

01 - Introduction

Acknowledgements: Daniele Panozzo

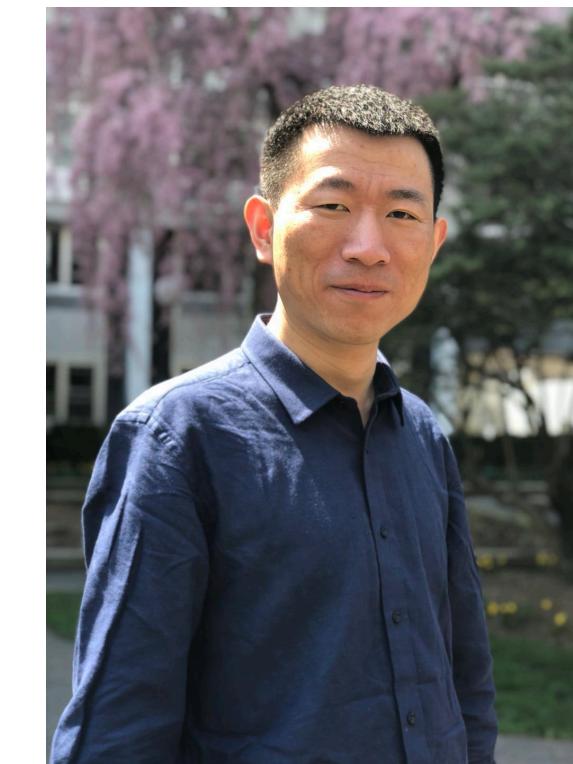
CAP 5726 - Computer Graphics - Fall 18 – Xifeng Gao



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Lecturer

Xifeng Gao

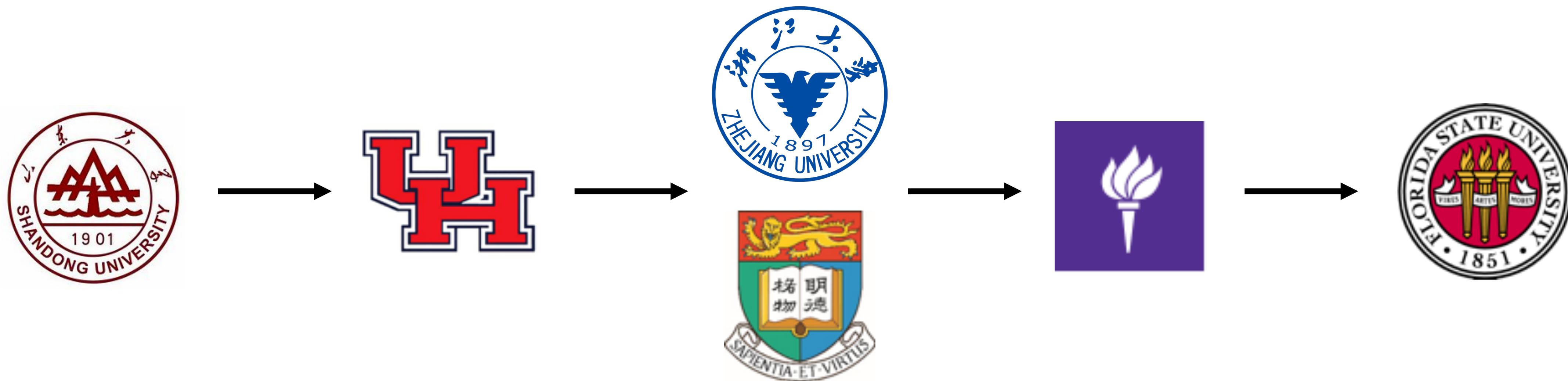


<https://gaoxifeng.github.io/>

gao@cs.fsu.edu



Who Am I?



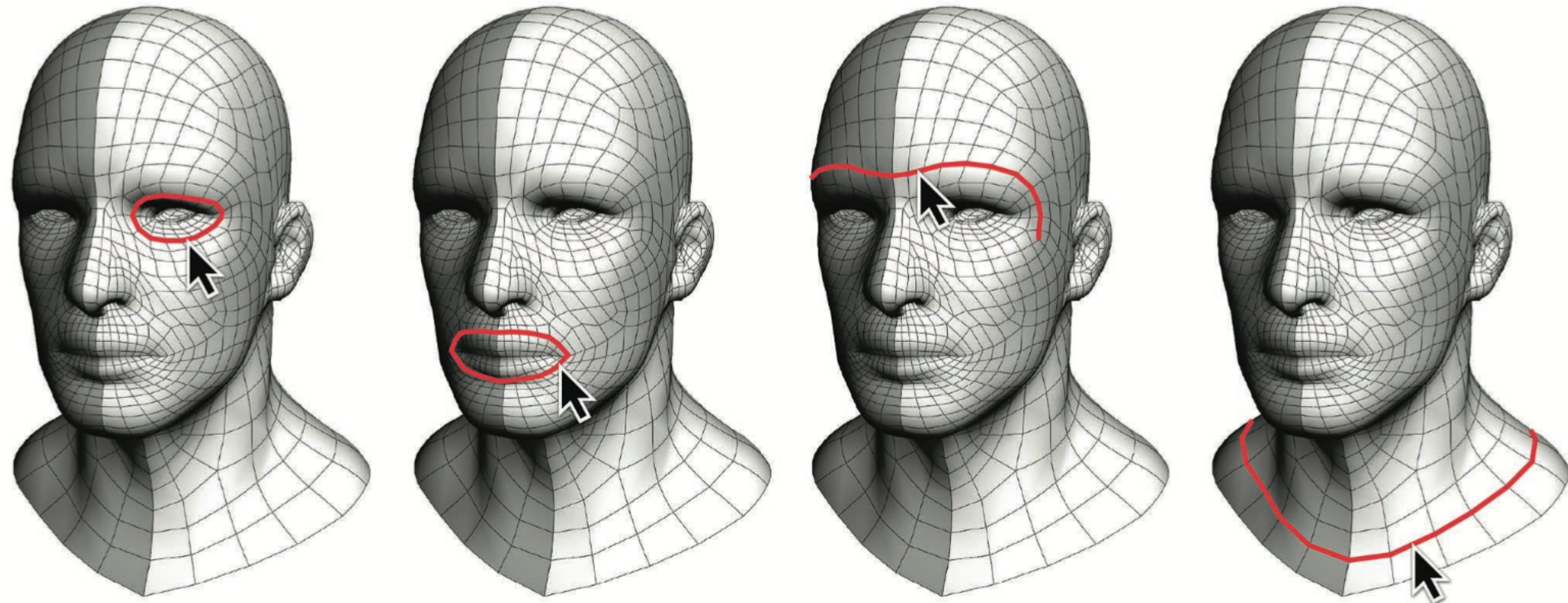
What is Computer Graphics?

