

# Computer Graphics

CSU4052 2023/2024

Lecturer: Prof. Carol O'Sullivan, [Carol.OSullivan@tcd.ie](mailto:Carol.OSullivan@tcd.ie)

TA: Donal Egan

Course Content: Blackboard

# Lecturer

Professor of Visual Computing, TCD

1997-now: Trinity College Dublin

2013-2016: Disney Research Los Angeles

2012-2013: Seoul National University

Long time ago: Dow Chemical, Germany



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Carol O'Sullivan  
Email: [Carol.OSullivan@tcd.ie](mailto:Carol.OSullivan@tcd.ie)

# Lectures

- 2pm-4pm Wednesdays
  - Lecture in tbd
- 4-5pm Thursdays
- Tutorial in LB01 (from Wk3)
- Discussion Board on Blackboard
- All content on Blackboard

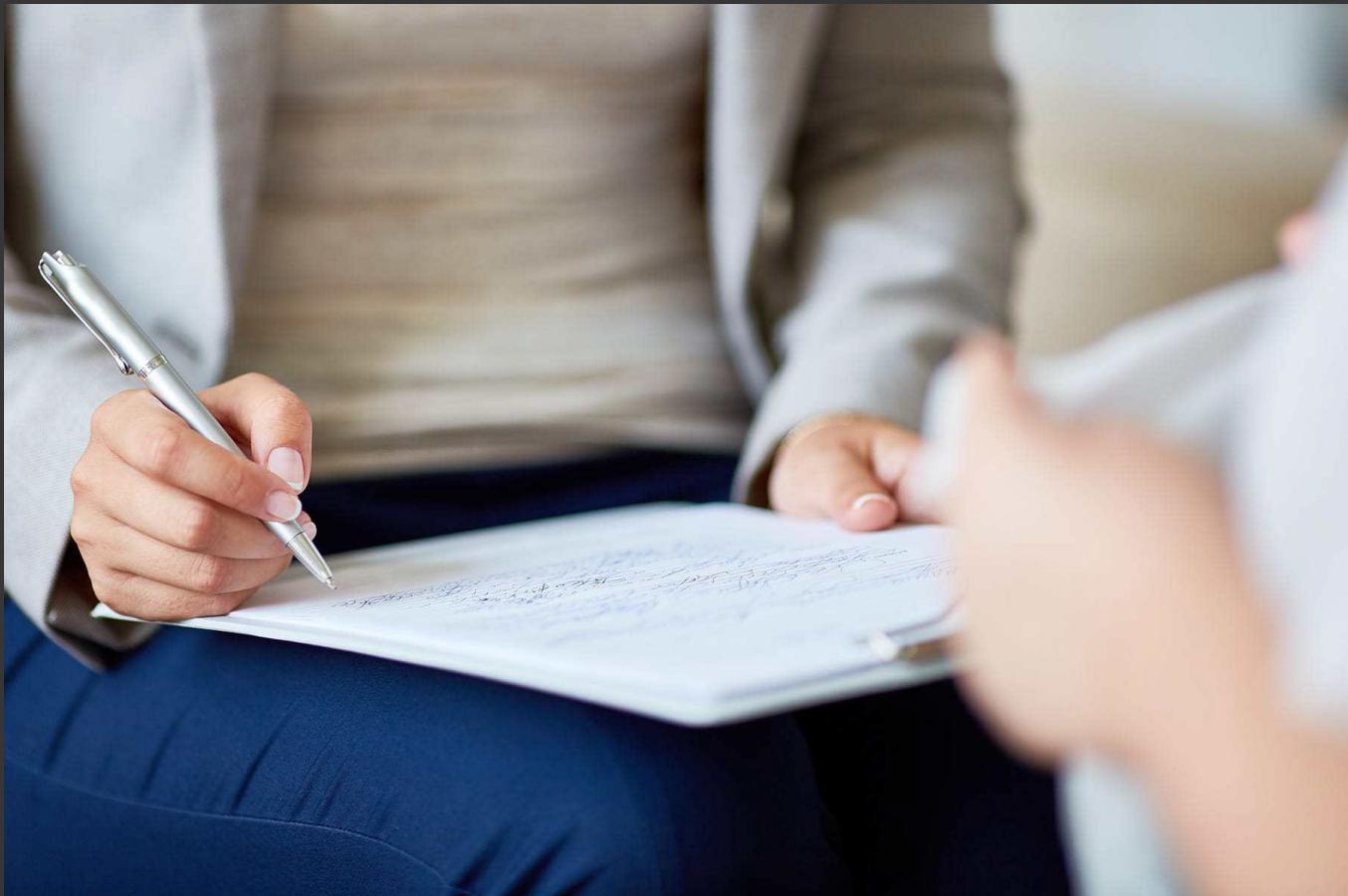


# Labs

- OpenGL 3 or 4 (Shader Based)
- C/C++
- Each lab teaches you how to use new features
- Viewing, animation, lighting and materials, textures etc.,
- NB: Try out Lab 1, troubleshoot
- Try out tutorials online, lots of great resources

# Assessment

- Individual Project (60%)
- Quizzes(40%)



