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SCHOOL of ELECTRICAL ENGINEERING *and* COMPUTING
FACULTY of ENGINEERING *and* BUILT ENVIRONMENT
The UNIVERSITY of NEWCASTLE

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COMP3320 Computer Graphics, Semester 2, 2018
Project: Extraterrestrial Life



Figure 1 – Examples of life on earth which are quite ‘alien’. Left: Puffball mushroom photographed in the Engineering carpark, UoN – When disturbed, fine dust like spores erupt from the central cavity and the wind carries the spores to spread the organism. Right: Glaucus Nudibranch photographed at Bar Beach, Newcastle - These tiny animals pack a painful sting thanks to the stinging cells they store, taken from prey such as bluebottles (aka Portuguese man o’ war).

I. Aim

The aim of this graphics programming project is to implement a computer graphics task of your choice (e.g. a game, an animation, a research visualization, computer art or an interactive simulation) that satisfies the following requirements.

- 1) The developed models should extend beyond the generic primitives offered by OpenGL with at least basic lighting and texturing (this is covered in the laboratories).
- 2) Cover at least two of the following graphics tasks:
 - a) Advanced texturing (normal maps, bump maps, environment map reflections)
 - b) Physically Based Rendering (PBR) (including at least diffuse, roughness and metallic maps)
 - c) Reflections / Refractions
 - d) Shadows
 - e) Post-processing (motion blur and bloom / depth of field / screen space ambient occlusion / fog with ‘god-rays’)
 - f) Character Animation (skinned mesh with animations)
 - g) Biological Materials (subsurface scattering / hair animation)
 - h) Physics (at least particle collision detection and forces like gravity)

- i) Weather (with clouds, day/night and rain)
 - j) Water (animated or simulated in 3D)
 - k) Procedural Landscapes (generating textured terrain with details like rocks / plants)
 - l) Procedural Objects (for example, growing alien plants algorithmically)
 - m) Modifiable Terrain (supporting real time digging and raising)
 - n) Dynamic particle effects (explosions / smoke / fire / clouds)
- 3) Address the topic “Extraterrestrial Life”.

Some notes

- You could, for example, create a game where an alien fitness garden is involved.
- The graphics simulation could be still, animated, or interactive.
- The extraterrestrial life aspect could involve a variety of graphics effects.
- If you use available research literature you should appropriately cite the source.
- If you plan to use non-standard or high level tools please include this in your proposal and discuss this with the course coordinator

This is a large multi-part group assignment that counts a total of 50 marks. In the Computer graphics industry it is common to work in teams. Therefore this project requires that you work in teams of **3-6** students (exceptions are possible but must be discussed with the lecturer).

Below follows a summary of the specifications. The specifications and assessment criteria are to be used in conjunction with those provided in the formal course outline. Please contact the CC immediately if you think there is anything not clear or requires further detail. Additional details such as the schedule for the background presentations will be provided on blackboard.

II. Specifications

For the implementation you have the freedom to choose in combination with OpenGL 2.0+ (or alternatives) whatever programming language you prefer. This could be Java, C/C++, C#, Python and so forth (from our experience C++ is recommended). Select what you think is most suitable for you and your project. However, it is expected that your team is able to deal with all technical details of your implementation (e.g. looking up Java commands, setting class paths, installing libraries, hard- and software compatibilities, debugging, etc.). With the project you should demonstrate that you are able to make decisions that lead to the best creative outcome for you and your team.

III. Supplement

A basic C++ base code will be made available to the class, which incorporates [GLFW](#) windowing and input management, [SOIL](#) image loading and [ASSIMP](#) 3D object loading. This is offered to provide students with a default starting-platform. However, you do not need to use this.

IV. Deliverables

There are four deadlines at which each team must deliver parts of the project. The important dates are as follows:

