

Computer Graphics at University of Toronto

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Chris De Paoli Steve Tsourounis
Xia Liu Pan Zhang Mazen Al Borno
Zhicong Lu Peter Hamilton
Mark Sheinin Noah Lockwood
Parsa Mirdehghan Issey Roquet
Janis Libeks Alecia Fowler Samuel Boivin
Gene Golovchinsky Beverly Harrison Leslie Mezei
George Fitzmaurice Marilyn Mantei
Tovi Grossman Matthew Carroll
John Zhou

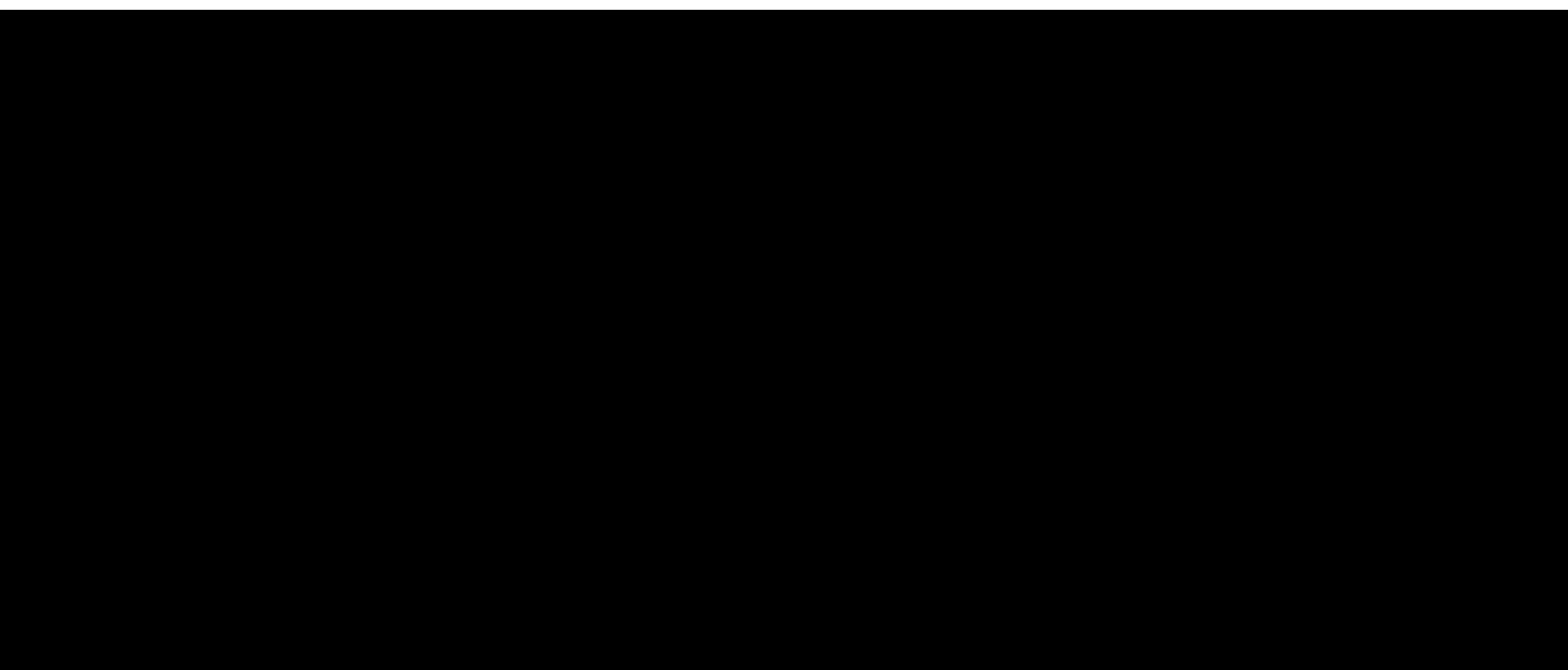
Marge Coahran Richard Guy
Michiel van de Panne Gary Hardock
Alina Gvozdik Anand Agarawala Kent Fenwick
Yusheng Wu Alain Fournier Tyler De Witt
Quiyang Xu Gerry Chu
Zhen Li Jiang Yue Vicky Bilbil John Buchanan
Mian Wei Ken Xu Andrew Tan Nikola Banovic
Hubert Hu Jonathan Daber Mark Green
Garry Ing Rachel Franz Maria Raso
Jos Stam Meng Leijun Ricardo Jota
Brad Myers Tom Nadas William Hunt
Karan Singh Michelle Annett Hanieh Bastani
Ron Baecker Chris Arnold Sam Hasinoff
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Kyros Kutulakos Robert Kevin Gibson Todd Goodwin
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Clifton Forlines Alex Tessier Xiang Cao
John Hancock Rahul Arora Iva Lu
Jaisie Sin Rinat Abdrashtov Ralph Hill
Christian Beermann Michael Tao George Drettakis
Yichen Dang Matthew O'Toole Nick Kim
Anuruddha Hettiarachchi Liang Chen
Yupeng Zhang Parastoo Abtahi Rhona Charron
Mingming Fan Mc schraefel Xianjun Bi
Alejo Hausner Jessica David Petros Faloutsos
Simon Breslav George ELKoura David Fono
Pierre Dragicevic John Funge

Anastasia Bezerianos Mira Rawady
Gery Castel Sangah Han Rhonda Hertzmann
Tristan Campbell Brodin Champion
Brodin Champion Tira Cohene Mohit Jain
T. De Weese Alison Lee David Dearman
Liang Chen Anuj Gujar
Michael Daum Hong Qin
David Fono John Funge
John Funge Chris Gonterman
Jeremy Birnholtz Rajat Dhariwal Hiroshi Ishii
Parastoo Abtahi Mingming Fan Edy Garfinkel
Rajat Dhariwal Jessica David Anna Lipka
George ELKoura Simon Breslav Pierre Dragicevic