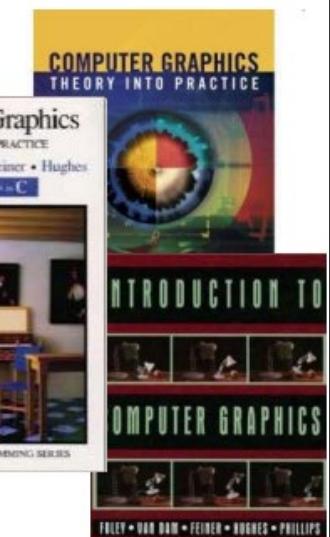
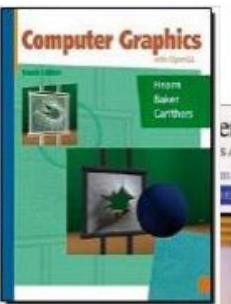
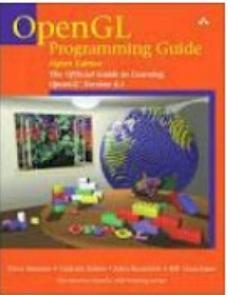
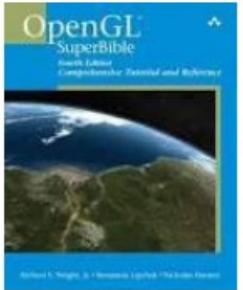
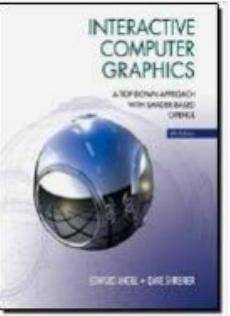
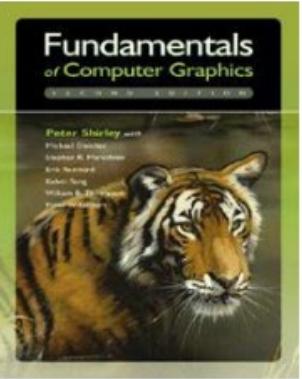
# Project

- Extend the theory you learned in lectures
- Previous example:
  - interactive spooky scene with crowds



# Recommended Texts

- **Fundamentals of Computer Graphics 3<sup>rd</sup> Edition,** Shirley, Marschner
- **Computer Graphics Principles and Practice 3<sup>rd</sup> Edition** Hughes, van Dam, etc.
- **Interactive Computer Graphics: A top-down approach with shader-based OpenGL, 6<sup>th</sup> edition,** Angel
- **Three Dimensional Computer Graphics:** Watt
- **OpenGL Programming Guide, 8<sup>th</sup> Edition,** Shreiner
- **Elementary Linear Algebra** Howard Anton



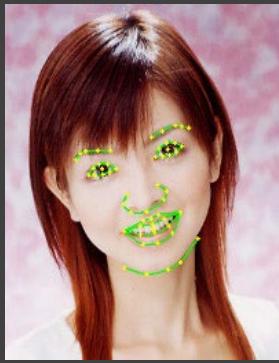
FOLEY • VAN DAM • FEINER • HUGHES • PHILLIPS

