Computer Graphics Seminar

MTAT.03.305

Spring 2020

Raimond Tunnel
Contact Information

Raimond Tunnel

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Organizational Information

- 4 introductory lectures
- 5 student presentations
- 3 special seminars
- 2 holidays (10.04, 01.05)
- 1 cancelled (21.02)
- 1 projects expo (29.05)
Organization

- ~16 seminars
  Attendance: ~24h = 0.85 credits

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

- ~16 seminars
  Attendance: ~24h = 0.85 credits

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

• 1 seminar

Preparation: **56h = 2.1 credits**

- Find suitable material (8h)
- Read and understand the material (25h)
- Synthesize a logical approach to the topic (10h)
- Create a presentation (10h)
- Practice the presentation (3h)

Conducting: **1.5h = 0.05 credits**
Organization

• 1 seminar

Preparation: **56h = 2.1 credits**
- Find suitable material (8h)
- Read and understand the material (25h 10h)
- Synthesize a logical approach to the topic (40h 2h)
- Create a presentation (40h 5h)
- Practice the presentation (3h)  
  - Implement a demo (28h)

Conducting: **1.5h = 0.05 credits**
CONFUSION

looks better sideways
What do you see?
What about this one?
This one?
But this one?
This one should be easy...
Bonus question...
The Seminar – Explore a CG topic!
The Seminar – Tackle topics together!
The Seminar – Tell the story!
How to choose a topic?
How to choose a topic?

- What do you need to understand for your thesis?
How to choose a topic?

- What do you need to understand for your thesis?
- What knowledge will benefit you after the uni?

Ninja Theory developer talking about atmospheric VFX in Hellblade: https://www.youtube.com/watch?v=jdZ1s3FHTFI
How to choose a topic?

- What do you need to understand for your thesis?
- What knowledge will benefit you after the uni?
- What did you come here to learn about CG?
How to choose a topic?

- What do you need to understand for your thesis?
- What knowledge will benefit you after uni?
- What did you come here to learn about CG?
- What do you find interesting in CG?
How to choose a topic?

- What do you need to understand for your thesis?
- What knowledge will benefit you after the uni?
- What did you come here to learn about CG?
- What do you find interesting in CG?
What is this?
Post-Processing: the Bloom effect
Back to the main track
How to find materials?
How to find materials?

• The Interwebs.
  • Examples of some quality web articles:
    – GTA V Graphics Study by Adrian Courreges
      http://www.adriancourreges.com/blog/2015/11/02/gta-v-graphics-study/
    – Article lists by Jendrik Illner
      https://www.jendrikillner.com/post/
    – Volumetric Fog by Kostas Anagnostou
      https://interplayoflight.wordpress.com/2015/07/03/adventures-in-postprocessing-with-unity/

• Just Google, but **be critical** about what you find!
How to find materials?

- The Interwebs.
- UT library databases.
  - https://utlib.ut.ee/andmebaasid
  - ACM SIGGRAPH
  - IEEE Transactions on Visualization and CG
  - IEEE Transactions on Games
How to find materials?

- The Interwebs.
- UT library databases.
- Books.
  - Fundamentals of Computer Graphics
  - GPU Pro 1-7, GPU Zen
  - Many-many others...
How to find materials?

- The Interwebs.
- UT library databases.
- Books.
- The CGVR Lab's Literature Page:
# Conditions

<table>
<thead>
<tr>
<th>First time student BSc, MSc</th>
<th>Choose any CG-related topic you want.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Returning student MSc, PhD</td>
<td>Your <strong>topic should be related to several scientific articles or books.</strong></td>
</tr>
</tbody>
</table>

- In either case, **ensure you benefit** from the topic!
  - Eg, that it is related to your thesis or other work.
- Can be the same that others have done before.
Previously On
South Park
ICS Day
Fur Rendering

(b) fins (alpha-blended)
(c) shells (non-overlapped patches)
DBV Visual Effects

How to use a Compute Shader
Use Case Study:
Journey - Effects and Terrain
Procedural Generation

Setting of Elite: Dangerous
The entire 1:1 scale Milky Way galaxy
Augmented Reality Frameworks
The CGVR Lab Field Trip
Guest: Peeter Nieler from Griffin
MACGYVER APPROVES
World is a vast and mysterious place!

