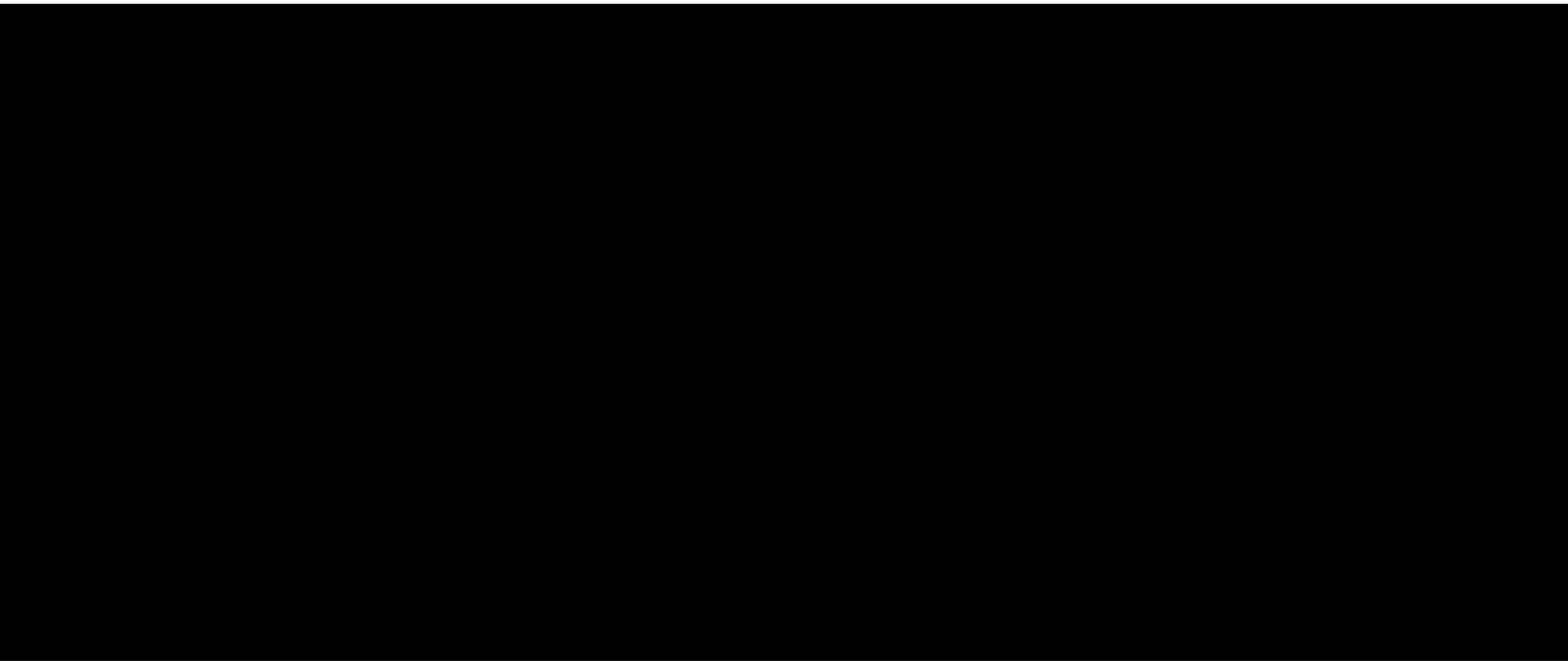


Computer Graphics at University of Toronto



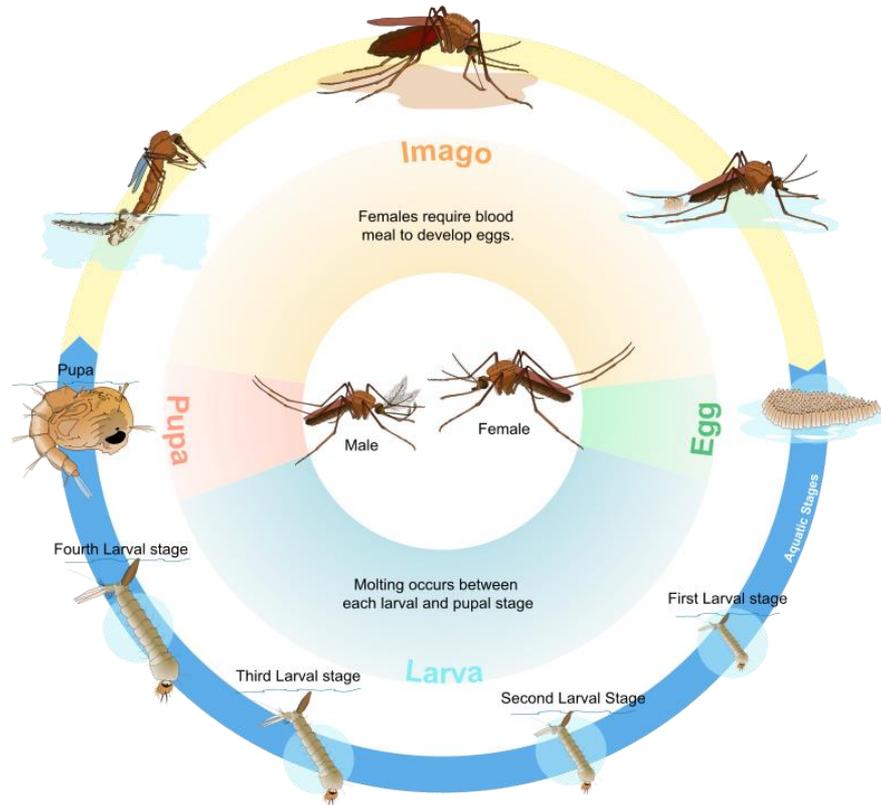
Dynamic Graphics Project

EST. 1967



Modeling

Geometry Processing is biology

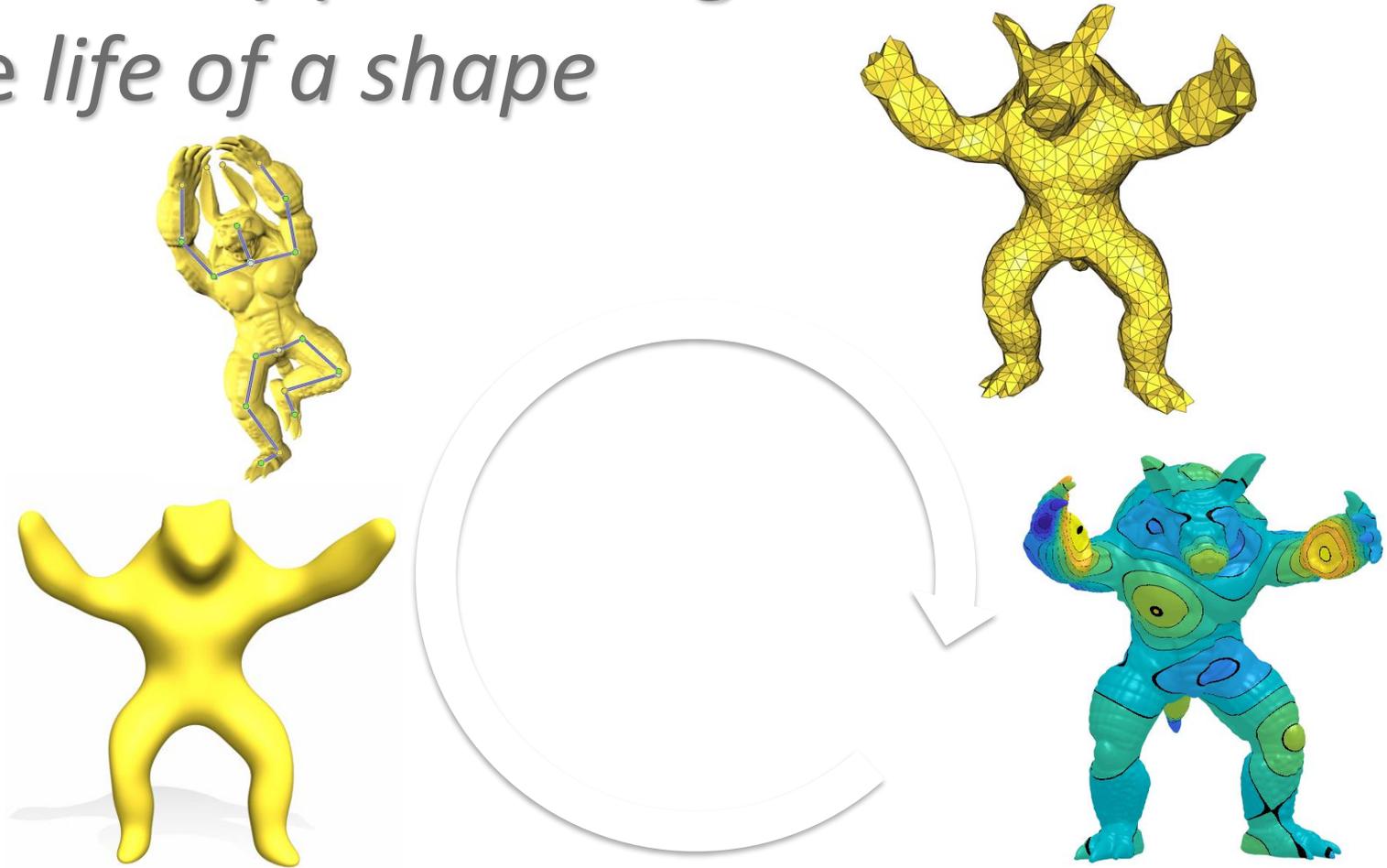


Geometry processing studies *the life of a shape*



e.g., scan of a physical
object or modeling in Maya

Geometry processing studies the *life of a shape*



Geometry processing studies the *life of a shape*



3d printing

Geometry Processing *Winter 2018*

Prerequisites:
Linear Algebra,
Calculus
Computer
Programming

Weekly, small coding
assignments

Problems in Geometry Processing...

