

3D Computer Graphics

TNM061, VT-2024

Martin Falk

Overview / Outline

General information

- Previous course evaluation

Course specific

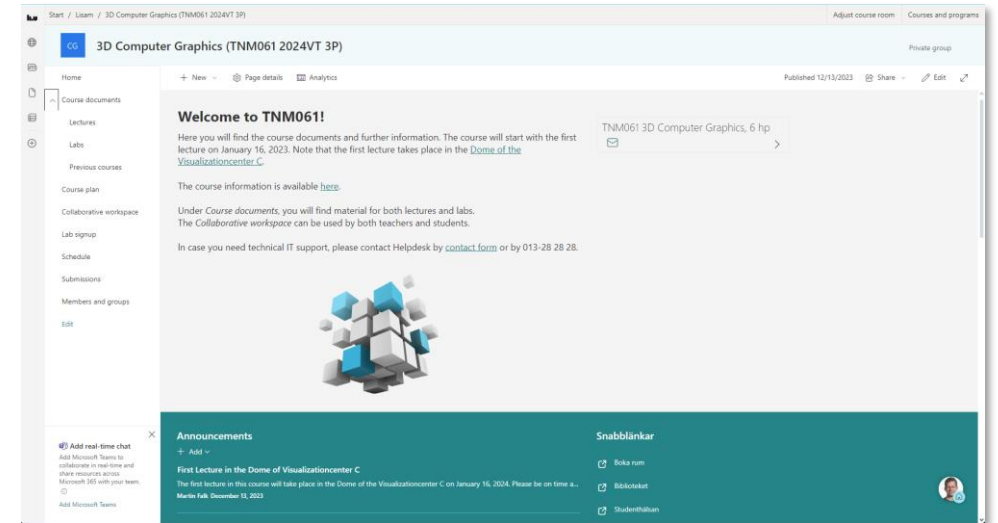
- Goals
- Course structure/outline
- Course topics
- Examination
- Literature & software

Introduction to computer graphics

General Information

Course room in Lisam

- Lecture slides
- Lab assignments
- Previous exams
- Contents of previous courses
- Teams room
- ...



General Information: Contact

Course responsible: Martin Falk (martin.falk@liu.se)

Labs:

- Tobias Pettersson (tobias.pettersson@liu.se)
- Sebastian Lindgren (student assistant)
- Rickard Fuks (student assistant)
- Albin Kjellberg (student assistant)

Questions & suggestions via email

- Subject should start with “TNM061: ” + subject
- Use your LiU email address
- Otherwise, emails are ignored