# Visual Computing

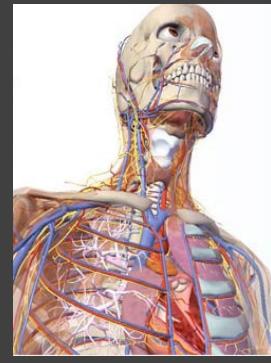
Graphics



Vision



Visualisation

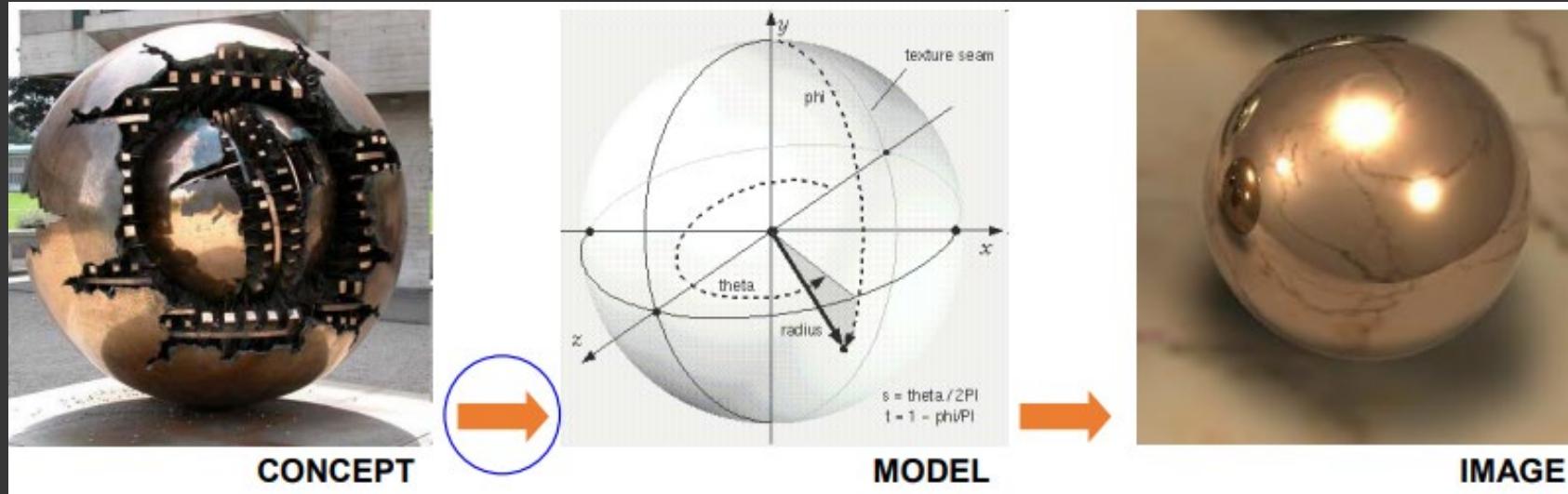


Virtual Reality



Using computers both to generate visual images synthetically and to integrate or alter visual and spatial information sampled from the real world

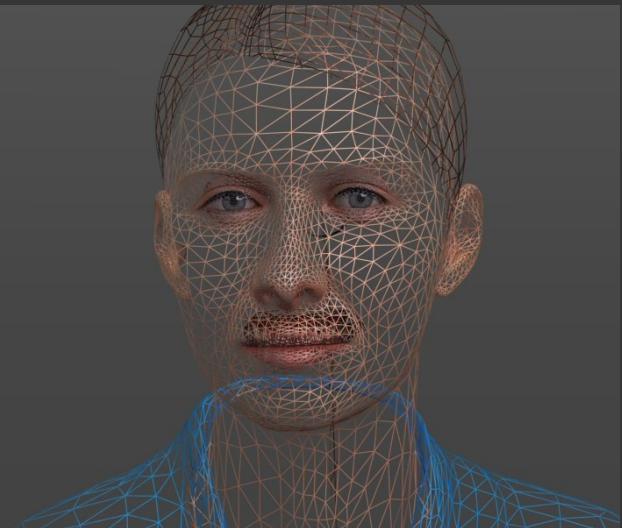
# Computer Graphics



“Computer Graphics is concerned with producing images (or animations) using a computer.”

# Computer Graphics

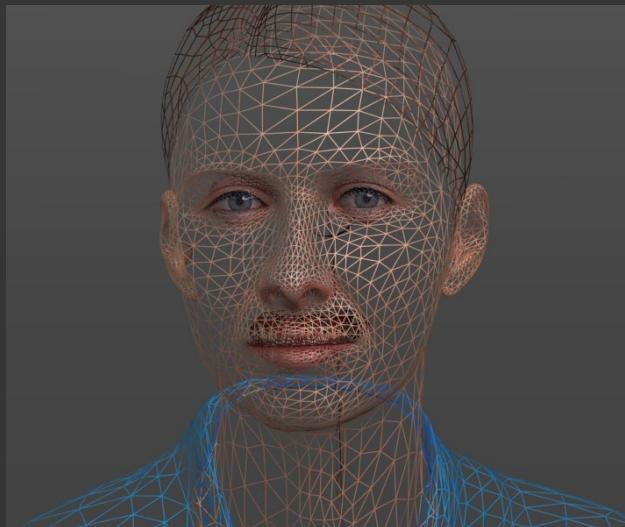
## Modelling



Creating or  
capturing the  
representation of  
objects - motion  
often geometrical