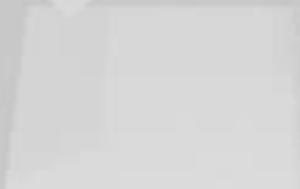


dgp | dynamic graphics project

- *Alec Jacobson*
- *University of Toronto*



Physical Simulation

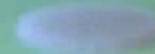


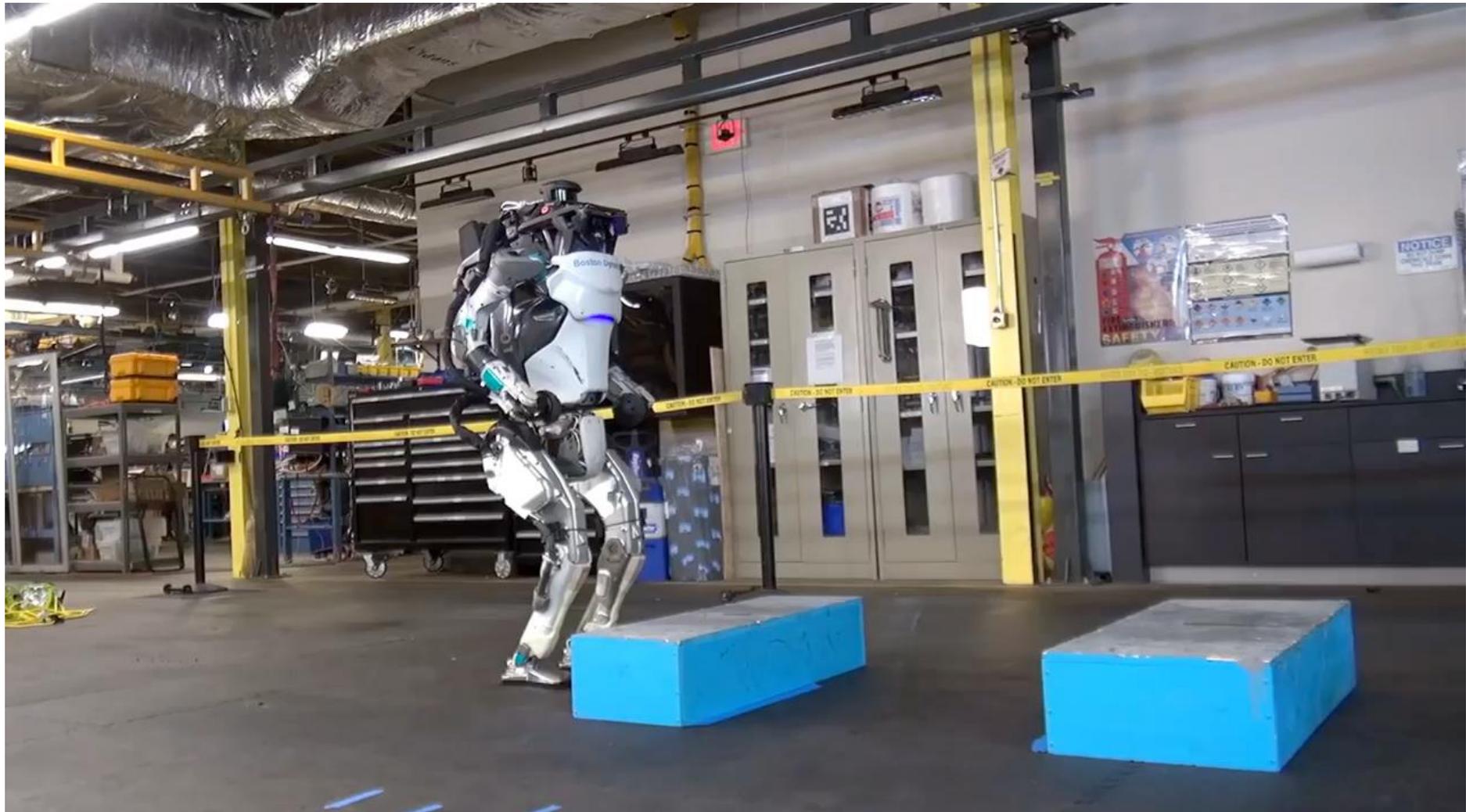


Solid-fluid density ratio
1.3 : 1



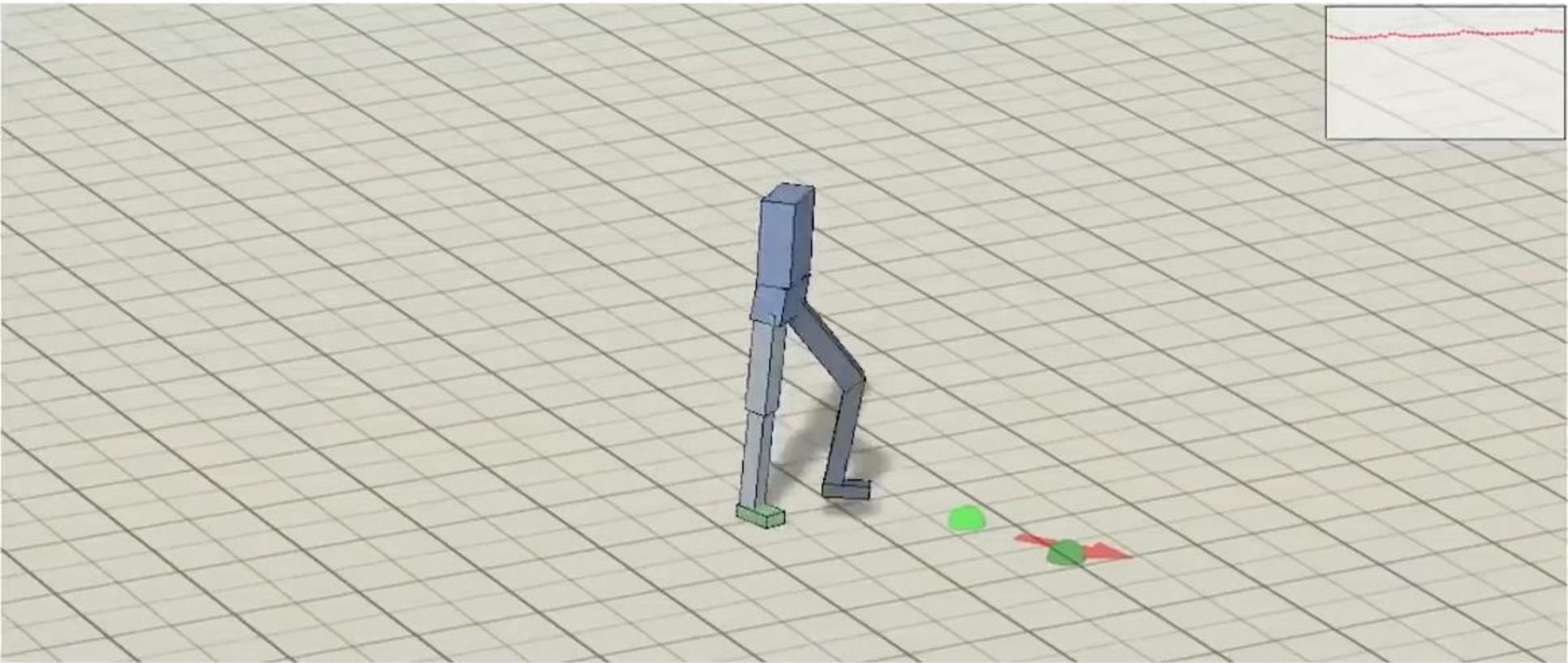
Solid-fluid density ratio
1000 : 1





Really ... its like Graphics

LLC: Walk



The LLC is first trained to locomote while following random footstep plans.

