles/  
Retail/Shared/PDFs/  
3D Printing Infographic FINAL.pdf](http://individual.troweprice.com/staticFiles/Retail/Shared/PDFs/3D%20Printing%20Infographic%20FINAL.pdf)

Tinkercad Blog. 3D Printing Materials Guide.

<http://blog.tinkercad.com/materialsguide>