# Computer Graphics

## Modelling



Creating or capturing the representation of objects - motion often geometrical

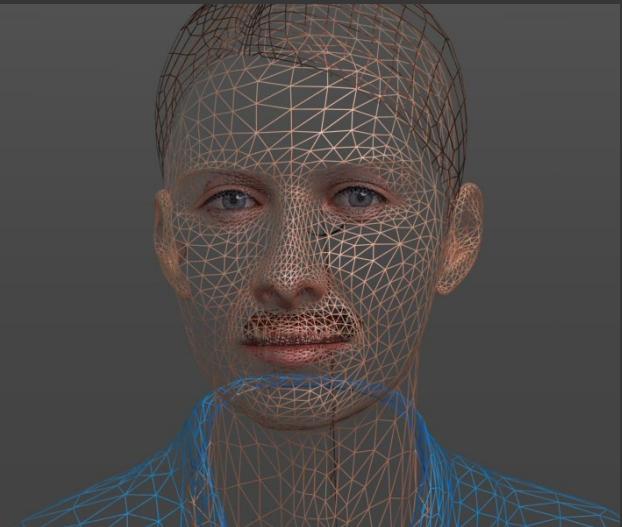
## Rendering



Creating an image of these objects on a display device

# Computer Graphics

Modelling



Creating or capturing the representation of objects - motion often geometrical

Rendering



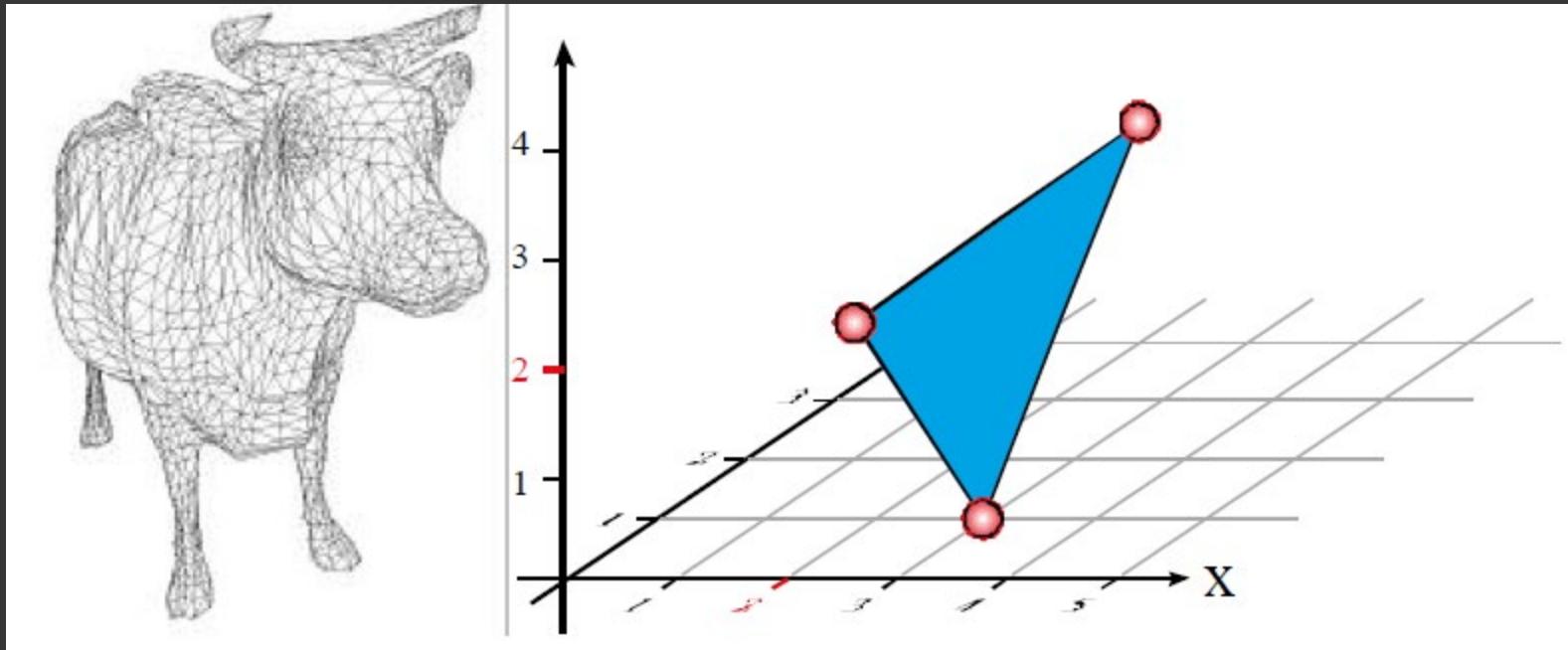
Creating an image of these objects on a display device