Computational Fabrication

3D Printing = Additive Manufacturing



https://commons.wikimedia.org/wiki/File:3D_printing_on_replicator_2.webm

Additive Manufacturing Technologies

Fused deposition modeling (FDM)

Stereolithography (SLA)

DLP 3D printing

Selective laser sintering (SLS)

Direct metal laser sintering (DMLS)

Plaster-based 3D printing (PP)

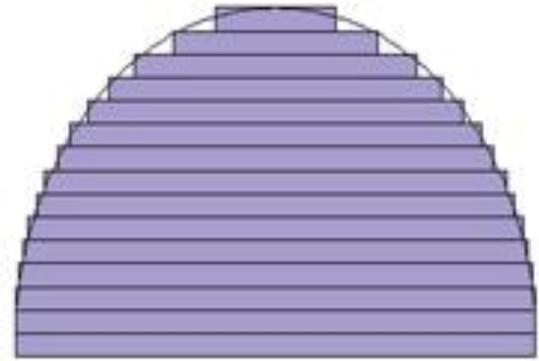
Photopolymer Phase Change Inkjets

Thermal Phase Change Inkjets

Laminated object manufacturing (LOM)

3D Printing Process

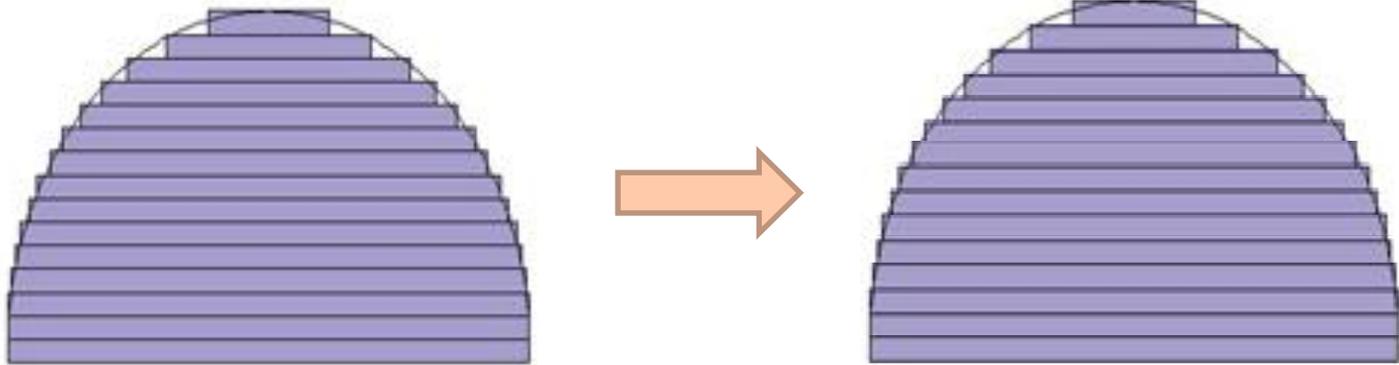
Slice 3D model into layers



3D Printing Process

Slice 3D model into layers

Manufacture layers one by one (e.g., bottom-up)



Applications: Dental and Medical Industries



Applications: Architecture & Design



Applications: Automotive



Applications: Aerospace



3D printed fuel injection nozzle for a jet engine



Airbus wing brackets

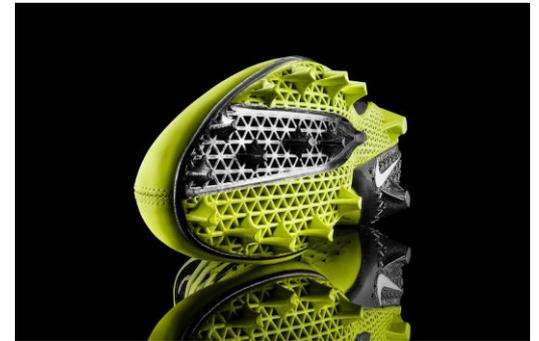
Applications: Jewelry

Direct metal printing and casting patterns



Source: Shapeways, replicatorinc.com

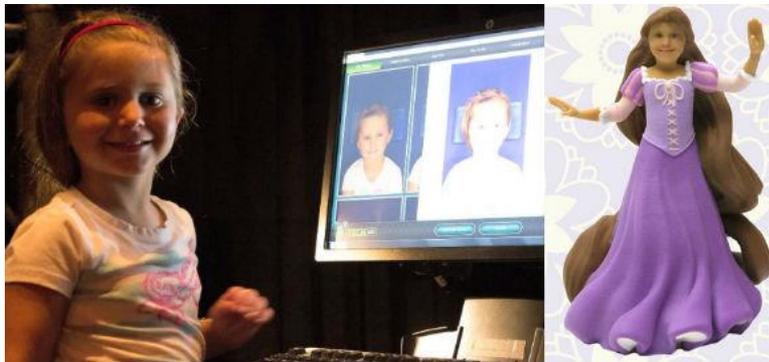
Applications: Footwear



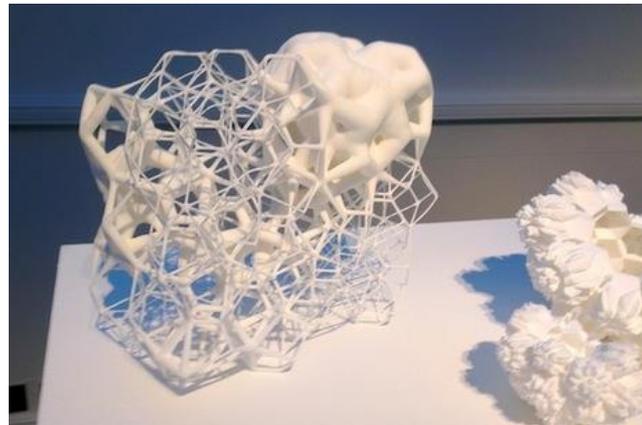
Applications: Consumer Home Products



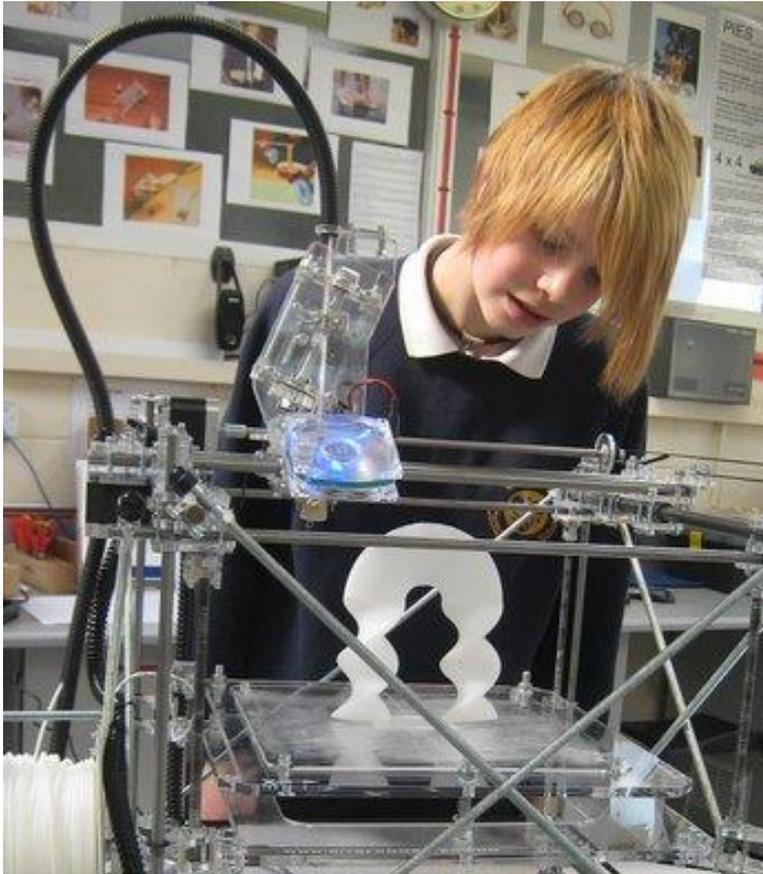
Applications: Toys & Gadgets



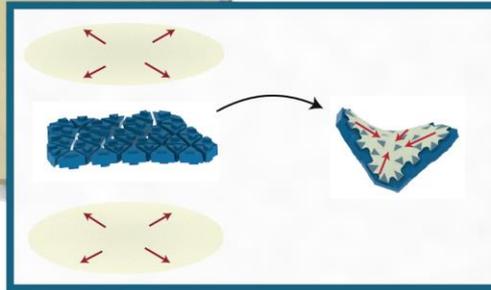
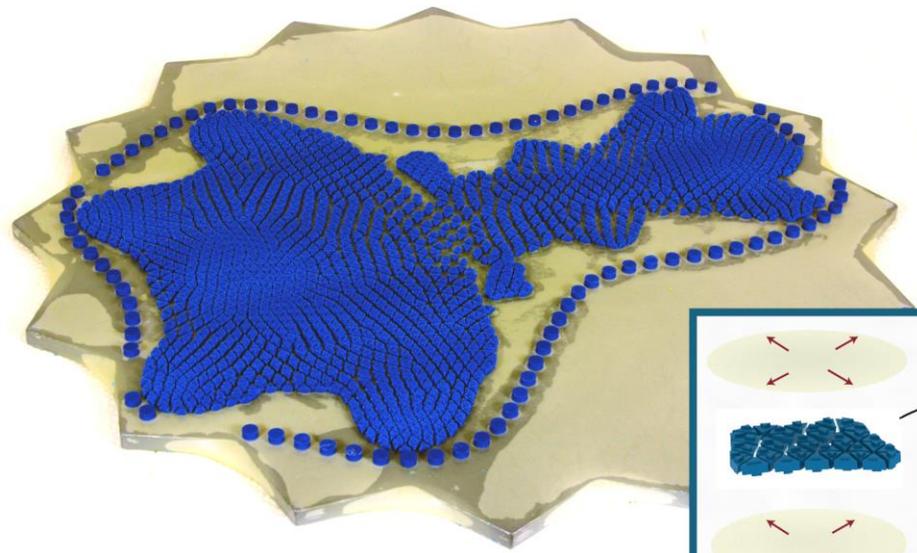
Applications: Art