- In a broad sense is the use of a computer to create and manipulate images
 - It involves a combination of hardware (input, processing, output) and software
 - It can be 2D or 3D
 - It is used in most electronic devices



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Graphic Areas



Modeling

<https://www.youtube.com/watch?v=Udno6EA5IXY>



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Graphic Areas

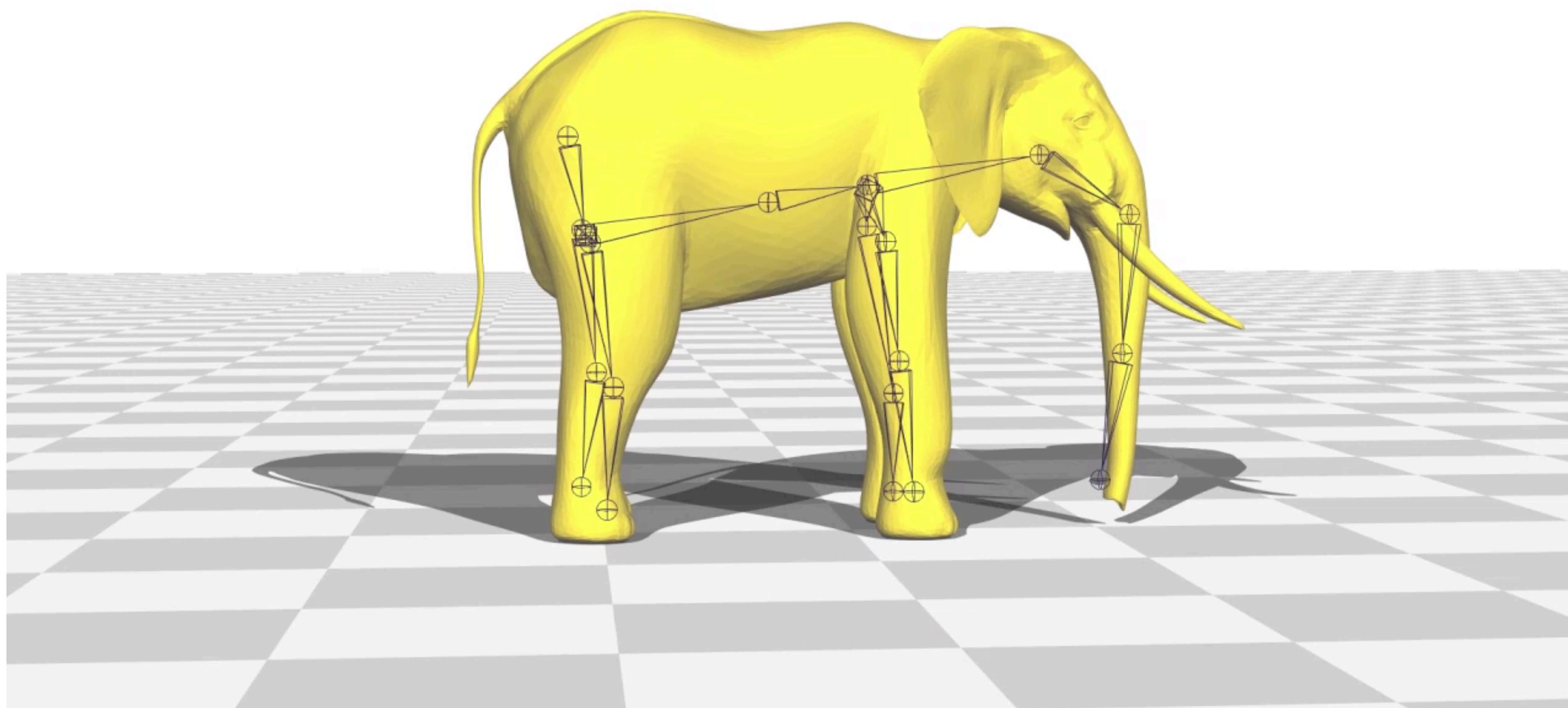


Rendering



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Animation



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Copyright: Andrew Guyton

User Interaction



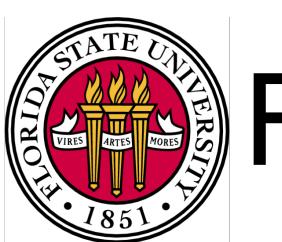
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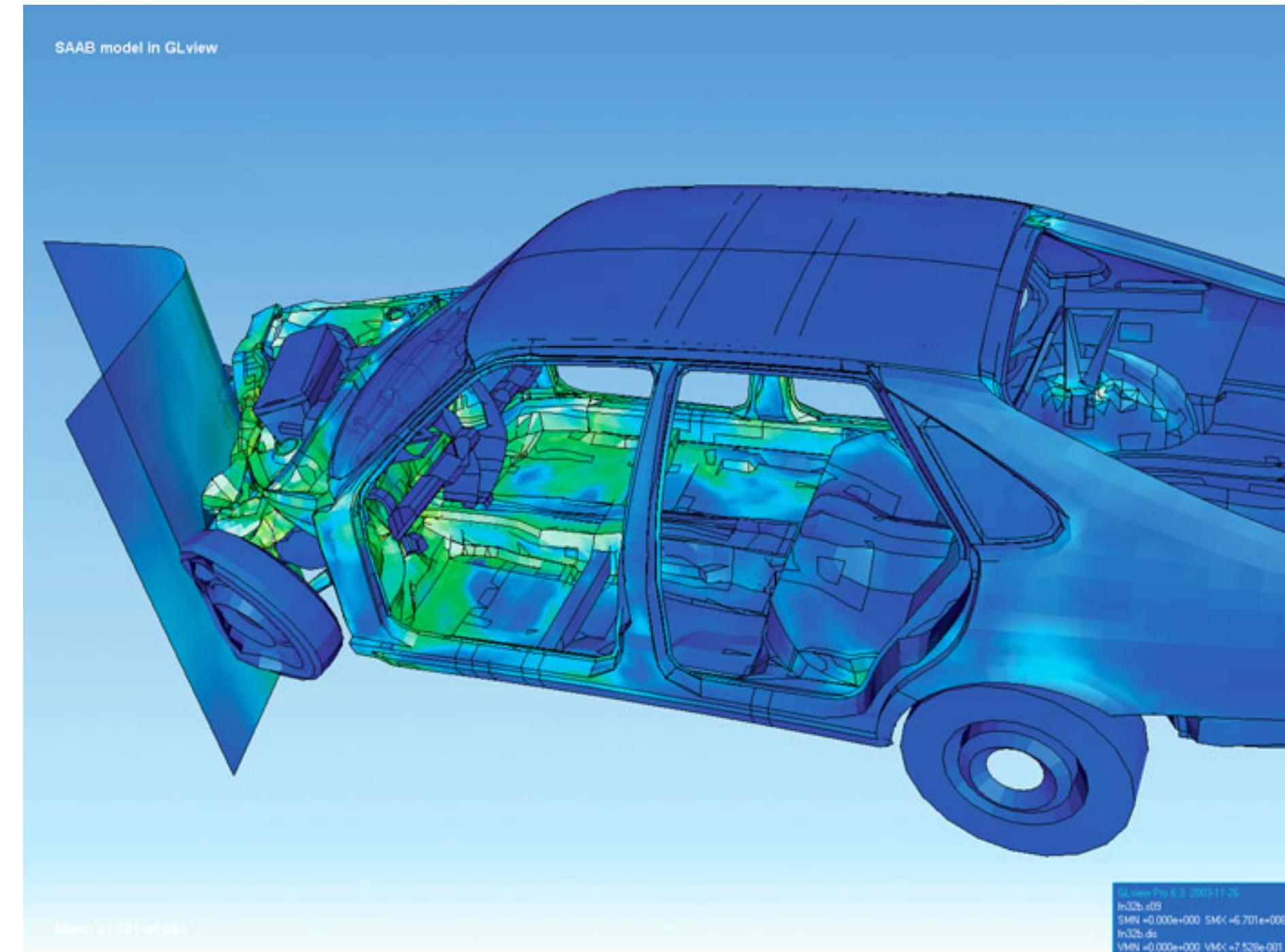
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Virtual Reality