Animating

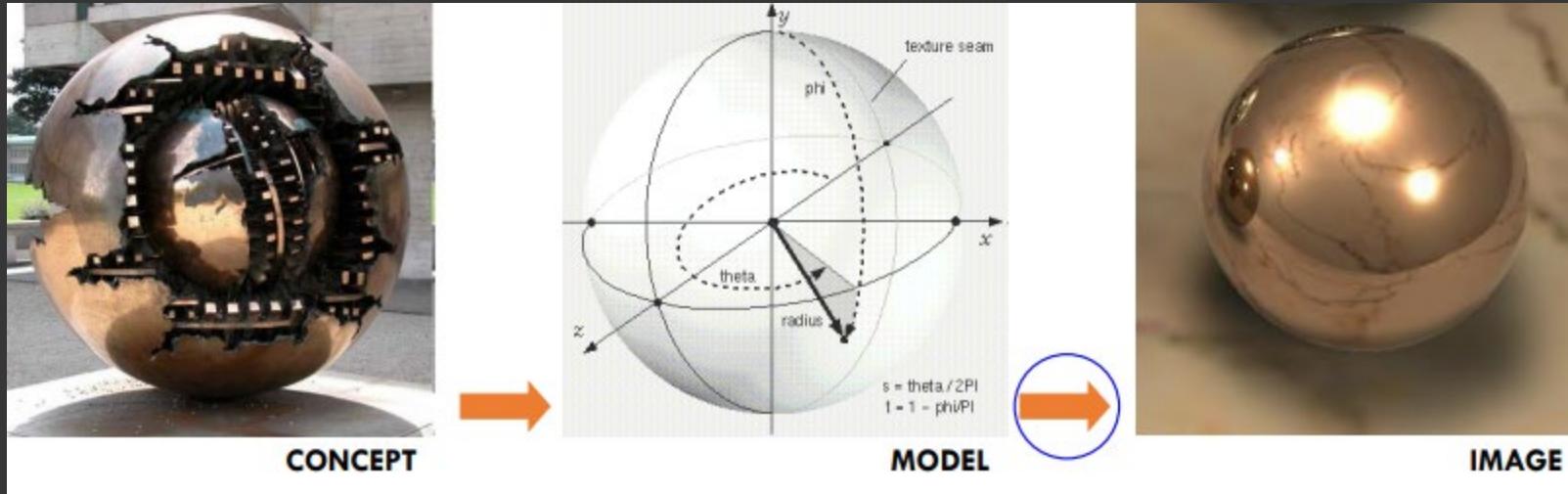


Making objects move by describing how they change over time

# Modeling

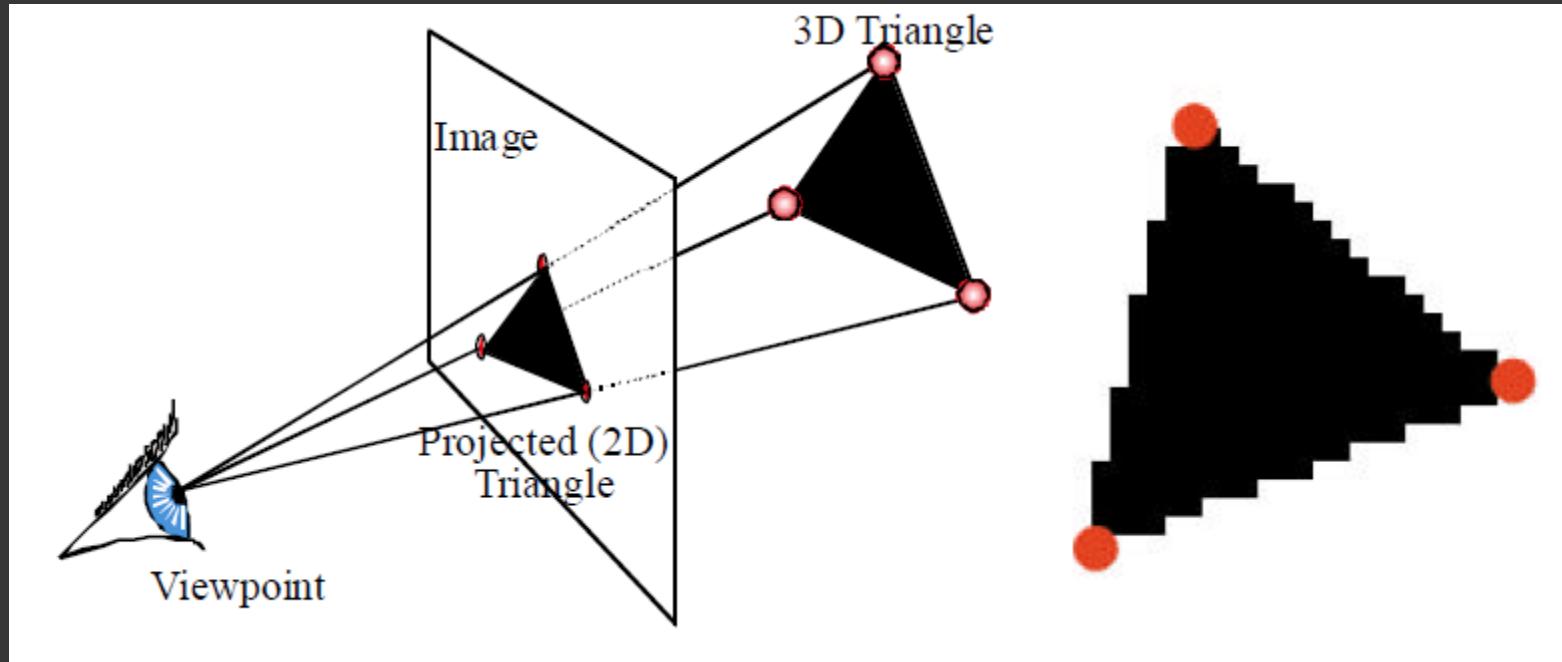


# Rendering

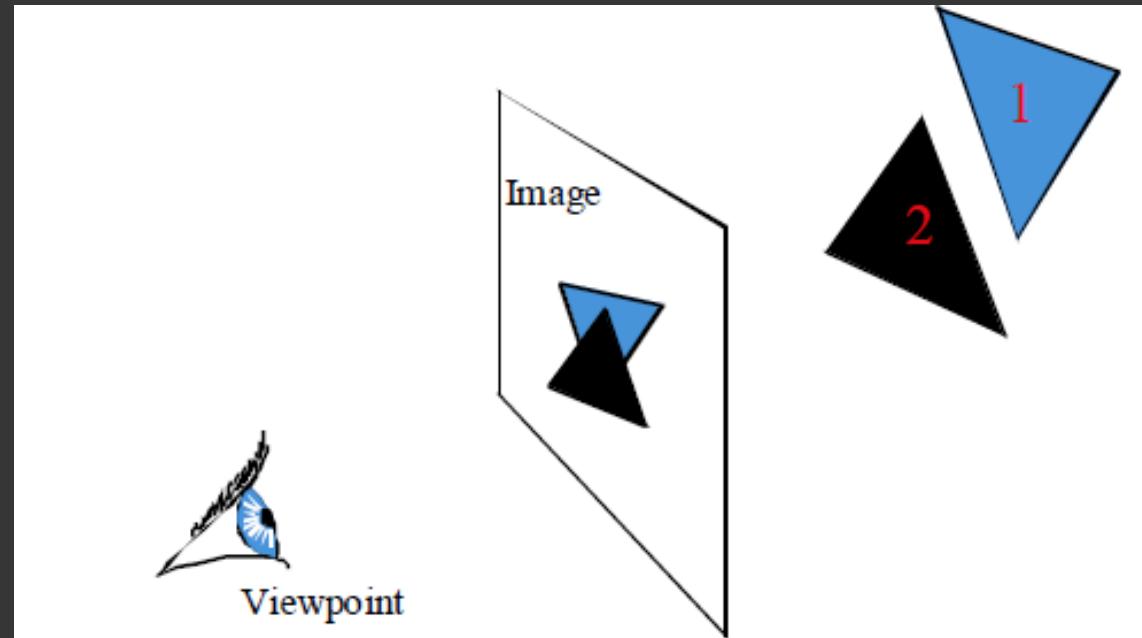


The rendered IMAGE is a visual representation of the model on digital output media.

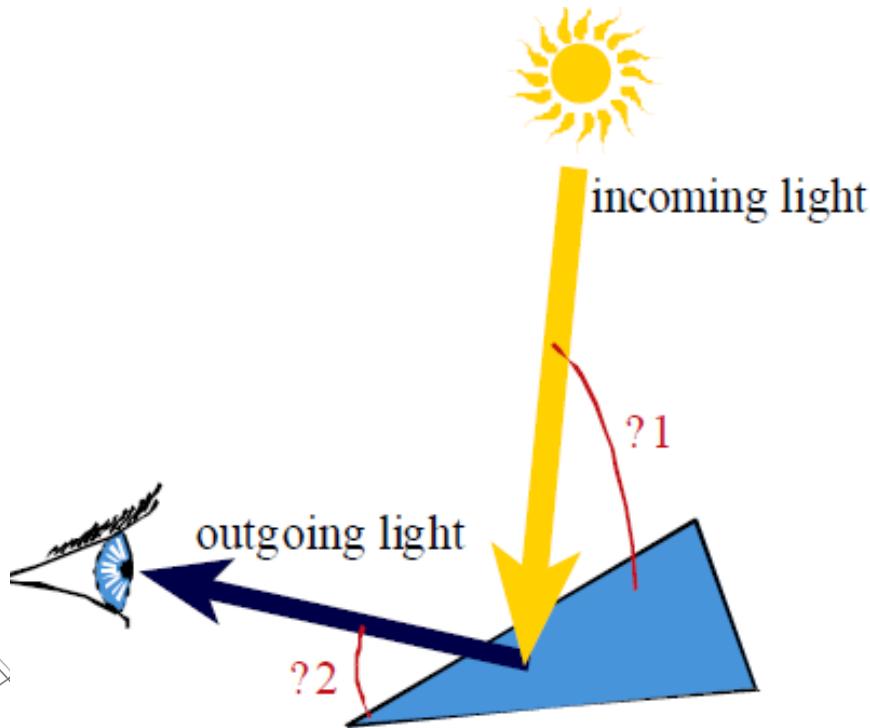
