Introduction to Computer Graphics
- Course Presentation -

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Overview

- Motivation

- Tentative syllabus

- Evaluation

- Class organization
- Some useful books

MOTIVATION

What is Computer Graphics ?

- Watch the videos after the lecture !

What is Computer Graphics ?

- Computer graphics deals with generating images with the aid of computers

- Core technology in digital photography, film, video games, cell phone and computer displays, virtual and augmented reality, and many specialized applications

[Wikipedia]

What is Computer Graphics ?

- CG encompasses 3D modeling, rendering, computer animation, data and information visualization, VR/AR, etc.

- CG is responsible for displaying art and image data effectively and meaningfully

- CG development has had a significant impact on many types of media and has revolutionized animation, movies, advertising, video games, etc.
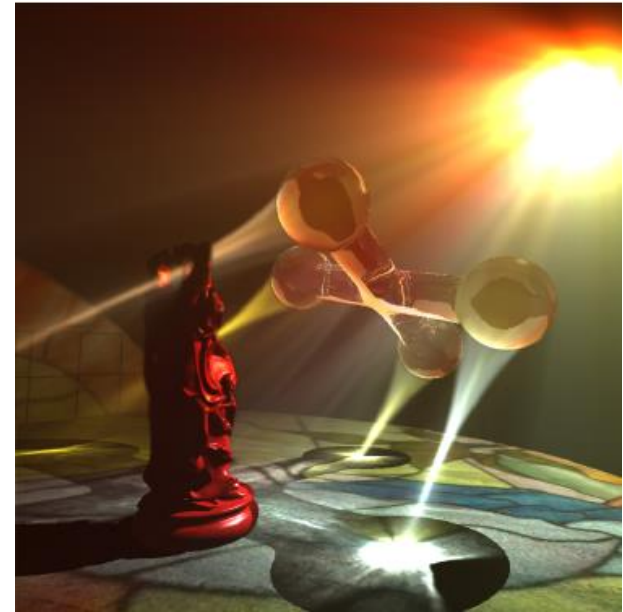
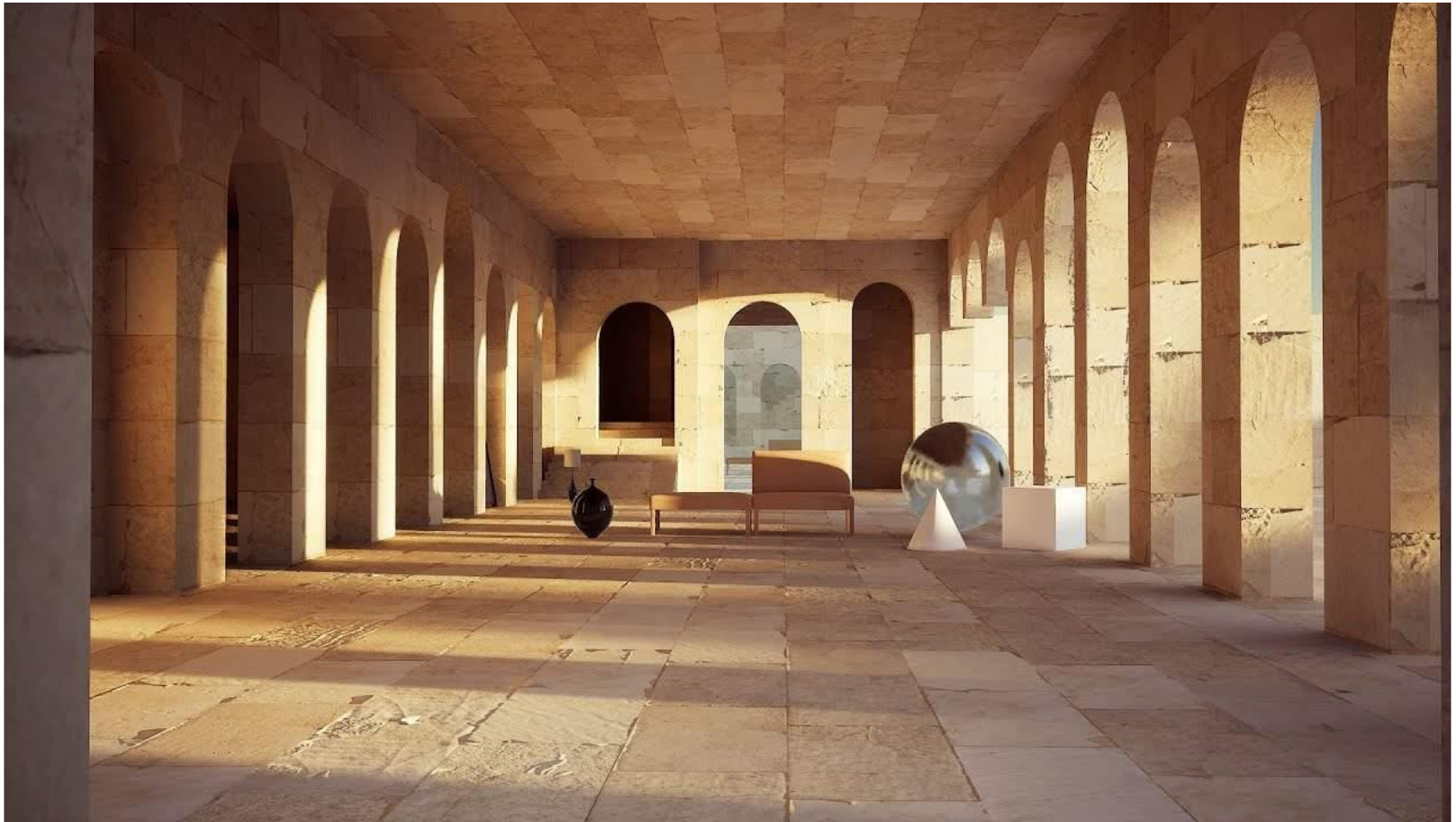[Wikipedia]