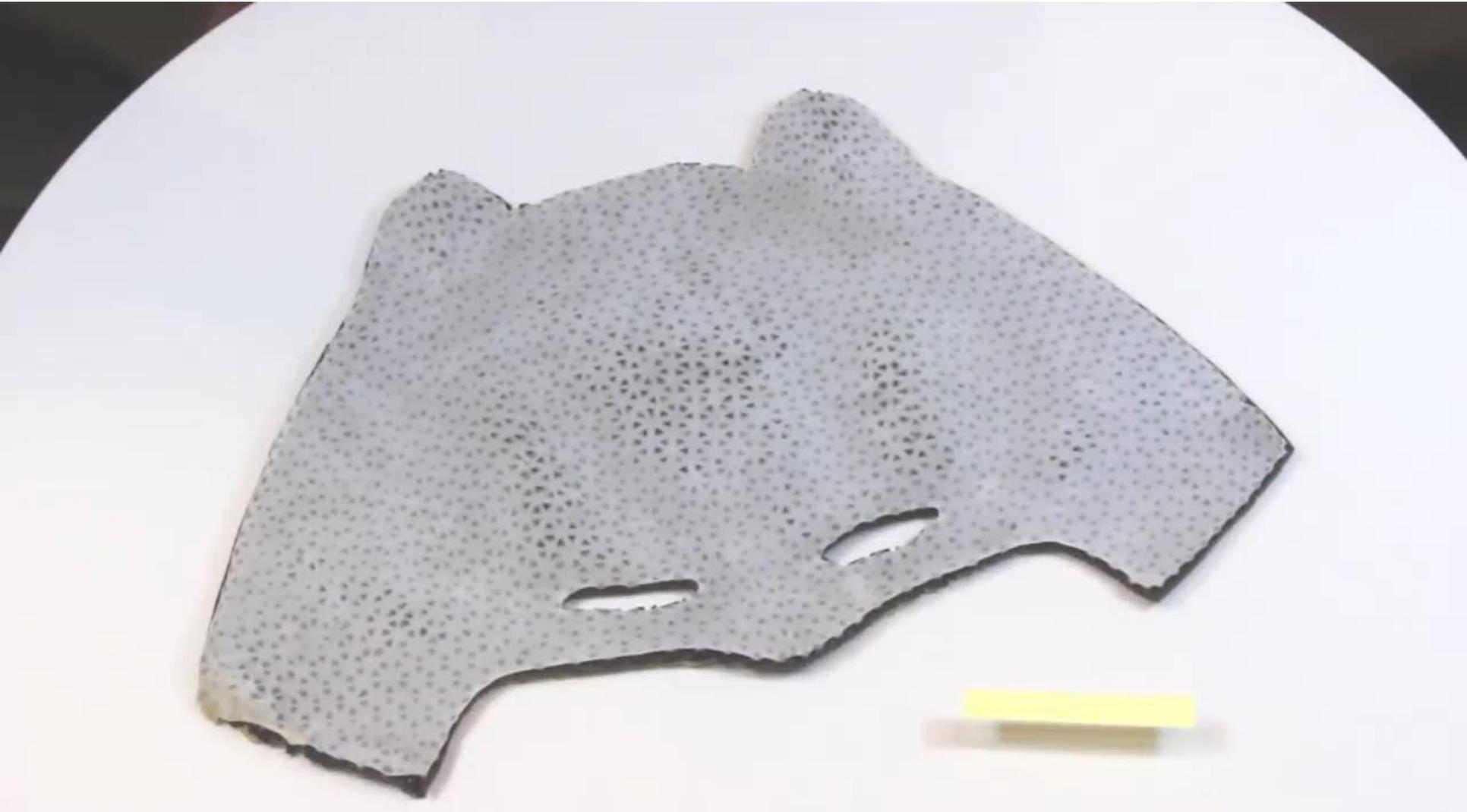
Applications: Education



Self Assembly

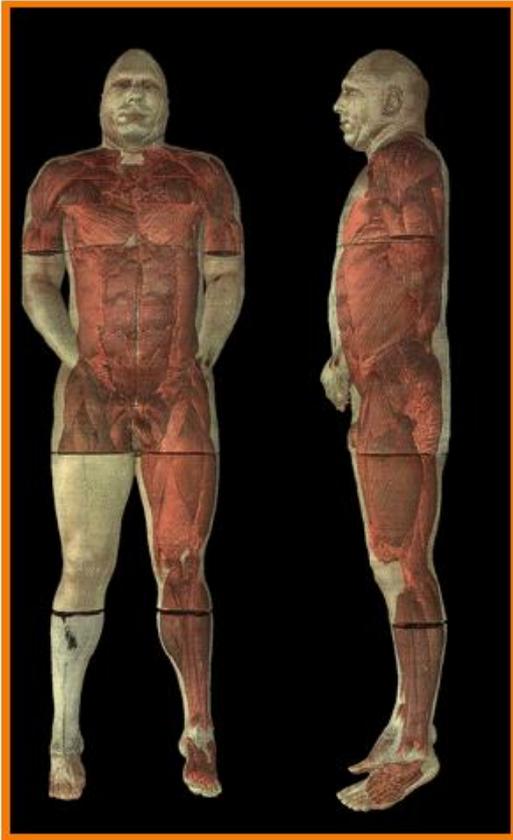


Self Assembly



Solid Modeling

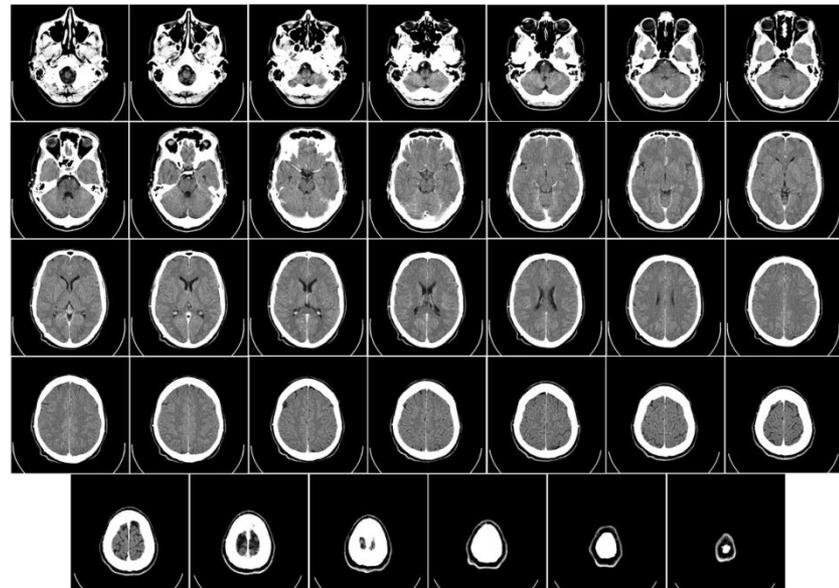
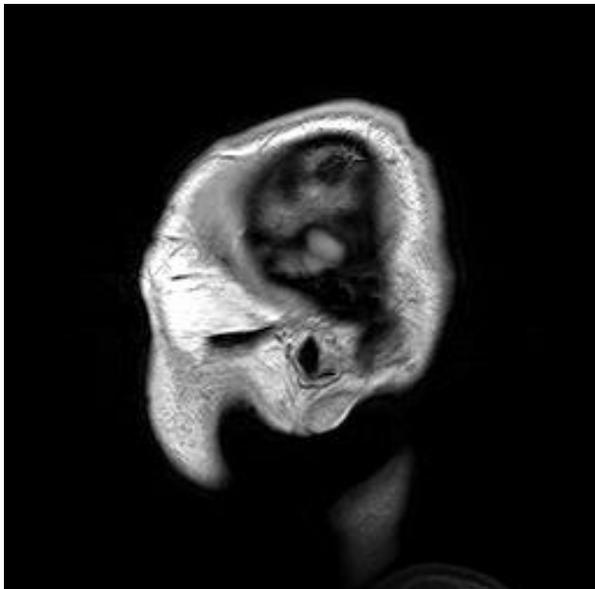
Represent solid interiors of objects



Why Volumetric Representations?

Some acquisition methods generate solids

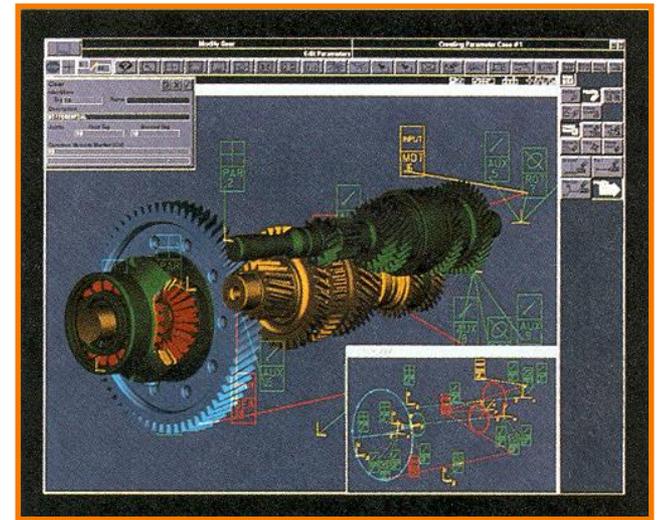
- Magnetic Resonance Imaging (MRI)
- Computed Tomography (CT/ CAT)



Why Volumetric Representations?

