

3D Printing for Scientists

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2018-04-12



What is 3D Printing?

The process of joining material together to create 3D objects

Allows for complex internal structures

Useful for creating custom parts, display pieces, rapid prototyping



<http://www.georgehart.com/rp/polyhedra-clusters/hand2.jpg>

How it works



Types of 3D Printing

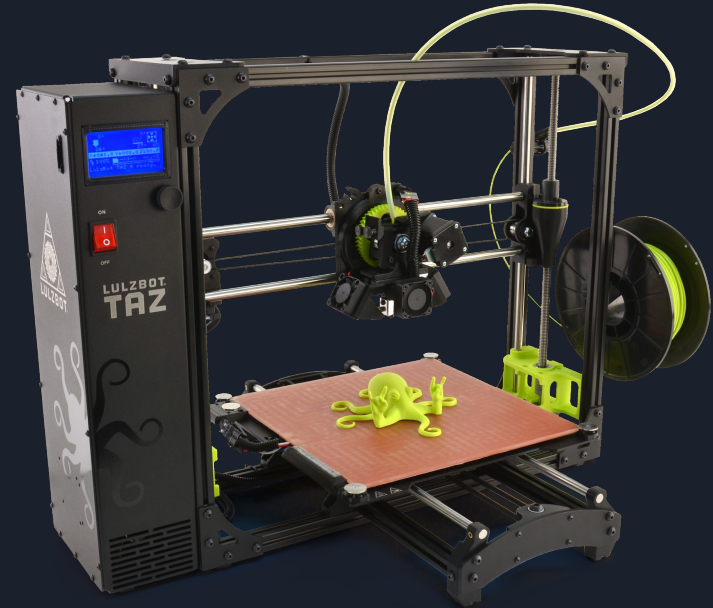
Stereolithography (SLA)

Selective Laser Sintering (SLS)

Fused Deposition Modeling (FDM)

Many others:

[3D Printing Processes \(Wikipedia\)](https://en.wikipedia.org/wiki/3D_printing)



https://www.lulzbot.com/sites/default/files/TAZ_6_Angle_Main_Product_Page.png

Stereolithography (SLA)

Buils by curing resin with
laser

High accuracy, smooth details

More expensive



Selective Laser Sintering (SLS)

Builds by fusing powder with laser

Good detail, rough surface finish, doesn't need support structures

Expensive



Fused Deposition Modeling (FDM)

Build by melting and extruding thermoplastic filament

Low-cost, fast

Low accuracy and details



FDM - Materials

3D Printing Materials: The Pros and Cons of Each Type

- PLA
- ABS
- PVA
- Nylon
- HDPE
- T-Glase/PETT
- Wood composite
- Metal composite
- Carbon fiber composite
- Conductive

