

Real-Time Rendering

Introduction

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Motivation

- Rendering in real-time
- Visualisation of 3D scene
- Fast approximation of reality
- Interactive framerates
- Games



Lecture plan

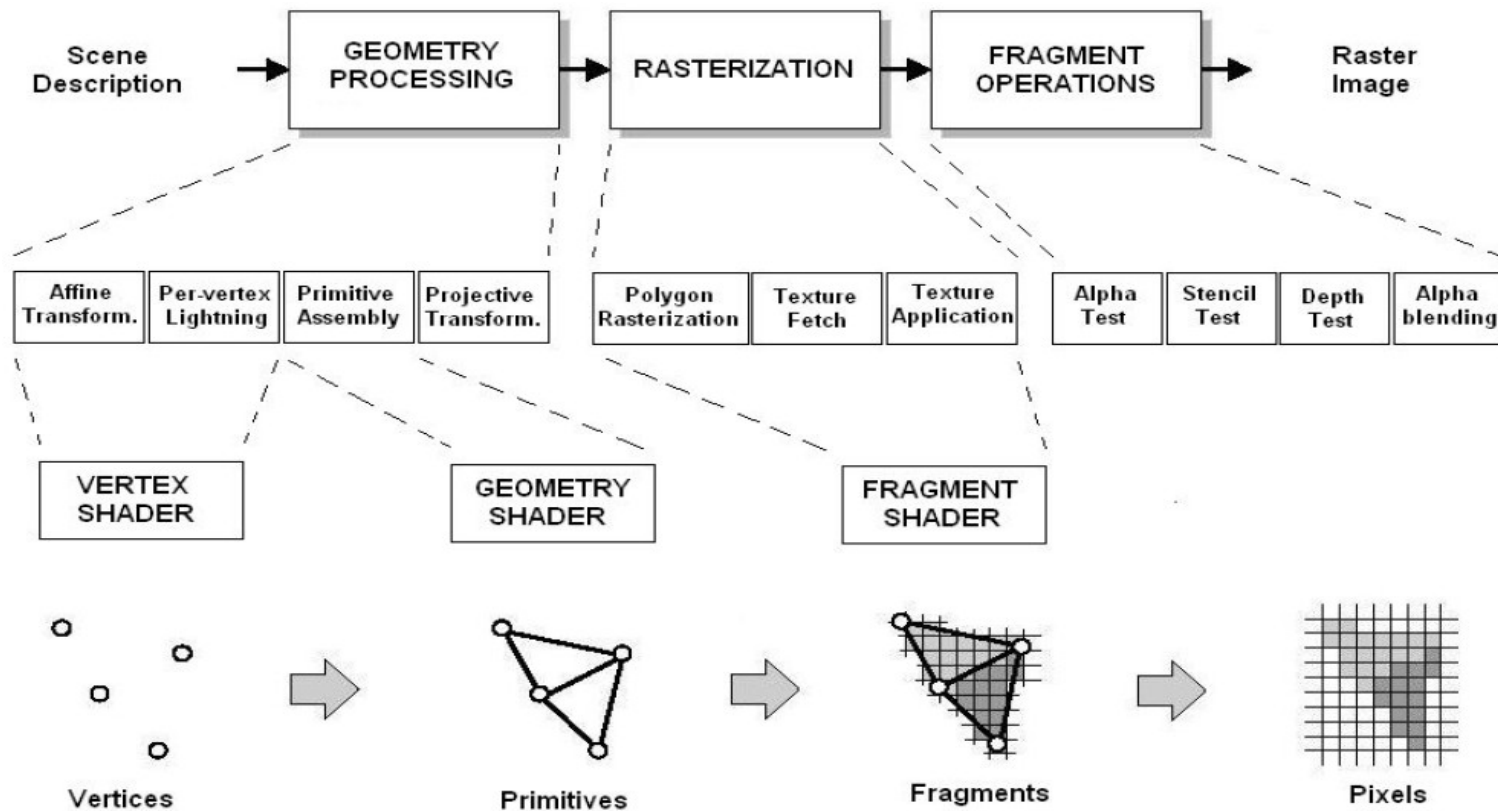
- Introduction
- Graphics pipeline
- Acceleration, optimization
- GPGPU
- Engine
- Shading, texturing
- Ray-tracing
- Shadows
- Volume rendering
- Post processing
- Non-photorealistic rendering