Some applications require solids

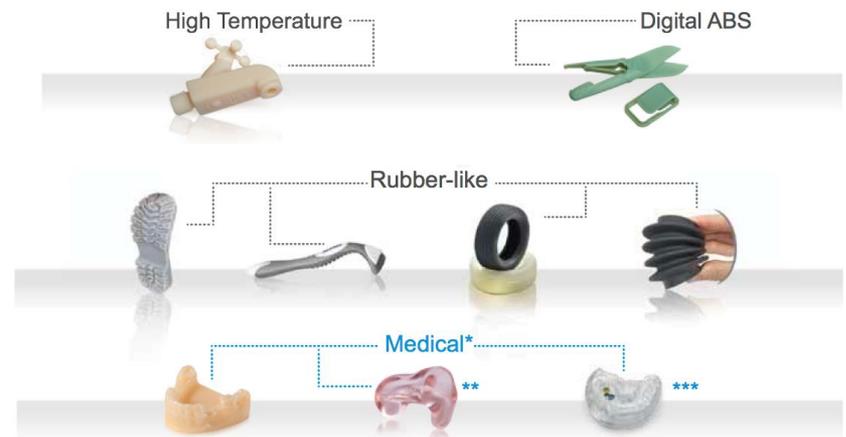
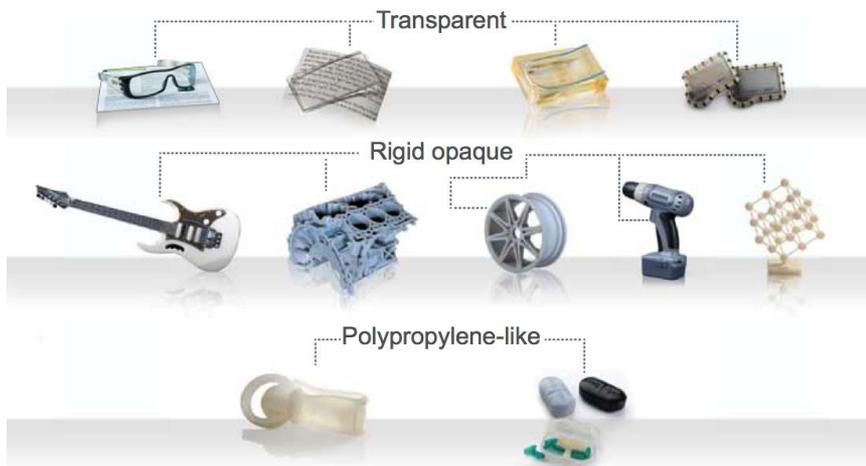
- CAD/CAM
- material(s) need to be specified inside the object



Challenges: Materials

Functional Materials

Large Material Library for AM



Courtesy of Stratasys

Challenges: Modeling Materials

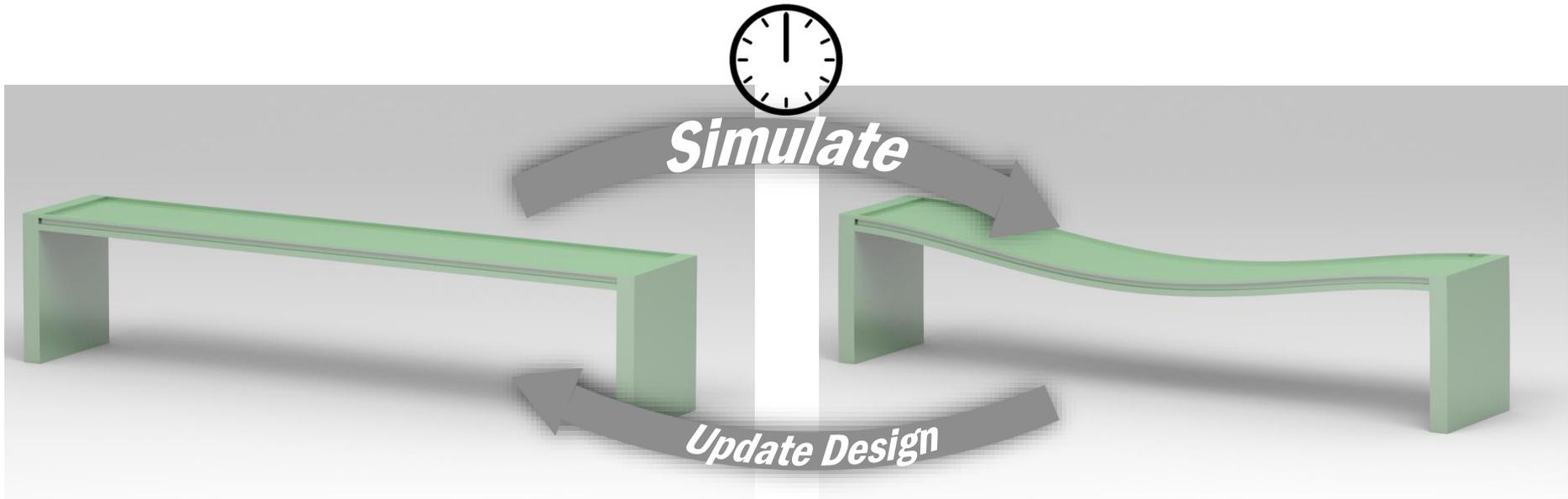
Focus on 3D geometry

Currently one material per part

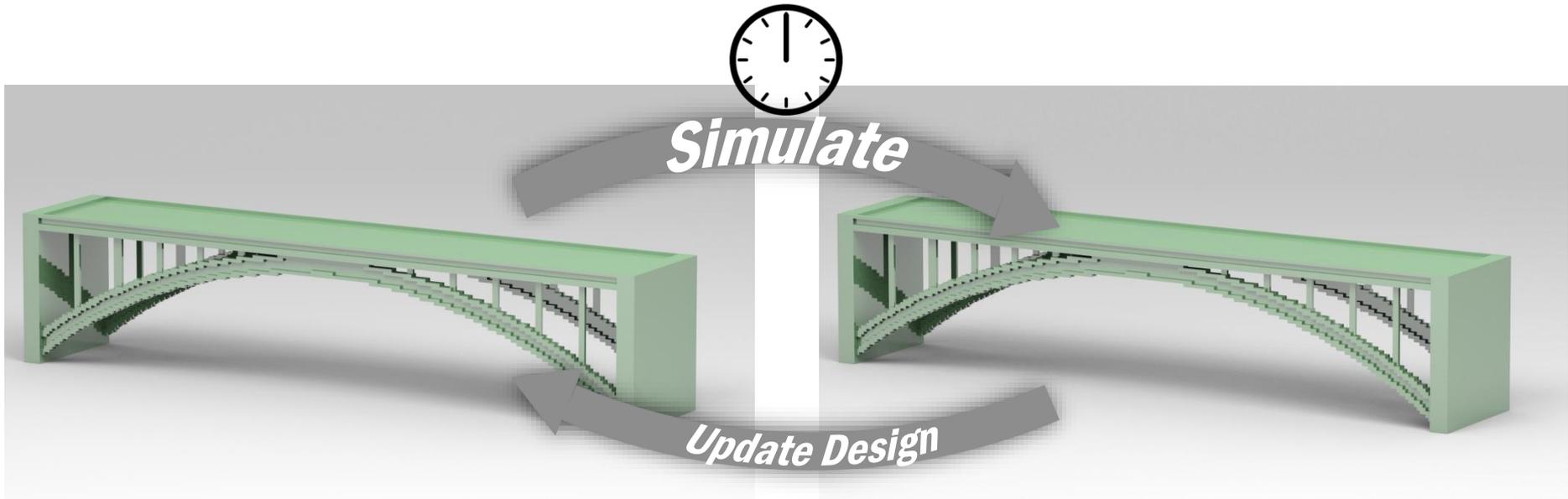
How to model parts composed of many materials?