Examples

Realistic image synthesis

Global illumination effects

Reflection editing

[http://www.master-visual-computing.de/]

Realistic Image Synthesis – dezeen

Global Illumination

Application Example

- From the real-world to synthetic models

[http://www.master-visual-computing.de/]
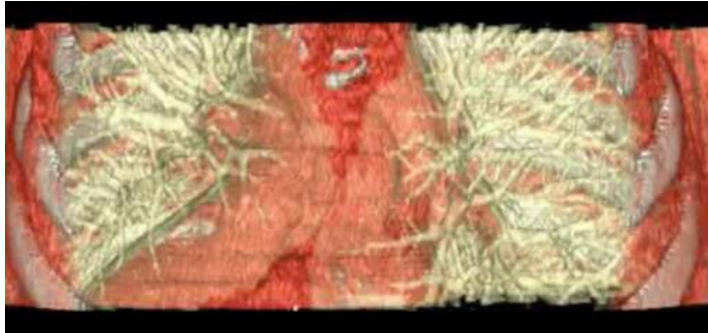
artec3d.com

- **Professional 3D scanners**

artec3d.com – Application areas

- Industrial models
  - Reverse engineering / Quality inspection / …

- Healthcare

- Science and Education

- Art and Design
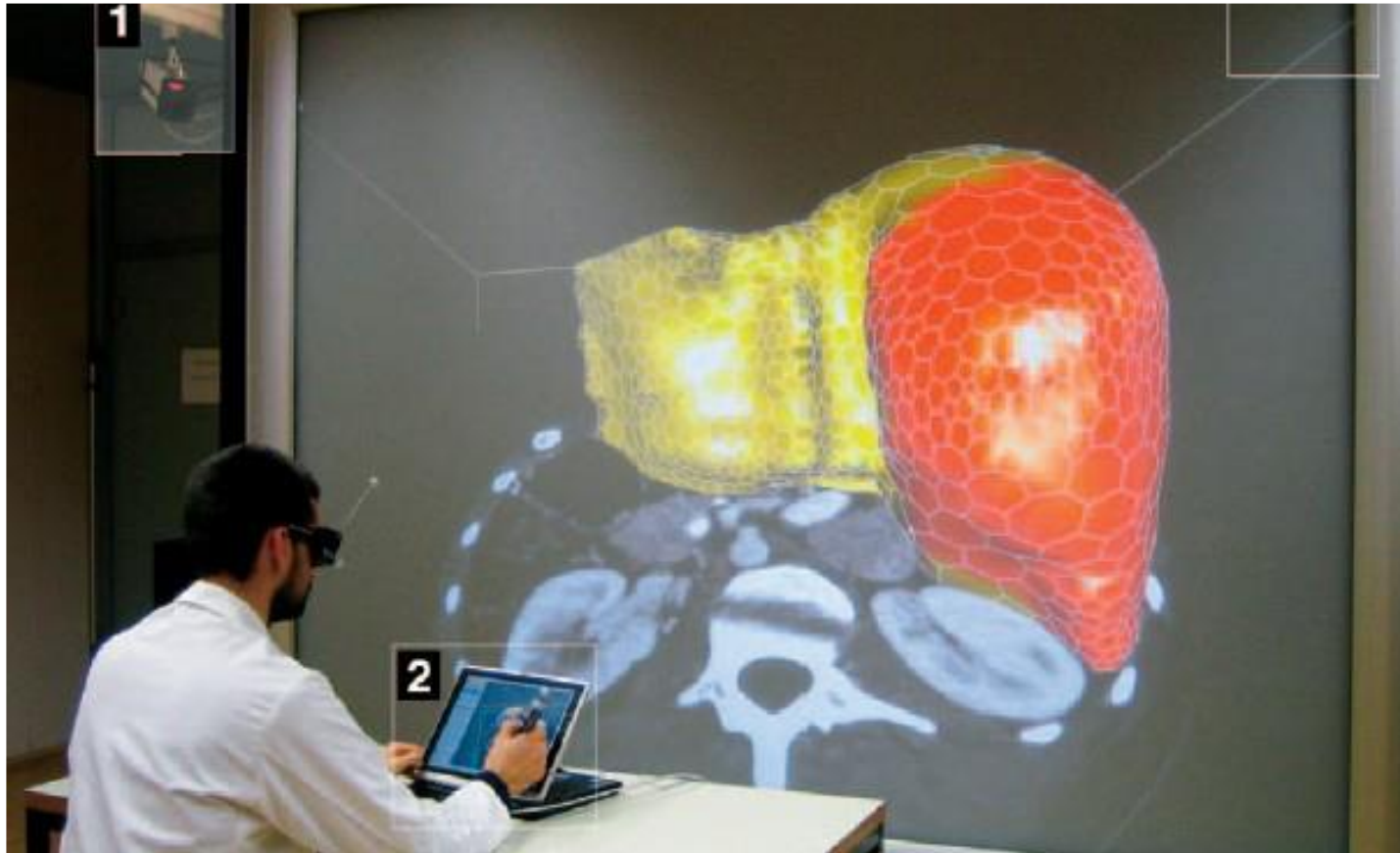
Application Examples
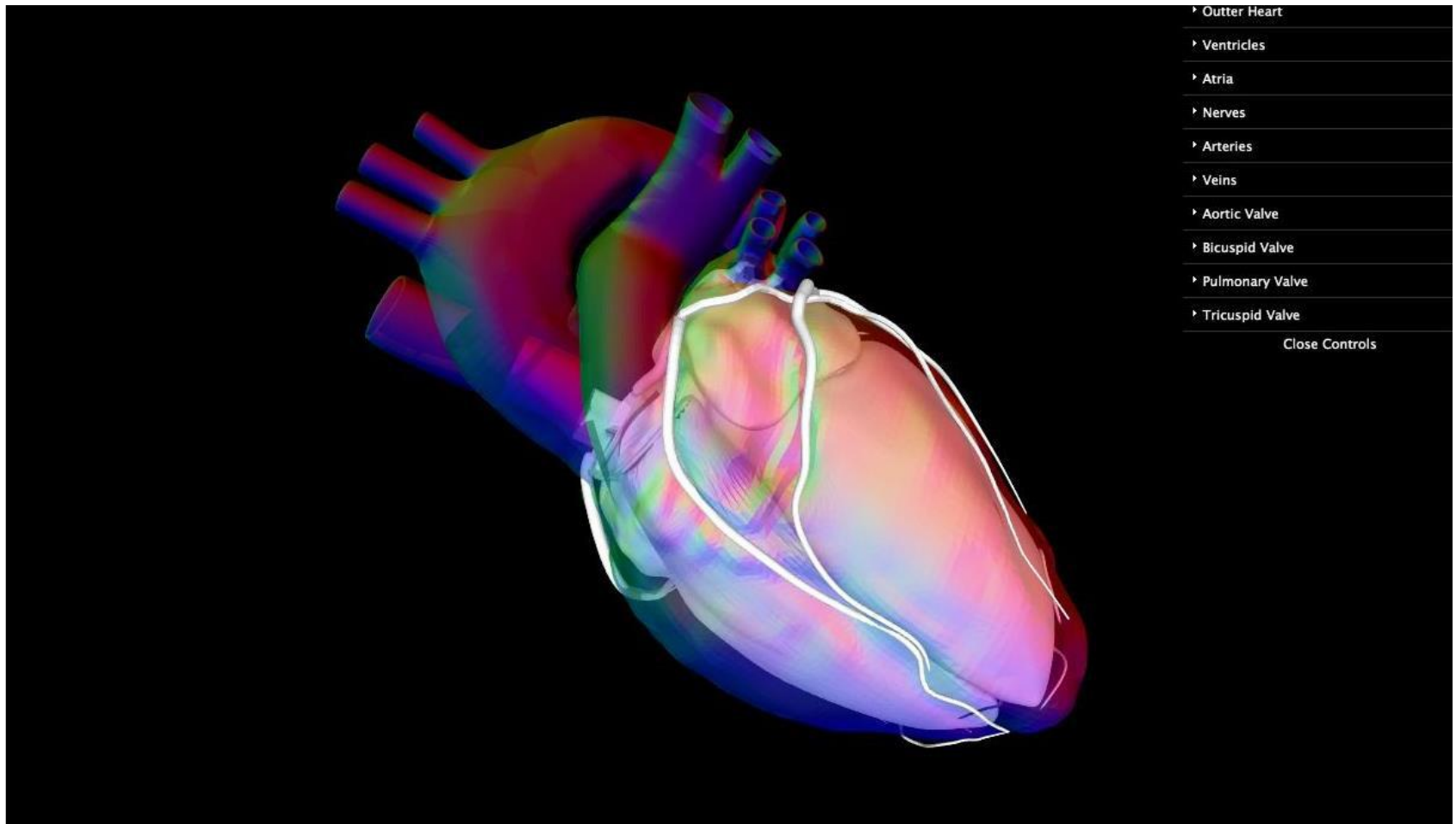