Or drop by at my office K2071, Kopparhammaren 2

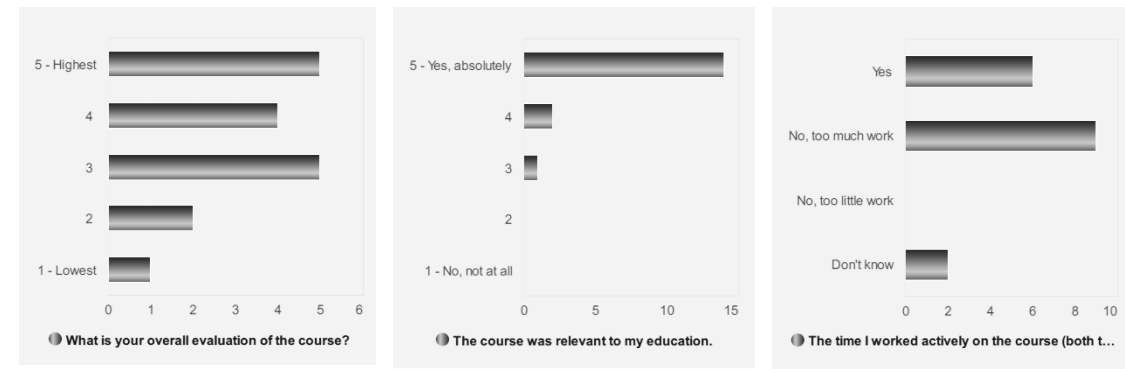


Course Evaluation 2022 and Updates 2023

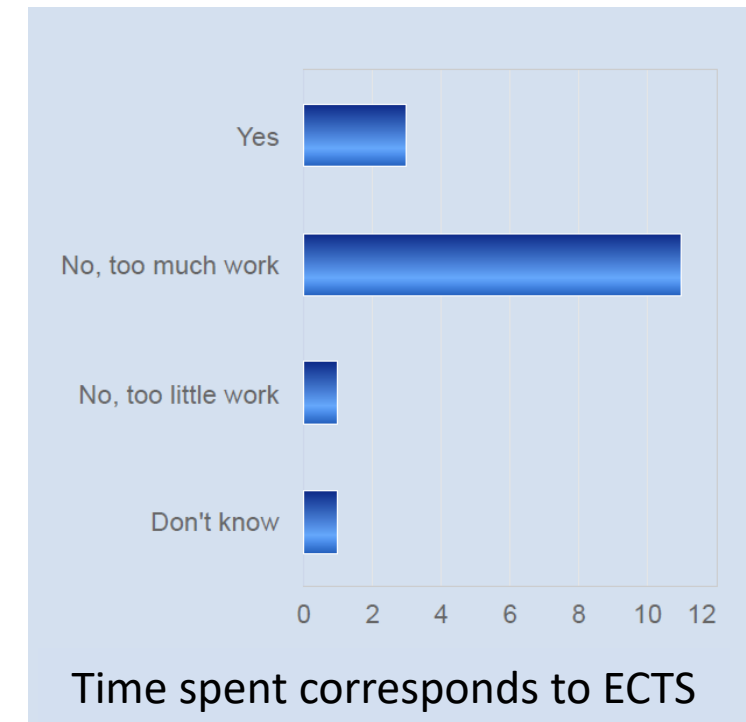
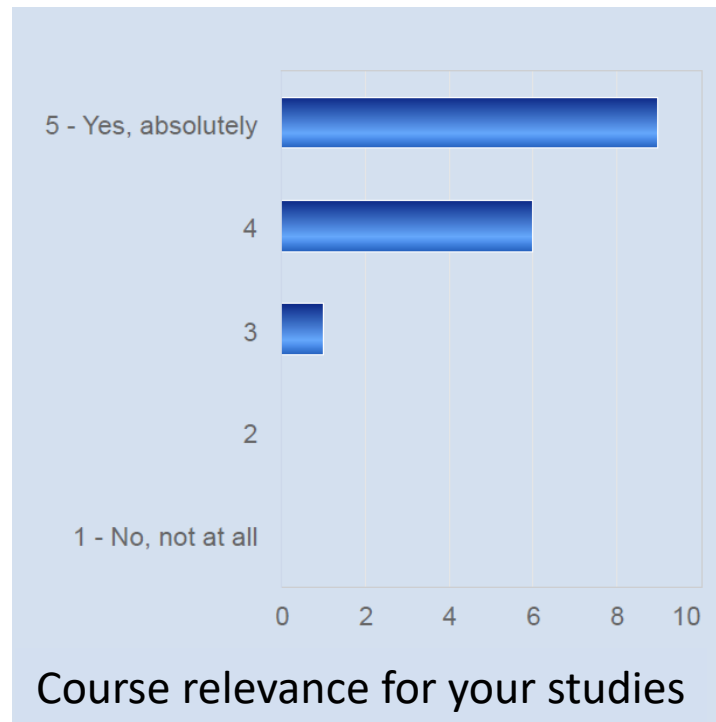
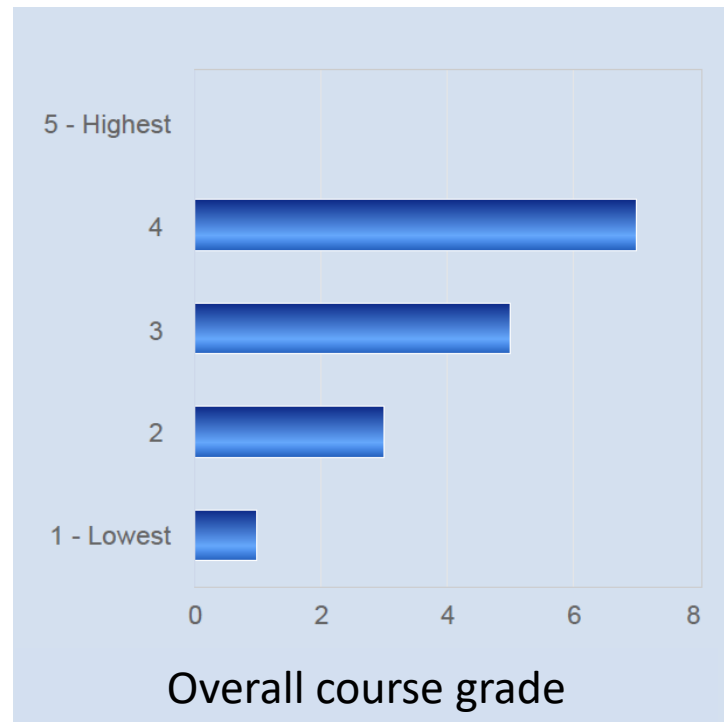
Course Evaluation 2023