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Visualization



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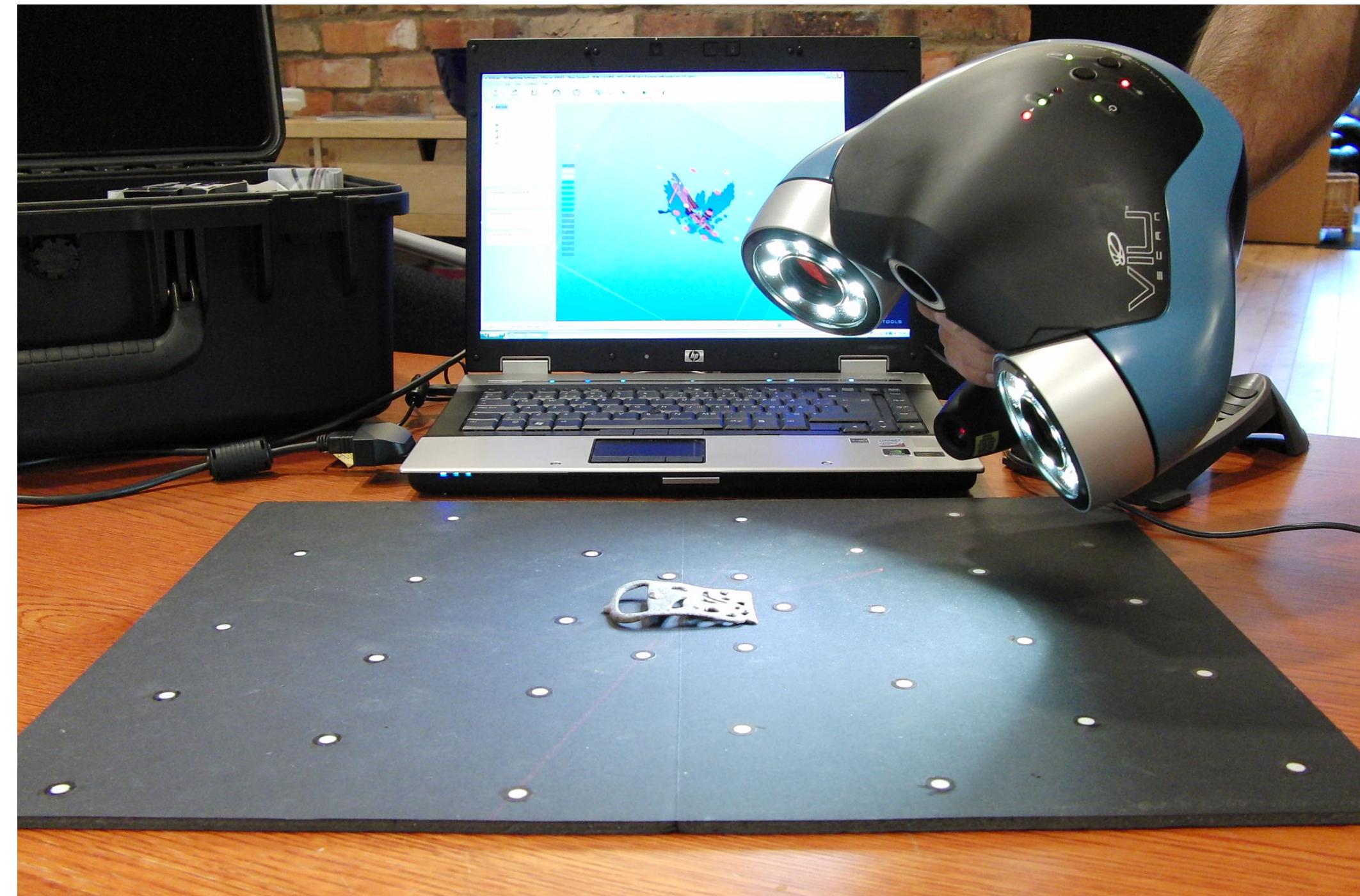
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Image Processing



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By Creative Tools from Halmstad, Sweden - CreativeTools.se - VIUscan - Laser-scanned - ZPrinter - 3D printed -
Viking Belt Buckle 24, CC BY 2.0, <https://commons.wikimedia.org/w/index.php?curid=12419129>