Data Visualization

Internet Security

Virtual / Augmented Reality

Medical Visualization

Medical Visualization

Visualizing Population Density

Population Density in Europe
1km cells - the big squares are 50km x 50km

Data: GHS_POP, EU
Software: Aerialod
Author: Alasdair Rae

VR / AR Visualization

[Weidlich et al, 2008]

immersivelearning.news
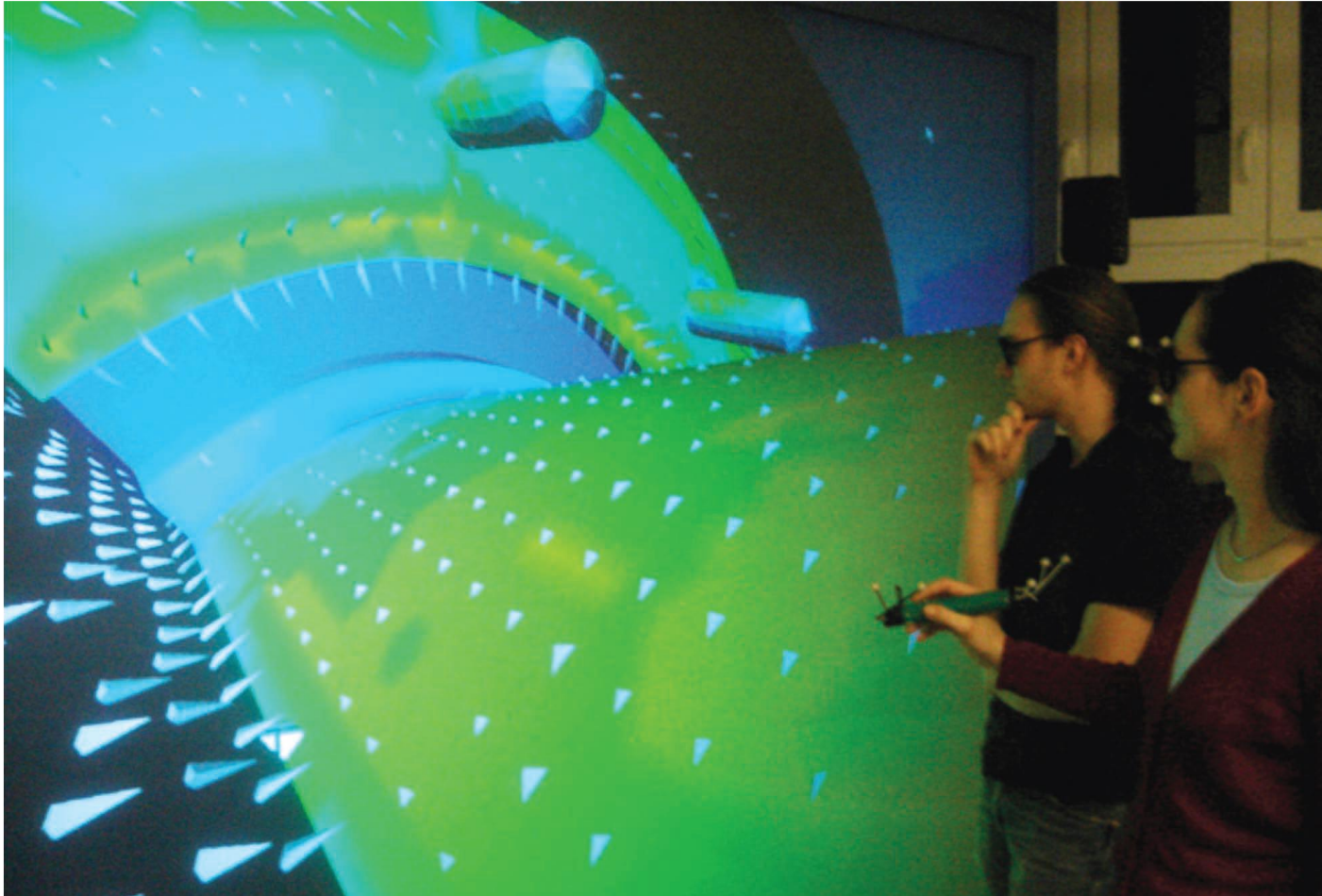
Mobile Graphics

[SIGGRAPH Asia 2017 Course Notes]

