# coms30058 cgi

The CGI unit COMS30058 introduces the classic pipelines and cycles of model development used to build computer graphics' assets; *from modular architecture to new types of actors.* Historically, Computer Graphics units in Computer Science focus on the rendering process, and the fundamentals of computer graphics algorithms. The world of computer graphics continues to move towards a goal of absolute photorealism in real-time - and in 2022 we are close to that goal. **This unit is different**. In COMS30058, we focus on the design of geometry and the process of creating animation cycles to bring assets to life. It is all about Digital Content Creation, and asset development. Professional DCC software is used as a framework to illustrate the process of building computer-generated characters and sets for deployment in films and games, for product visualisation and for immersive display. With a focus on the development pipeline, the topics introduced throughout

this unit are not software-specific. Your project submission will be developed in Autodesk Maya, but the story will occasionally bounce between applications to highlight how the key concepts apply in different contexts — offline rendering for animation and visual effects production **and** real-time rendering for games and interactive display. Although the terminology can often be different in different software environments, the design process and the core principles apply to both domains.
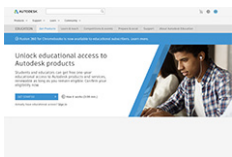
AUTODESK.

Register and download Autodesk Maya

In a modern production environment different Digital Content Creation software applications – and different render engines – are used throughout the pipeline: to paint concept art, to build characters and sets, for tracking, for animation, for texture development, for visual effects, for post-production and for compositing. At the moment, Autodesk Maya is used throughout the sector for character and creature animation. It is used to produce content for games, for product visualisation and for visual effects simulation. In this unit we use Autodesk Maya to build polygon models and for object and character animation. For lighting design and shot production, Arnold is introduced to illustrate offline high-end rendering for film using indirect global illumination.

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As a student you can download the educational version of Autodesk Maya (which includes the Arnold MtoA plugin) for **free** – you simply need to create an Autodesk student account."

　colin.dalton@bristol.ac.uk

0.1   coms30059 and comsm0076

In the Computer Science curriculum, the unit COMS30058 is classified as a *lecture unit.* COMS30058 is an administrative container for the CGI teaching and content. It has no assessment associated with it. In terms of assessment: for the project that you need to complete this term you will either be registered on (and submit your project on Blackboard to) the unit COMS30059 or the masters-level unit COMSM0076. It is in these individual projects, where you will experience design and asset development and – for the unit assessment – demonstrate the intended learning outcomes of the unit. For both project submissions:

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the design challenge for 2022 is to design, model, texture and animate a robotic hero character asset for a fictional animated feature film: **Olympoids**."

0.2   Olympoids

Assume that a script is being developed for a new Pixar-style animated feature film and game franchise. The working title of the film is **Olympoids**. The film is set in the year 2040. In 2040 the Olympic Games are as exciting and as globally popular as ever. The Olympic spirit and the core Olympic events remain exactly as the Games of today - but the days where humans physically compete in the Games are long gone. In this post-pandemic world, the technology that we see now in science fiction and AAA games is a reality. There are no human competitors. Each nation is represented

by robotic droid characters. Olympoids. To inform the art direction of the film, I would like you to design and model an Olympoid hero character - and then animate it. Your design process should start with research: collect visual references and create style sheets to inform your design. Create a brand new character design, not a carbon copy of an existing film character.

In 202021 CGI students created exoskeleton designs about an Autodesk character model. **This year is different** – you can be more creative in your character design. There is no requirement for your Olympoid to be human or humanoid. Think R2D2 not C3PO. You do not need to fit your character design to an existing model.

In fact – do not download or use *any* existing models in your design. Do not use any component parts of other models, download any kits, or use any motion capture data. This unit is about you being the author, and creator, of a digital asset – not a consumer of pre-built content. You need to create an original character design, to build the geometry, light and shade your model, setup your hero with character controls and then animate it ...

Your character in motion

▶ YouTube

Tokyo 2020 kinetic sports pictograms
0:05:23

In terms of animation, you have a ten second window to showcase your character in motion. Early in the design process - at the outset of the unit - you need to choose an Olympic sport for your athlete to compete in. Research, and collect as much visual reference as possible about that event. The sport you choose, should be reflected in the design of your character. If you simply search Youtube for your favourite event, you will find hours of Olympic Games video reference to guide your character design and animation. Find

colin.dalton@bristol.ac.uk

the one – iconic – movement that you think best represents the event. You will either be registered on COMS30059 or COMSM0076. It is at this point that we differentiate the submission requirements for different cohorts:

If you are registered on the unit COMS30059: even if the Olympic sport that you select is a team or combat sport you only need to animate **one** character. In ten seconds or less, animate your character acting out an Olympic sport motion, as it would in a feature film or game.

If you are registered on the unit COMSM0076: you need to select an Olympic sport where athletes do compete against each other. You need only create one character model though. Duplicate your Olympoid character and animate both athletes in competition. The additional challenge for masters students is about animating action and reaction so that the **two** Olympoid characters respond to each other as they compete.

0.3   Submission guidelines

These project guidelines are designed for you to read and reference throughout the unit, and to use as a guide when you create your files for submission in May. Importantly this unit is about the design process– from concept to final pixel. If you have no experience of 3D design I appreciate that some of the detail here will make no sense to you **yet** - but as we explore each new topic and chapter it will.

All submissions will be through Blackboard. In May you will need to submit an animated shot of your Olympoid character - rendered using Arnold and submitted as a Quicktime or mp4 video file. An accompanying technical

report should also be submitted as a pdf file that introduces your Olympoid character and outlines the design process used to produce the shot. As a guide, the Quicktime or mp4 file that you submit should not exceed 25mb. If this is not possible please contact Colin Dalton for help and advice – well in advance of the submission deadline. For the technical report there is no strict page limit but as a guide we would expect the body to be about eight-ten pages – with an appendix for development storyboards and sketches. The Blackboard unit spaces for COMS30059 and COMSM0076 will become live at the end of the unit – you only need to access them to check your registration, and for your project submission in May. You do not need to submit your Maya binary source file in Blackboard, but it must be available to submit on request.