Aaron Hertzmann Luis Velho

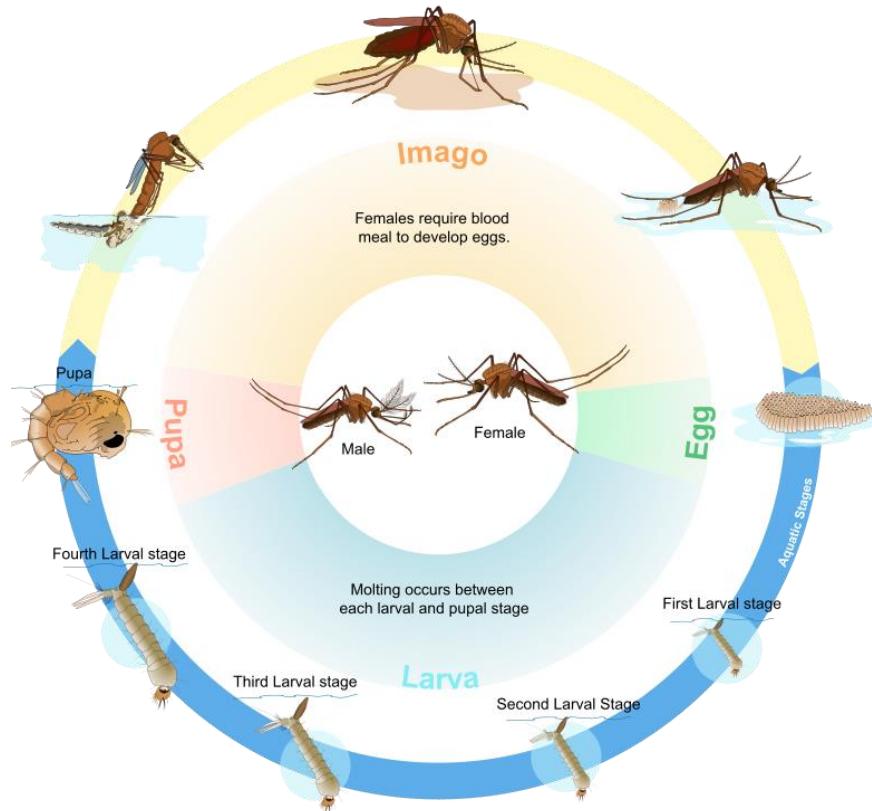
Dynamic Graphics Project

EST. 1967

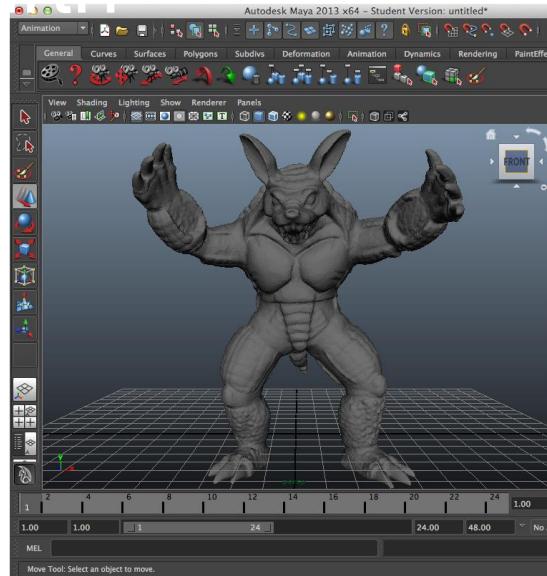


Modeling

Geometry Processing is biology

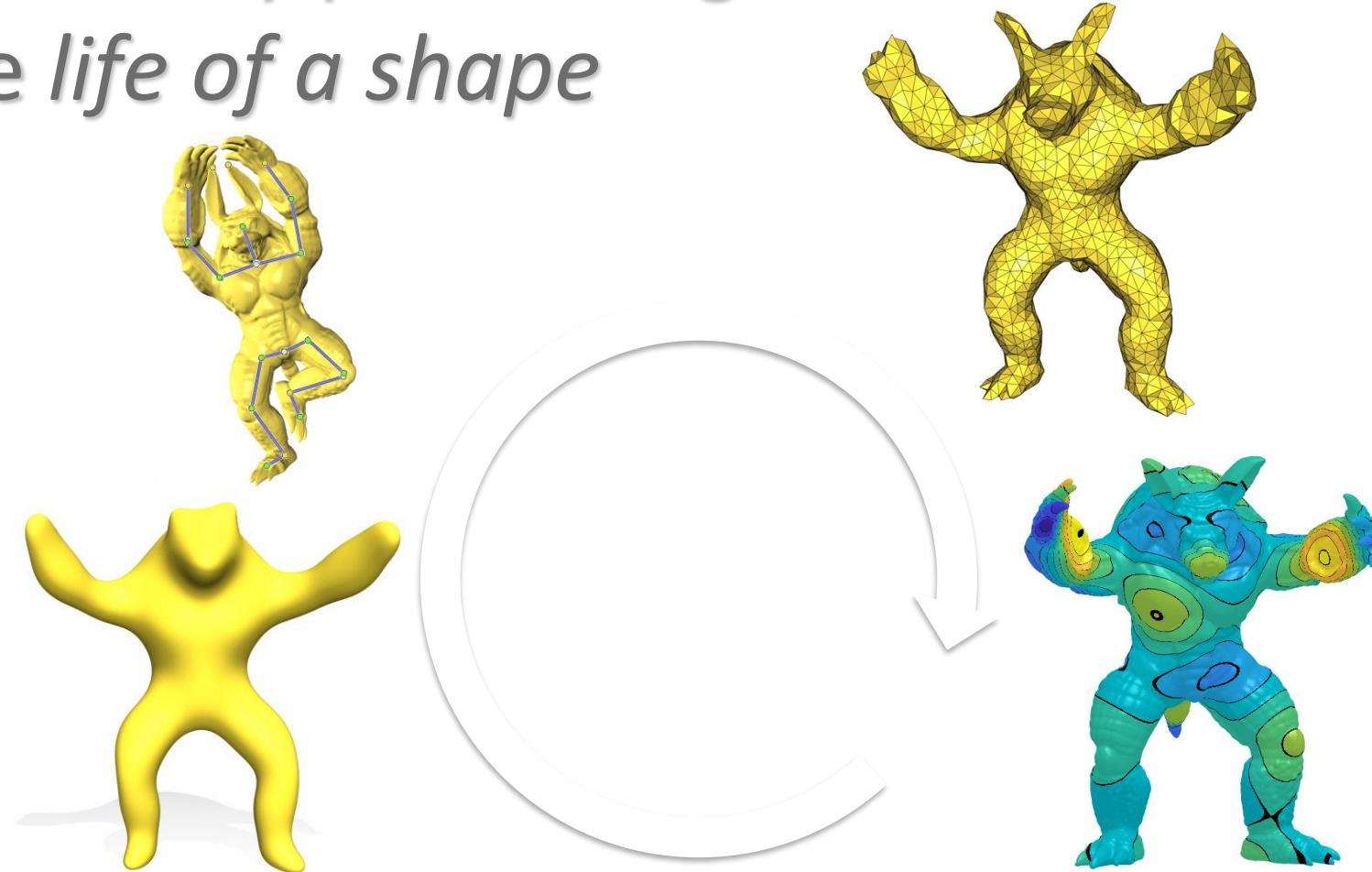


Geometry processing studies the *life of a shape*



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

Geometry processing studies the *life of a shape*



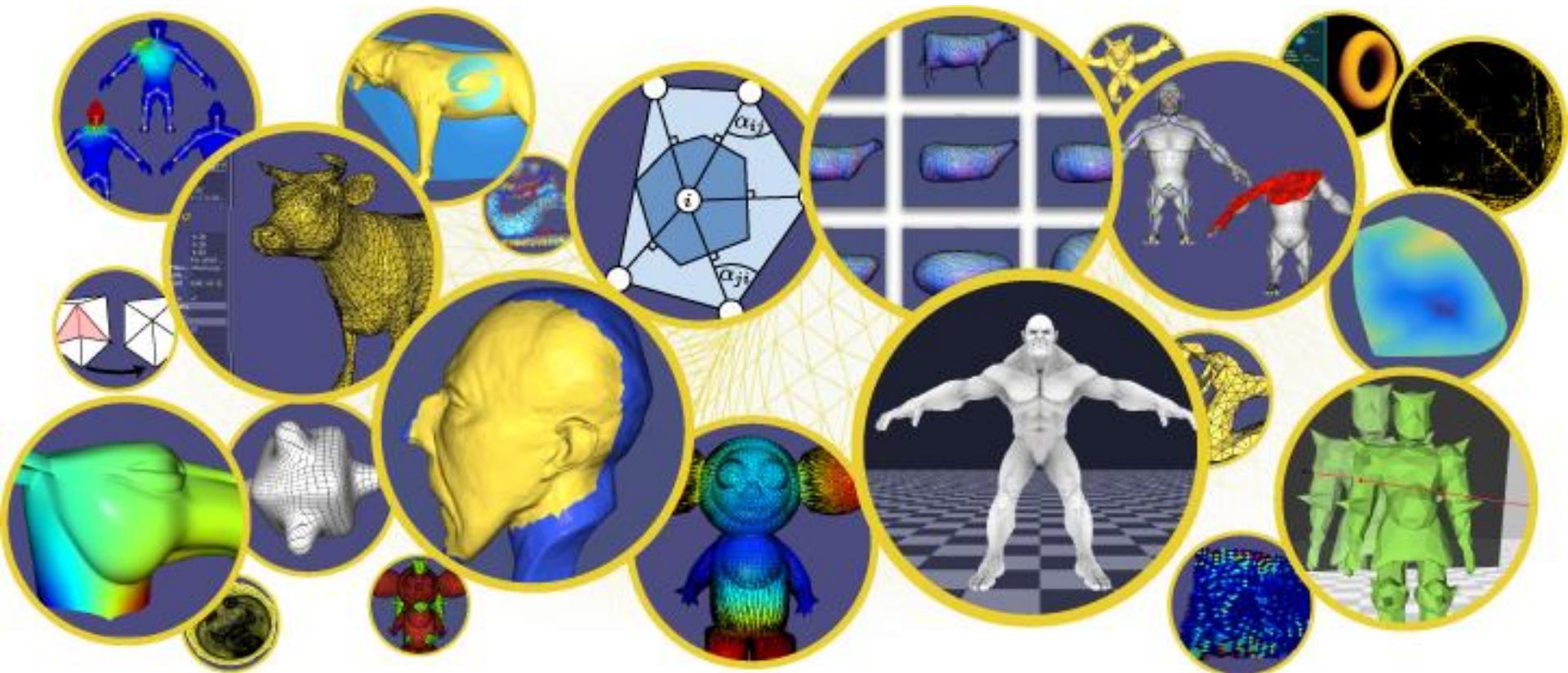
Geometry processing studies
the *life of a shape*



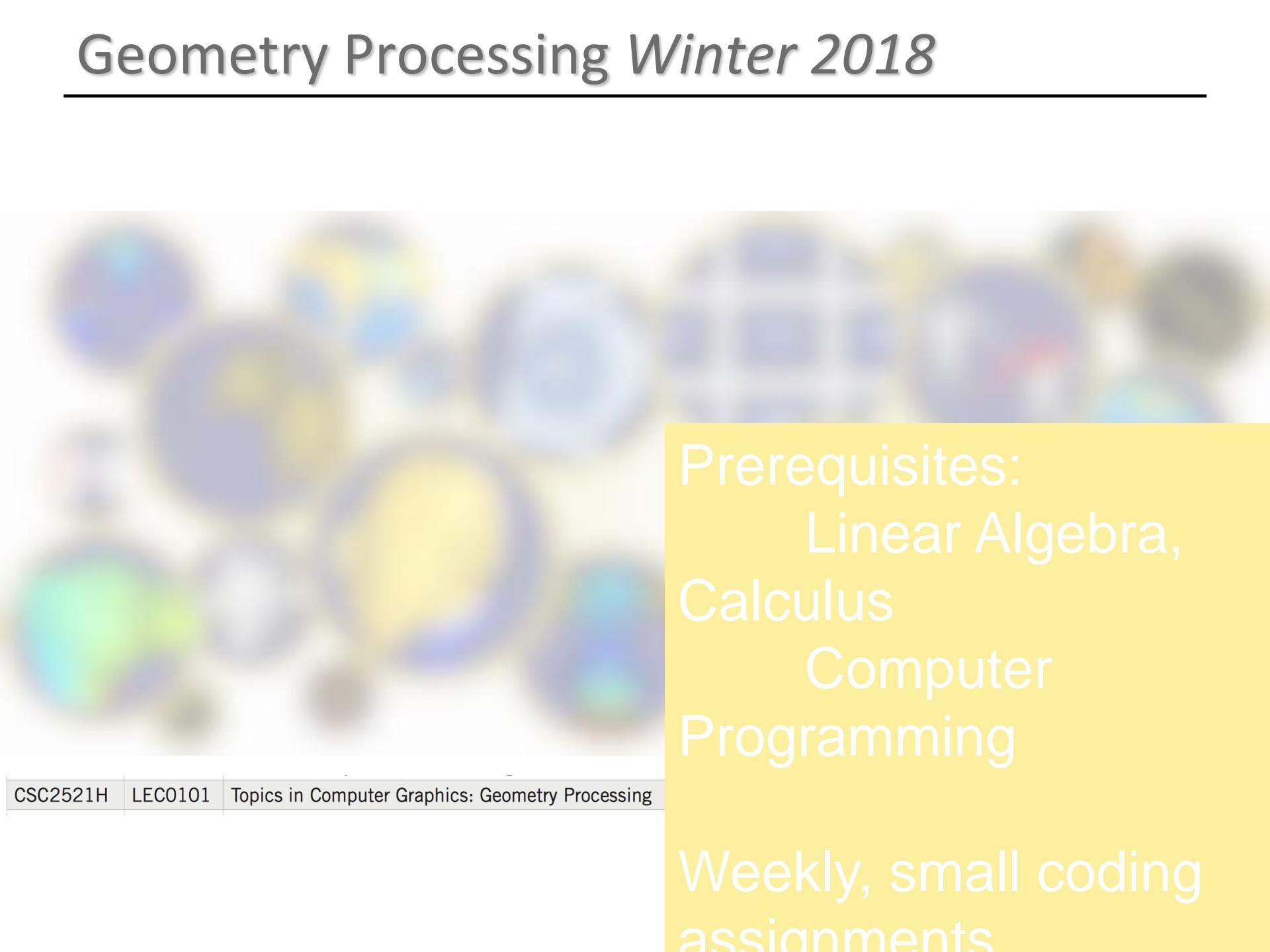
Image courtesy Romain Prévost

3d printing

Geometry Processing *Winter 2018*

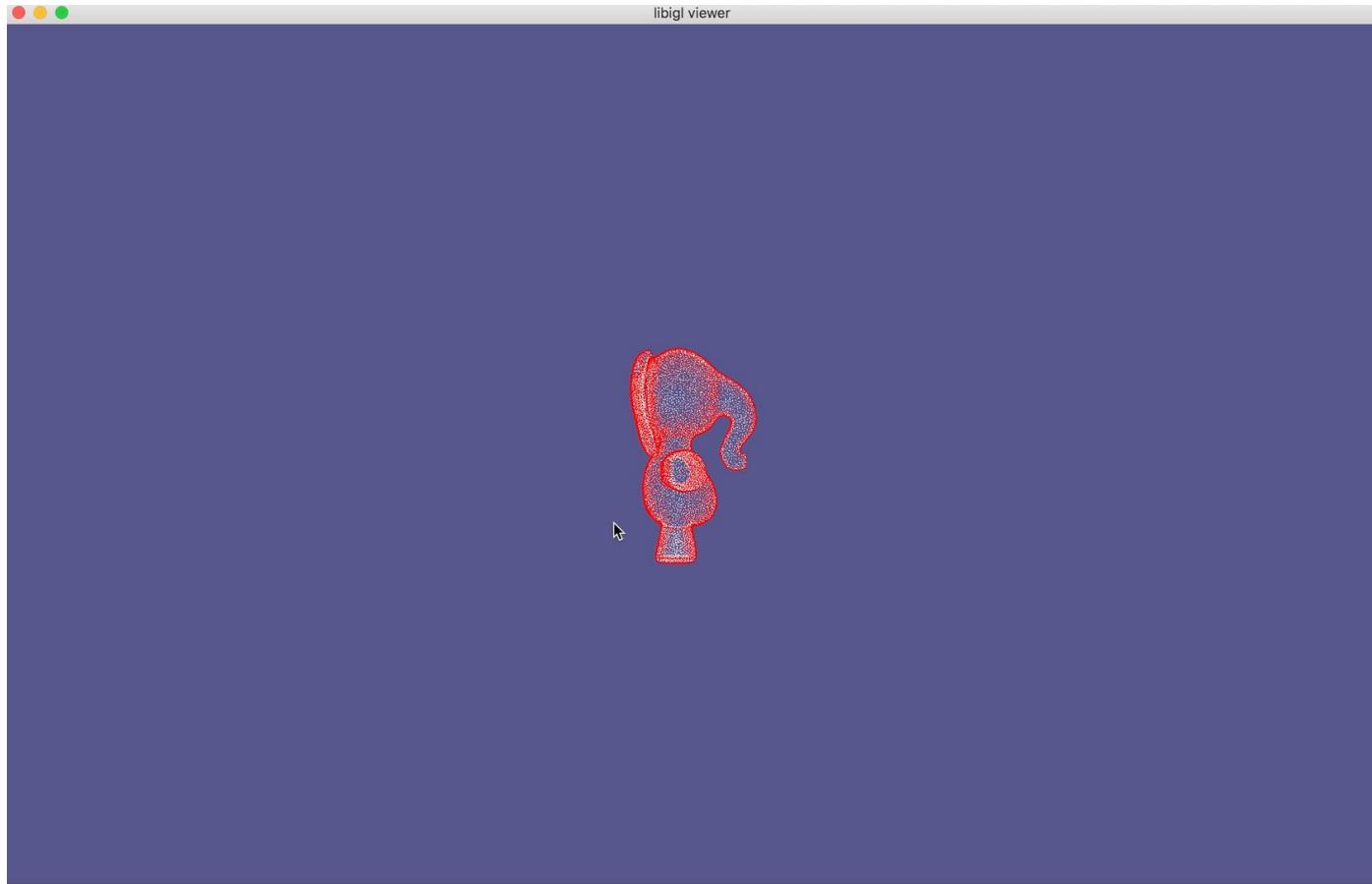


Geometry Processing Winter 2018



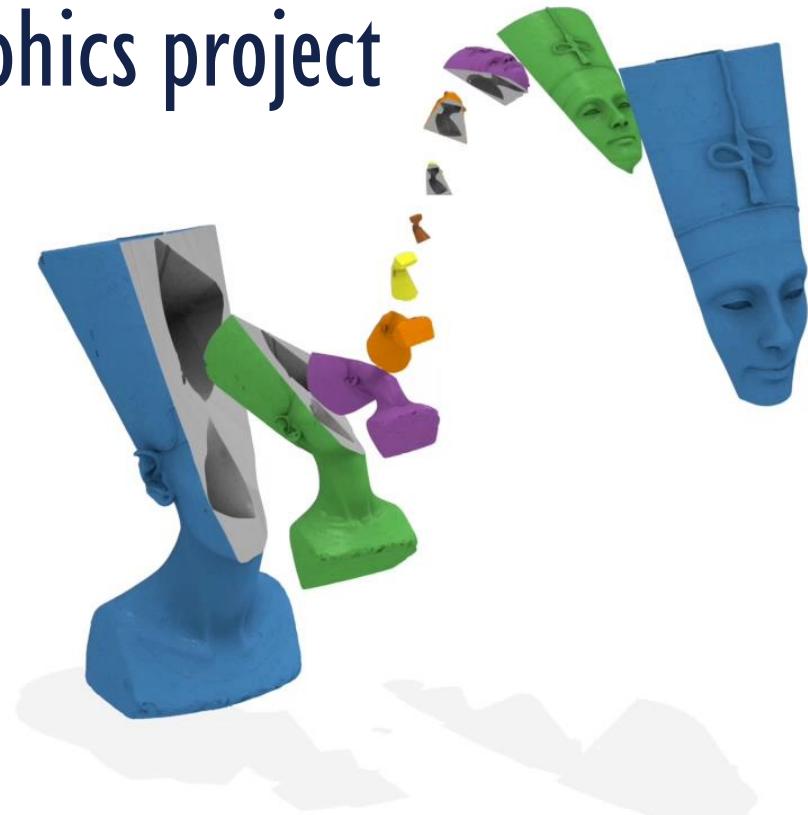
Prerequisites:
Linear Algebra,
Calculus
Computer
Programming

Problems in Geometry Processing...