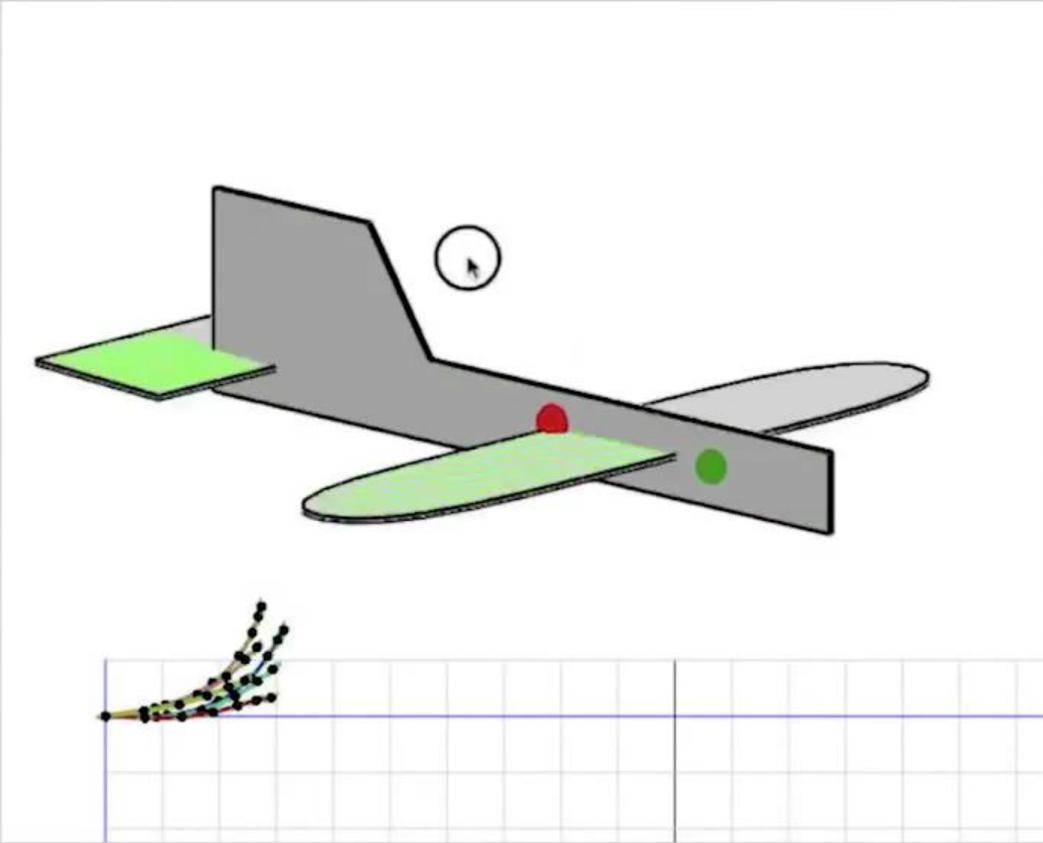
Challenges: Fast and Accurate Simulation



Challenges: Fast and Accurate Simulation



x5 Concurrent Flight Simulation



The interface displays a 3D model of a paper airplane with a grey fuselage and green wings. A mouse cursor is positioned over a circular control on the fuselage. Below the 3D view is a 2D grid with a blue horizontal line and a trajectory of black dots with colored tails (red, green, blue) showing the path of the airplane's nose.

3D Preview (TrackBall View)

Top View
Side View

Drag Sketch Smooth

Current editing mode: Drag

Delete Selected Wing

Weight:
 0g 1g 2g 3g 4g 5g

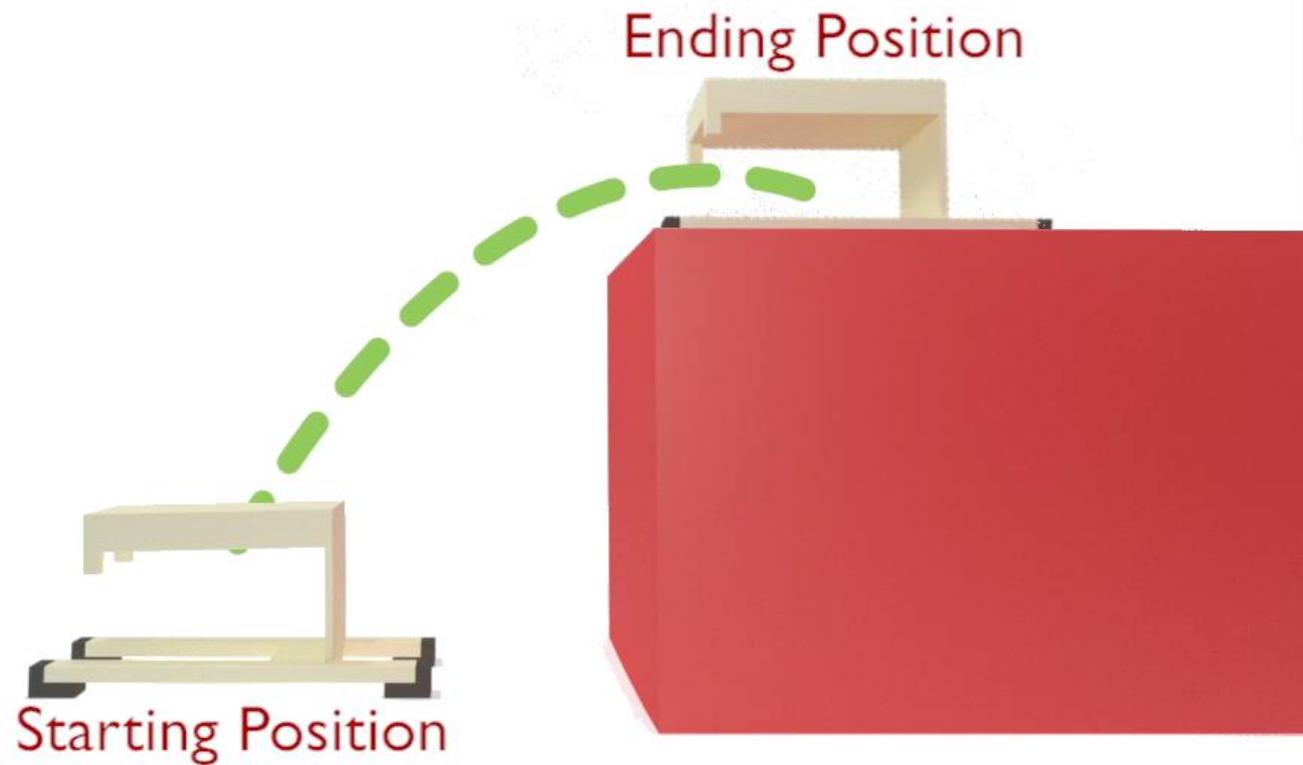
Mounting angle: -2.5 deg

Make It Fly

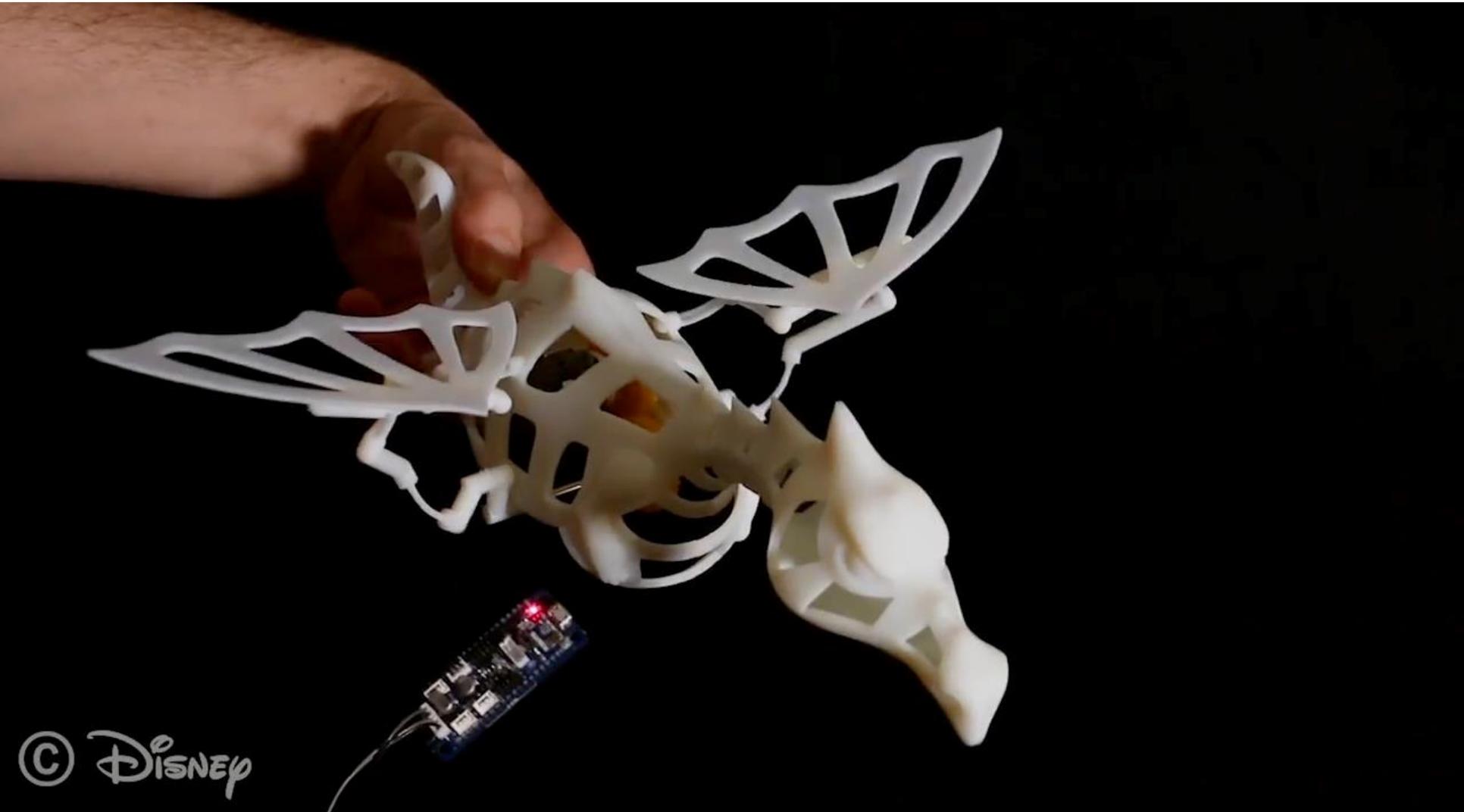
Mass: 9.3 g

Jumpers

Results



And More !!!