1. Project release date: 6/8/2018
2. Project proposal (Deadline week 3: 21/8/2018): 5 marks
Please submit via blackboard:
 - a. Project title
 - b. Project goal
 - c. Team description (names, student numbers, meeting schedule, planned responsibilities with a signed agreement by all team members)
 - d. 100-200 word abstract
 - e. Planned modules and expected completion dates. You can use a Gantt chart.
3. Background presentation (27/8/2018 is the deadline for the presentation titles. As soon as these have been submitted I will release the presentation schedule on blackboard): a maximum of 10 marks will be awarded in class on the day your presentation is scheduled.
 - a. Team presentation: One or more speakers; Length about 15min
 - b. Topic of your choice somehow related to some aspect of your project (it's best to select a clear and focused topic)
4. Module 1 (Deadline week 8: 18/9/2018): 5 marks
 - a. Deliver an implementation of the environment (or basic research visualization, etc.).
 - b. A report describing the gaming environment (or basic research visualization, etc.). Also report any team variations or changes to your initial plan (if any).
5. Module 2 (Deadline week 10: 16/10/2018): 5 marks
 - a. Deliver an implementation of the environment with the gaming characters (or intermediate research visualization etc.).
 - b. A report describing the gaming characters (or intermediate visualization etc.), report team variations etc. (if any).
6. Gaming logic and final presentation (Report deadline week 12: 30/10/2018): 25 marks
 - a. Deliver the entire game (full visualization or project).
 - b. Provide a class presentation demonstrating your gaming environment, the gaming characters and the gaming logic (alternatively demo the visualization project, simulation etc.).
 - c. Final report including updates, revisions and changes from intermediate reports.

V. Marking Criteria

- Each deliverable module must be executed without runtime errors. Readme files are important to explain how to execute each deliverable.
- Reports should be free from spelling mistakes, grammatical and punctuation errors. The presentation of the reports is also important.

- If you use code, images, etc. from other sources, you must cite and acknowledge this appropriately in the presentation and report. You have to respect copyright regulations.

What isn't marked:

- Coding style is not marked. However, appropriate comments are expected.

VI. Submission

ALL SUBMISSIONS **MUST BE IN PDF FORMAT** (e.g. CutePDF writer).

Always submit via blackboard ("Assignments section") and include the ACS.

Be aware of the deadlines and learn to manage time and responsibilities with your team.

Please feel free to approach the lecturer or demonstrators for discussion, for example, after the lecture, during the lab sessions, or during consultation hours.

VII. Notes on Groupwork

a. Purpose: In the computer graphics industry it is common to work in groups. In the project you will have to deal with technical issues, learn new programming tools quickly and as a team it can save time to overcome teething problems and smaller technical hurdles more quickly. During the project you will have to write a proposal and extend this into a project report. This will be marked (Module 1-3). In addition each individual team member will have to keep a non-marked **project diary** where you document your contributions, milestones and meetings (a simple list with dates, topics and contributions is sufficient. Please compare with your team members so that it is consistent). These diaries can be checked in the lab meetings and can be used to assist marking.

b. Process of group allocation: This project requires that you work in teams of **3-6** students (exceptions are possible but must be discussed with the lecturer). Please start forming teams as soon as this project is released. If you have not found a team within one week contact the lecturer immediately and attend the first lecture and lab meeting in week 3. If you have not found a team by 9.8.2018 you will be allocated to a team that will be announced on blackboard in the course outline section.

c. Expectations of group members: We remind students that a 10 unit course requires at least 10 hours per week of work. This is a significant work load and each member of the team has to make a clear commitment to the others in the team about availability for team work. You are free to discuss roles and responsibilities in your team. You are required to document the team structure in your team report and project diary.

d. Conduct of group meetings: You are required to have regular weekly group meetings with your team members. These can be face-to-face or on-line. You have to elect one team leader who organizes the meetings. Dates, times, topics and attendance of the meetings have to be documented in the project diaries.

e. Conflict resolution: If the team requires conflict resolution support please contact the course coordinator in time. Group or collaborative learning is one important element of the learning process. When used effectively, group work can develop students' interactive working techniques (such as teamwork and negotiation skills), and can enhance student understanding of course content (through group discussion and peer support). A good team can achieve much more than a single programmer in graphics.

f. Evaluation of individual performances: If a workload statement agreed by all the members in a group is submitted with an assessment item the marks will be distributed to each member according to their workload (electronic copy submitted to Blackboard). If no workload statement is submitted it will be assumed that the workload has been evenly distributed and all students in the group will receive the same marks.

g. Feedback will be given verbally in the lab evaluations Module 1 – 3.

h. Strategies: The best advice is to establish a dialogue between all team members and do not let a situation with great work unbalances to occur. Clarify from the beginning how you want to proceed and include this in your proposal. Make a clear contract with your team members right from the beginning. Include this in the proposal and report. Each team member has to keep their project diary up-to-date. Please attend the lab meetings so that your team can discuss the project with the tutor. You also may want to see how the other teams are going.

(a.-h. are detailed to complement the course outline and to satisfy policy 000996)

We wish you best success and lots of fun with your Comp3320/6370 graphics programming project and are looking forward to see what you can achieve.