<http://www.agisoft.com>

Geometry Acquisition



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Applications

Video Games



Copyright: Nintendo

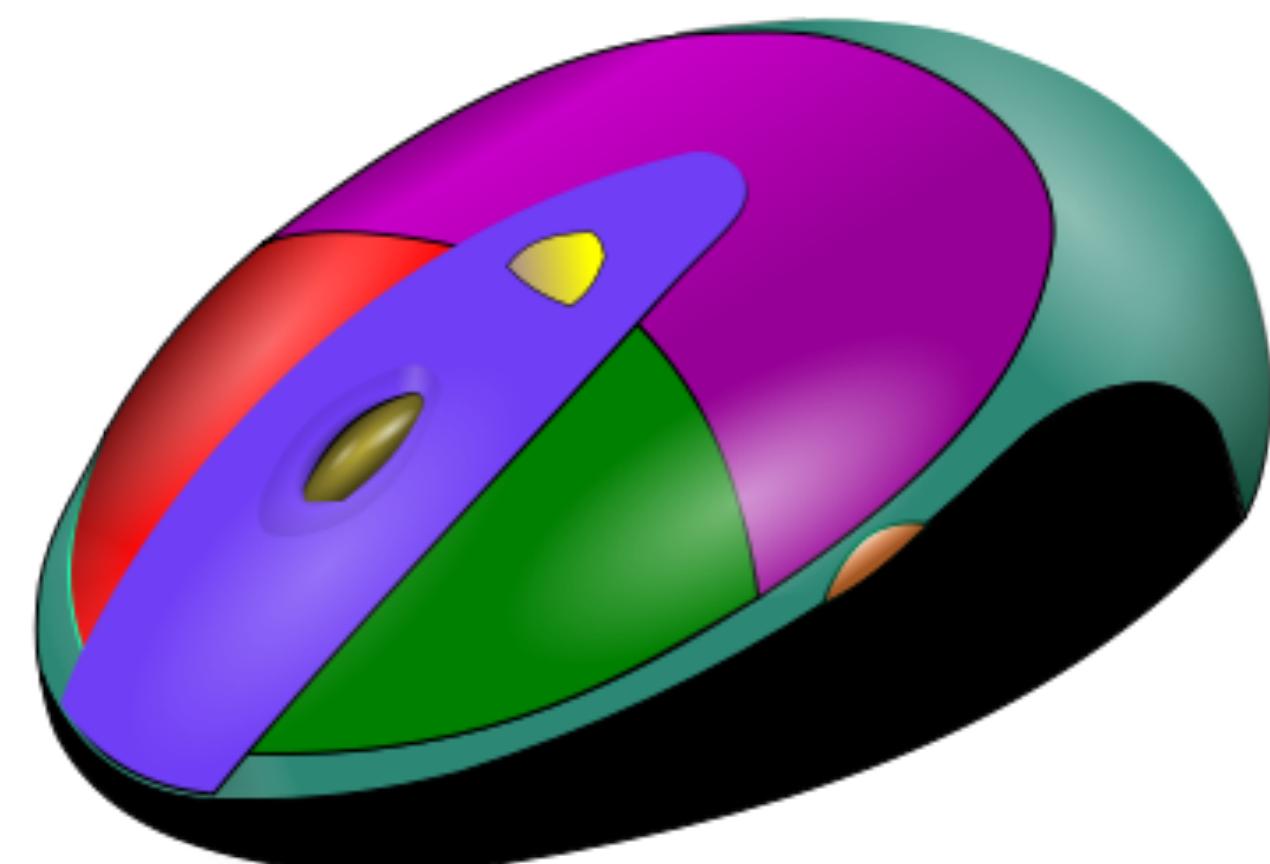
Cartoons/Visual Effects/Films



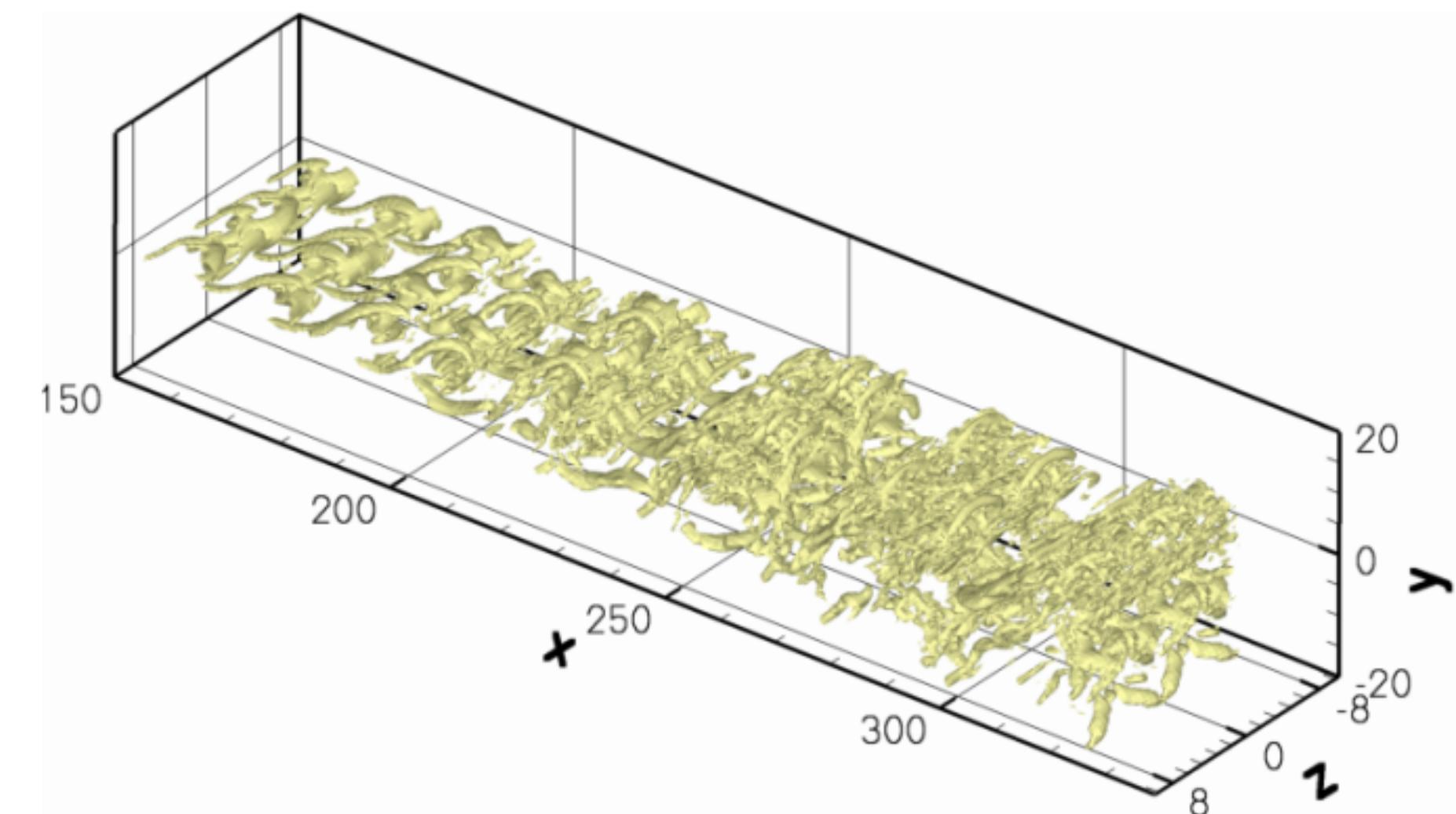
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Applications

CAD/CAM



Simulation



By Andreas Babucke - self made with EAS3, original upload at
http://de.wikipedia.org/wiki/Bild:Lambda2_scherschicht.png, CC BY 3.0 de,
<https://commons.wikimedia.org/w/index.php?curid=2999003>