Evaluate (16 of 72 students),
LinTek (38 of 77 students)

- Course evaluation performed after the exam (results available in Lisam)



Previous year



Course Evaluation 2023: Exams

Exams, 60 points, pass with 33 points

- Regular, individual exam
- 4h

Passing rates

- May: 80.9% (47 submissions)
 - Grade 3 25%
 - Grade 4 34%
 - Grade 5 21%
- August: 60.0% (5 submissions)
- October: 50.0% (4 submissions)

Course Evaluation 2023: Comments

Emellertid, fanns det kritik om arbetsbelastningen. Kursen, som hölls på halvfart, ansågs ha för hög arbetsbelastning och tentamen ansågs vara för bred i förhållande till antalet högskolepoäng den bidrog med. Studenterna upplevde också att bedömningskraven för tentamen var för höga.

Studenter tyckte även att det var för många frågor på tentamen och att gränserna för högre betyg än 3 var orimliga med tanke på hur brett innehåll tentamen täckte.

The exam is too big and too far apart from the time of the lectures. Maybe split the exam into two parts? Maybe have part one closer to the time of the lectures and part two before the summer.

- The exam covers both theory from the lectures **and** the practical parts from the project and labs. Most of the areas are covered in the exam, which is the reason for the number of questions. The number of lectures was reduced in exchange for more time to prepare for the exam (3 ECTS for lectures, labs, and exam).

Course Evaluation 2023: Comments

The only other suggestion I have for the course is to have the labs in and be designed for blender (instead of 3ds max) as better preparation for the projects.

- The lab instructions contained instructions for 3ds max, Blender, and Maya. The lab material will be updated to Blender-only.

Studiemiljön var bra men laborationerna var schemalagda i datorrummet ~~k4504~~ ~~k4507~~ k4504 som har bättre grafikkort.

- The labs took place in K4507 due to historical reasons. After consultation with colleagues and scheduling, it was decided to use K4504 instead. These computers are more powerful.

Jag hade önskat mer tips på hur man kunde få ner renderingstiden.

- There will be an additional lab exercise focusing on of the issues.

Course Evaluation 2023: Comments (cont.)

The project have been really fun and I have learned a lot. It was fun to actually see what you are making.

I really enjoyed the actual work of the project. It was a lot of fun to see an initial idea take form from sketches to a virtual scene to a rendered video. The labs were also really useful to see the theory learnt in lectures be put in practice.

Course Evaluation 2023: Changes & Updates

Lab updates

- The labs will be updated to Blender only
- Introductory lecture on Blender + exercise on rendering performance
- Labs now take place in K4504
- Still possible to use other 3D modeling software (3ds max, Maya, ...) w/o lab support

Project phase in VT2

- Initial meeting/lab session for projects in March/April together with lab assistants
- Template for report with more details

No changes planned with respect to exams

- Used to assess course objectives
- Note: fall exam moved from October to January

Quiz

Photograph or computer generated?























Motivation

3D Computer Graphics, why?

All examples shown are
computer generated

- Sometimes hard to distinguish
from real images

CG present in everyday live

- Entertainment/advertisement
- Training material
- Art
- VR/AR

Looks cool



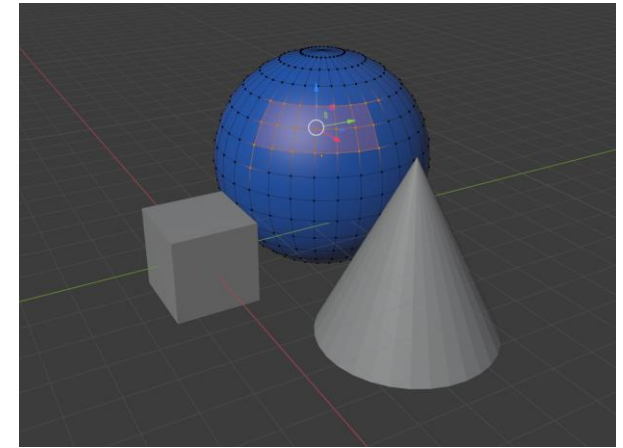
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REBIRTH

Course Goals

Course goals

- Providing an overview of 3D computer graphics (Modelling, rendering, animation, graphics programming)
- Mix between **theory** (lectures) and **practice** (labs, project)



Afterward you should be able to

- name, explain, and apply basic concepts used in 3D computer graphics (TEN1, LAB1)
- select and motivate methods and techniques to solve common problems in the field (TEN1, UPG1)
- use 3D computer graphics software for the modeling, animation, and rendering of simple scenes (LAB1, UPG1)

Prerequisites

- Builds upon Computer Graphics course (TNM046)

Course structure

Taught at half speed across two half semesters

VT1

- Lectures (between 8 to 9)
- Lab sessions (6 assignments)

VT2

- Group project assignments (1 to 5 students per project)
more details at the end of VT1
- Project presentations scheduled for
May 16, 13:15 to 17:00
- Exams on June 1 and August 22

Sign up for lab groups
in Lisam by Thursday!