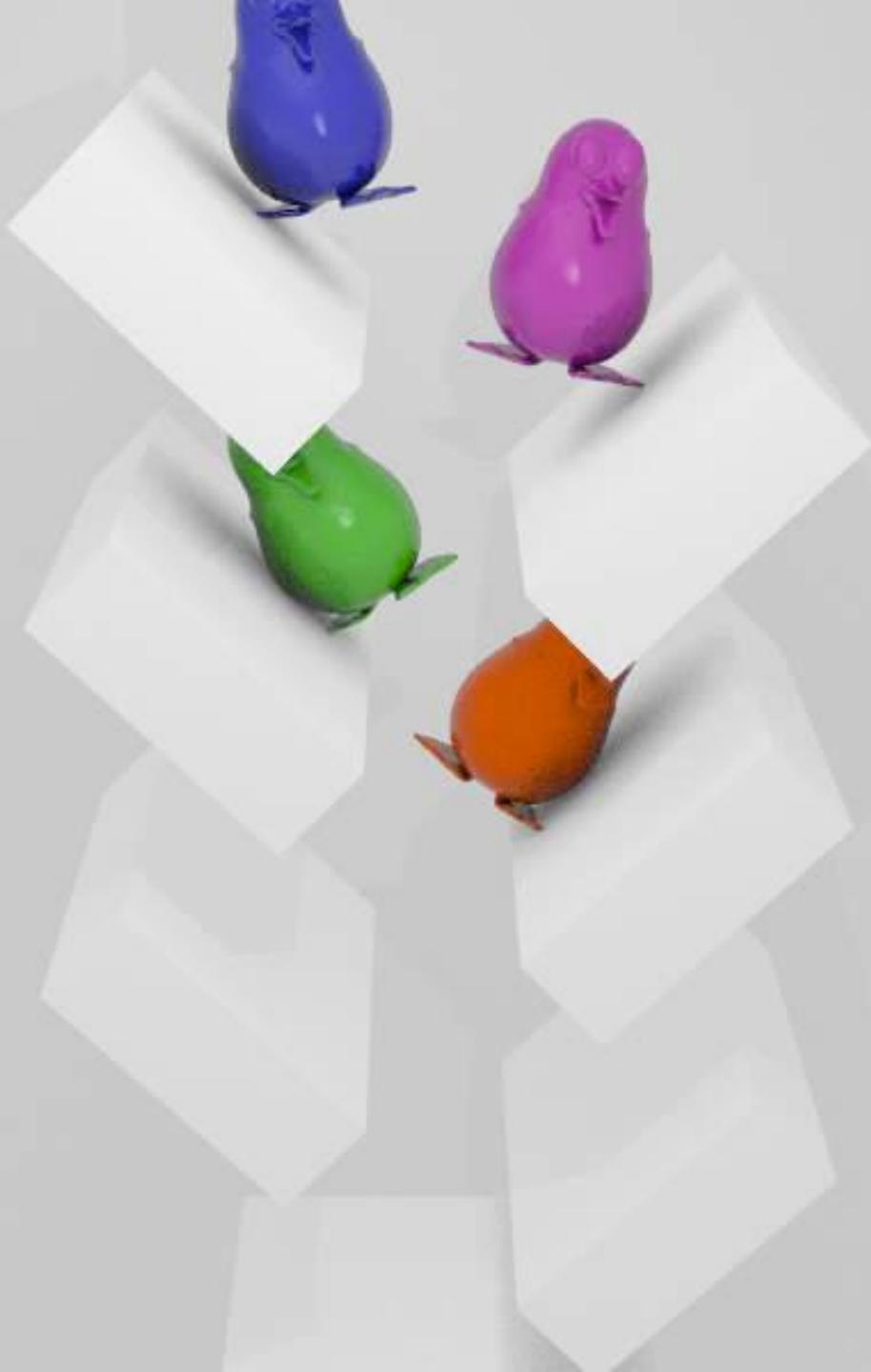


dgp | dynamic graphics project

- *Alec Jacobson*
- *University of Toronto*



Physical Simulation

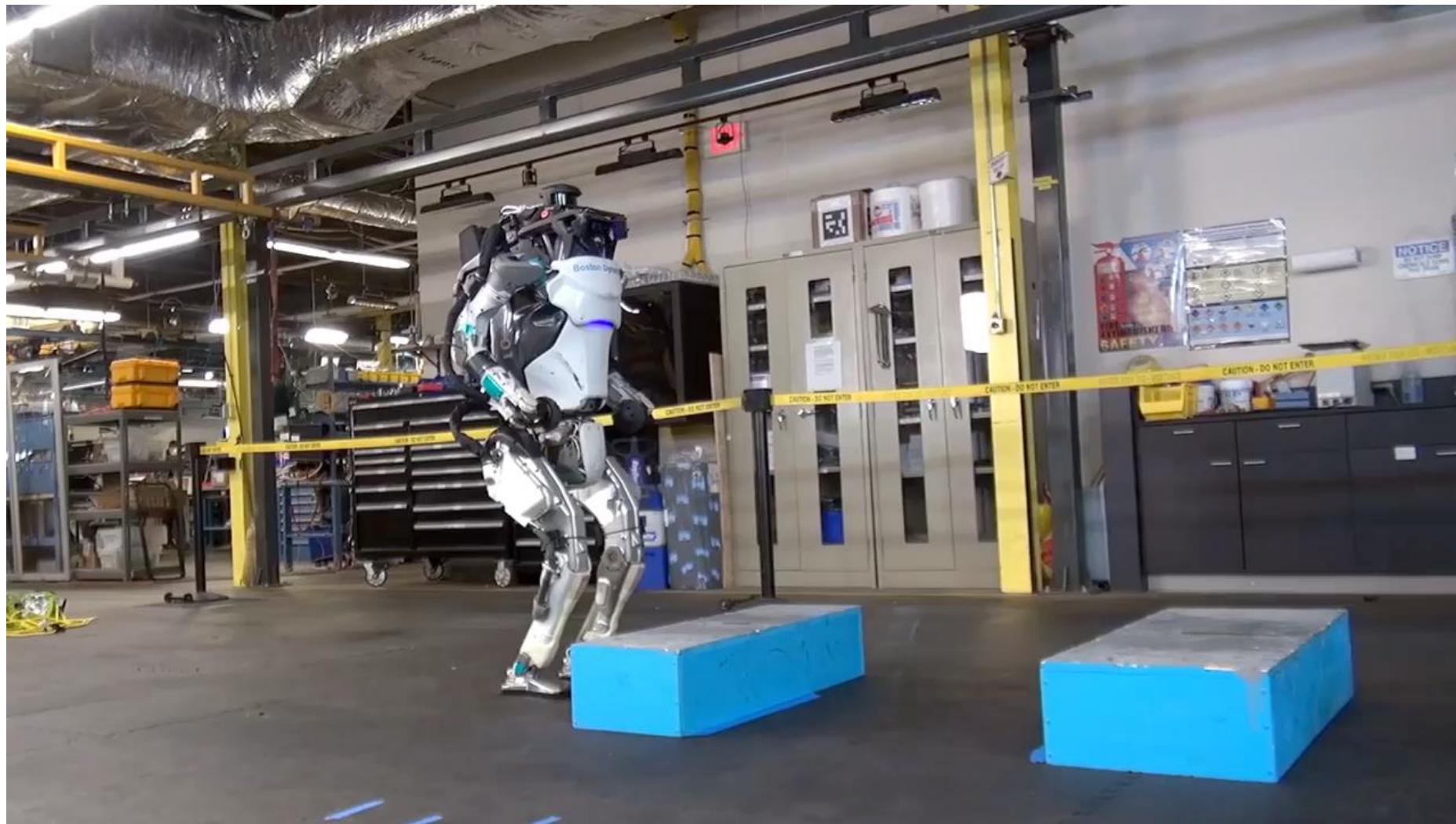




Solid-fluid density ratio
1.3 : 1

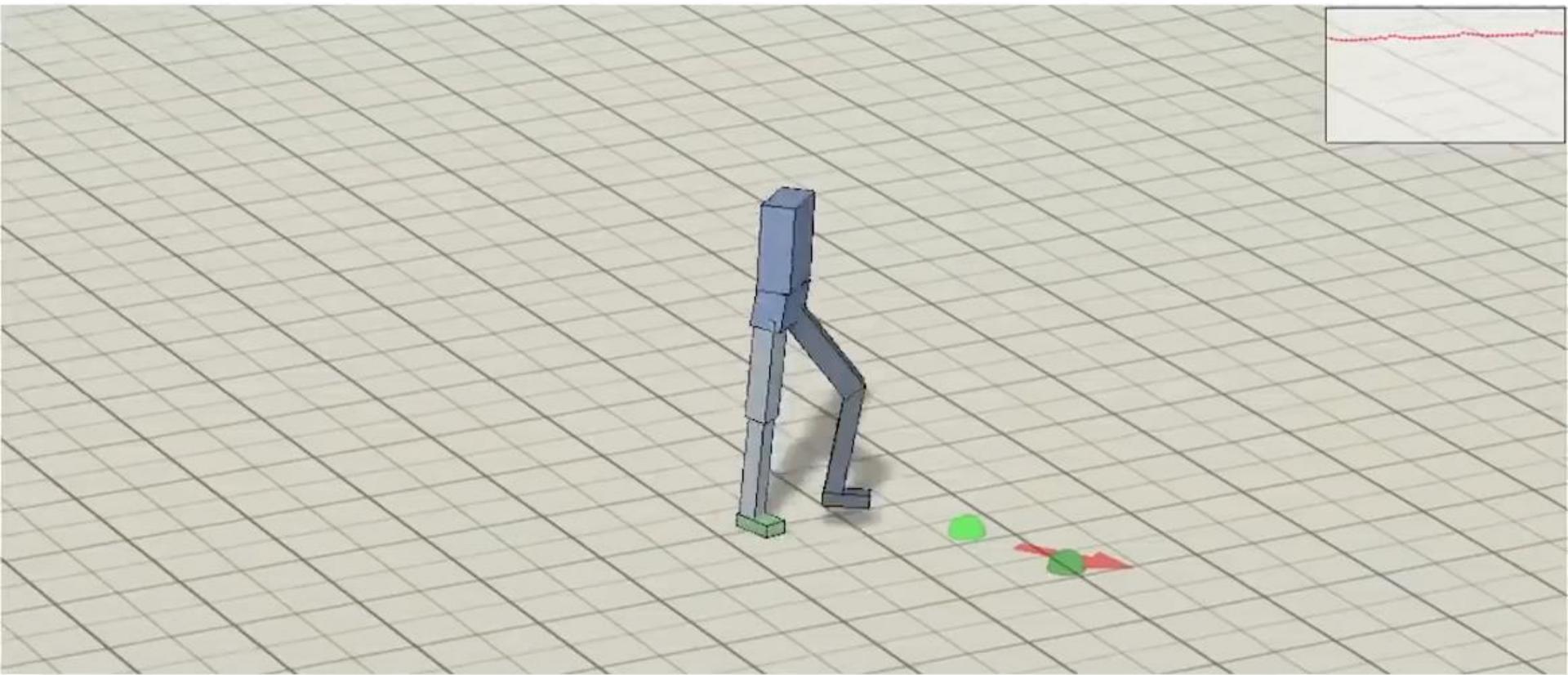


Solid-fluid density ratio
1000 : 1



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_reproducer_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)