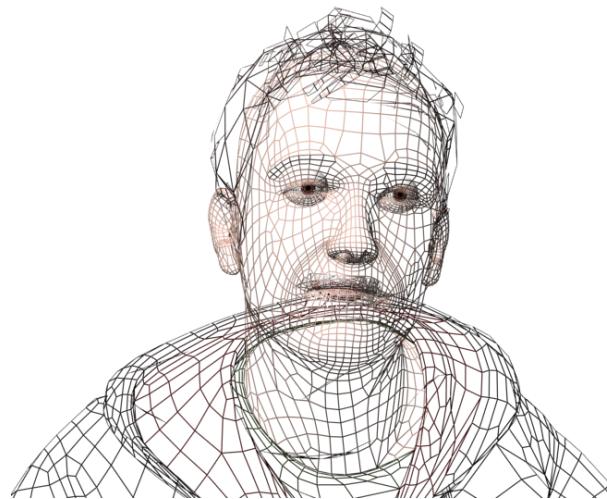
# Rendering

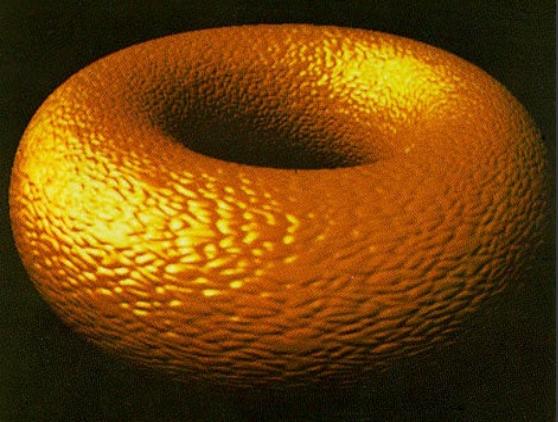


# Visibility

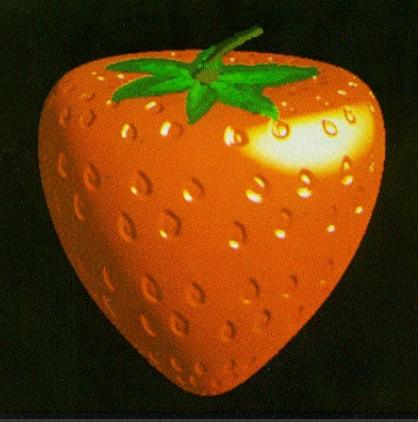


# Shading and Materials





First bump-mapped images (Blinn 1978)



Early texture-mapped image (Catmull 1974)



First distributed ray traced image (Cook 1984)



First ray traced image (Whitted 1980)

What is CG used for?