World is a vast and mysterious place!
Special Seminars

- Academic Poster Workshop
- CGVR Lab Field Trip?
- Ats Kurvet's Job Shadowing?
- Physically Based Rendering by Raimond?
- 3D Printing by Raimond?
When you have a topic...

- Find, investigate, research
- Examples are good
- Try it out yourself
- Engage others
  - Discussion
  - Interactive demo
  - Workshop
Creating a Presentation
Creating a Presentation

Ensure you understand what you put on the slide!

\[ L_o = L_e + \int_{\Omega} L_i \cdot f_r \cdot \cos \theta \cdot d\omega \]
Creating a Presentation

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Use big fonts, use your slide space optimally.
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Make the illustrations, drawings, diagrams *yourself*.

paint.net
GeoGebra
draw.io
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Make the illustrations, drawings, and pictures on the slides!
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Make the illustrations, drawings, diagrams yourself.

Put pictures on the slides!

Try to implement what you share.
Creating a Presentation

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Put pictures on the slides!

Try to implement what you share.

The quality should be on par with a thesis level.
Creating a Presentation

Ensure you understand what you put on the slide!
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Make the illustrations, drawings, diagrams yourself.
Put pictures on the slides!
Try to implement what you share.
The quality should be on par with a thesis level.

You are the master of your topic!
Creating a Presentation

- Ensure you understand what you put on the slide!
- Use big fonts, use your slide space optimally.
- Make the illustrations, drawings, diagrams yourself.
- Put drawings, diagrams etc on the slides!
- Try to implement what you share.
- The quality should be on par with a thesis level.
- You are the master of your topic!
The goal of the module is to give students the opportunity to deepen their understanding of the field most interesting for them and to develop their communication skills.
Computer Science: MSc Seminar Module

Goal:

The goal of the module is to give students the opportunity to deepen their understanding of the field most interesting for them and to develop their communication skills.

Learning outcomes:

After completing the module the student:
- is capable of independent work with modern research literature and other field-related material;
- can effectively communicate his knowledge of the field to others.
Questions?
List of some arbitrary 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-photorealistic rendering** – Where is it used and how is it achieved?
8. **Tessellation** – How is this done in OpenGL 4?
9. **Post-processing effects** – What effects are there? When and how are they used?
10. **Procedural generation** – Cover a couple of cool algorithms in depth.
11. Physically-Based Shading – What is it? Why is it important to understand physical properties of materials for shading? What games / game engines use it?

12. Rendering in VR – What extra considerations are in VR? How do different technologies overcome them?

13. Vulkan / WebGL 2.0 – What is it for? Why is it useful? How to Vulkan / WebGL 2.0?

14. Subsurface scattering – What is it? How it is implemented? What does it solve?

15. Reflections and caustics – What are the modern techniques, which do those?

16. GLSL vs HLSL – What are the differences? How are both used?

17. Use case study – Find out in detail how graphics are done in one game or movie.

18. Motion capture – What are the difficulties today? Best budget setup for it?

19. Modern GPU architecture – How are GPU-s built today? What are they optimized for?

20. Graphics on consoles / smartphones – What limitations are there in consoles or embedded systems vs the PC? How to overcome them compared to the PC approach?
21. **Tileable Textures** – What methods are there for creating those?
22. **Ray Tracing with RTX** – What can be done with Nvidia's RTX cards?
23. **Occlusion Culling** – How is this achieved? What data structures are used?
24. **Volumetric Rendering** – How to simulate volumetric light transport? Fog, fire?
25. **Facial Animations** – What are the modern, cheapest, professional solutions?