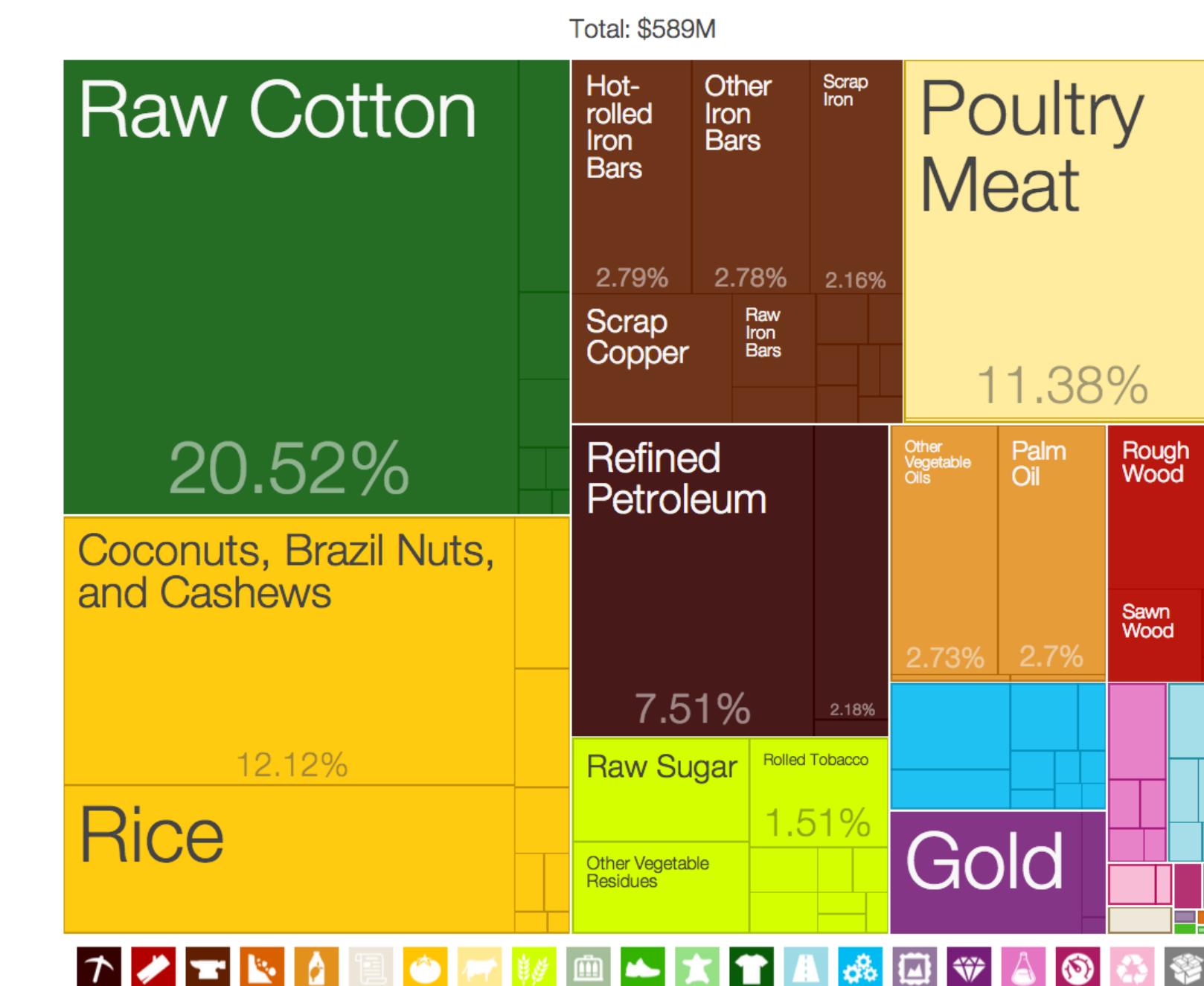
Applications

Medical Imaging



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Visualization



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SIGGRAPH

ACM's Special Interest Group on Computer Graphics and Interactive Techniques



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SIGGRAPH

[SIGGRAPH 2018 - ACM SIGGRAPH 2018 Awards](#)

[SIGGRAPH 2018 Appy Hour](#)

[SIGGRAPH 2018 Art Gallery](#)

[SIGGRAPH 2018 Computer Animation Festival](#)

[SIGGRAPH 2018 Courses](#)

[SIGGRAPH 2018 Educators Forum](#)

[SIGGRAPH 2018 Emerging Technologies](#)

[ACM Transactions on Graphics content \(incl. 37\(4\)\) presented at SIGGRAPH 2018](#)

[SIGGRAPH 2018 Posters](#)

[SIGGRAPH 2018 Production Sessions](#)

[SIGGRAPH 2018 Real-Time Live!](#)

[SIGGRAPH 2018 Studio](#)

[SIGGRAPH 2018 Talks](#)

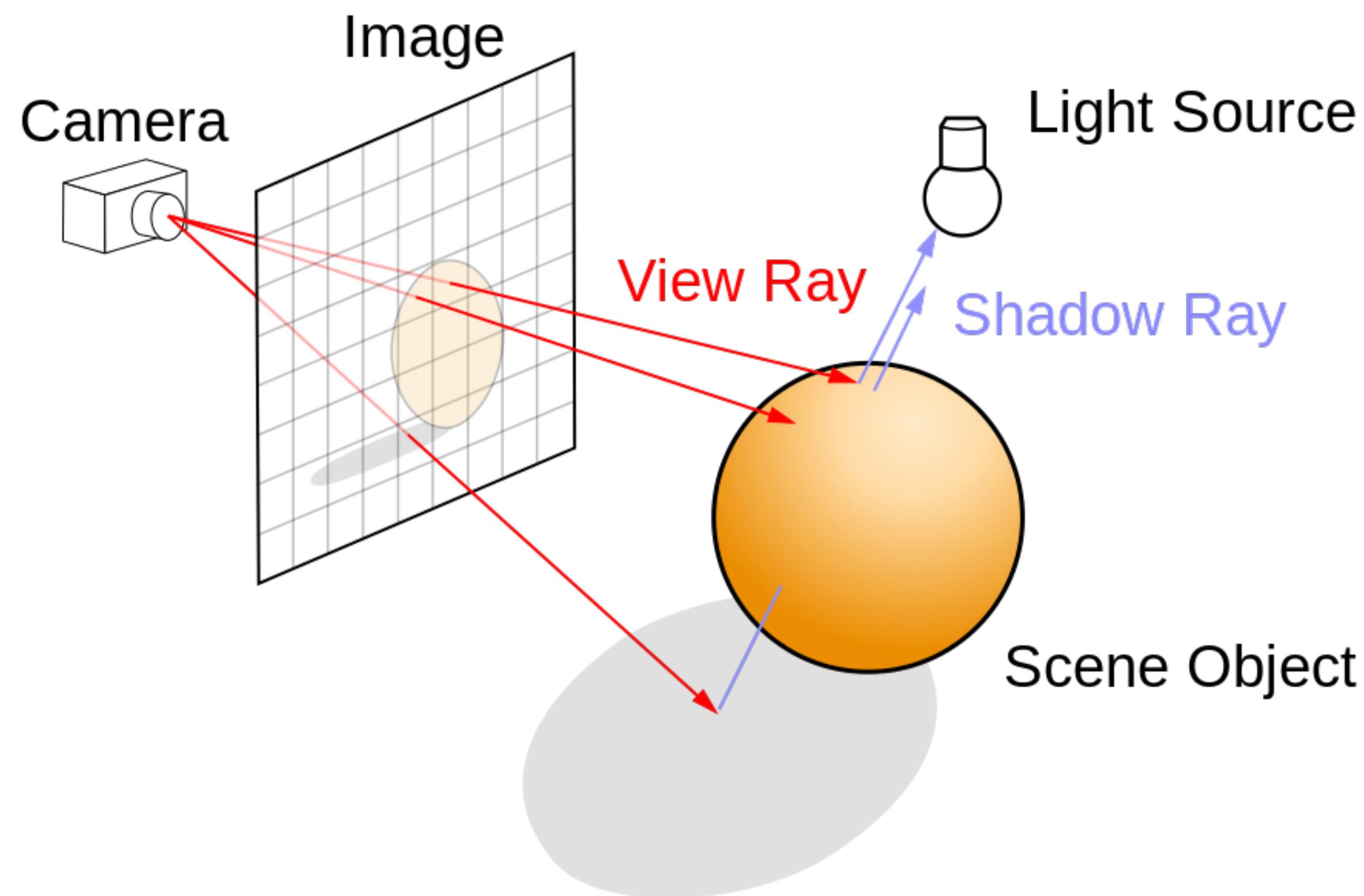
[SIGGRAPH 2018 Virtual, Augmented, and Mixed Reality](#)