# Computer Animation



Inside Out, Disney 2015



Peter Rabbit, Sony Pictures, 2018



Incredibles 2, Disney, 2018

PIXAR  
ANIMATION STUDIOS

# Visual Effects

CGI augmenting reality



Avengers Infinity War, 2018



Ted, Universal Pictures, 2012

# Visual Effects

CGI replacing reality



Rogue One: A Star Wars Story, 2016



The Irishman, 2019



The Social Network, 2010

# Games



Fortnite, Epic Games, 2018



Uncharted 5, Naughty Dog, 2018



Spiderman, Insomniac Games, Sony, 2018



Minecraft, Mojang, 2011

# Virtual Influencer / Model



# Augmented and Virtual Reality



# Virtual Concerts



# Chatbot

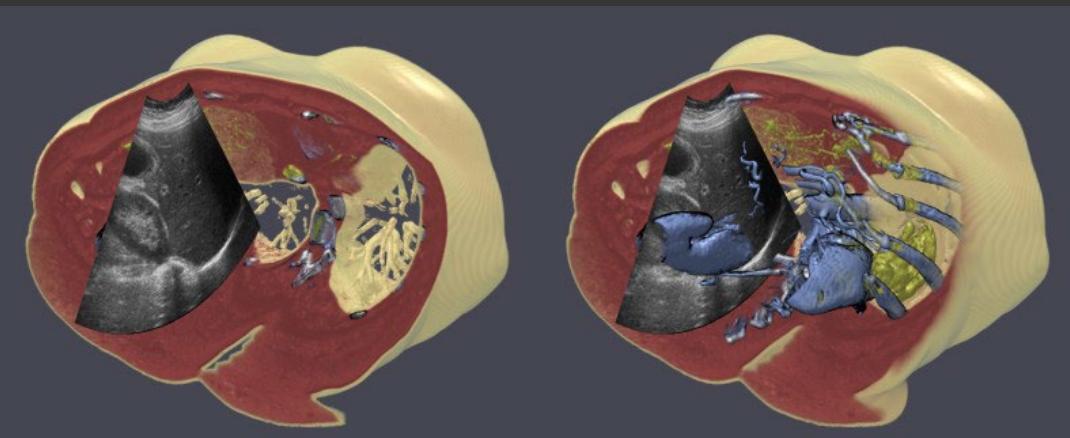


Autodesk, Soul Machines

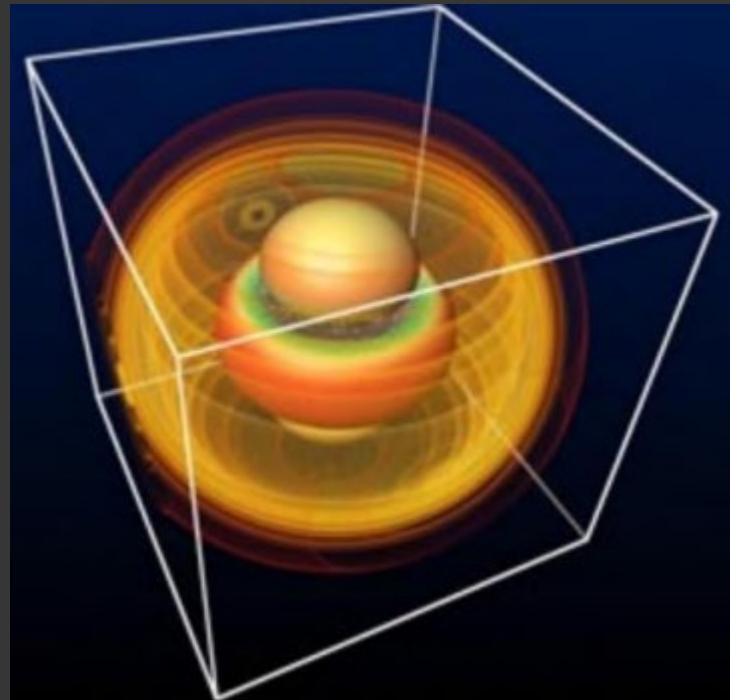
# Room Layout Design & Architectural Simulations