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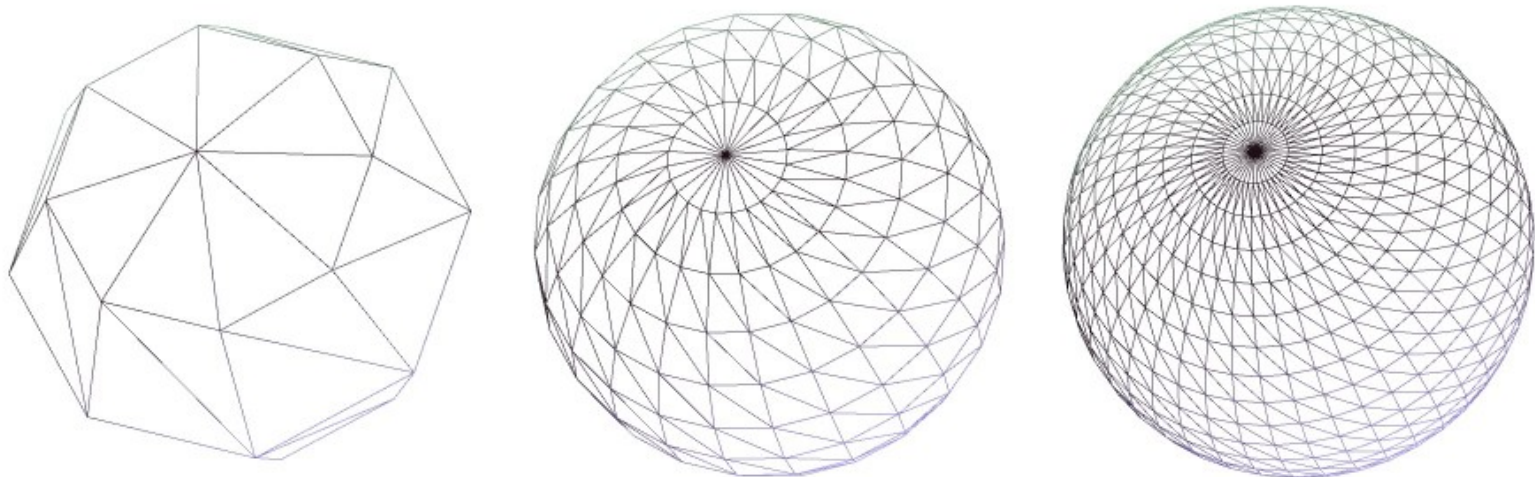
Graphics pipeline