Examination (6 ECTS)

The course has three mandatory parts:

1. Lab assignments (LAB1) to be performed and presented. Graded pass/fail (VT1).
2. One written exam (TEN1). Graded fail, 3, 4, and 5 (VT2).
3. One project assignment (UPG1) to be performed in a group and presented orally and in writing at a seminar. Graded fail, 3, 4, and 5 (VT2).

Passing the course with grade 3-5 requires passing LAB1 and grade 3-5 for both TEN1 and UPG1.

For final grade 4 in the course, at least grade 4 is required in both TEN1 and UPG1.

For final grade 5, grade 5 is required in both TEN1 and UPG1.

Course Outline

Introduction to computer graphics

- Scenes
- Hierarchical transformations
- Scene graphs

Real time graphics and interaction

- Modern graphics hardware
- Rendering, shading
- Data structures for large scenes

Modeling

- Polygon meshes
- Parametric curves and surfaces
- Implicit modeling, CSG

Materials

- Texture coordinates
- Reflection mapping, bump mapping
- Complex materials, procedural textures

Illumination

- Lighting
- Reflection and refraction
- Shadows

Global illumination

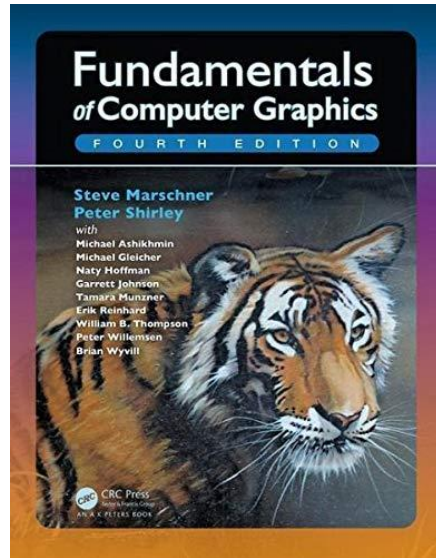
- Raytracing
- Radiosity

Animation & simulation

- Keyframe animation
- Inverse kinematics
- Particles, cloth, fur, ...

Project information

Literature



The Internet

*Chapter references on slides refer to this book, like **Chapter 12.2***

Marschner & Shirley

“Fundamentals of Computer Graphics”

Fourth edition, CRC Press, 2016

(also recommended in TNM046)

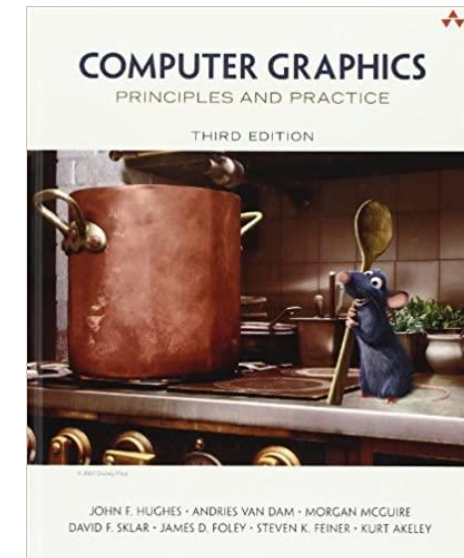
More advanced & more detailed:

Foley, van Dam, Feiner, and Hughes

“Computer Graphics: Principles and Practice”

Third edition, Addison Wesley, 2013

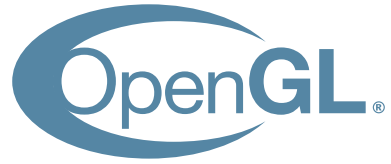
(slight overkill)



Compendium available from course in 2020

<https://itn-web.it.liu.se/~stegu76/TNM061-2020/>

Software used



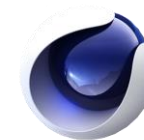
khr.org/opengl/



Educational licenses available for free at autodesk.com



Other modelling software



CINEMA 4D

Remote use of lab computers:

<https://www.student.liu.se/itsupport/fjarrinloggning?l=en>