The intended learning outcomes for COMS30058 state that on completion of this project, a successful student will be able to ...

– Model complex polygonal geometry and define UV space for 3D assets

– Experiment with key framing, motion design and character setup for animation

– Design and create environment lighting

– Construct shaders and design surface effects for visualisation

– Document, illustrate and explain the creative design process for CGI asset development

At the outset of this course a number of you will have no previous experience of using Autodesk Maya, of model development or animation. At the point of submission you will own the design of an Olympoid character. You will have built the geometry, animated an Olympic action and produced a fully rendered shot. Your report just needs to take me on that journey, and

explain the how and why, for each part of the design process. It is also a reflective report. Since you will not be in the room when I – or our external examiner – views your animation, it is the report that explains where all of your time and effort has been spent. Consider your report a complete making-of document which explains the entire design process from creative idea through to final shot production. What did you do prior to technically modelling your geometry in Maya? Explain your creative design process. Beyond the page limit for the core of the report you can include additional style-sheets, visual references, development drawings, sketches and blueprint designs as an unlimited appendix.

Please populate your report with interim screenshots to illustrate the text. Hopefully they will not be visible in your rendered shot, but do show us the polygon wireframes in your report. Discuss the process you went through to complete the task, explain how the design evolved and why certain techniques or surfaces were used for different parts of the model. Sensible justification of your design decisions and your choice of technique will gain you higher marks. One approach may lead to a more realistic result than another, or may lead to the same result but provide more flexibility during construction – or it may simply take less time. You may have thought forward about edge flow and surface design for texturing? If you have experimented with different ways to create the same shape and found one approach to be better than another - why? What does better mean? Reference clearly any external tutorials that you followed, or any sites that you used to download textures and files. Explain your thought processes and be sure to mention those parts of the model that you found most difficult, and the parts that you are most proud of. Feel free to take artistic licence with

the lighting and rendering, but remember that we are primarily looking for a semi-realist 3D style and not a flat 2D cartoon look. Please do not toon shade or use any non-photorealistic, painterly or other abstract or highly stylised technique – think Pixar and not the Simpsons.

Model development

Although this is a creative project, your submission is evidence that you can model objects, and then bring them to life. Presumably some Olympic-related objects and Olympic references could feature in your design? Modelling from reference is a vital skill. The ability to study and visually break-down a real object into component parts allows you to make decisions about the tools and procedures that you use to create a virtual copy. Whether the reference is a design from your imagination, or a real-world Olympic object, being able to model from reference is a vital skill for a 3D artist. Did you make use of image planes to import drawings and photographs to model off of? As you created your character did you experiment with different ways to build your geometry? Simply producing lots of geometry using only one rehearsed procedure repeatedly, or by mass duplication is time-consuming and limiting. The more skilfully and appropriately you apply different ways to model the higher your mark will be. A common level of detail and resolution throughout your design, clean geometry, and complexity of design are all important factors. I will explain the importance of building with clean quadrilateral geometry that has edge loops and flows lines to select. Did you think forward about edge flow and surface design for animation or for texture placement? Did you model asymmetry and damage to add realism? Avoid non-manifold models and self-intersection.

colin.dalton@bristol.ac.uk

For many of your objects you will have been able to colour and texture them using a Standard Surface Shader model and Maya procedural shaders. Some of your objects may require you to project or place external textures or photographs. No object should be left as a default diffuse Lambert grey model. We are particularly keen that you experiment with, and demonstrate, your understanding of texture projection and or UV space. Avoid stretched or distorted patterns, and pay close attention to the relative size of your textures in relation to your character, objects and the environment. A common mistake is to apply texture information at the wrong scale. If you have built complex shader networks, using advanced techniques such as displacement maps, and UV mapping to control image placement (and to minimise distortion) explain it and show us the UV shell layouts and Hypergraph node networks.

Please remember that every component of the design that you submit must be built and animated by you. Do not download and then assemble found geometry. Do not use an existing character rig. Do not attempt to reverse engineer motion capture data. If you do it is plagiarism. You learn nothing – *and most importantly it is dull.*

Animation design

The primary goal of the animation component is to bring your Olympoid hero character to life. It is an assessment of your skill at generating complex and realistic motion, using keyframe animation. Try to successfully convey weight, momentum and acceleration. Pay particular attention to the interpolation between keyframes in the graph editor. For secondary animation, experiment with constraints, scripting and set driven key. Where appropri-

ate experiment with your own built controllers. If your character interacts and reacts with a secondary object, how did you manage that process? Complex and challenging choreography, solid impact and - where appropriate - applying the Disney animation principles will help you to attain the highest marks.

We will also mark you on your production design. This is a subjective criterion based on the overall flow of your animation, the story it tells and how you convey character. Think about your animation as a film: where are the impact points? Where is the climax? How does it build towards that climax? Is it well paced? Ensure that your animation is a complete designed shot, rather than starting and stopping abruptly as though it were a snapshot of a longer animation. Do you devote enough time to those elements of your model and key framing which took effort to implement – or do they disappear in a split second? You can of course add a soundtrack, or sound effects, to guide your animation – but there is no requirement to. If you have filmed reference video to work from, then please include it in your submission. Where online references have been used for the design simply include Youtube or Vimeo links in your report.

To complete your report – personally evaluate your submission. How could it be improved with more time?

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What would you do differently if you did it again?"