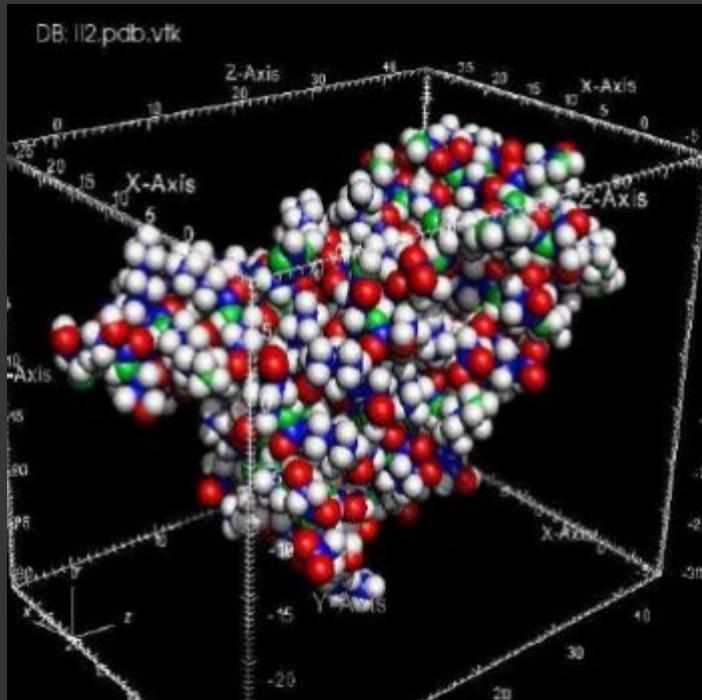
# Medicine and Virtual Surgery



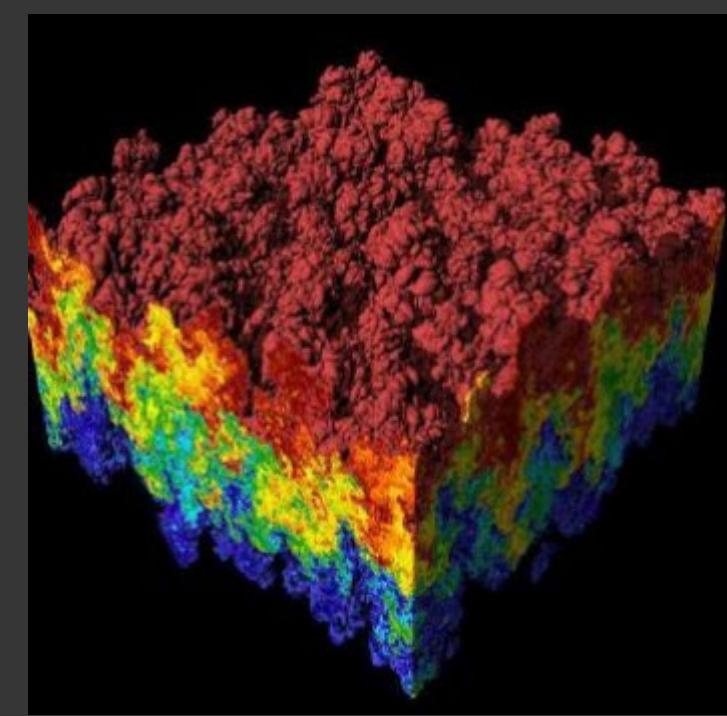
# Scientific Visualisation



Gravity Waves,  
Ian Foster,  
Carl Kesselman & Steve Tuecke



Molecular Visualisation, by UCRL-WEB



Fluid simulation,  
by Lawrence Livermore National Laboratory

# History and cultural heritage



# Flight Simulator



Microsoft Flight Simulator 2020

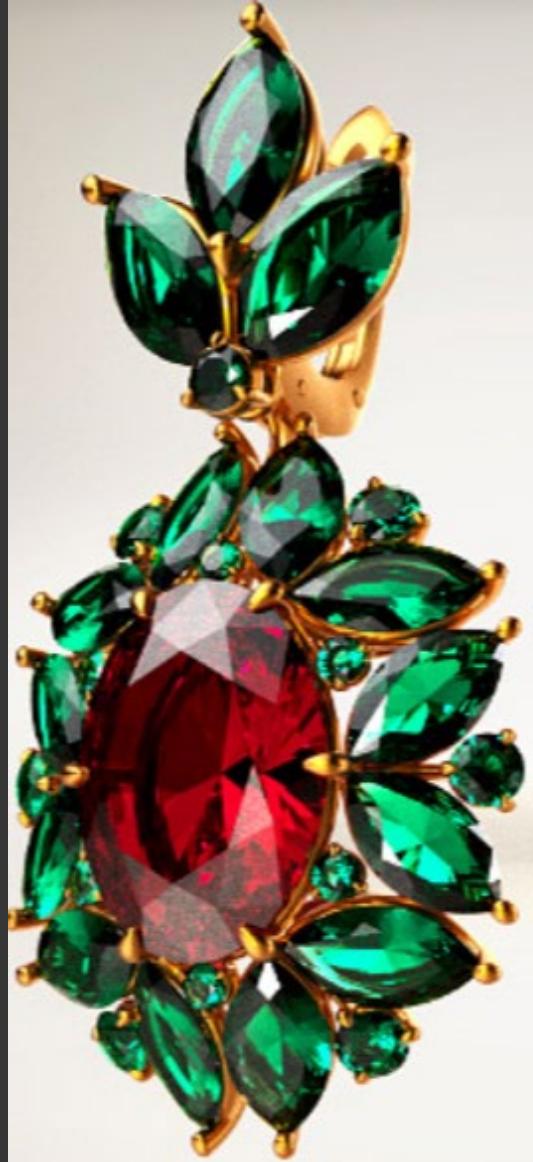
**REAL OR COMPUTER GRAPHICS?**















# Graphics & Vision Discipline