Web-based VR

[https://aframe.io/examples/showcase/snowglobe/]
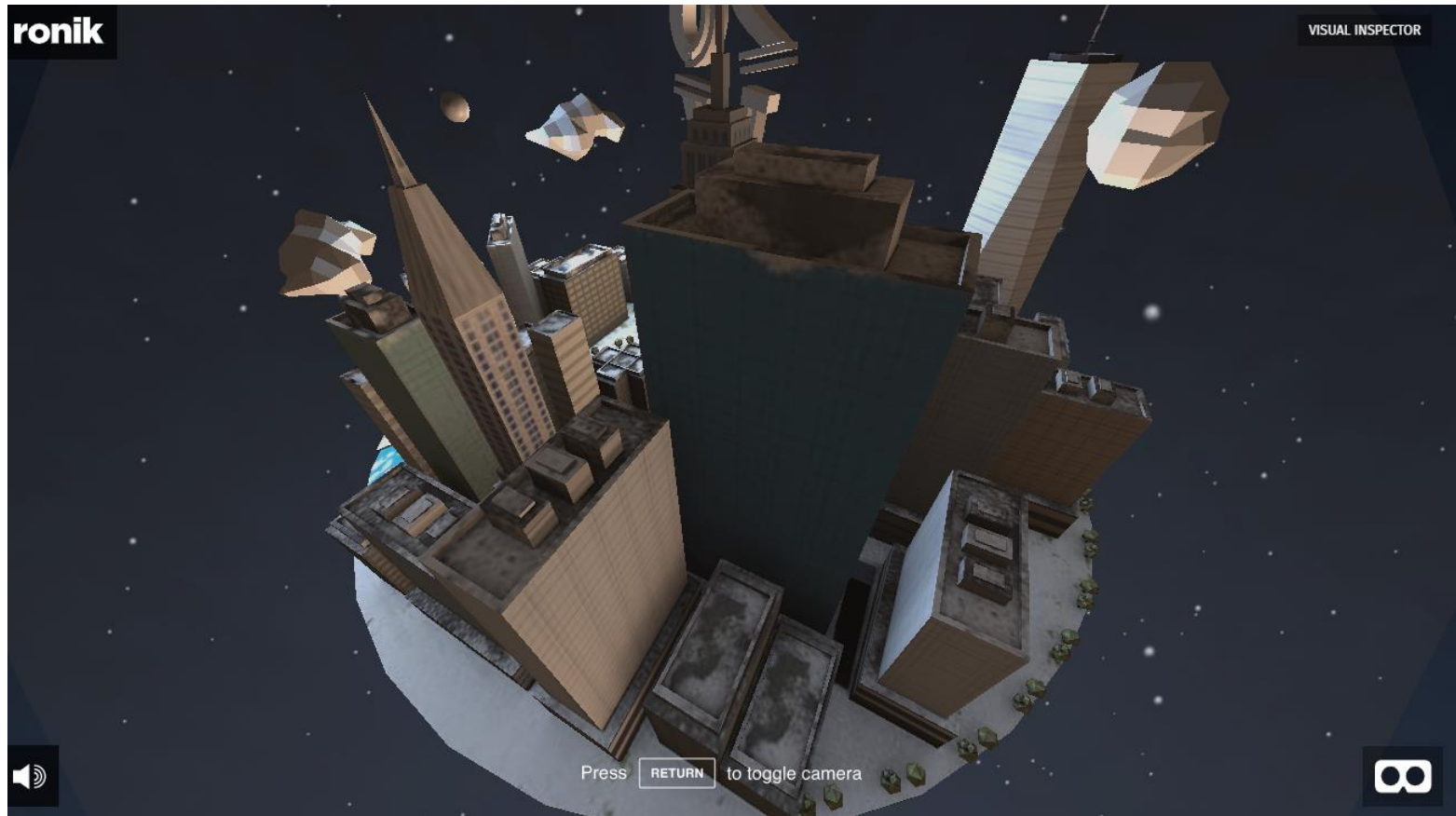
Reconstructing Ancient Sculptures

[https://spectrum.ieee.org/computing/software/ancient-sculptures-return-to-mosul-as-digitally-reconstructed-replicas]

First holographic 5G call in Portugal

Realizada a primeira chamada holográfica 5G em Portugal

14 AGO 2019 · NOTÍCIAS   39 COMENTÁRIOS

A Vodafone e a TVI realizaram a primeira transmissão holográfica 5G em tempo real, um marco inédito no nosso País.

[https://www.youtube.com/watch?v=9zoC5iT6dXI]

VR headsets for cows

Russian cows fitted with VR headsets show 'reduced anxiety and improved emotional mood'

A Russian dairy farm has strapped virtual reality headsets to its cows in an experiment to "improve their wellbeing" CREDIT: @OLDLENTACH/TWITTER

Follow

By **Matthew Bodner,** MOSCOW
26 NOVEMBER 2019 · 7:37PM

AR goggles for dogs

The US military is trialing augmented reality goggles for dogs

By Sara Spary, CNN Business

Updated 1623 GMT (0023 HKT) October 9, 2020

The technology, which the US Army says is the first of its kind, works by letting a handler see everything the dog can see and then provide specific commands using visual cues that show up in the dog's line of vision.