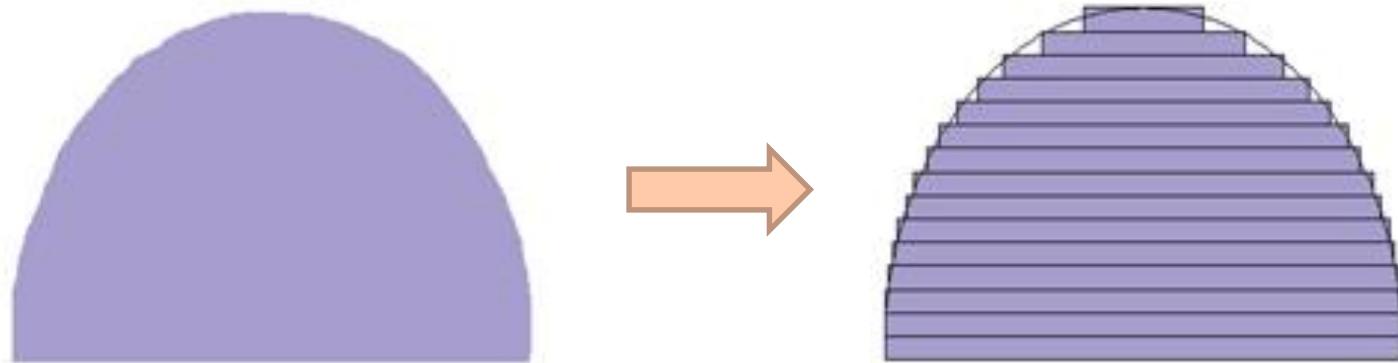
Photopolymer Phase Change Inkjets

Thermal Phase Change Inkjets

Laminated object manufacturing (LOM)

3D Printing Process

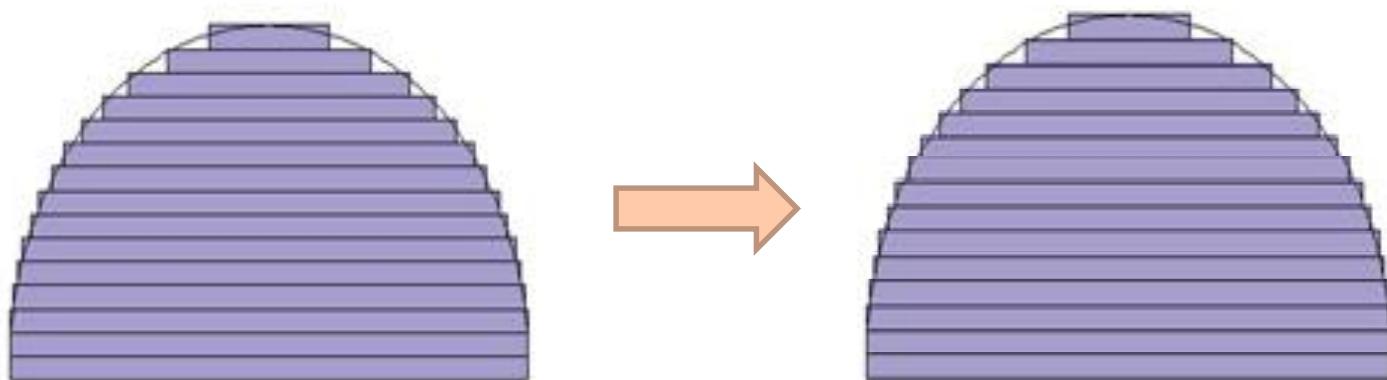
Slice 3D model into layers



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



www.uprint3dprinting.com

Applications: Aerospace



3D printed fuel injection nozzle for a jet engine



Airbus wing brackets

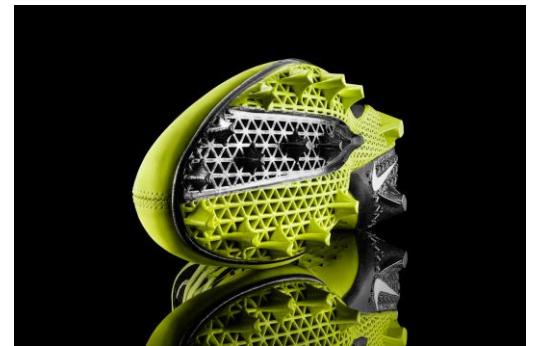
Applications: Jewelry

Direct metal printing and casting patterns

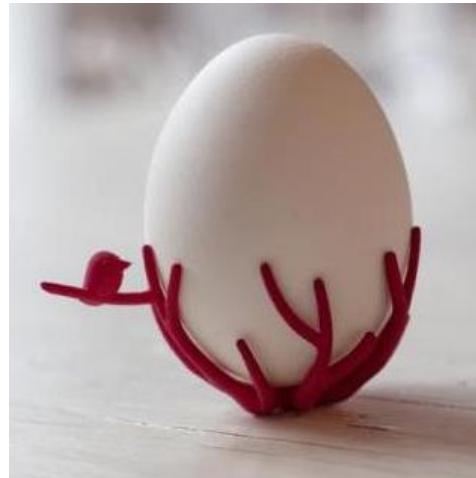


Source: Shapeways, replicatorinc.com

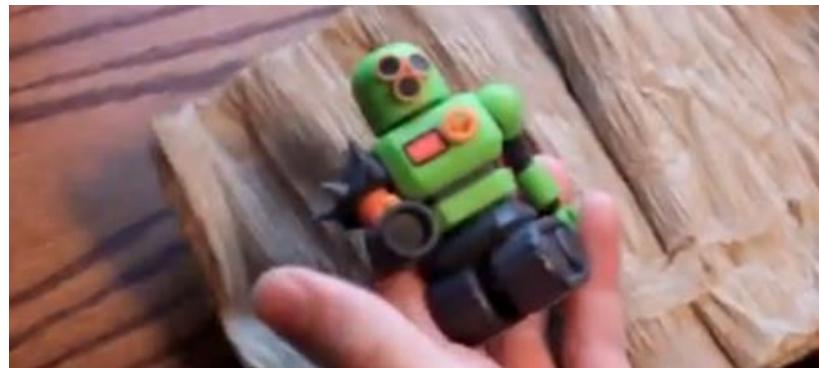
Applications: Footwear



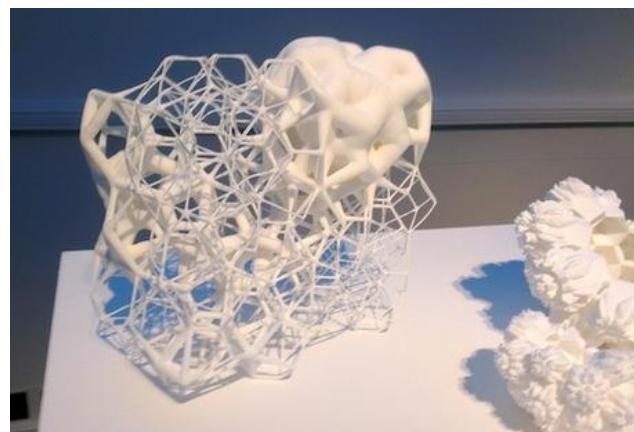
Applications: Consumer Home Products



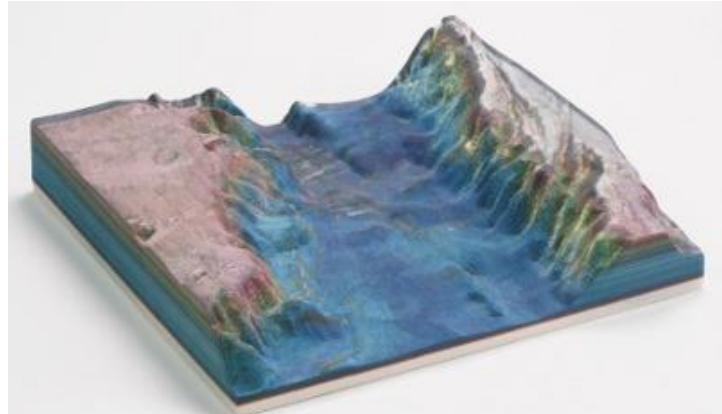
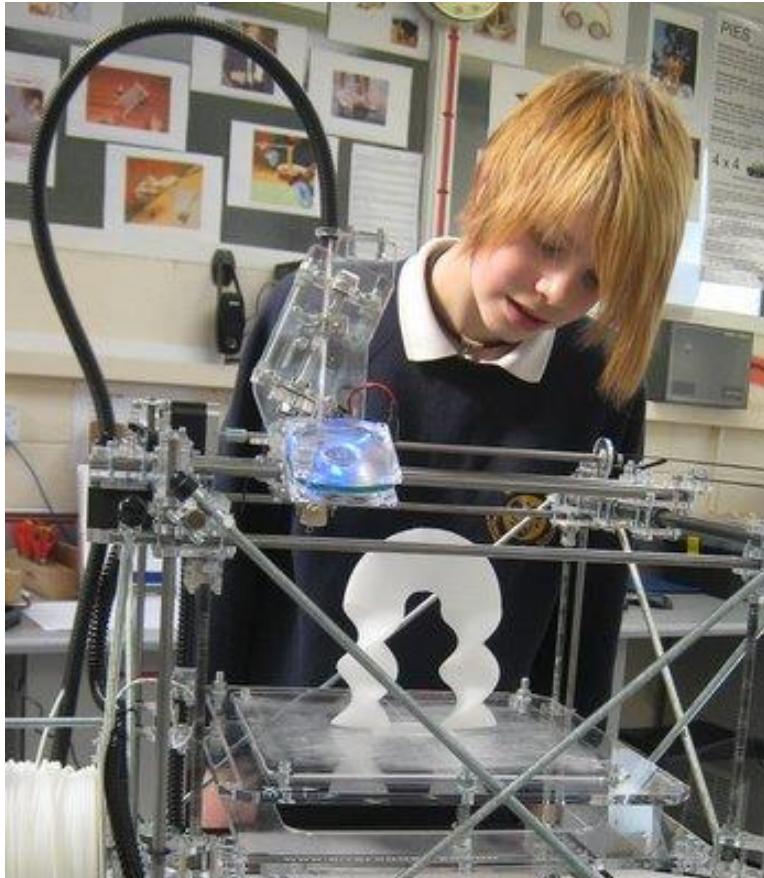
Applications: Toys & Gadgets