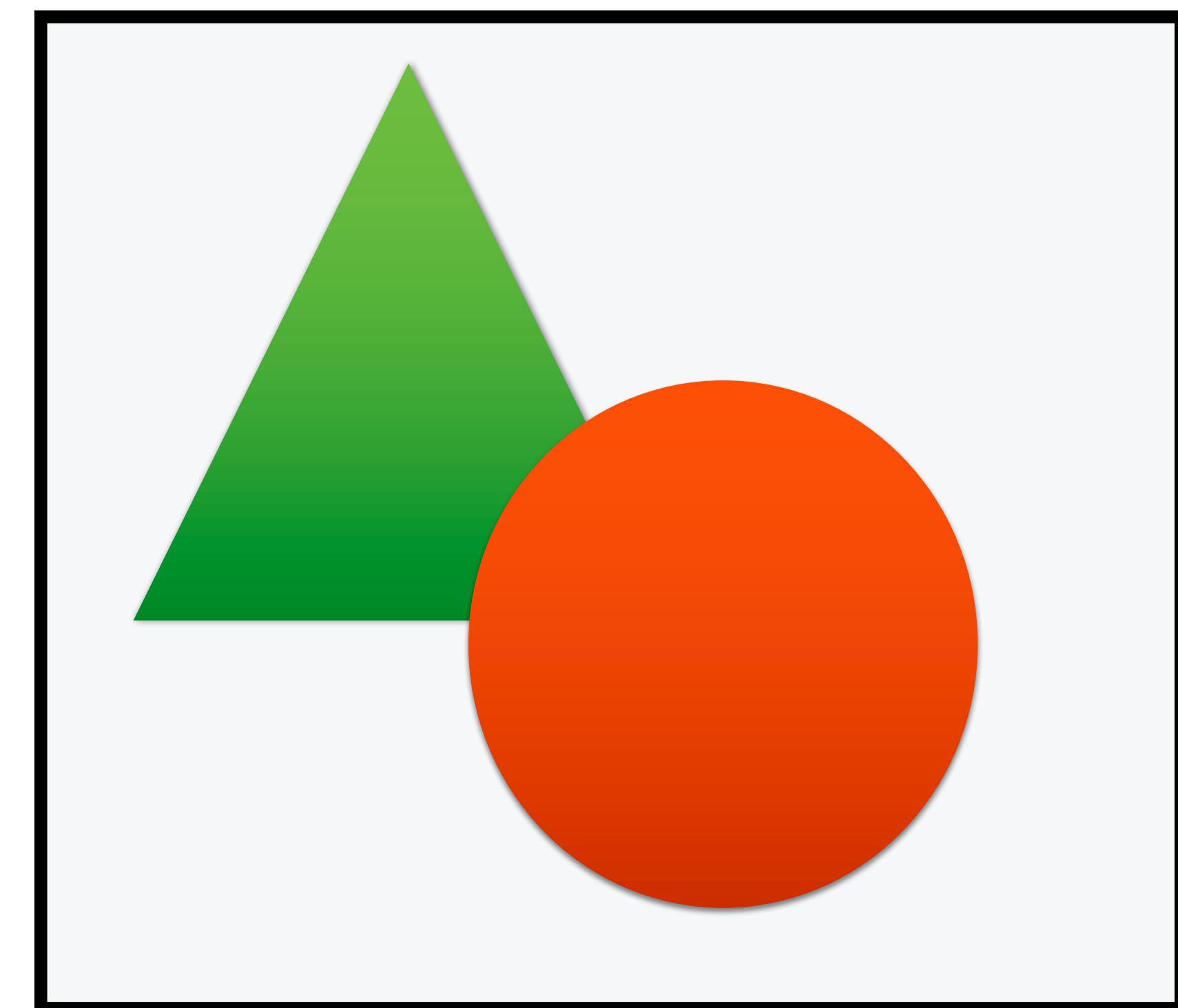
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Two major approaches

Per-pixel - “Raytracing”

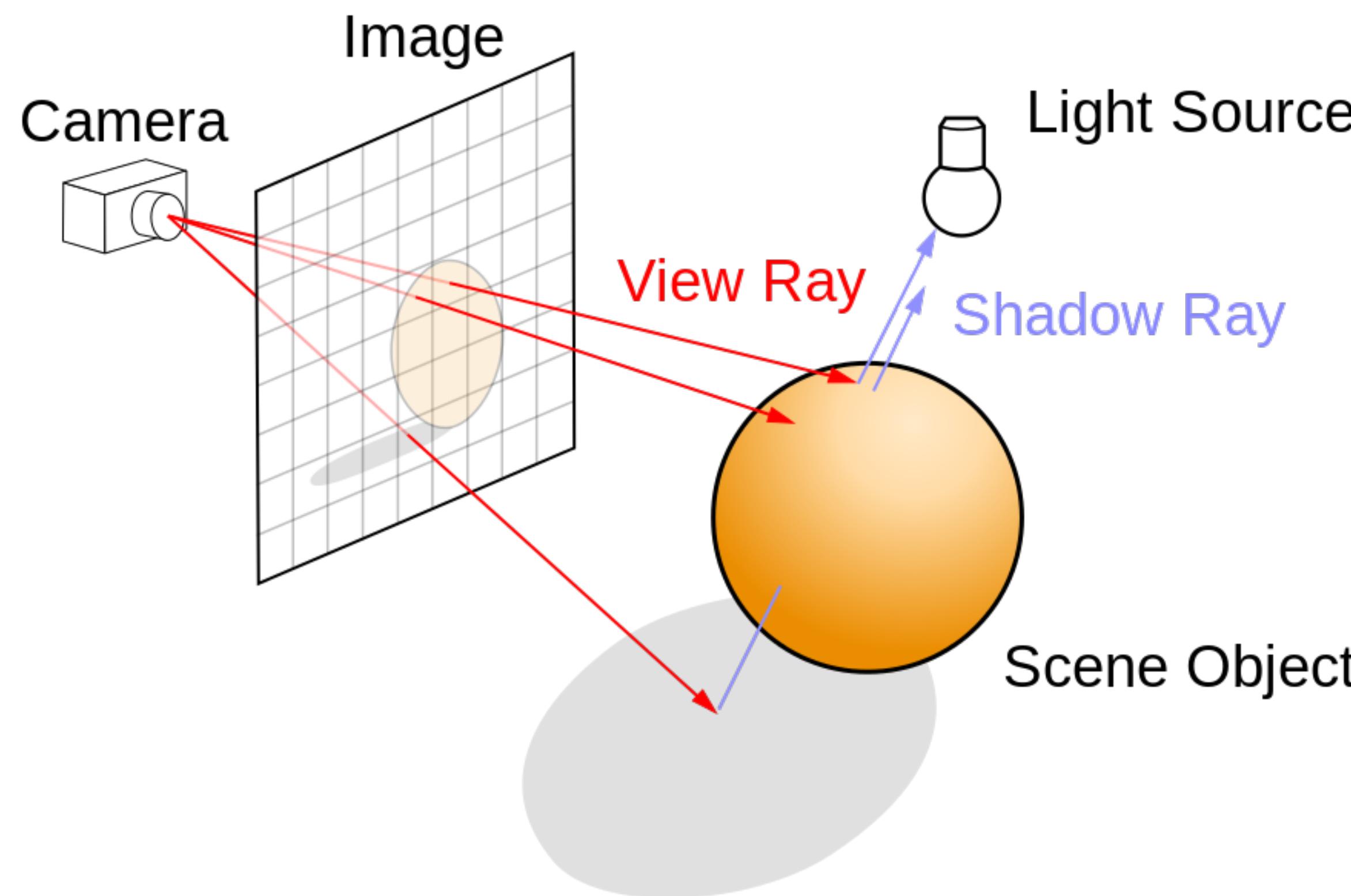


Per-object - “Rasterization”