[https://edition.cnn.com/2020/10/09/tech/army-dogs-goggles-scli-intl/index.html]

Computer Graphics vs …

		Output	
		Model	Image
Input	Model	Geometric Modeling	Computer Graphics
	Image	Computer Vision	Image Processing
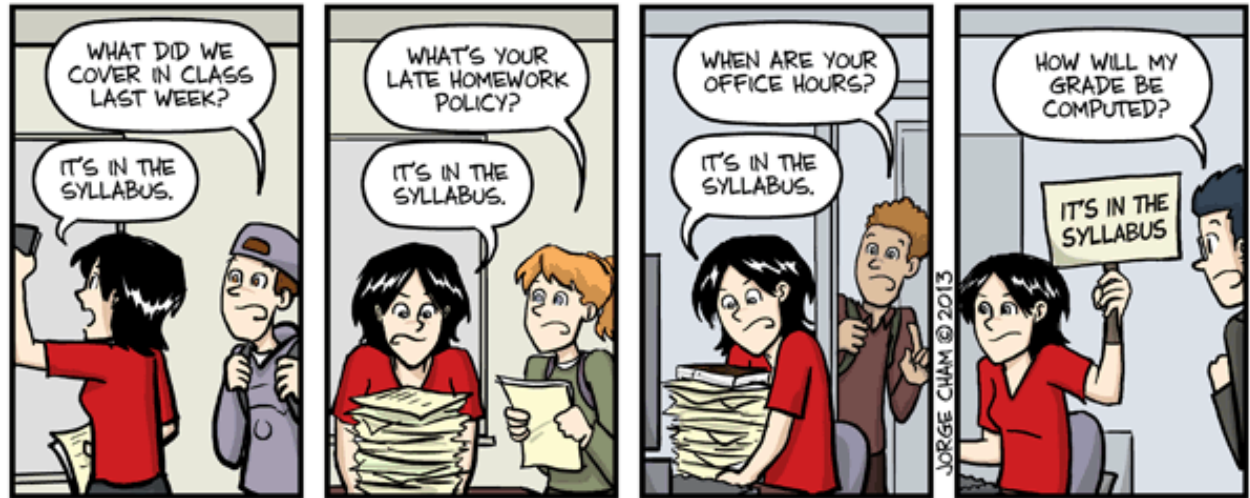
[phdcomics.com]

SYLLABUS

Tentative planning

– Introduction to CG and Three.js

– The Visualization Pipeline

– 2D and 3D Transformations. Projections

– Illumination and Shading

– 3D Modeling using Triangle Meshes

– Intermediate Project Presentations

– Textures

– Animation

– Advanced Techniques

– Final Project Presentations

[irinstitutes.org]

EVALUATION

Grading

- **Mixed grading / Avaliação discreta**
  - Exam ("normal" or "recurso") : 35 %
  - 1 project : 60%
  - Class participation : 5%

- **1 project using Three.js**
  - Individual – not group work !
  - Intermediate + Final delivery
  - Code + video + slides + presentation + live demo

ORGANIZATION

Lecture Organization

- Additional materials: videos, etc.
  - View them before or after the lecture !

- 1st part : Lecture / presentation
- 2nd part : Hands-on : Design / programming /…

- Weekly OT on Zoom
  - Mondays : 18:15 to 19:15
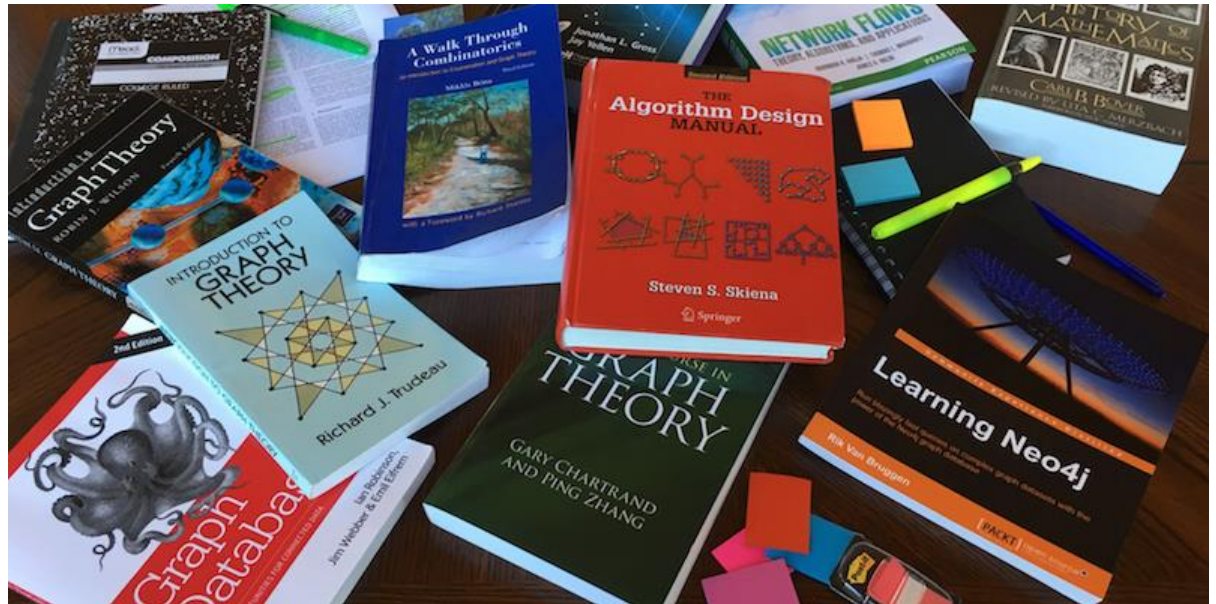
[hackernoon.com]