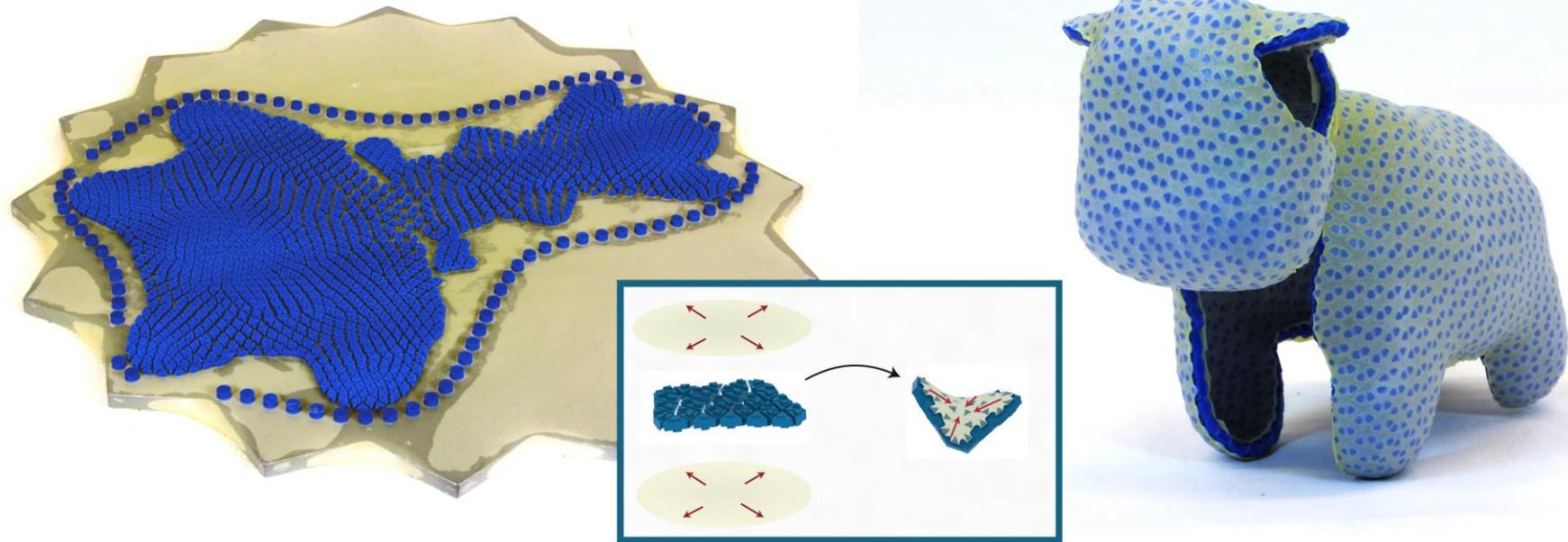
Applications: Art



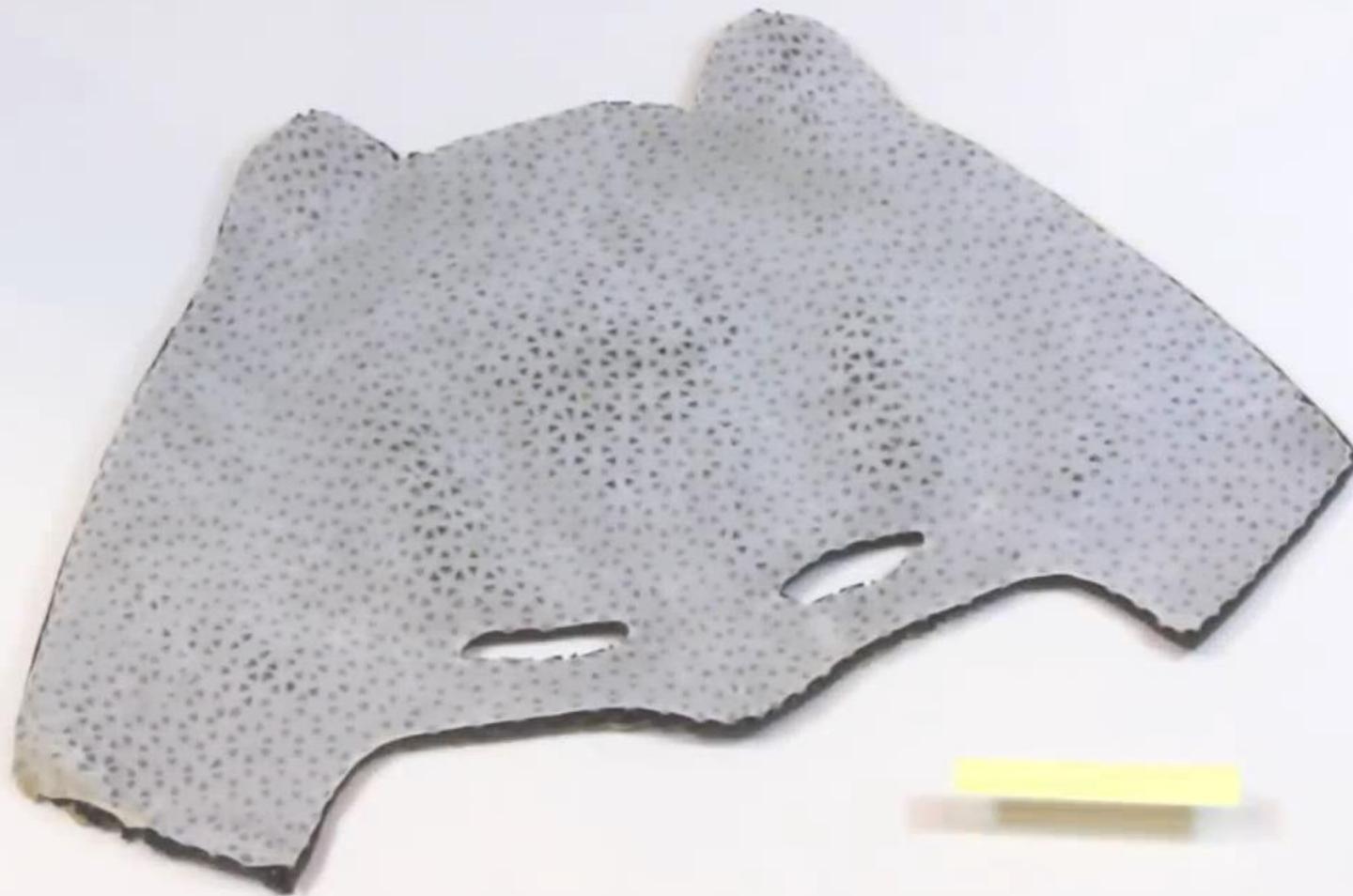
Applications: Education



Self Assembly

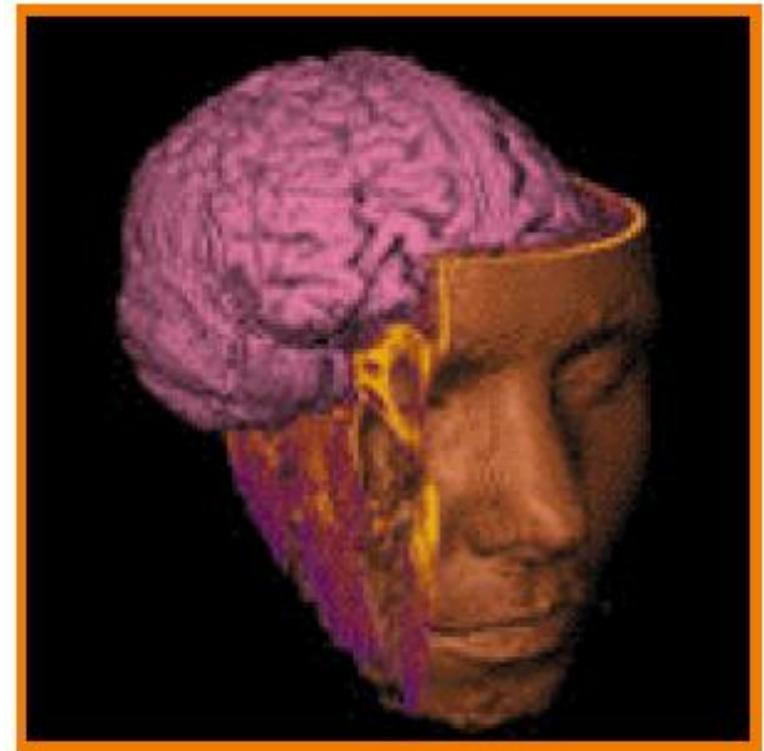
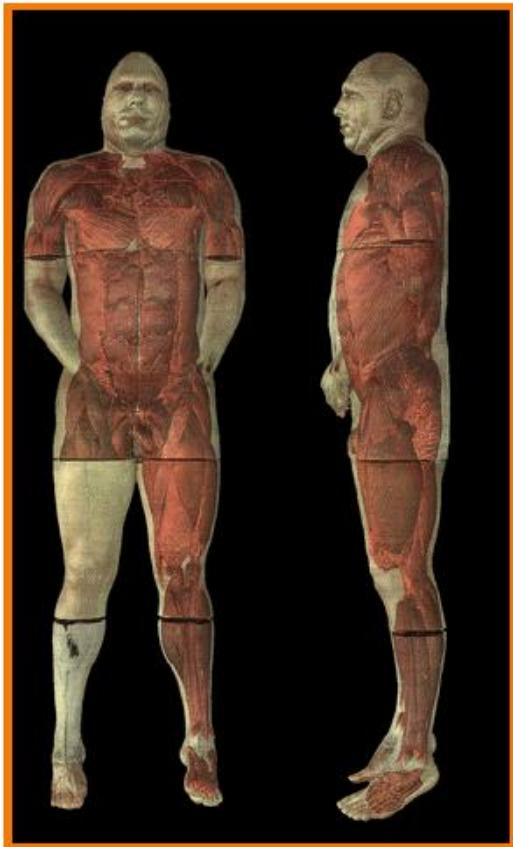


Self Assembly



Solid Modeling

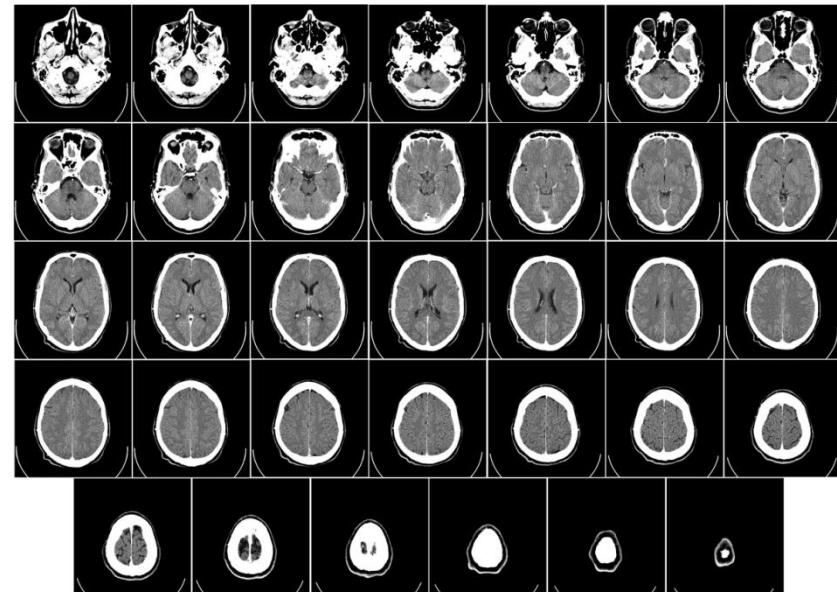
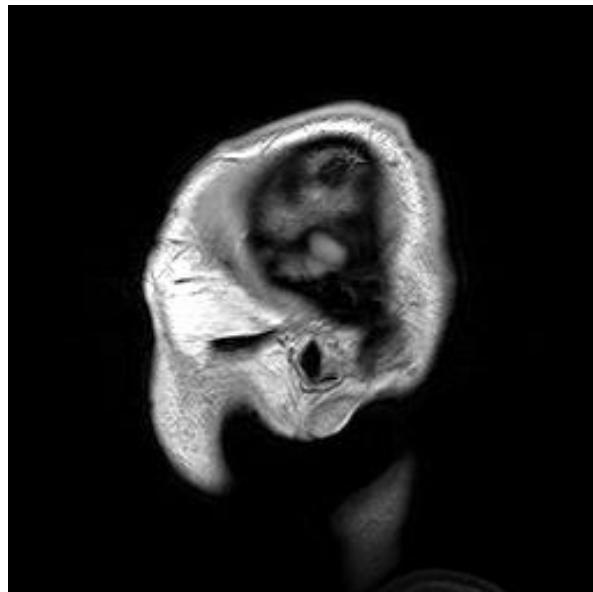
Represent solid interiors of objects



Why Volumetric Representations?

Some acquisition methods generate solids

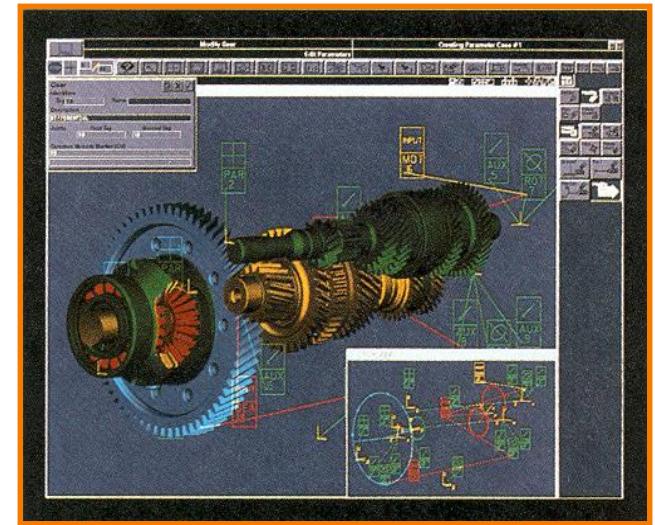
- Magnetic Resonance Imaging (MRI)
- Computed Tomography (CT/ CAT)



Why Volumetric Representations?