- OpenGL
- Shaders
- Debug tools



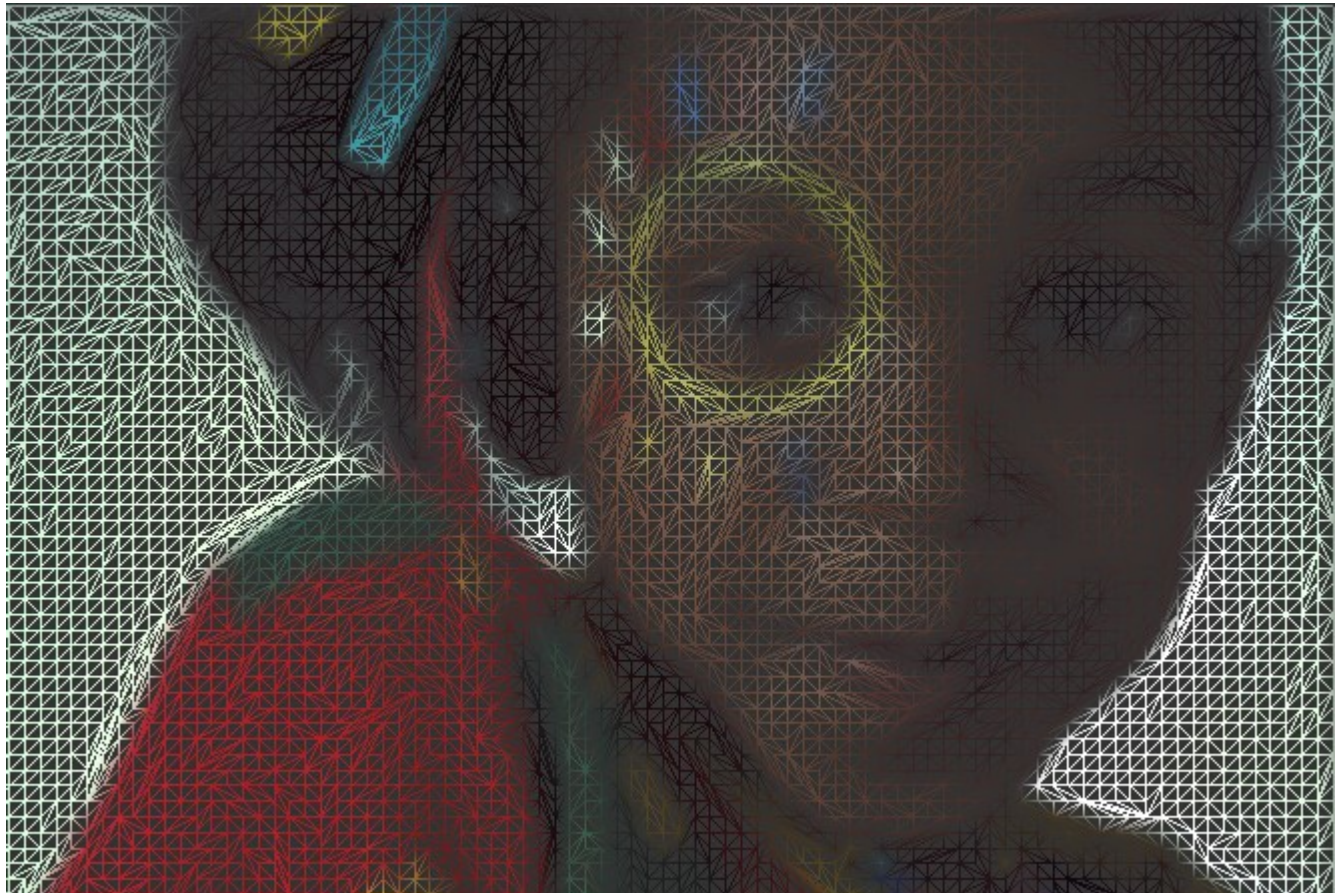
Acceleration, Optimization

- Culling
- LOD
- Geometry instancing
- HW specification



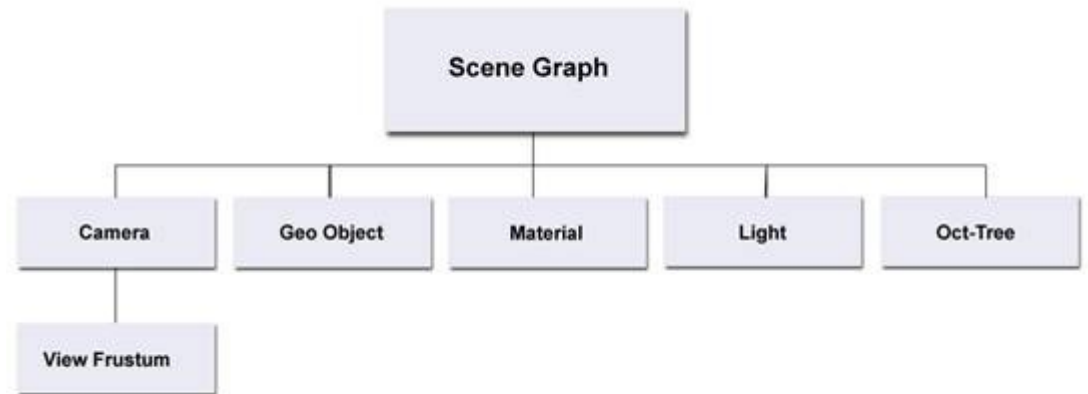
GPGPU

- Algorithms
- Standard design
- CUDA



Engine

- Scene
- Camera
- Rendering
- Scene Graph
 - OpenSceneGraph
 - nvSG
 - Ogre



Shading, Texturing

- Texturing modes
- Mapping techniques
- Multi-pass, Multi-texturing
- Compression