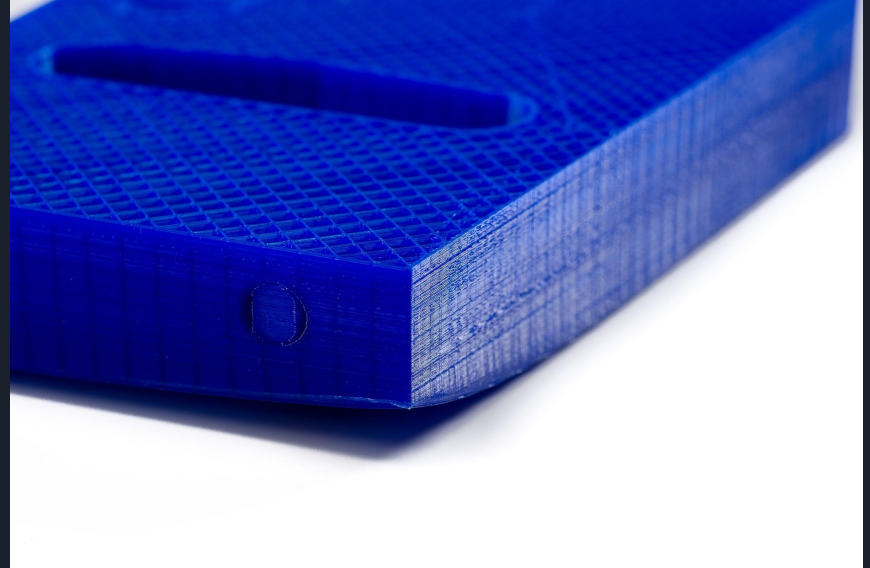


Shrinkage & Warping

Shrinkage: A Problem of 3D Printing

How To Fix Warping

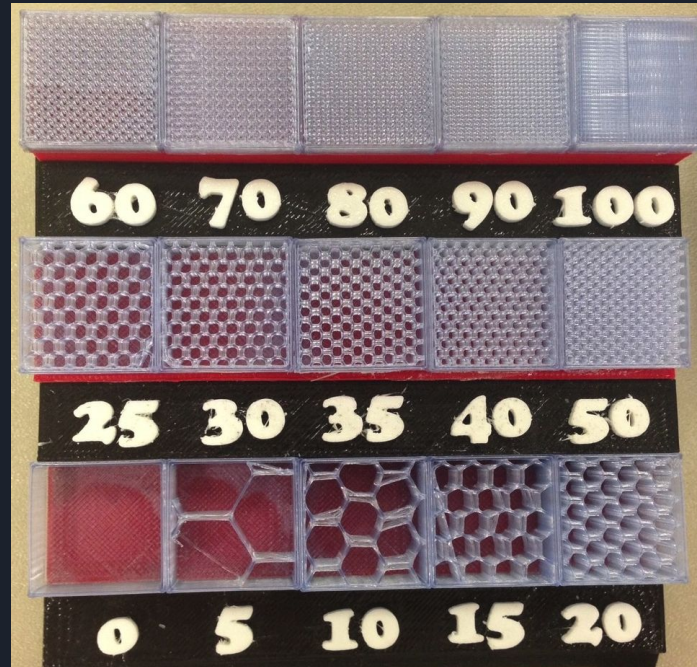
Adhesives, heated plates,
draft guards, rafts



<https://d3v5bfco3dani2.cloudfront.net/photo/image/0x0/56cc754c5a96b/img4924.jpg>

Important Terms - Infill

<https://3dprint.com/82668/infill-shells-3d-printing/>



Important Terms - Shells

<https://3dprint.com/82668/infill-shells-3d-printing/>



Important Terms - Rafts & Supports

<https://3dprint.com/82668/infill-shells-3d-printing/>



Printing Models

Home printers

Libraries

Universities

Online services



<https://innovationacademy.ufl.edu/media/innovationacademyufl.edu/images/resources-tab/prototype-and-build/Lib-3d-printer.jpg>

Creating Models

Online sources

3D scanning

Direct modelling

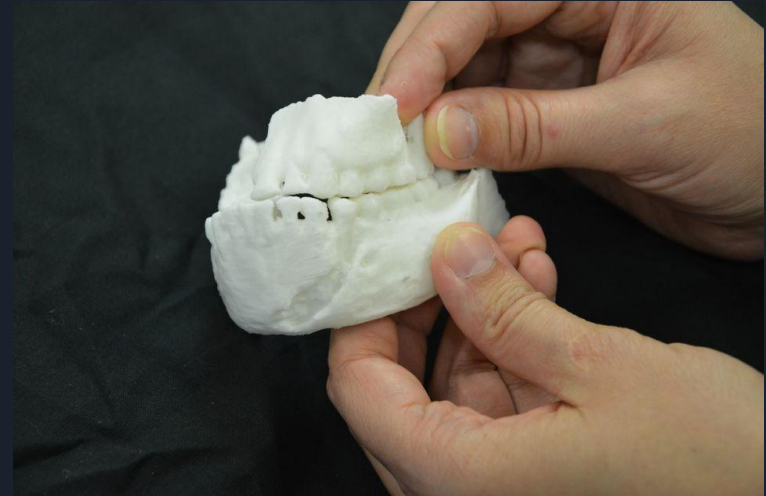
CAD



Applications

3D Technology Helps
Democratize Science as CMU
Studies 3D Printed *Homo
Nadeli* Fossils

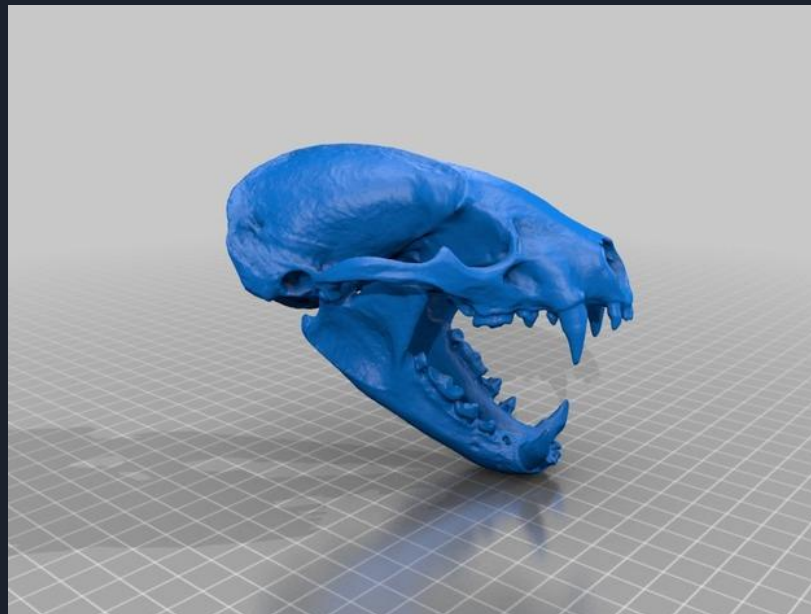
How To Print Your Own 3D
Replicas Of *Homo Naledi* And
Other Hominin Fossils



https://thumbor.forbes.com/thumbor/960x0/smart/https%3A%2F%2Fblogs-images.forbes.com%2Fkrinakinakillgrove%2Ffiles%2F2015%2F09%2FDSC_1682-1940x1284.jpg