Some applications require solids

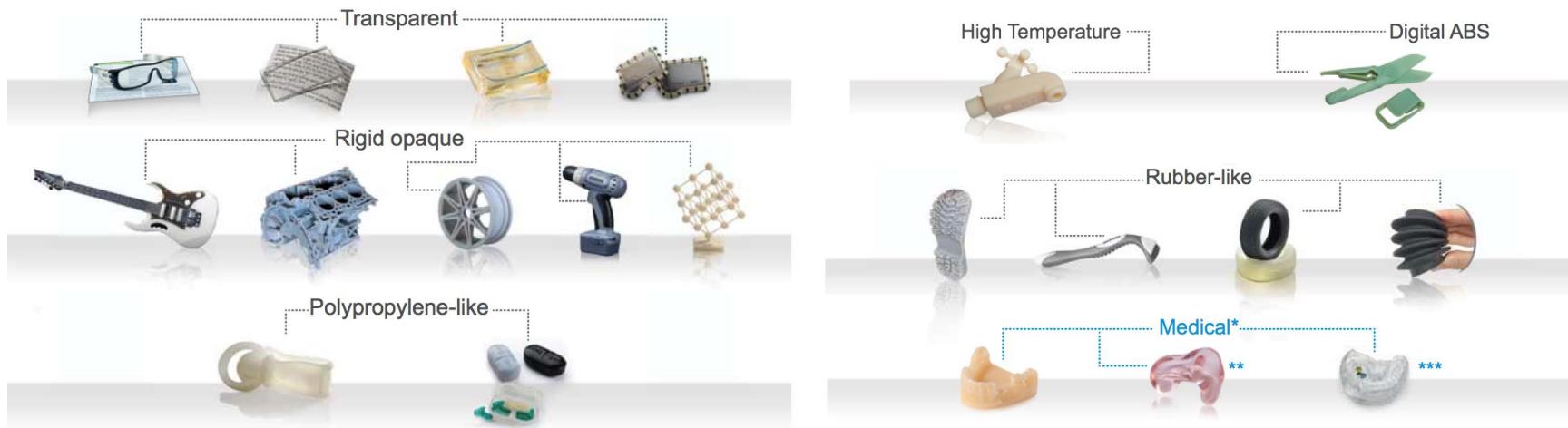
- CAD/CAM
- material(s) need to be specified inside the object



Challenges: Materials

Functional Materials

Large Material Library for AM



Courtesy of Stratasys

Challenges: Modeling Materials

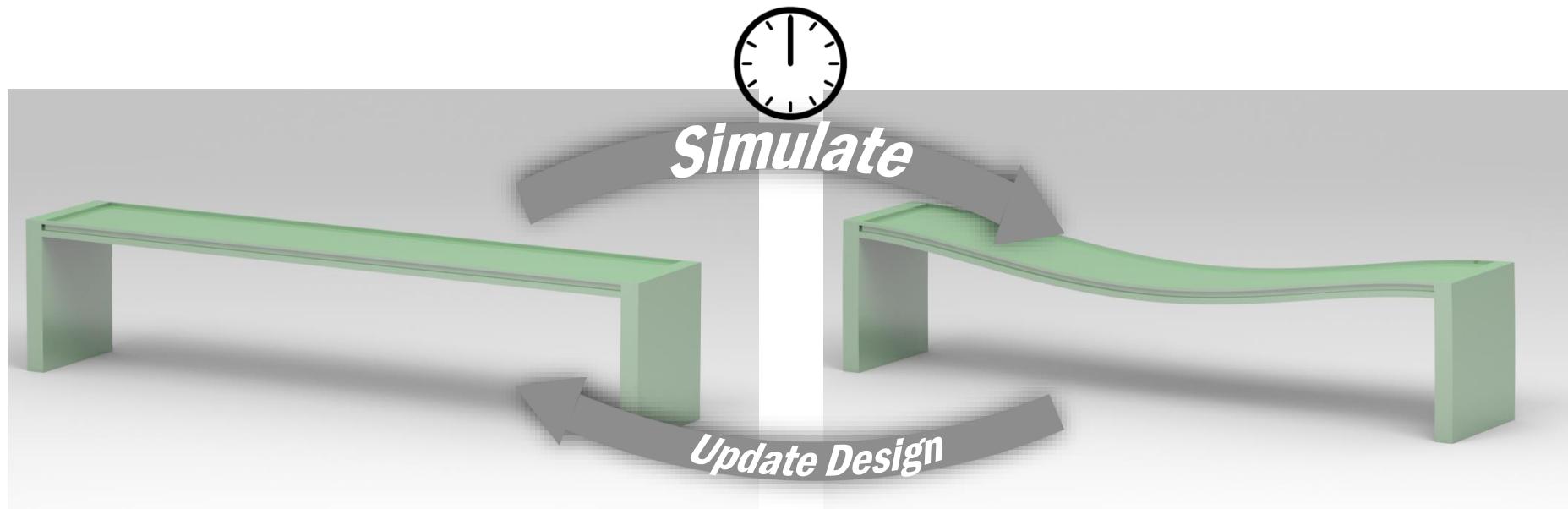
Focus on 3D geometry

Currently one material per part

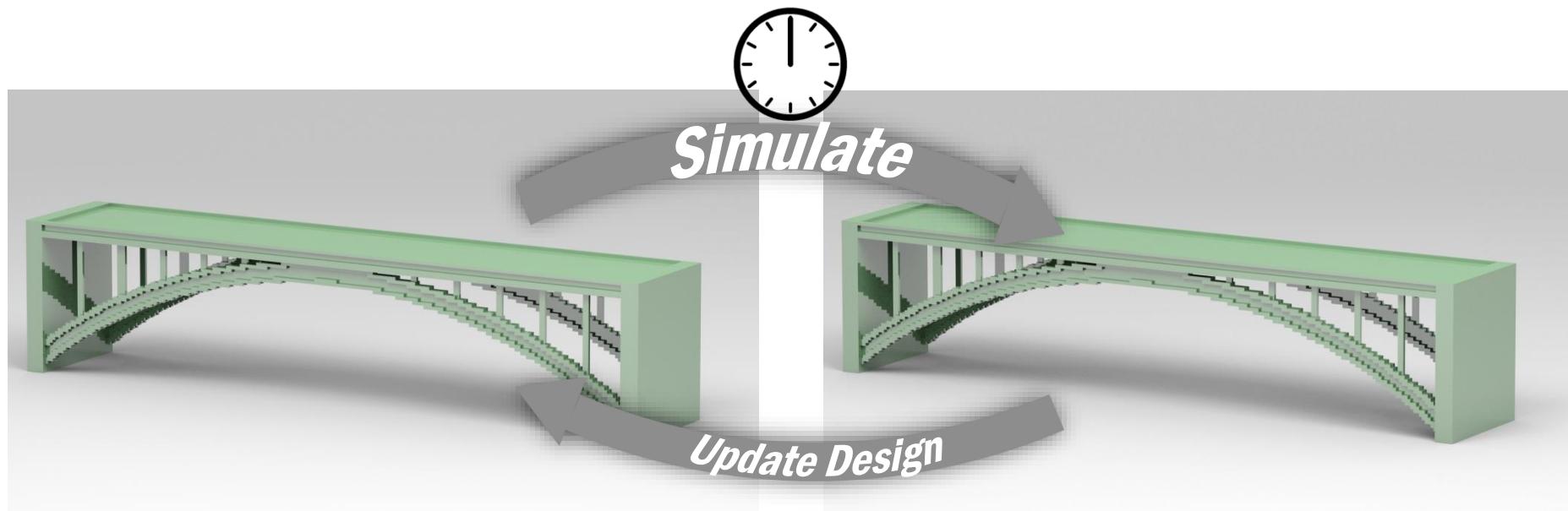
How to model parts composed of many materials?



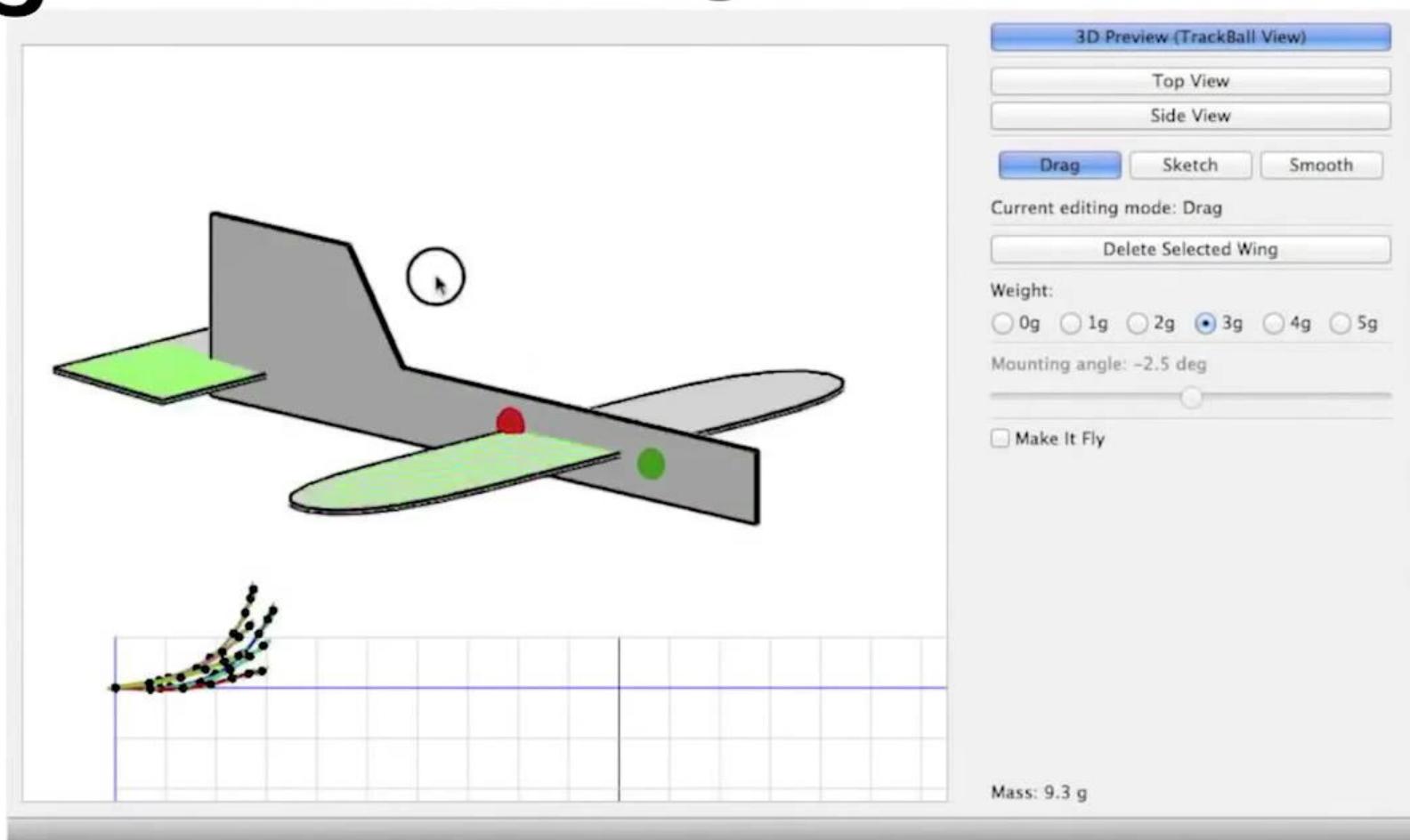
Challenges: Fast and Accurate Simulation