Ray-tracing

- Data structures
- Speed-up techniques



Shadows

- Shadow volumes
- Shadow maps
- Post processing



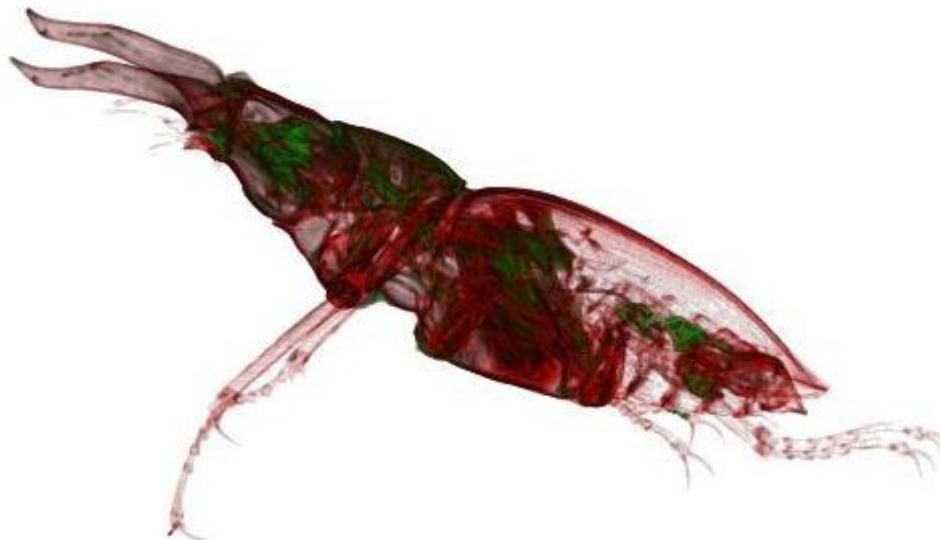
Realistic Soft Shadows with PCSS



Ordinary Shadows

Volume Rendering

- Visualisation methods
- Improving quality
- Improving performance



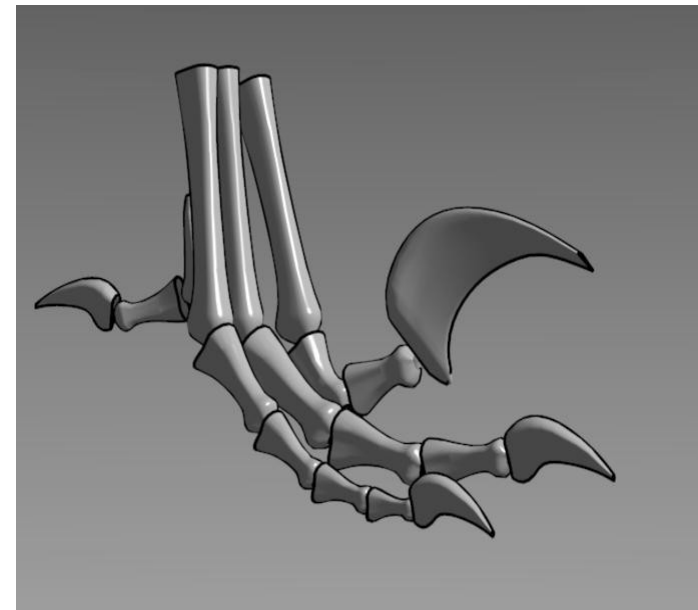
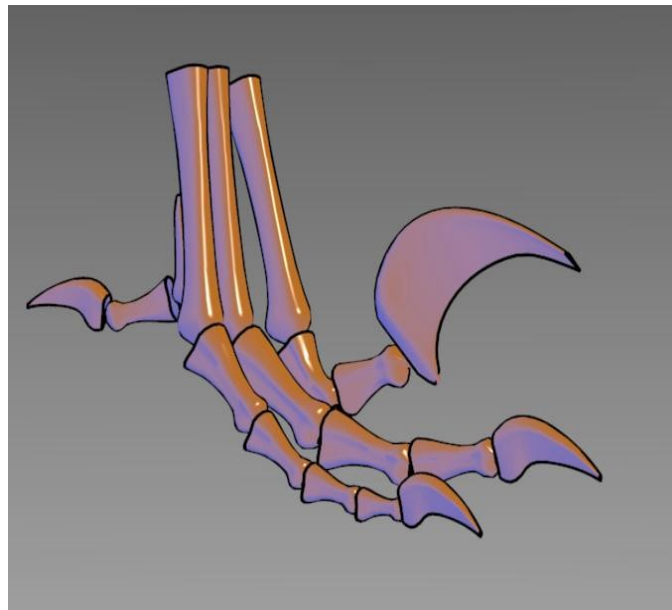
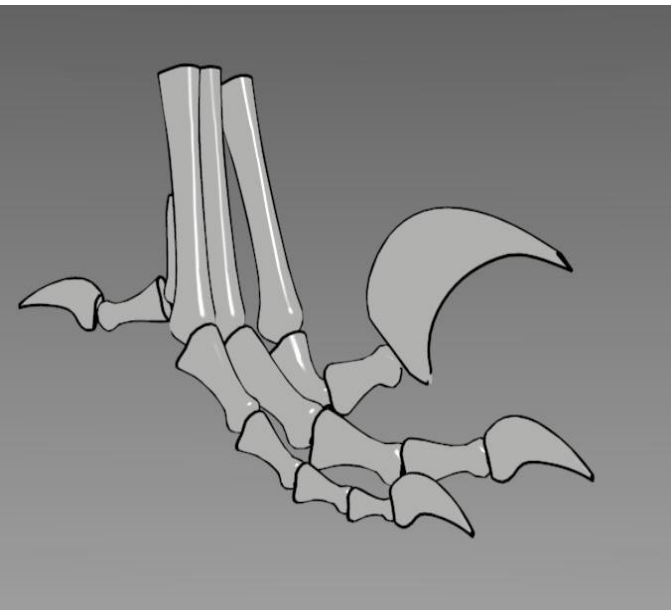
Post-processing

- Motion blur
- Depth of field



Non-photorealistic rendering

- Tone shading
- Silhouette rendering



Project

- Program (GPGPU)
 - Scene with non-convex object - animated
 - OpenGL, Shaders, Multitextures
 - VBO, FBO,
 - Lightning, shading, dynamic shadows, post-processing
- Dates
 - 1.3.10: specification, algorithms, technology
 - 1.4.10: scene, camera, models, rendering, lightning
 - 1.5.10: lightning, shading
 - 7.6.10: post-processing, final project
- Rating (complexity, interactivity, ...)

Literature

- OpenGL Programming Guide (redbook, slides)
- OpenGL Shading Language
- Real-Time Rendering
- GPU Gems I,II,III
- The Cg Tutorial
- Shader X1,X2 ...
- TU Wien (slides, projects)
- Web

