Computer Graphics

COMP3421/9415

2021 Term 3 Lecture 9

What did we learn last week?

Scene Graphs

- Hierarchical, tree based organisation of transforms and objects

Depth Testing and Blending

- How to tell what's in front?
- What to do with transparency

Parametric Curves and Splines

- Mathematical methods for curves and curved surfaces

What are we covering today?

Art

- Why is Graphics a field? What makes it important?
- The Art pipeline
- Ideas, Concepting, Prototyping
- The interplay between artistic and technical

Why does Graphics exist?

This is a pretty big question

- Why did people start developing technology for display?
- What's the overall purpose of Graphics technology?
- Is there some kind of goal for the Graphics Industry?

Tennis for Two (designed in 1958), Brookhaven National Laboratory

Siren by Cubic Motion (and Epic Games) 2021

The SAGE control room (US Air Force 1950s)

Graphics is for Humans

More than most other computing fields

- We want to be entertained
- We want a spectacle
- We want a simulation of reality
- We want to believe

Graphics supports artistic vision!

Spider-Man Into the Spiderverse (Columbia, Sony and Marvel 2018)

Ghost of Tsushima (Sony and Sucker Punch Studios 2021)

What is art?

We're aiming at gigantic questions today . . .

- An expression of human emotion?
- A creation of something not necessarily utilitarian?
- Designed to be experienced by others?
- Evokes an emotional response in viewers?

There is no single easy definition and the boundaries are very vague

- But we do know that Computer Graphics is definitely a medium for art to be created

The Starry Night (Vincent Van Gogh 1889)

Computer Games Art

Let's narrow our perspective a little

- Computer Games are a form of art (and also contain art)
- "Digital Immersive Interactive Storytelling"
- Computer Graphics is integral in nearly all games
- The graphics will be created based on what the game is
- As Graphics Programmers, we might be building the tech behind the art
- We're only one step in a long process

Concept of a Computer Game

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Let's create a Computer Game Concept

Any% Speedrun of the Game Pitch Process

- Let's put together the ingredients for a modern game
- Setting
- Character(s)
- Story
- Gameplay

Setting

Where is this game happening?

- World, Realm or Planet?
- Human scale, smaller or larger?
- What makes it stand out?
- Is it dangerous?
- Technology/Magic/Special Features?
- Why do people (human or otherwise) live (or not) there?

Character(s)

Is there a main character?

- Human or not? (we're often human-centric as that's 100% of our audience)
- Relationship to the setting?
- Any backstory?
- Reason to act?

Story

What drives us to engage? (Don't say microtransactions)

- Hero's Journey?
- Why are we playing? Why is the character interacting with the setting?
  - Righting wrongs?
  - Exploring?
  - Puzzles?
- Where do we want the player's imagination to go?
- What's overt and what's hidden or implied?
- Is there a narrative (or just a setting to play in)?

Gameplay

This should follow from the previous ideas

- Sometimes gameplay dictates everything else (abstract games)
- But often the theme comes first, and gameplay is informed by the situation
- Is the player the character?
- How do we want the player to feel?
- How do we want the player to interact?

The Elevator Pitch

Tying it all together

- Name the Game
- Describe it in less than 30 seconds

Break Time

Want to learn the whole process? Try a Game Jam!

- 48 hour game jams are very quick and dense learning processes
- But they cover the entire process in a microcosm
- Concept -> Design -> Implementation -> Testing -> Release
- https://globalgamejam.org/
- https://itch.io/jams

From Concept to Design

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Reacting to the Concept

From a Graphics Perspective

- A graphics programmer will be responsible for
  - a significant portion of the game engine
  - building up the tech pieces you need the games needs
- What kinds of things are needed?
  - Hyper realism or a specific stylistic technique?
  - Viewpoints? What kind of cameras do you need to develop?
  - What does the player need to see and how?
  - Is this setting calling for particular tech?
- Limitations
  - Specific hardware?

Plans following our Concept

What would you do?