Applications

American Badger Skull



https://cdn.thingiverse.com/renders/68/90/35/2a/78/32b41350fb08f5363f18501fc778b504_preview_featured.jpg

Applications

Bird Macaw Skeleton



https://cdn.thingiverse.com/renders/86/1e/c5/a6/2b/88f62d936d656912703e6ddbdf463e72_preview_featured.JPG

Applications

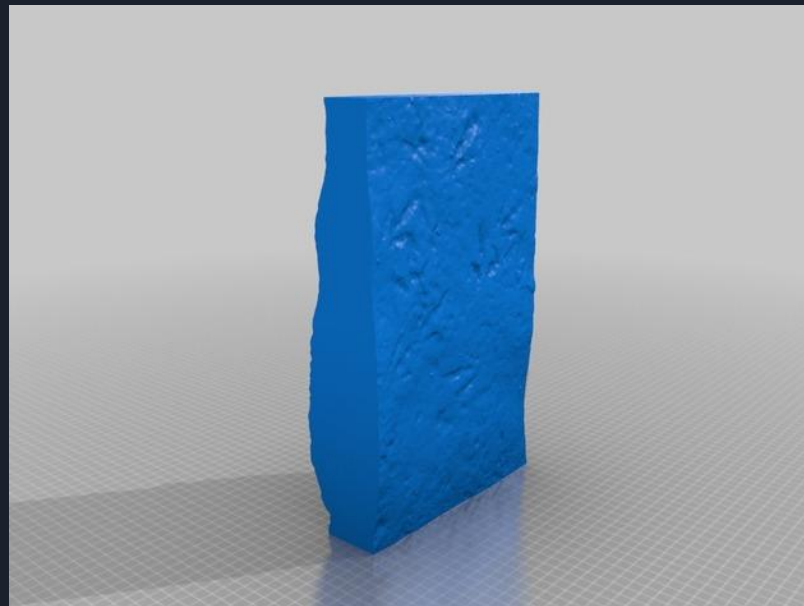
Trilobite articulatum



https://cdn.thingiverse.com/renders/51/9b/75/97/b3/Trilobite_stripes_preview_featured.jpg

Applications

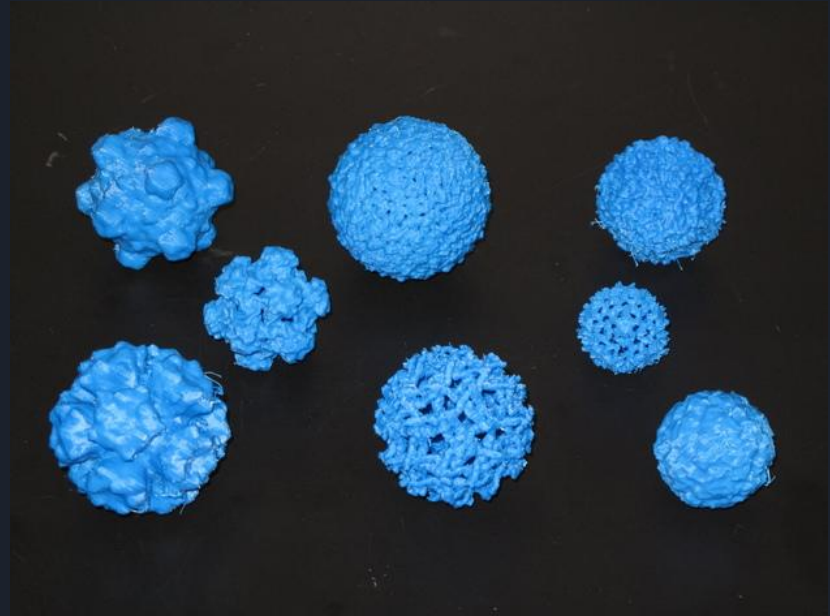
Triassic Dinosaur Tracks



https://cdn.thingiverse.com/renders/f9/68/3e/09/96/37d8de043d6fb45658a54a96a5b0c3b4_preview_feature_d.jpg