Videos

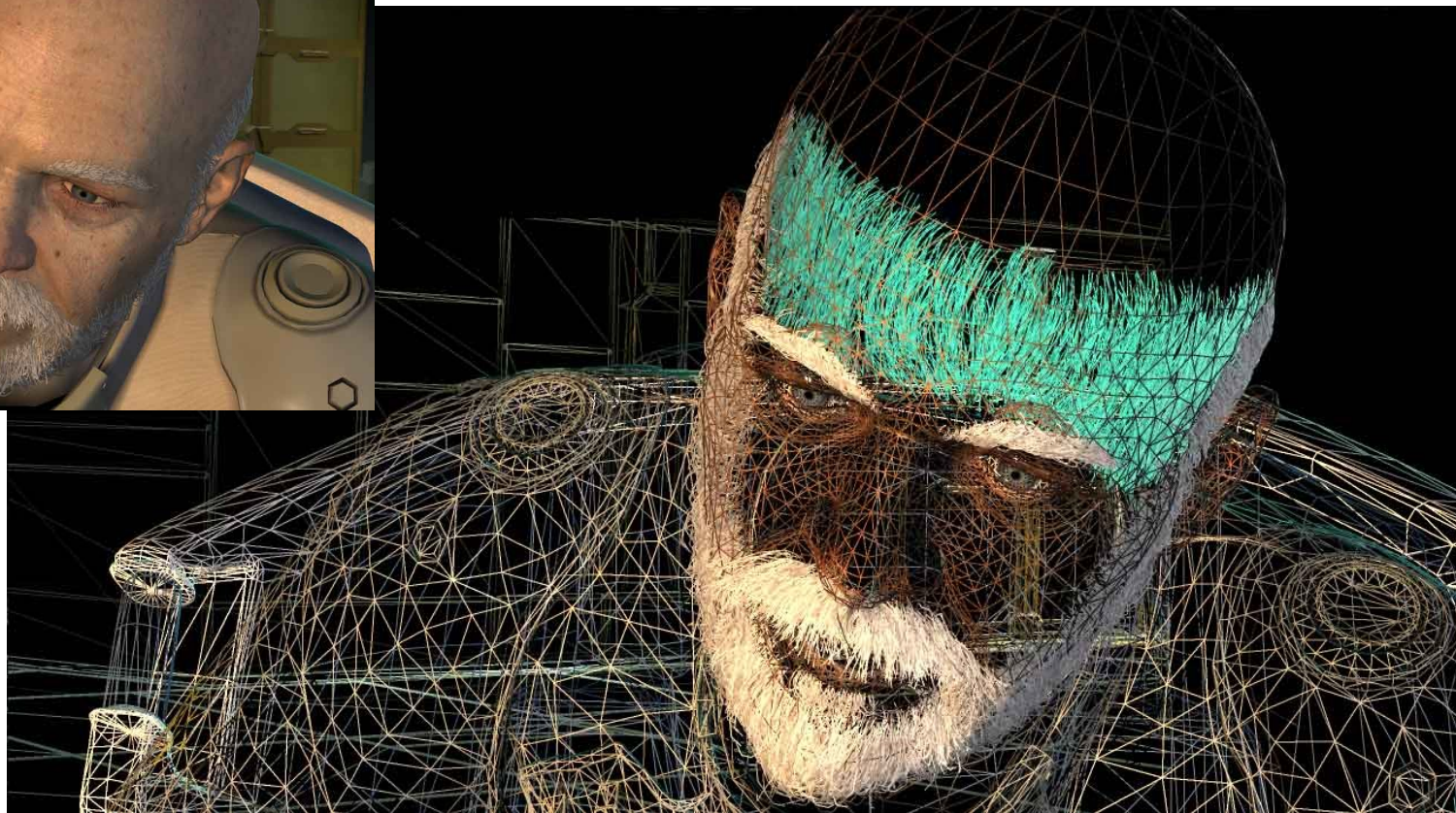
- Projects form TU Wien

<http://www.cg.tuwien.ac.at/courses/Realtime/HallOfFame/index.html>

References

- Books:
 - Real-time rendering, Akenine-Möller, Haines
 - GPU Gems I,II,III
 - Shader X...
 - 3D Game Engine Design
- Images:
 - Crysis, FarCry by Crytek Studios
 - Real-time rendering slides
 - <http://en.wikipedia.org/wiki/>
 - <http://www.cs.utah.edu/~gooch/thesis/images.html>
 - Hellgate: London by Flagship Studios
 - Fast Collision Detection for Skeletally Deformable Models-Kavan, Zara
 - Liangshou Wu <http://www.vrac.iastate.edu/~lswu/homepage/research/thesis.php>
 - Subdivision for Modeling and Animation – Zorin, Schroder
 - GPU Particles - NVidia SDK 9.51.108.100
 - Skin(Cg) - NVidia Cg Toolkit 1.1
 - http://www.hortus3d.com/fr_bil.htm
 - www.openscenegraph.org

Questions ?



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