Computer Animations in Games and Film

Computer Literacy 1 Lecture 11
14/10/2008

Topics

- Brief History of Animation
- CGI and RTR
- Rendering
- 3D Animation software

Brief History

- Almost 50 years ago 3D animation began
- General Motors and IBM created DAC (Design augmented by computers)
- 1961 first sketchpad is invented
  - Now main instrument for computer animators
- 1970 "hidden surface" algorithm was invented
  - This was a way for the computer to know which surfaces of the object it was creating would be hidden from the viewer

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Brief History

- In the seventies the first CGI con was held, rendering of curved surfaces was invented and texture mapping was discovered
- In 1975 a mathematician (B. Mandelbrot) published on what he termed "fractional geometry", that would end up shaping how computers would render the infinitely chaotic images found in nature more realistically

Brief History

- In 1986 Pixar was founded
- And despite Pixar's successful short and feature length animations, animators agree that their best contribution to computer graphics is a known as **Renderman**
- For computer animation **Renderman** is perhaps *the* standard of software used today due to it's versatility and simplicity, not to mention it's ability to render life-like images

CGI

- CGI = Computer Generated Imagery
- 1982 Star Trek II is the first film ever to use CGI effects
- 1991 The Beauty and the Beats by Disney is first film to mix CGI and traditional animation
- 1995 Toy Story by Pixar is first feature length fully CGI animated film
- 1996 A Bugs Life by Pixar first major-motion picture to be transferred digitally from the computer's hard drive onto a DVD
  - All other movies had to be transferred from film to DVD

CGI vs RTR

- CGI is mainly used for 3D effects in film and TV
- Video games use real-time computer graphics or real-time rendering (RTR)

Computer graphics is a Sampling & Filtering process

- You need to look at your pixels to get a clear image
- You need to look at your texture
- And you should synchronise your time stamps

Computer graphics is a Sampling & Filtering process

Pixels: blury vs clear

Timeline

Texture: look at the back
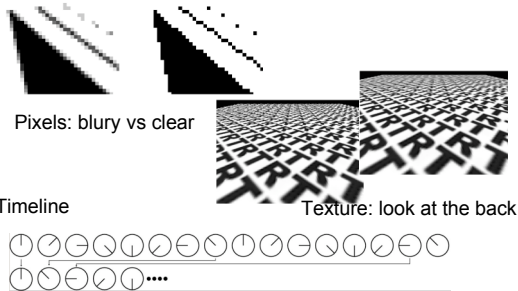
Rendering

- Digital rendering is a process that involves using a software program to generate an image from a previously created model
- 3D rendering is a creative process that is similar to photography or cinematography, because you are lighting and staging scenes and producing images

Rendering

- Rendering sometimes takes a long time, even on very fast computers. This is because the software is essentially "photographing" each pixel of the image
- The calculation of the colour of just one pixel can involve a great deal of calculation

CAD

- CAD = Computer Aided Design
- CAD is mainly used for detailed engineering of 3D models of physical components
- It is also used for the conceptual design and layout of products
- It's much cheaper and more convenient than building models

CAD
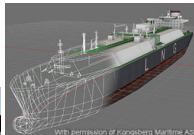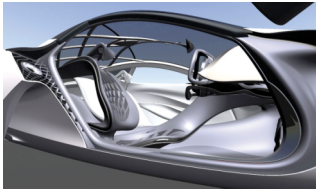
Autodesk - Maya

- High end 3D computer graphics and 3D modeling software
- Node-based 3D software (other form would be layer based)
  - Node-based means: entire composite is layed out as tree graph, linking media objects and effects in a procedural map

Maya and Animation

- Maya's core is written in C++
- Support for Python scripting was added
- Various Animations
- Path animation: controls the position and rotation of an object along a curve
- Skinning: Is the process of setting up a character's model so that it can be deformed by a skeleton. You skin a model by binding a skeleton to the model

Maya and Animation

- Motion Capture Animation
- Skeletons: Are hierarchical, articulated structures that let the animator pose and animate bound models. A skeleton provides a deformable model with a similar underlying structure as the human skeleton gives the human body
- Forward Kinematics (FK) is an animation method that involves moving each joint without the restriction of an expected final position
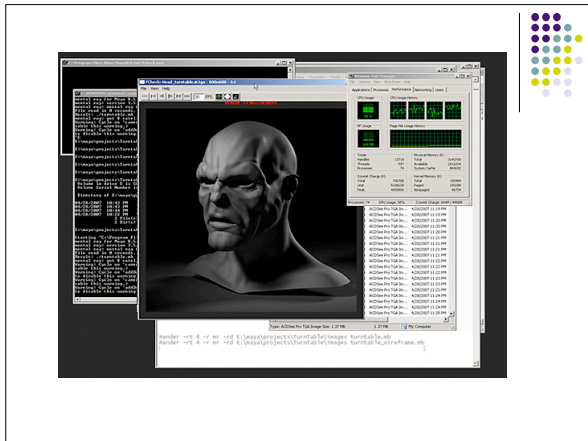
Blender

- Free 3D graphics application
- It can be used for modeling, texturing, rigging (skeletal animation), water simulations, skinning, animating and rendering
- Has a relatively small installation size and runs on several popular computing platforms

Blender Features

- Support for a variety of geometric primitives, including polygon meshes
- Versatile internal rendering capabilities
- Key-framed animation tools including inverse kinematics, armature, hook, curve and lattice-based deformations, morphing, non-linear animation, soft body dynamics including mesh collision detection

Rigging

Blender
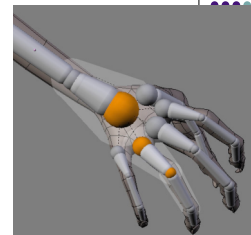
http://www.blender.org/

Pixar

- Pixar and Dreamworks Animation create most feature length animated films
- Pixar is renown for its inovations in the area of software development in film Animation

Fizt

- Fizt = Physics Tool
- Pixar invented it for their film Monsters Inc. (2001)
- Before it wasn't possible to animate certain realistic effects like hair blowing in the wind or a shirt moving with its wearer
- Fitzt makes it also possible to portray a wide variety of emotions in animated characters by enhancing facial expressions and the realism of body language

Fizt

- Developed by David Baraff and Andy Witkin of Pixar Animation Studios, Fizt is said to incorporate the natural laws of physics to control the behavior of virtual objects in computer animation
- Speeds up the production of special effects, in some cases by a factor of more than 150 to 1, and can also make the effects appear more life-like

RenderMan Interface Specification

- Is an API (application programming interface) developed by Pixar to describe 3D scenes and turn them into digital photorealistic images
- It's the highest quality renderer available anywhere and has been tested through successful use in feature films for over ten years (actually almost all movies using animations use RenderMan)

RenderMan's Shading Language

- RenderMan's powerful shading language and anti-aliased motion blur allow designers to believably integrate stunning synthetic effects with live-action footage
- C based syntax

Try it at home

- Blender: http://www.blender.org/
- Google sketchup: http://sketchup.google.com/

The making of an Animation film
http://www.dreamworksanimation.com/
Go to studio and Animation 101

Keypoints

- Films use CGI while Video games prefer RTR
- What is rendering
- Software to create animation uses mainly C/C++ syntax
- What different kinds of software are out there for animation