By Henrik - Own work, GFDL, <https://commons.wikimedia.org/w/index.php?curid=3869326>

Per-pixel



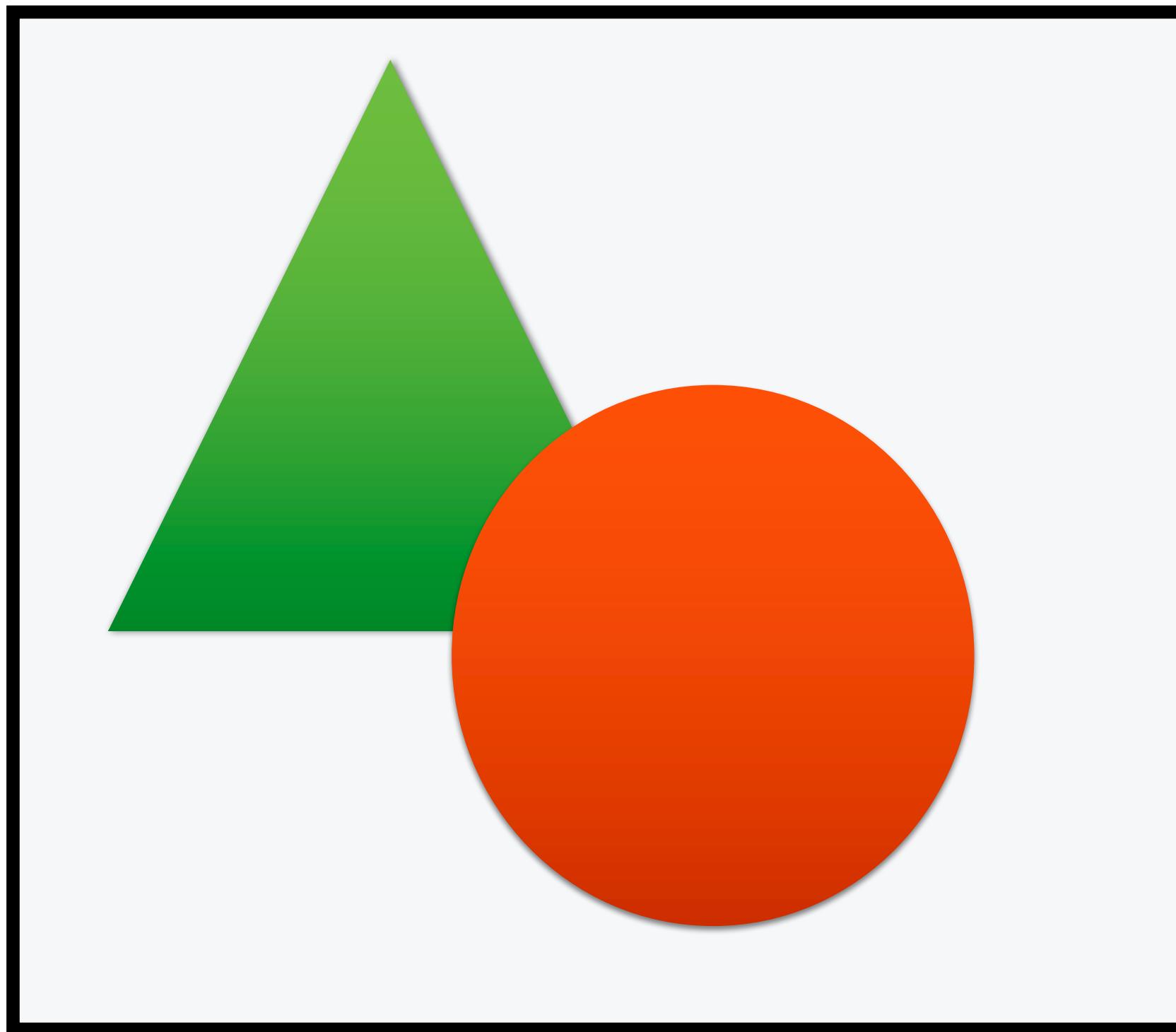
- Easy to parallelize but hard to map to hardware
- Expensive!
- It can be extended to model many physical phenomena such as internal scattering, diffraction, reflections, etc.
- Used to obtain high quality images

By Henrik - Own work, GFDL, <https://commons.wikimedia.org/w/index.php?curid=3869326>



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Per-object



- Easy to map to hardware
- While it cannot model directly complex effects, we can approximate them
- Used in interactive applications (mostly)



Course Goals

- Study the fundamental mathematical concepts used in image synthesis algorithms
- Implement a basic rendering system based on ray tracing
- Implement two interactive applications based on object-order rendering (rasterization), one in 2D and one in 3D
- Apply these techniques in a final coding project



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Final Coding Project

- Individual project, I will publish the rules later but you are essentially free to do whatever you want, as long as it requires computer graphics
- The project will be presented in a fast-forward session at the end of semester (10-15 minutes per project)



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Prerequisites

- Linear Algebra
 - We will quickly review the concepts that you need, if you are not familiar with basis, points, vectors, matrices and linear systems, please review it on the textbook (Chapter 2, 5)
- C++
 - We will review the basic concepts of C++ next week, comparing them with Java. Keep this reference at hand <http://www.cppreference.com>
 - Why C++?
- Git
 - It will be used to distribute course materials



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Organization

- Communication through the course repository/website:
<https://github.com/gaoxifeng/CAP5726-Computer-Graphics>
- Lectures: Tuesday/Thursday 8 - 9.15 AM
- Office hours: Tuesday/Thursday 9.15 – 10.00 AM, 103 Love Building



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Lectures

- I will upload the slides on the website before the class, so that you can directly annotate them
- For every class, I will always add references in the end to the textbook and/or external resources
- At the end of every lecture, I will quickly introduce the topic of the next lecture and give you pointers — you are encouraged to take a look at the material **before** I present it in class

