



COMP220: Graphics & Simulation

1: Introduction to Graphics and Simulation



Learning outcomes

By the end of this week, you will be able to:

- ▶ **Understand** the context of computer graphics and simulation in games.
- ▶ **Recall** some of the main areas of interest in graphics and simulation.

Computer graphics



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 - ▶ (Photo)realistic vs. stylised, e.g. cel shading
 - ▶ How light travels around the scene - **rendering**

Modelling



Image courtesy of Framestore

Modelling

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- ▶ Algorithms can be used to reduce model complexity without compromising appearance

Shading and rendering

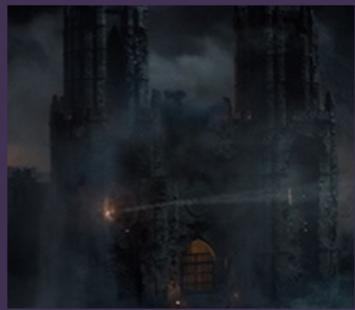


Image courtesy of Framestore

Shading and rendering

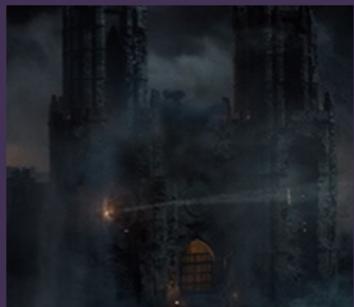


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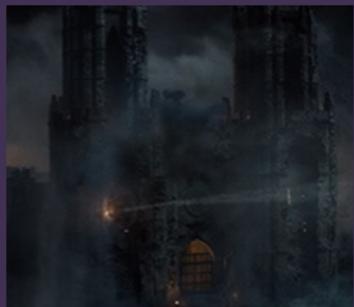


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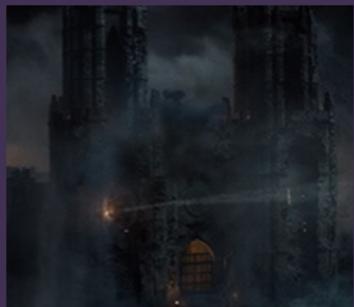


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- ▶ A variety of simplifications exist that approximate (some of) the full equation, e.g. Phong shading

Simulation



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 - ▶ Automating aspects of manual animation processes - e.g. **inverse kinematics (IK)**

Particle simulation



Image courtesy of Framestore

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- ▶ Computed one frame at a time, to account for **collisions**
- ▶ Can be used for fluid-like effects such as smoke

Rigid body dynamics



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- ▶ Global motion is computed as for particles...
- ▶ ... combined with local motion (rotation) about the object's centre of mass
- ▶ Commonly used for destruction sequences

Soft body dynamics

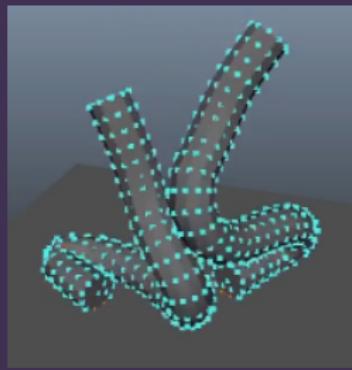


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Soft body dynamics

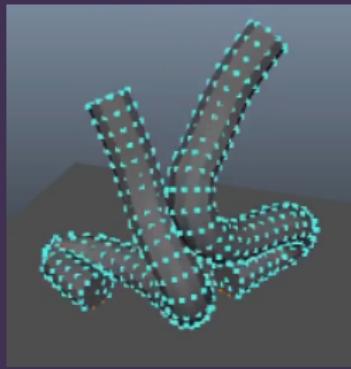


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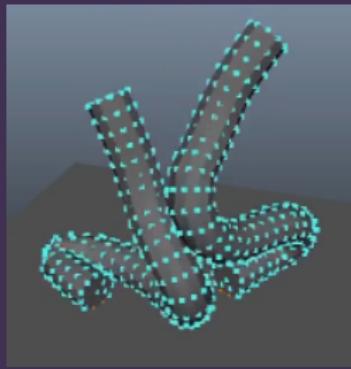


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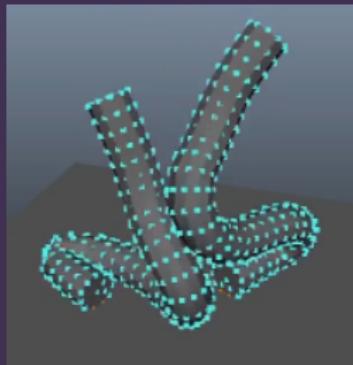


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- ▶ Often approximated using **constrained rigid bodies** and other techniques

Other types of dynamic simulation



Images courtesy of Framestore

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- ▶ These have their own equations and techniques...
- ▶ Beyond the scope of this module!

Rigging and animation

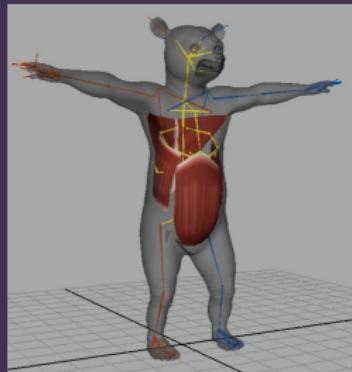


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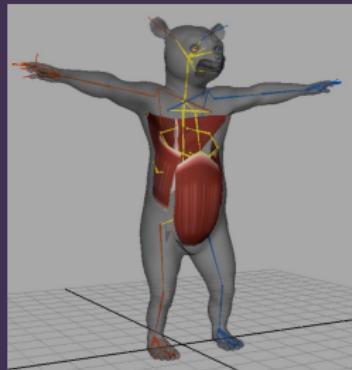


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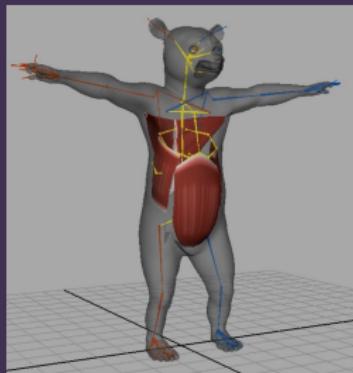


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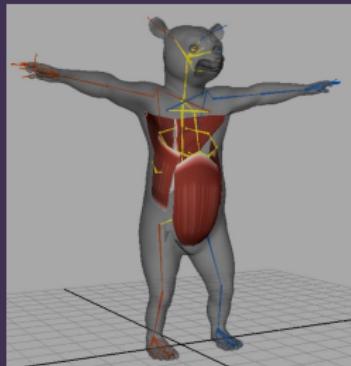


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- ▶ Key characters (and objects) are hand-animated by artists using a **skeleton rig**
- ▶ Positioning each joint would be a laborious process...
- ▶ Techniques such as Inverse Kinematics (IK) have been developed to automate certain aspects.

Context and applications



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 - ▶ statistical or experimental results

Applications

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- ▶ Optimisations are possible at each stage of the graphics pipeline
- ▶ Different applications require different balances of trade-offs; in games, speed is paramount (but detail is desirable!)

Next steps

Now you have a general idea of what graphics and simulation is about, and the factors to bear in mind whilst implementing the techniques,

- ▶ **Review** content from COMP270 on the graphics pipeline.
- ▶ **Research** the main topics within graphics and simulation to decide which areas you'd like to focus on for your artefact.