USEFUL BOOKS

Reference books

Edward Angel, Dave Shreiner

Interactive Computer Graphics, 7th Ed.
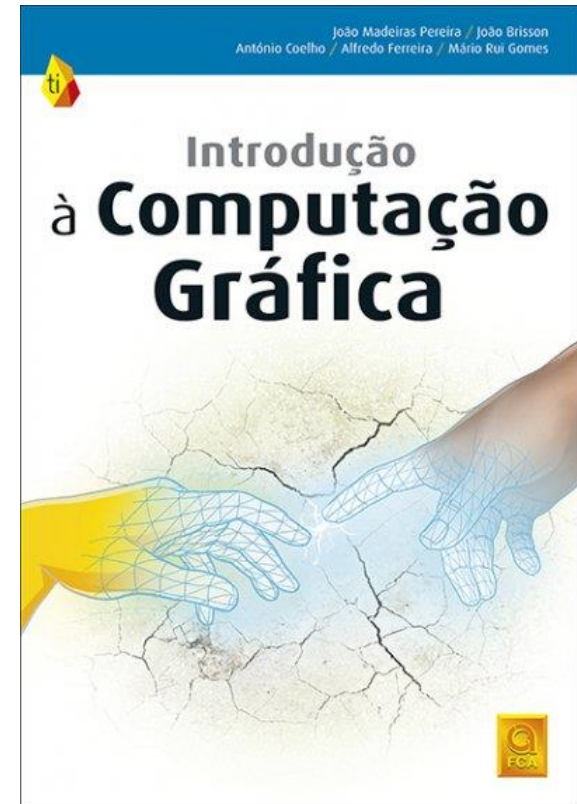
Addison-Wesley, 2015

Jos Dirksen

Learning Three.js , 2nd Ed.

Packt Publishing, 2015

Um livro recente

J M Pereira, J Brisson, A Coelho, A Ferreira e M R Gomes

Introdução à Computação Gráfica.

FCA, 2018

Additional books

- Hughes, J. F., A. van Dam, et al., *Computer Graphics – Principles and Practice*, 3rd ed., Addison-Wesley, 2014

- Foley, J., A. van Dam, et al., *Introduction to Computer Graphics*, Addison Wesley, 1993

- Rogers, D., J. Adams, *Mathematical Elements for Computer Graphics*, 2nd ed., McGraw-Hill, 1989

- …

Course materials on-line

- **CS 123 – Introduction to Computer Graphics**
  - ❑ Brown University, USA – Andy van Dam

- **CS 581 – Graphics Programming**
  - ❑ Philipps-Universität Marburg, Germany

- …

Udacity free course

- **Interactive 3D Graphics**
  - Eric Haines and Gundega Dekena
  - Autodesk

SIGGRAPH University on YouTube

- [Fundamentals Seminar](#)

- [Introduction to 3D Computer Graphics](#)

- [Introduction to "Physically Based Shading in Theory and Practice"](#)

Warnings

- **Classes are not mandatory !**
  - But you should always be present…

- **PACO : choose how you want to be graded…**