Applications

Infectious Pathogens



https://cdn.thingiverse.com/renders/ce/20/e3/55/b4/IMG_3922_preview_featured.jpg

Applications

Owl Pellet Discovery Kit



https://cdn.thingiverse.com/renders/92/f8/f1/5e/33/522c80ae390e09a6fa7a48ff272c4282_preview_featured.JPG

Applications

Grand Canyon South
Corridor



https://cdn.thingiverse.com/renders/93/c6/79/dd/f8/DSC_0023_preview_featured.jpg

Applications

Automatic Transmission Model



https://cdn.thingiverse.com/renders/26/14/39/6f/c3/transmission4_preview_featured.jpg

Applications

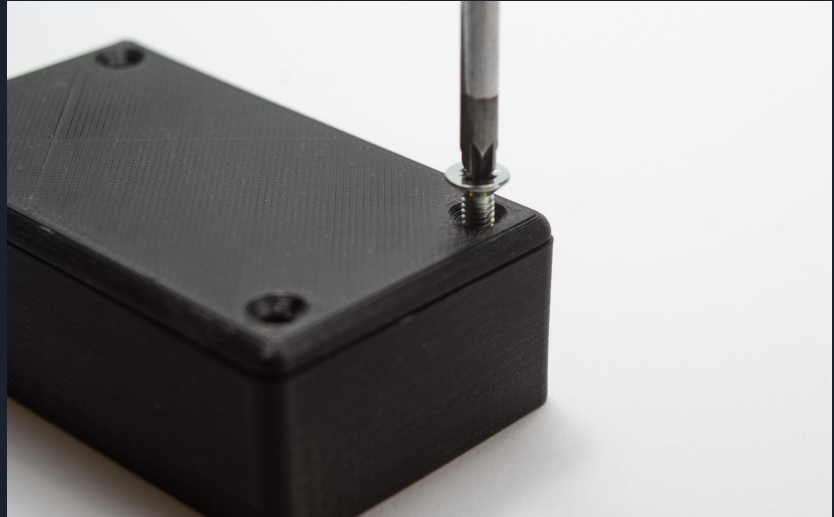
Bionic Wildlife: 3D Printing
Technology Gives Animals
Second Chance



<http://cdn.roaring.earth/wp-content/uploads/2016/11/beauty-eagle.jpg>

Applications

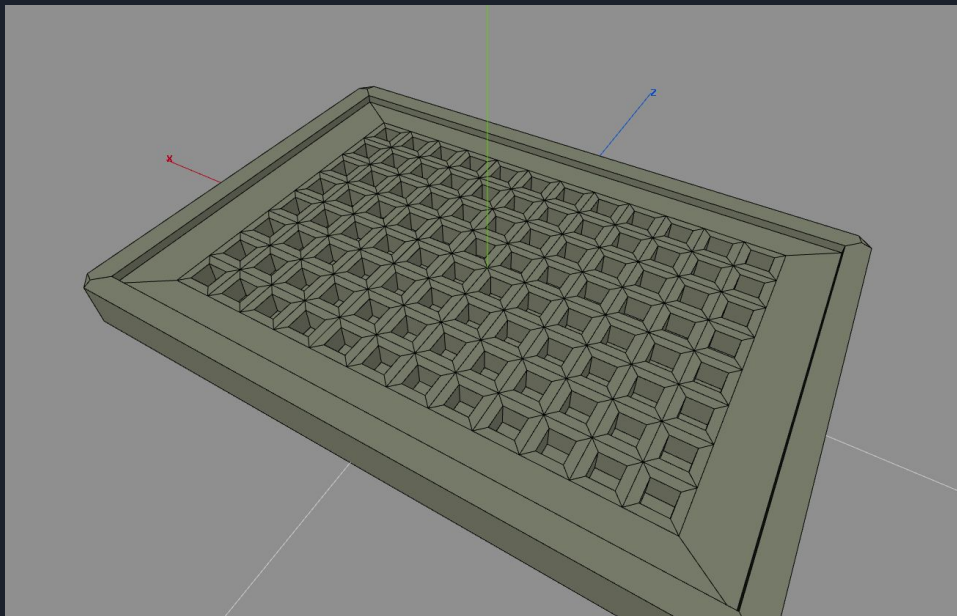
[Enclosure design for 3D Printing: A step-by-step guide](#)



<https://s3-eu-west-1.amazonaws.com/3dhubs-knowledgebase/enclosure-design-for-3d-printing/photo4.jpg>

Applications

Lab Equipment





Software

Ultimaker Cura: Visualizing and preparing models for printing

Wings3D: Direct modeling

FreeCAD: Computer aided design

Go here: www.thingiverse.com

Search: [low poly](#)



FreeCAD Tutorial

https://www.freecadweb.org/wiki/Basic_Part_Design_Tutorial