Challenges: Fast and Accurate Simulation

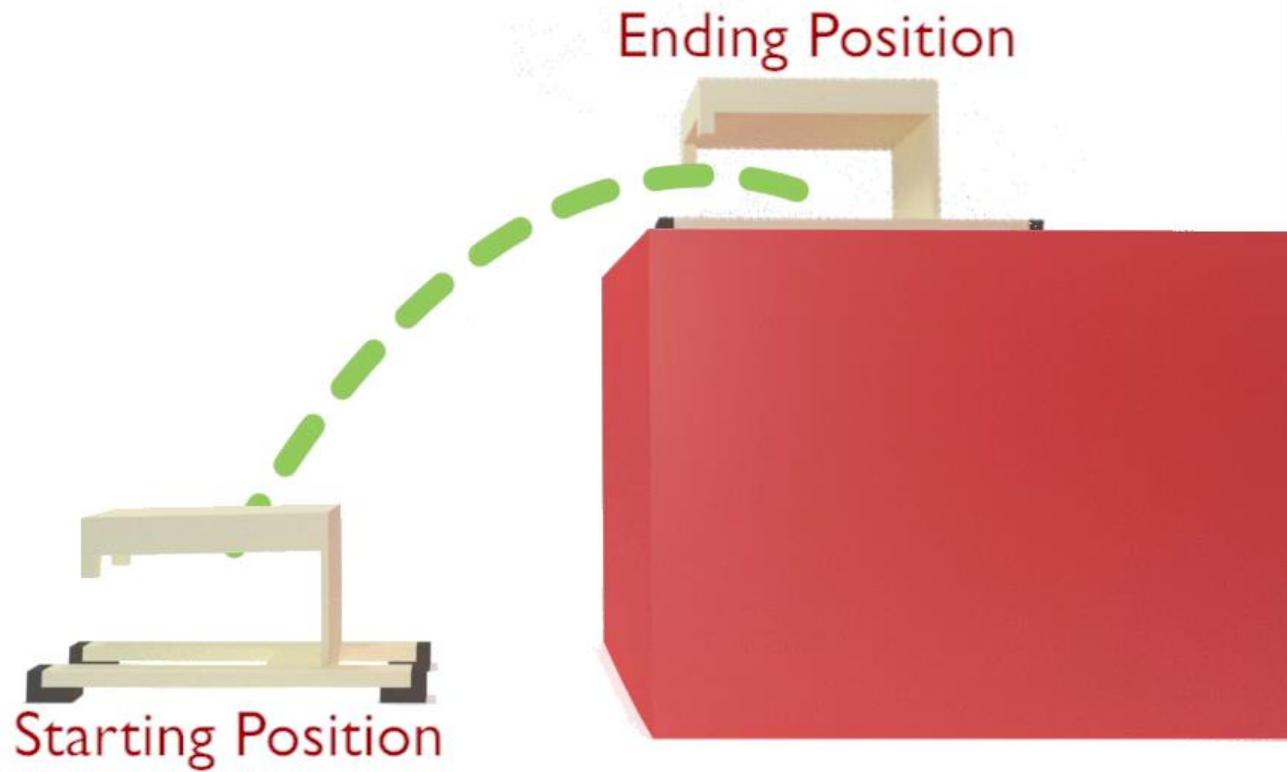


x5 Concurrent Flight Simulation

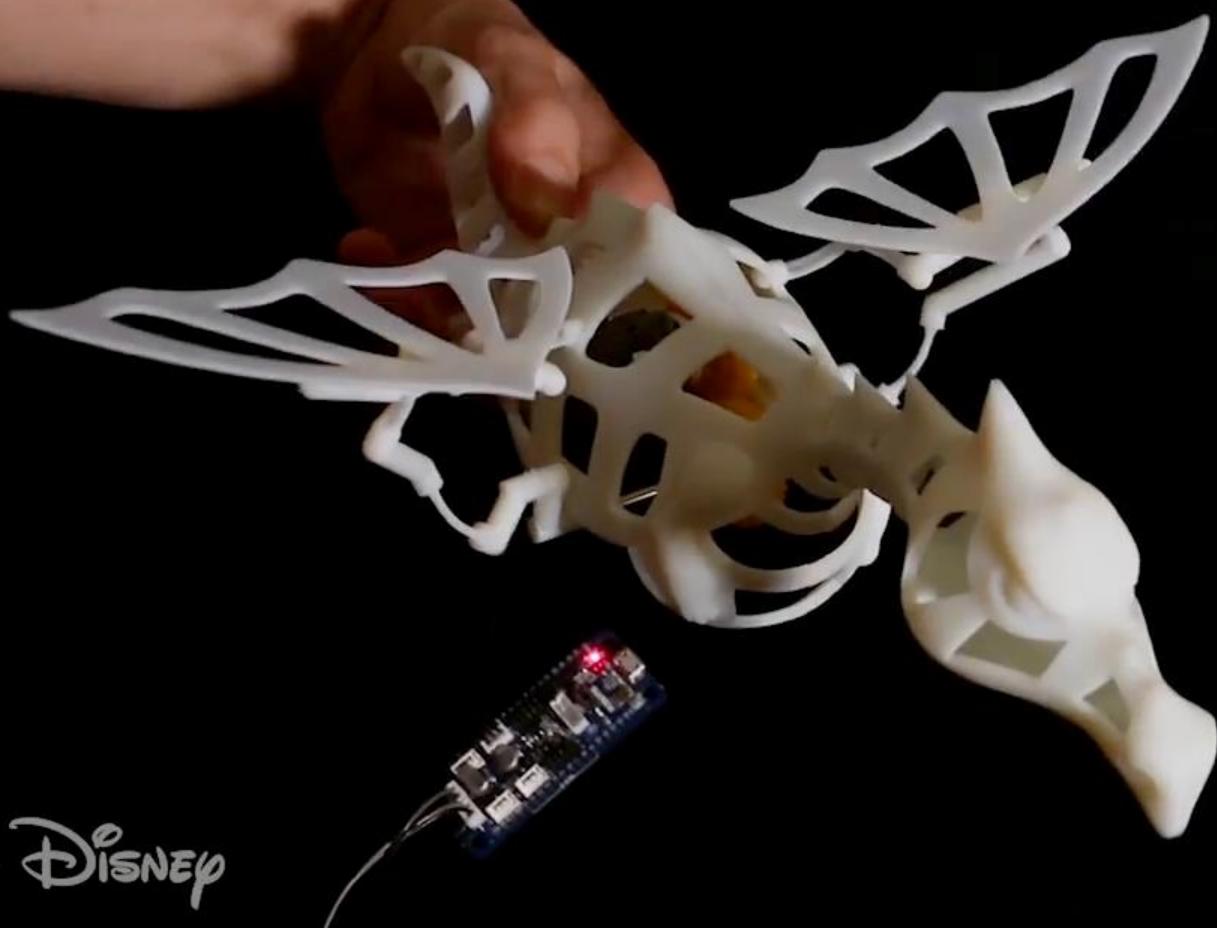


Jumpers

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?

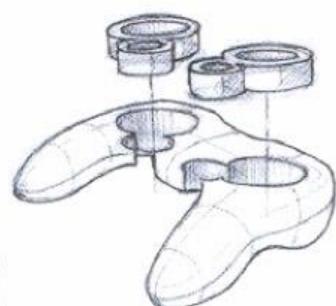
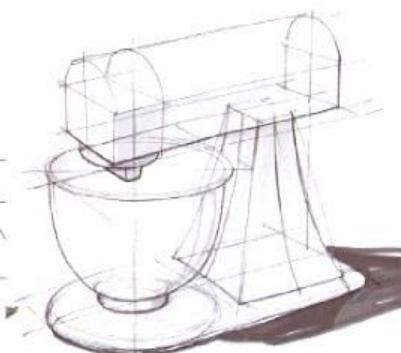
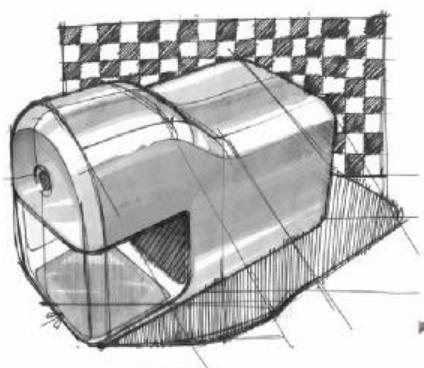
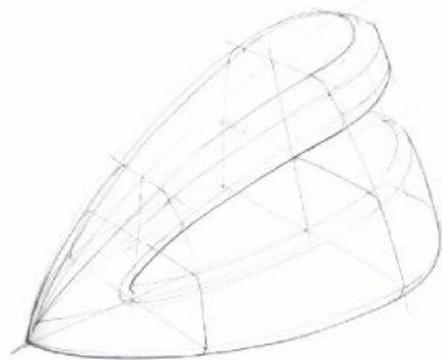
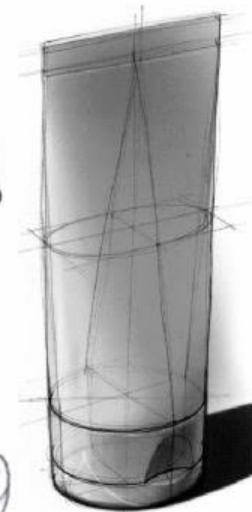
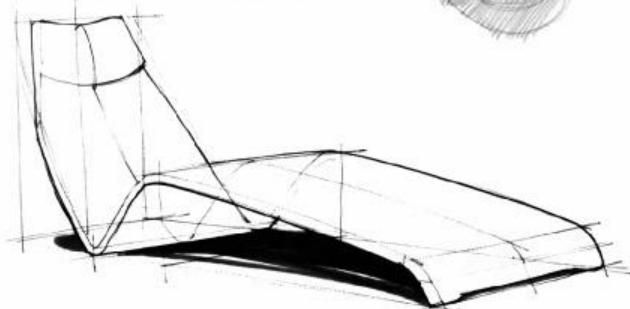
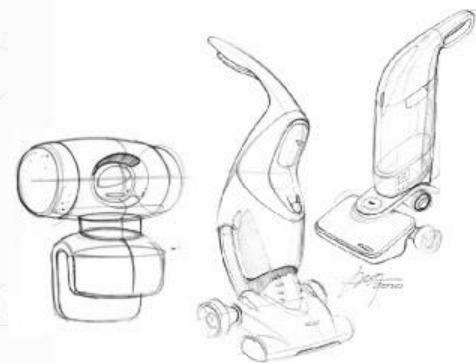
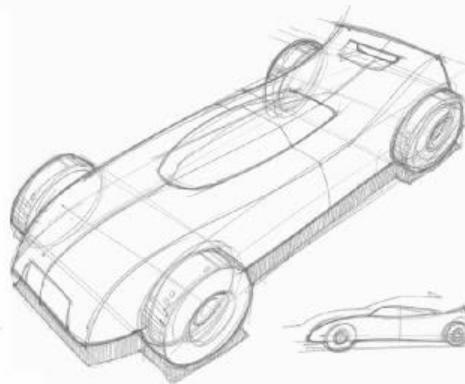
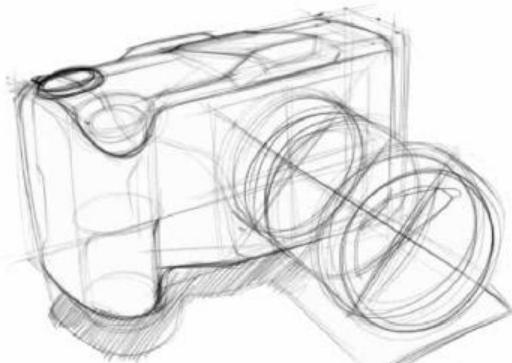
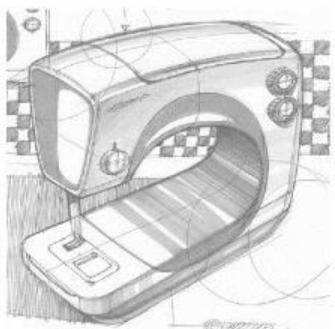
Creative visual communication