© Disney

Computational Design and Fabrication Course

David Levin

Course Code: CSC2521

Half-Lecture, Half-Seminar Course, final project only

Interactive Techniques

Course on interactive modeling and animation

Karan Singh

Seminar style course

What is it about?

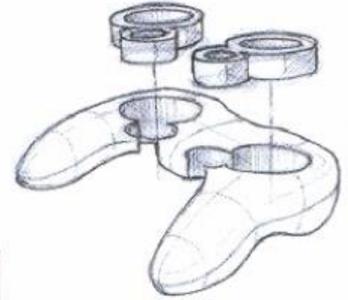
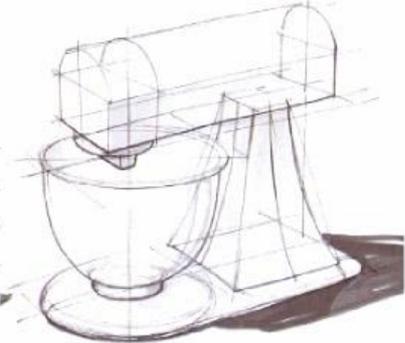
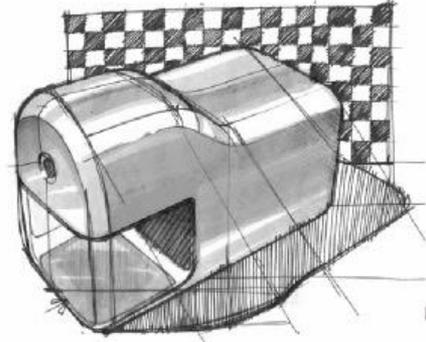
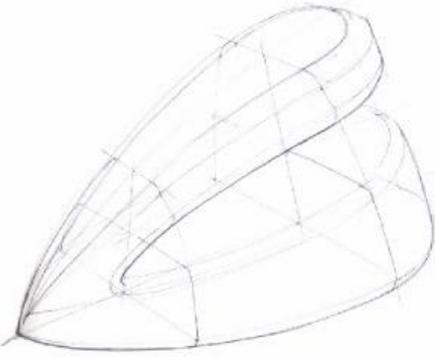
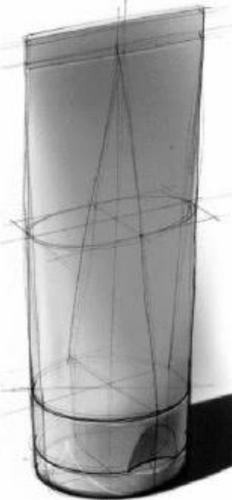
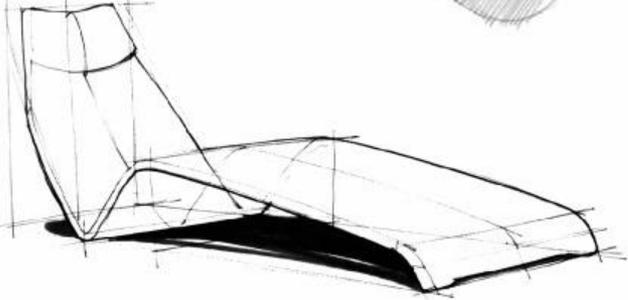
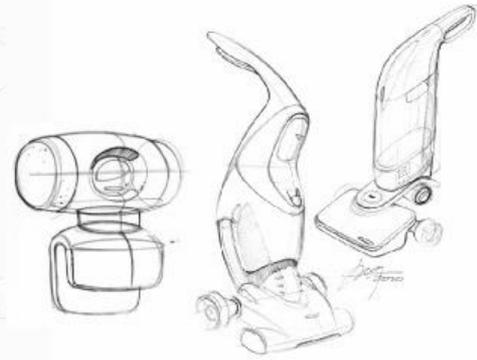
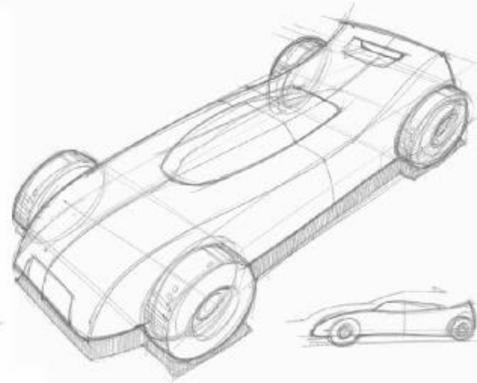
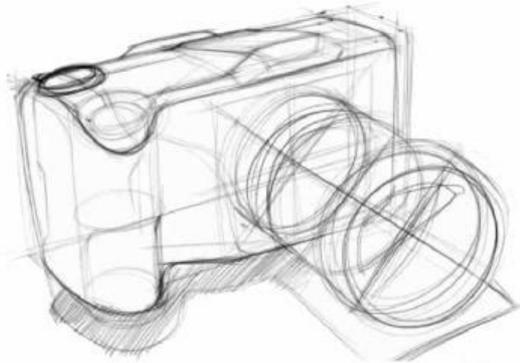
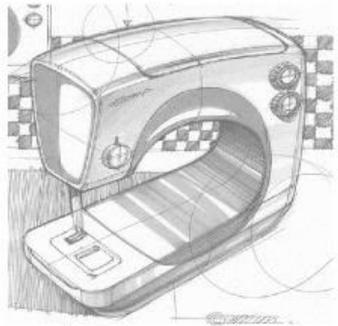
Creative visual communication

The transformation of a creative vision into a digital reality,
that is easy to refine and reuse.

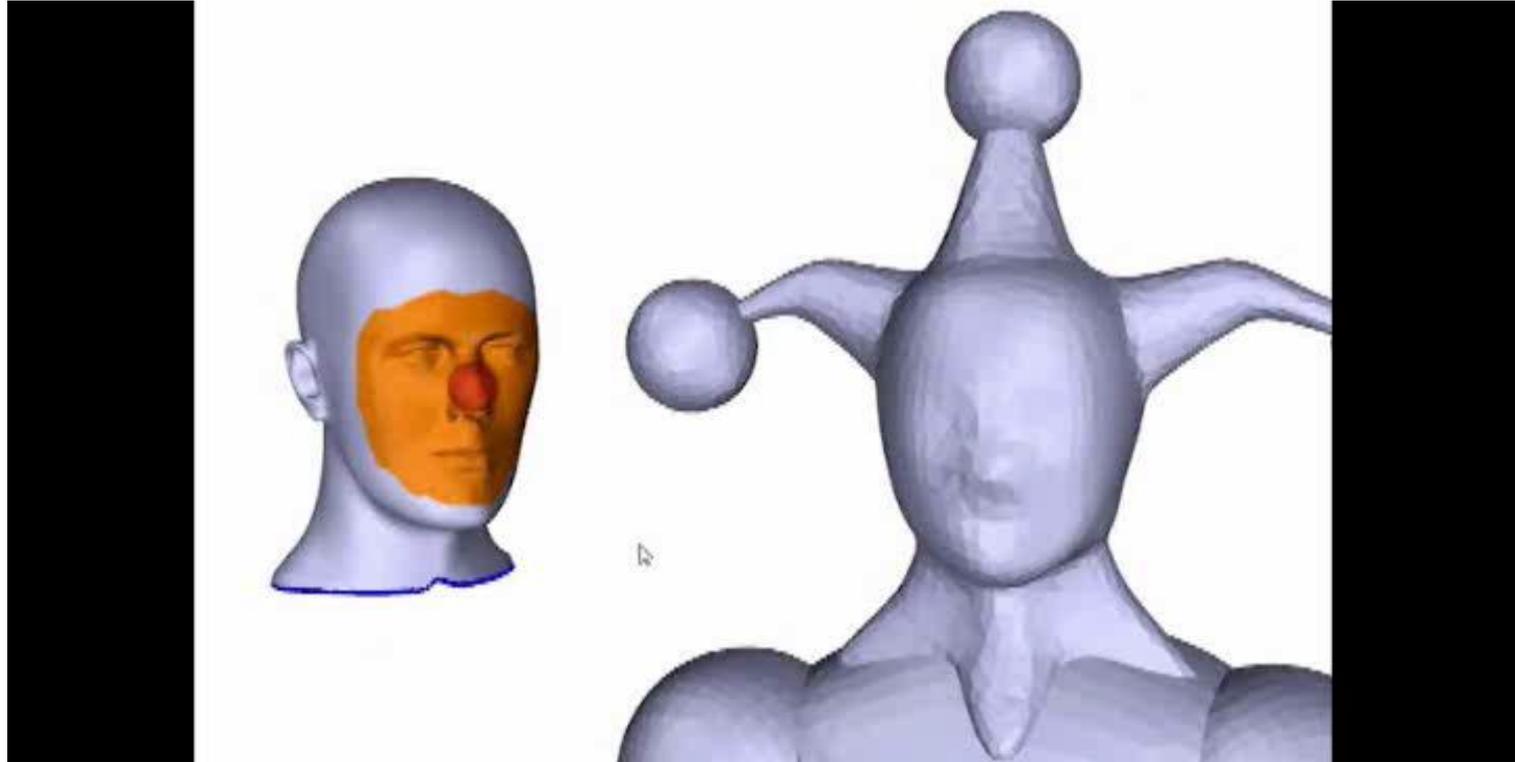
Sketchpad (Ivan Sutherland 1963)



Humans have an audio IN and OUT,
a video IN but no explicit video OUT!