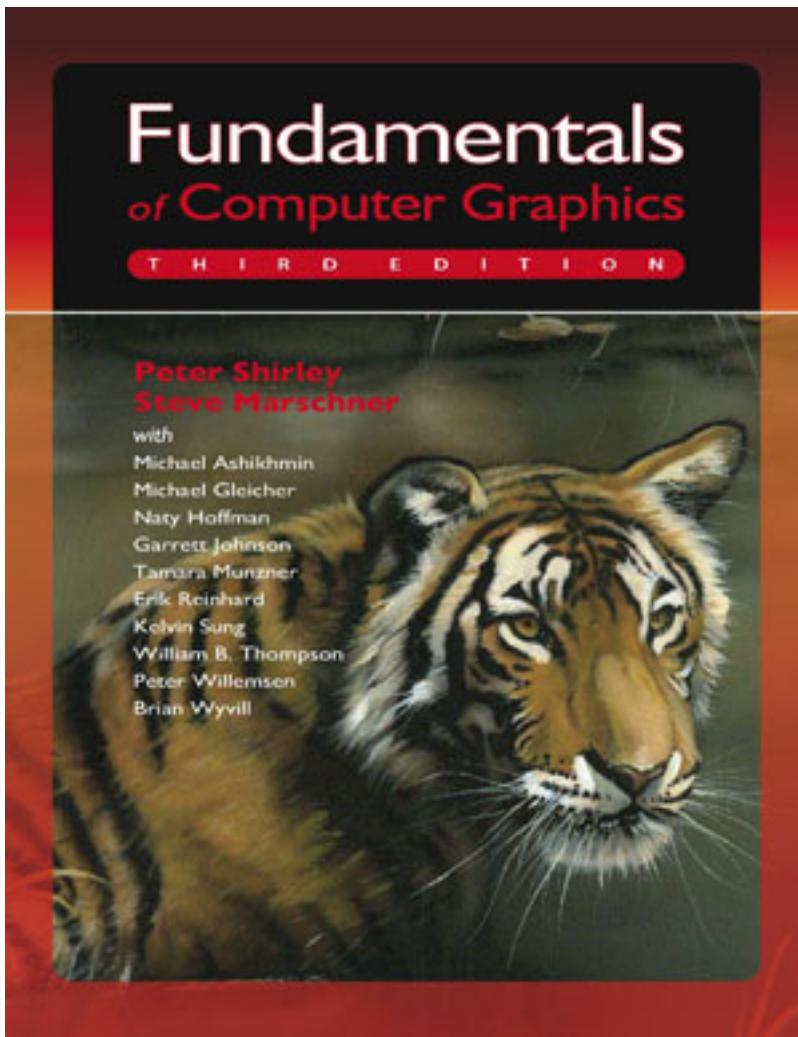
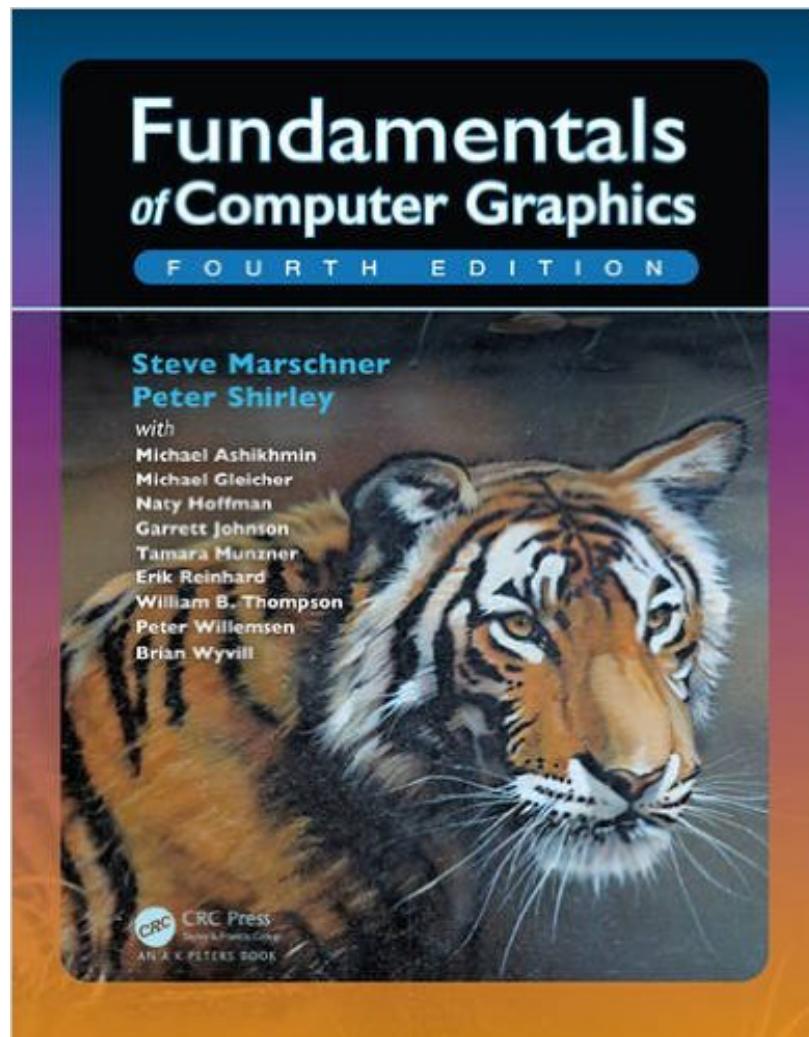


Lectures

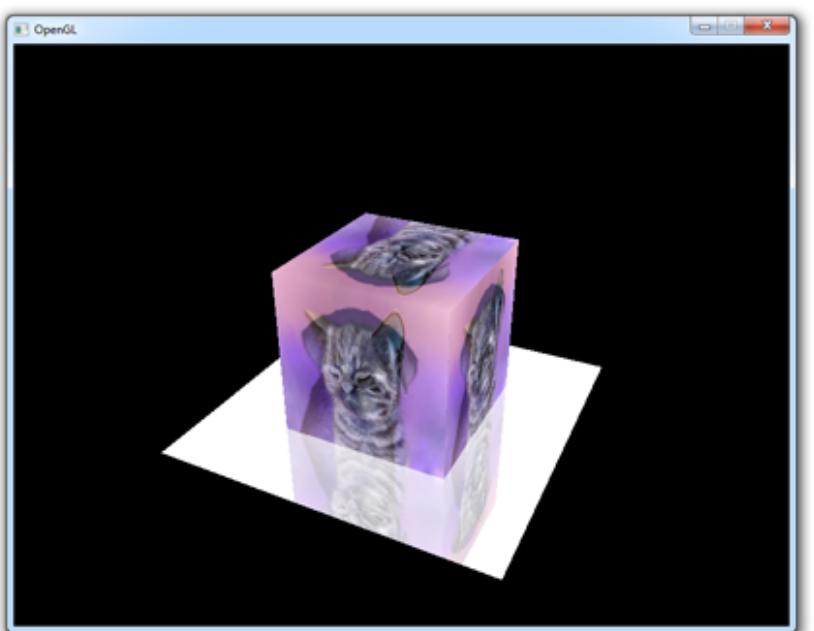
- Please interrupt me at any time to ask questions



Material



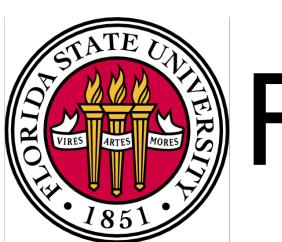
Fundamentals of Computer Graphics, Fourth Edition
4th Edition by [Steve Marschner, Peter Shirley](#)



<https://open.gl>



<https://www.wikipedia.org>



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Grading

Assignment	Topic	Grade
1	Ray Tracing	15
2	Raster 2D	15
3	Raster 3D	15
4	Final Project	35

Total Exercises: 80%

- **Final Presentation: 20** (you must get at least 10% in the final to pass)
- You **must** pass the final to pass the class
- There will be optional tasks, that will allow you to recover points lost in the assignments



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Policy

- You are encouraged to consult with your classmates/friends but collaboration in the assignments is **NOT allowed**
- You are **not allowed** to copy code online or use external libraries (except those provided in the class) for the first 3 assignments
- I will use plagiarism tools to validate all homework
- I am horrible with names but I would still like to make an effort, please help me :)



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References

Fundamentals of Computer Graphics, Fourth Edition
4th Edition by [Steve Marschner, Peter Shirley](#)

Chapters 1,2

