

COMPSCI 715

Advanced Computer Graphics

- Advanced course looking at the most recent cutting edge developments in computer graphics technologies
- Project-based
- Explore topics in
 - Rendering, Animation, Modelling
 - Scientific and Biomedical Visualization
 - Game Technology
 - Innovative Graphics-based Human-Computer Interfaces



Time Table

- **Week 1**
 - Course introduction
 - Presentation of topics
 - Formation of groups and selection of topics
- **Week 2-11**
 - Weekly meetings with each group
- **Week 6**
 - Interim report due date and presentation
- **Week 12**
 - Final report due date and presentation



Assessment

- Group topic presentations, Thur+Fri of Week 2, 20-30 minutes/group
- Group interim report presentations, Thur+Fri of Week 6, 20 minutes/group
- Interim individual written report, Due at the end of Week 6
- Final Report and Source Code, Due at the end of Week 11
- Final presentations and demos, Week 12, 50 minutes/group

Note: For the presentations each group member has to speak for approximately equal amounts of time. Both the presentations and the capability to answer questions will be assessed.



Assessment Weighting

- **Assessment Weighting:**
- **60% Exam (Individually Assessed)**
- **10% Presentation and participation (Individually Assessed)**
- **10% Interim reports (Individually Assessed)**
- **20% Final reports & implementation (Group Assessment)**



Student Feedback after Lecture 1

- Interest in
 - Character Animation
 - Physical Simulation
 - Sketching 3D Shapes
 - Game development
 - Terrain rendering, skys and atmospheres
 - Rendering optimizations
 - Landscape rendering & rendering of natural processes (water/grass/tree/wind)
 - Photorealistic rendering
 - Visualization



Project Topics

- Serious Games
 - Develop a healthcare game for helping patients understanding the hospital environment (e.g. to make kids less afraid of going to the hospital)
- Serious Games / Sketch-based Modelling
 - Develop an interactive sketch-based language learning tool
- Texture Synthesis
 - Implement, Evaluate and if possible improve a 3D Texture Synthesis technique
- Sketch-based Modelling
 - Designing free-form surfaces with 3D curves
 - PLUSHIE: Interactive design system for plush toys

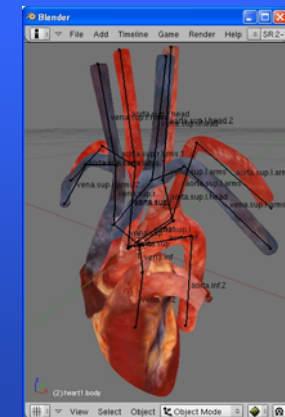


Game Engines for Health Education

- Background
 - Health care is major component of government expenditure
 - Most people do not pay attention to their health until they are sick & often do not cooperate well during treatment and rehabilitation
 - By using a game engine we hope to make health education more enjoyable and interesting
 - The Graphics Group is currently conducting two large projects in this field:
 - Game engines for simulating teamwork in virtual surgeries
 - Heart visualization for improving patient rehabilitation



Game Engines for Health Education



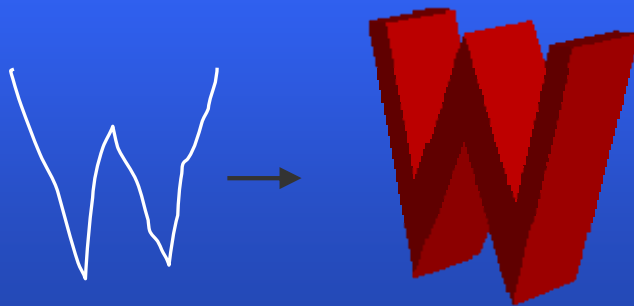
Project Goals

- ❑ **Learn how to use modelling tools**
 - Model at least two characters: a surgeon and a nurse
- ❑ **Learn how to use animation tools**
 - Animate the characters such that they can perform basic movements such as walking and reaching a tool
- ❑ **Learn how to use game engines**
 - Use the "Source engine" (Half-Life 2) to implement your game
- ❑ **Learn how to program games**
 - Develop a simple game play which has an educational component

Sketch-based Modelling and Animation for Language Education

- ❑ **Background**
 - Research suggest that for humans learn best by utilising more then one brain region for a learning task
 - Repetitive learning is not successful since the brain's neurons become insensitive to repeated stimuli
 - By using an interactive game utilising multiple brain regions (eyes, ears, hands) learning can be made more enjoyable and effective

Sketch-based Modelling and Animation for Language Education



Project Goals

- ❑ **Develop a tool for sketch-based modelling of characters**
 - The user draws a few strokes and the tool will create a 3D model of the character
- ❑ **Develop or integrate a tool for character recognition**
 - The tool has to be able to recognise what character was drawn
- ❑ **Develop or integrate tools for physically animating the 3D characters**
 - The user should be able to move the 3D characters around. It's recommendable to use a physics engine such as ODE
- ❑ **Develop and implement a suitable game play**

Texture Synthesis

Background

- Texture synthesis is a useful tool for creating complex 3D textures which are difficult to capture from nature
- Texture synthesis can be used to create arbitrarily large textures
- Applications in many areas involving Graphics, Visualization and Computer Vision



Texture Synthesis



Project Goals

- Understand, implement and evaluate the technique presented by Kopf et. al at SIGGRAPH 2007



Sketch-based Modelling

Background

- 3D modelling complex and often non-intuitive
- Sketch-based modelling is a powerful and intuitive artistic medium
- Useful for inexperienced users (children) and users who want to create rough "default" models (medical professionals, engineers)



Project Goals

- Understand, implement and evaluate the SIGGRAPH 2007 papers:
 - **FiberMesh: Designing Freeform Surfaces with 3D Curves** (Andrew Nealen, Takeo Igarashi, Olga Sorkine, Marc Alexa)
 - **Plushie: An Interactive Design System for Plush Toys** (Yuki Mori & Takeo Igarashi)