MeshMixer



[**Schmidt, Singh**, MeshMixer *SIGGRAPH 2010 talks*]

www.meshmixer.com (acquired by Autodesk Inc.)

[**Takayama, Schmidt, Singh, Igarashi, Boubekur, Sorkine**, GeoBrush: interactive mesh geometry cloning. *Eurographics 2011*]

Augmented and Virtual Reality

What is Virtual Reality?

virtual reality

noun

Simple Definition of VIRTUAL REALITY

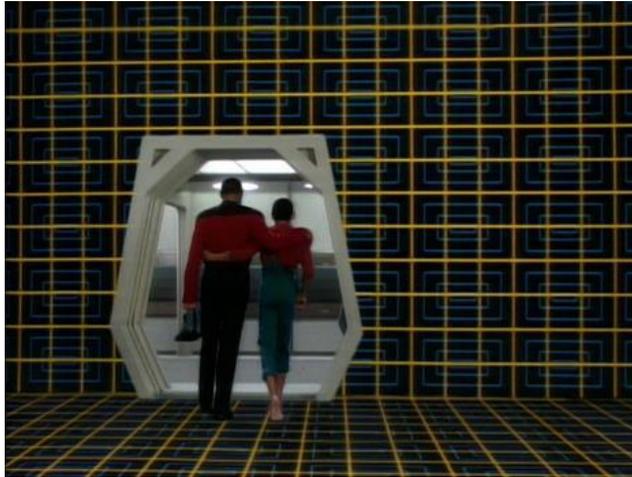
Popularity: Bottom 40% of words

: an artificial world that consists of images and sounds created by a computer and that is affected by the actions of a person who is experiencing it

Source: Merriam-Webster's Learner's Dictionary

a computer technology that replicates an environment, real or imagined, and simulates a user's physical presence and environment to allow for user interaction.
(Wikipedia)

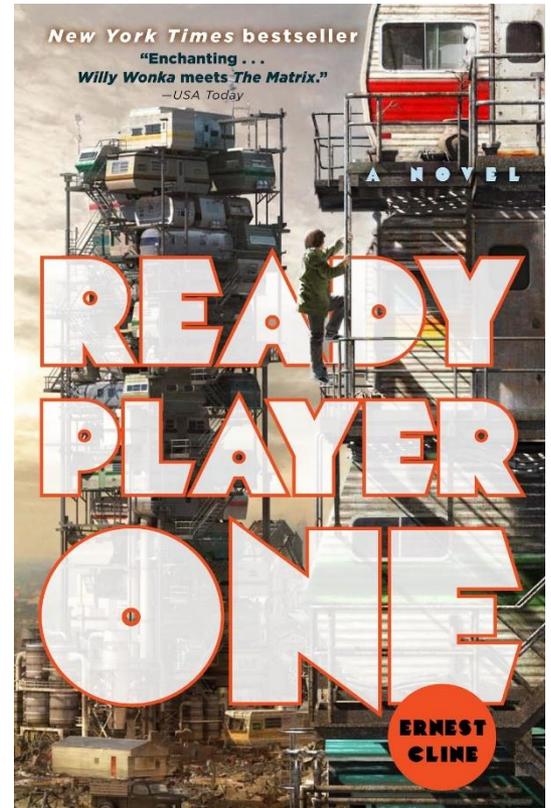
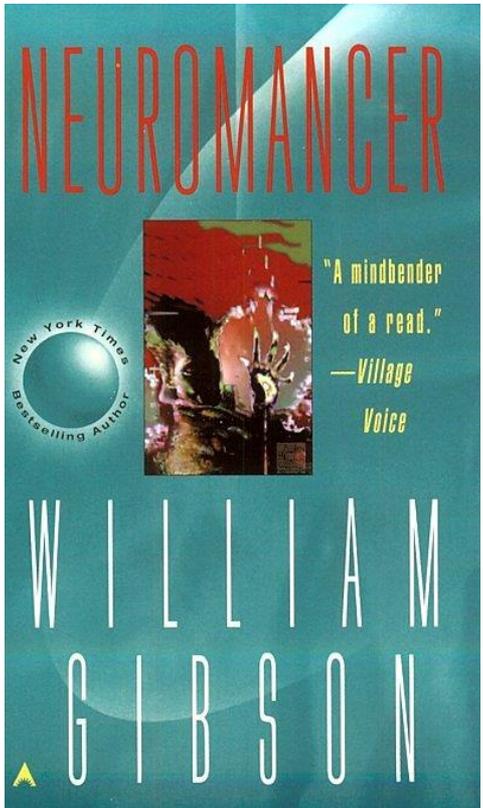
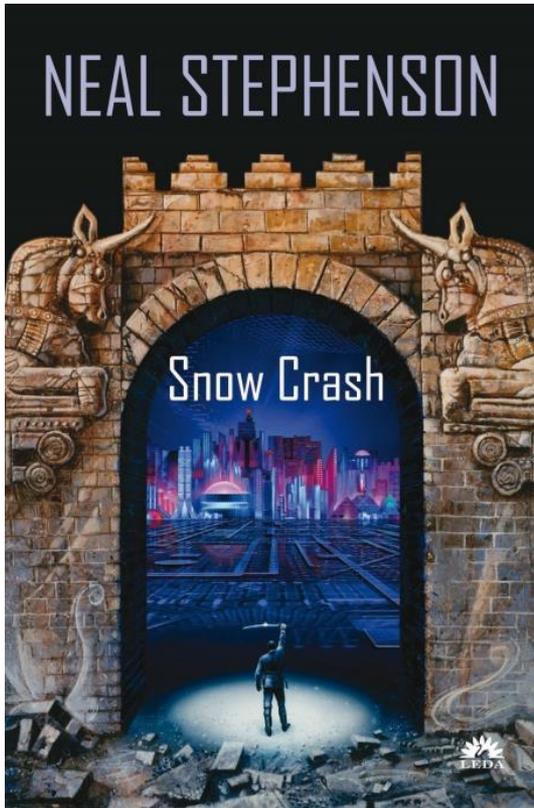
Holodeck (Star Trek: The Animated Series 1974)



What is Virtual Reality?

In general VR is any variant of R where our stimuli and responses are natural or easily learnt!

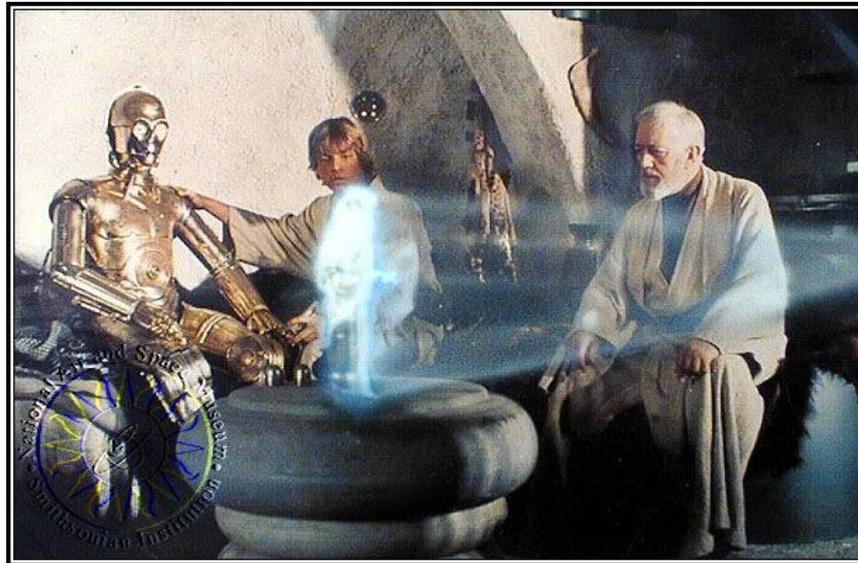
Popular perception of VR is a 360 image viewed in an HMD.





Augmented Reality

- Combines Real and Virtual Images registered in 3D.
- Interactive in real-time for virtual content.



Pokemon GO..



SymbiosisSketch = 2D sketching + 3D sketching + more

Course on AR/VR

Karan Singh

Seminar style course

Rendering



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