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

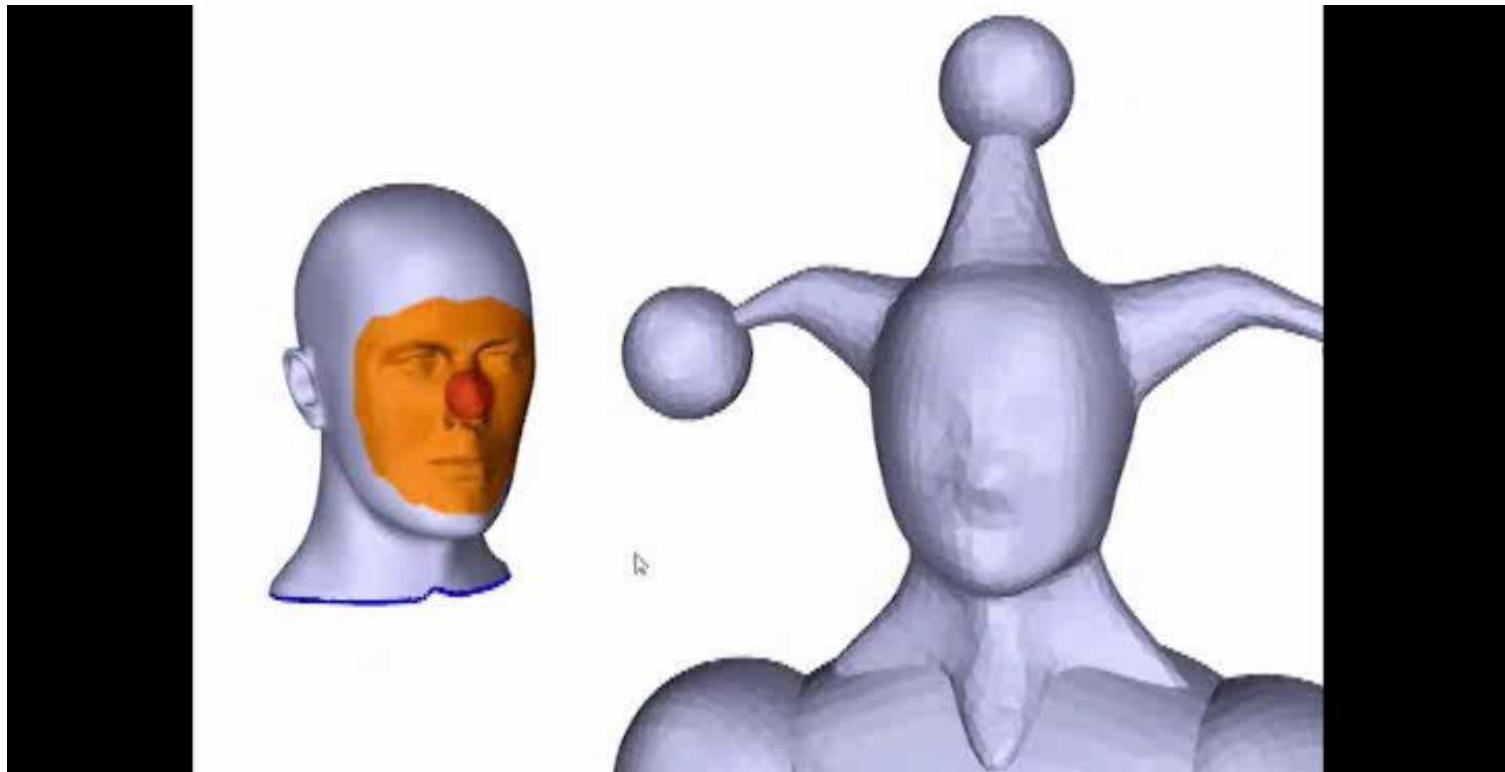
Sketchpad (Ivan Sutherland 1963)



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, Boubekeur, Sorkine**, GeoBrush: interactive
mesh geometry cloning. *Eurographics 2011*]

Augmented and Virtual Reality

What is Virtual Reality?

virtual reality

noun

Simple Definition of VIRTUAL REALITY

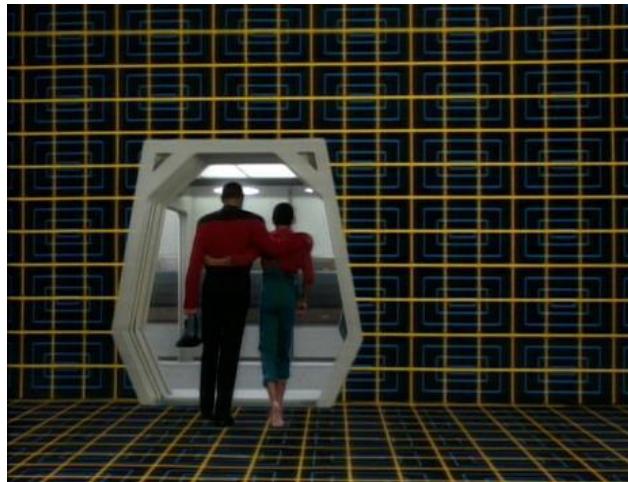
Popularity: Bottom 40% of words

: 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)

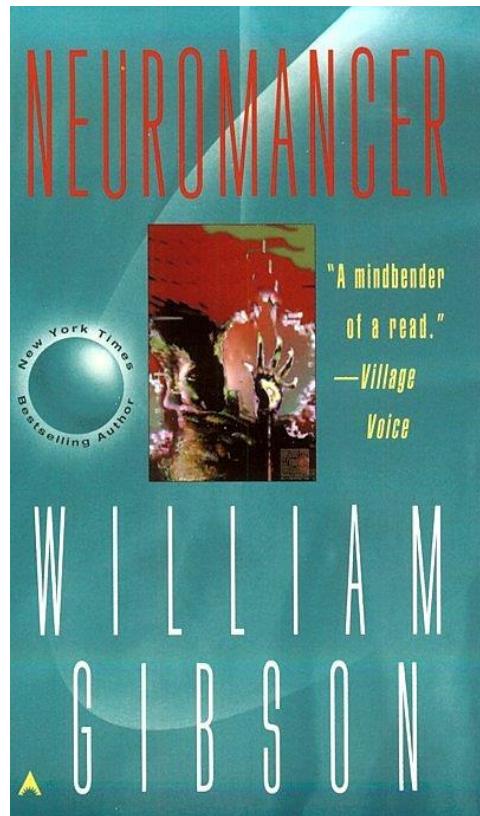
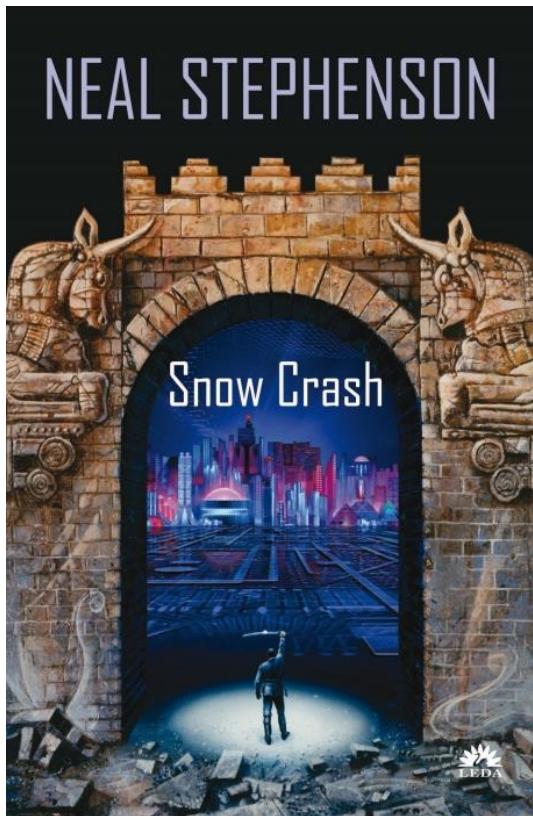
Holodeck (Star Trek: The Animated Series 1974)



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.



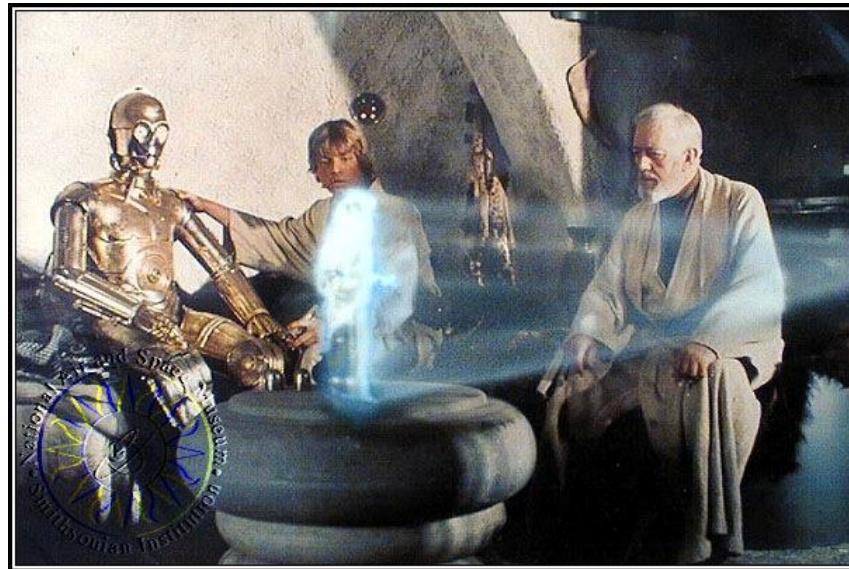


JANUSVR



Augmented Reality

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



Pokemon GO..



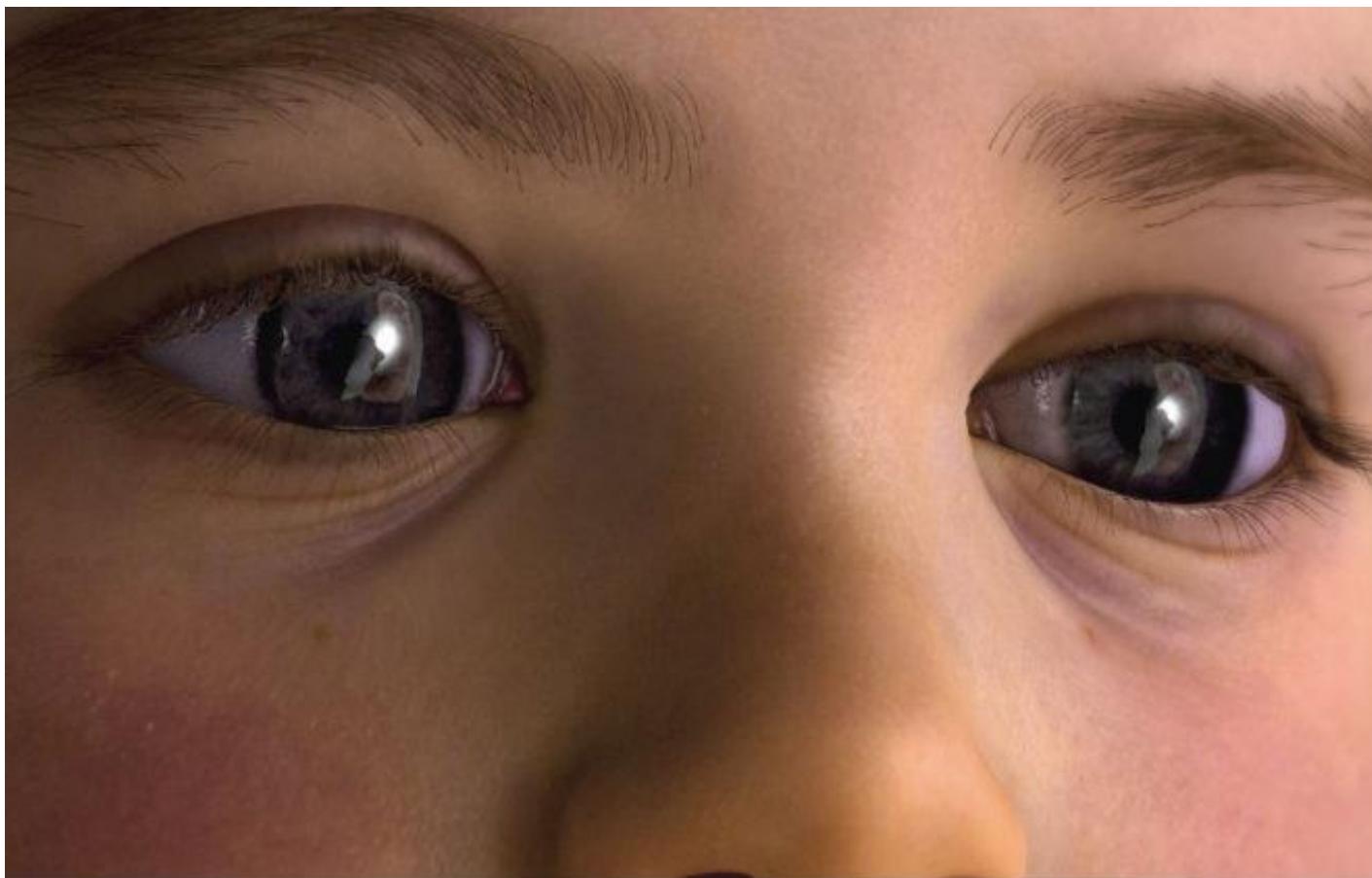
SymbiosisSketch = 2D sketching + 3D sketching + more

Course on AR/VR

Karan Singh

Seminar style course

Rendering



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