Computer Graphics Seminar

MTAT.03.305

Fall 2016

Raimond Tunnel
Contact Information

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Organizational Information

• 15 seminars:
  • 3 introductory lectures
  • 9-11 student presentations
  • 2 project demonstrations
We hope that...

- ~15 seminars
  Attendance: 22.5h = 0.85 credits

- 1 seminar
  Preparation: 16h = 0.6 credits
  Conducting: 1.5h = 0.05 credits

- Project
  Everything: 40h = 1.5 credits
... but it may happen that ...

- ~15 seminars
  Attendance: 22.5h = 0.85 credits

- 1 seminar
  Preparation: 56h = 2.1 credits
  Conducting: 1.5h = 0.05 credits

- Project
  Everything: 0h = 0 credits

I read 3 books and am now a master of the subject.

Ain't nobody got time for that...
What am I even doing here?

CONFUSION
looks better sideways

ICANNASCHWEETBURGER.COM BY 🐱
What do I see?
What about this one?
This should be easy...
Regular seminars

- Listen to your fellow student's awesome presentation
- Ask questions, discuss
- $X > 1$ heads are better than one
Your seminar

- Choose an interesting CG topic
- Make the seminar fun and interactive
- Present some applications / demos
- Workshop
Sidetrack: Gamma correction
Sidetrack: Gamma correction

Sidetrack: Bloom effect

Need for Speed: Most Wanted

Elephant's Dream

Hitman: Absolution

Warframe: https://www.youtube.com/watch?v=gYHxhlvEyHk
Back to the main track
How do I choose a topic?

• I just gave you two possibilities:
  • Shader effects (like the Bloom effect)
  • Gamma correction
• Read something and find interesting topics
  • OpenGL's Red Book
  • GPU Gems
  • More "sophisticated" literature
• Continue on some already discovered theme
  • My example: Procedural tree generation?
How do I choose a topic?

- Continue on some already discovered theme
How to choose a topic?

- OpenGL ver 3.0 & 3.1
- Practical
- Basic topics:
  - Viewing
  - Color
  - Lighting
  - Blending
  - Textures
  - Buffers
How to choose a topic?

- Advanced topics:
  - Display lists (perf.)
  - Tessellation
  - Quadrics
  - Evaluators (curves & surfaces)
  - NURBS
How to choose a topic?

• OpenGL ver 4.3
  • Lots of new techniques and topics.
  • For example:
    - Tessellation shaders
    - Geometry shaders (access to all vertices)
    - Procedural texturing

http://www.ics.uci.edu/~gopi/CS211B/opengl_programming_guide_8th edição.pdf
How do I choose a topic?

- Covers all topics already mentioned and more
- Math heavy, but most of it you should be at home with
## Extra conditions!

<table>
<thead>
<tr>
<th>First time participant</th>
<th>Returning participant</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BSc, MSc</strong></td>
<td><strong>MSc, PhD</strong></td>
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<tr>
<td>No additional requirements – you can choose any CG-related topic.</td>
<td>Your topic should be related to several scientific articles / a book.</td>
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ACM SIGGRAPH (Special Interest Group on GRAPHics and Interactive Techniques):
http://www.siggraph.org/
Previously...

PREVIOUSLY, ON SCRUBS...

Oh Wait, This Ain't Scrubs...
Light Intensity

- Light is radiation
- Light intensity may mean:
  - Radiant intensity
  - Luminous intensity
  - Irradiance
  - Radiance
  - Brightness
  - Luminance
3D Scan Data

- We did 3D scans in the Institute of Technology
- Then used the data to create a mesh
Two Guests

• Peeter Nieler – http://criffin.com/ (VR)

• Hendrik Proosa – http://kalderafx.com/ (VFX)
Global Illumination Techniques

- Radiosity

- Path Tracing

- Photon Mapping
Collision Detection

• In games vs simulations

• A posteriori (discrete) vs a priori (continuous)

• When it goes wrong...
Procedural Generation

- Maps
- Perlin Noise
- Cellular Automaton
Post-Processing Effects

- Lens Flare
- Motion Blur
- Color Grading
- Tone Mapping
- Antialiasing
  - SSAA, MSAA, CSAA, EOAA, FXAA, TXAA
- Bloom
- Depth of Field
- ...

![Images showing examples of post-processing effects such as lens flare, motion blur, and color grading.]
Rendering Water

- Reflections

- Refractions
Still confused?
You can...

• ... pick any topic from previous year
• ... pick some other CG related topic
World is a vast and mysterious place!

Ok, so I have a topic now...

• Look for materials
• Investigate, research
• Find examples
• Try it out yourself
• Present your findings
• Engage others
  • Discussion
  • Interactive demo
  • Workshop
What about the project?

- Interactive demo on the same topic as your seminar
What about the project?

- Advance something you've already done
What about the project?

• Can, of course, be a team / group effort!
What about the project?

- Do something fun and exciting
Want to do a LARGER project?

- Computer Graphics Project (MTAT.03.316)
  - 3 credits course
  - Consists entirely of a project
  - Work on your own idea throughout the semester
  - Roughly 6h per every 2 weeks
  - [https://courses.cs.ut.ee/courses/index/2016/fall](https://courses.cs.ut.ee/courses/index/2016/fall)
I didn't understand >70% of what you said...

- Don't worry about it!
- Pick a topic that suits your knowledge base
- Your topic may very well be:
  - Rasterization of triangles
  - Comparison of lighting models
  - How to do simple shadows?
  - Raytracing explained
  - etc
I don't even know where to start!

- There will be 2 more introductory lectures about the basics.

- Check out slides and tasks from Computer Graphics MTAT.03.015:
  - https://courses.cs.ut.ee/2015/cg/spring
  - https://courses.cs.ut.ee/2015/cg/fall

- Check out the slides from the previous seminar:
  - https://courses.cs.ut.ee/2015/cg-sem/fall/Main/Seminars
  - https://courses.cs.ut.ee/2016/cg-sem/spring/Main/Seminars

- Find some online tutorial that seems manageable for you and try it out.
Questions?
List of some topics

1. **Color blending** – What happens when there are transparent objects in your scene?
2. **Lighting models** – What are the common models? Where and when are they used?
3. **Texturing** – How can one sample from a texture? What kinds of artefacts may appear?
4. **Curves** – Why are they important in CG? What about curved surfaces?
5. **Global illumination** – Pick one or compare different methods: Radiosity, path tracing, photon mapping.
6. **Realtime realistic rendering** – Provide an overview of the common methods or pick some effect (light, wetness, fog, fur / hair) and find out how it's rendered realistically in real time.
7. **Non-realistic rendering** – Where is it used and how is it achieved? Realtime vs prerendered?
8. **Tessellation** – How can this be done in OpenGL 4?
9. **Post-processing effects** – What effects are there? When and how are they used?
10. **Procedural generation** – Where and how is it used? How to apply procedural textures to procedurally generated meshes?