- Look at the game we created a concept for
- What kind of plans would you have for the Graphics?
- Are there any special visuals you want to think about?
- Is it looking like a mobile, console or PC game?
- Decisions like this form the framework and requirements for our initial development

Developing a Character

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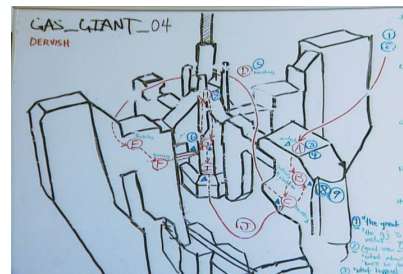# Computer Games Art Pipeline

It's a long process from idea to polygons
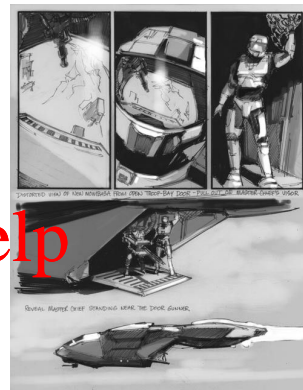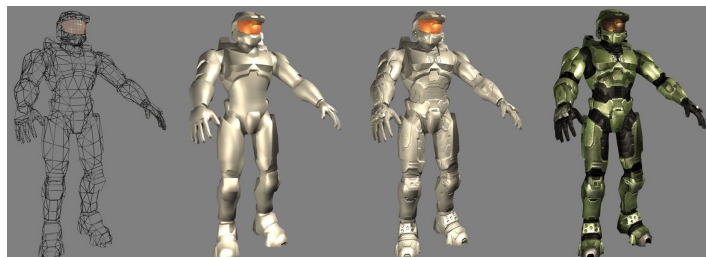
- Concept
- Design
- Pre-Production (Technical Graphics appears here)
- Post-Production (iteration may involve redoing earlier steps)

Today, we're looking at Concept and Design

Various Production Images from Halo and Halo 2 (Bungie Studios and Microsoft 1999-2002)

Concept

We should have an idea of this now

- Have we given them a name? Should they have one?
- Is there any visual information yet? (probably not)
- Start doing research
- Visual References (start a pinterest board?)

Concept Art

Visual representations of ideas

- An early step in the design of a character (or location or vehicle etc)
- A lot of work will come from references here
- Very much the domain of the traditional sketcher/painter

Sculpting

Most likely digital sculpting

- Initial ideas going from concept art to 3D model
- Options for sculpting in clay and the 3D scanning
- More often sculpted and modelled digitally
  - This work will be done in a 3D modelling and/or 3D sculpting program
- Unlikely to be game ready at this point
  - Too many polygons to run efficiently
  - Only vertices, no other important information

Programmers working with artists

In the meantime, us, the programmers are also working

- We'll establish a scale for the game world
- And most likely set up our source control (not always git when working alongside artists)
- Artists will provide us with a sample object (like a cube)
- We'll set up correct transforms for this and start building up graphics engine capabilities

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Optimisation and Texturing

Getting a model ready for use

- If a model has been sculpted, it might have a lot of extra polygons
- It will either be remodelled or optimised to remove vertices
- Then it must be UV mapped
- This is the process of adding texture coordinates to the vertices
  - Texture coords are usually called (u,v)
- Then once mapped, actually "painting" the textures
  - Creating the 2D images, usually in a digital painting program
  - This also means adding other maps which we haven't learnt about yet in this course
  - Artists might refer to these as "materials"

Rigging and Animation

Skin and Bones

- Animation in games is usually done via an internal bone system
- (We're going to cover the technical details next lecture)
- Artists will create a skeleton
- And "rig" the mesh to the skeleton
- With a rigged skeleton, animations can be created
- Animations are dependent on game needs, so they might not all be planned in advance

What ends up in the game?

As programmers we receive:

- A 3d model
- with textures and other maps (materials)
- and a set of animations

We will then:

- Make sure these are imported and handled in our engine correctly
- Transform the model into its correct place in the world
- Write code to activate its animations at the right time

How many artists was that?

There are many specialisations in this pipeline

- Concept Artists
- Sculptors
- 3D Modellers
- Texture Artists
- Riggers
- Animators
- Depending on the project, these might all be different people!

What did we learn today

A glimpse into the work that goes into creating art

- An overview of Graphics and Art
- Creation of Game and Character Concepts
- Following the Art Pipeline (from a games perspective)

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