

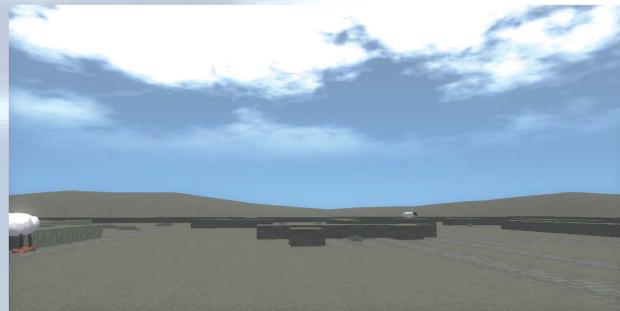
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## Objectives

- Provide a tool for teaching programming to students
- Must introduce the C programming language
- Must be visually appealing

Educators in the area of computer science constantly face the challenge of encouraging the next generation of students to engage in the subject of computer programming. Application numbers for degree courses are down, and potential candidates often view the subject as unglamorous. In this poster we introduce the Crossbow Engine which resides at the heart of "The Meadow", an educational game designed to teach students the fundamentals of computer programming in a novel and exciting way. "The Meadow" presents a visually rich virtual environment where the user writes programs to control the behaviour of a virtual sheep. By using modern 3D computer graphics techniques more commonly found in computer games, our goal is to help students to realise that computer programming can be an enjoyable and rewarding experience. "The Meadow" is a work in progress, and deployment is planned for later this year, when it will be used as a teaching aid in an undergraduate degree program.



## Introducing the Crossbow Engine

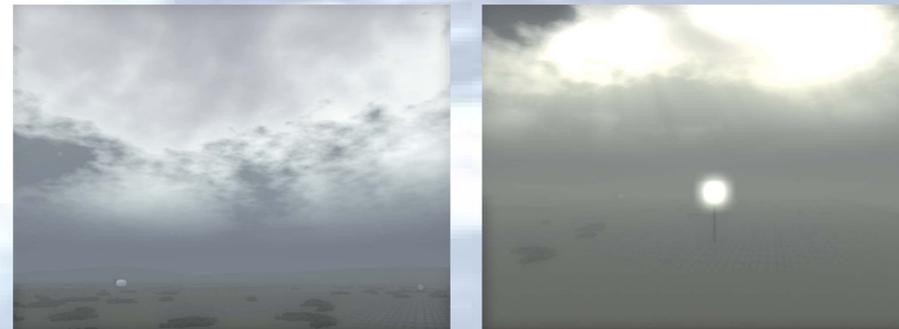
- Scene graph makes use of the visitor design pattern.
- Lua scripting interface for engine initialisation and management of user input
- Abstract machine for control of virtual sheep
- Rendering engine uses OpenGLAPI and NVIDIA Cg shaders

The Crossbow Engine is a compact game engine designed specifically for "The Meadow", yet it is flexible in design and offers a number of features common to more complex engines.

The main game engine is itself subdivided into a number of modules and supporting structures. The Crossbow Engine provides a GUI system, with basic window management and input/output methods. Scene management is achieved through a scene graph data structure, which makes use of the visitor design pattern. A virtual machine provides the actual control of the sheep, through its execution of C-Sheep compiled bytecode. Rendering is achieved with a rendering engine, which uses the programmable graphics hardware pipeline through NVIDIA Cg Shaders.

## Project Overview

- Aim to teach students to program in C
- Introducing "C-Sheep":
  - Mini-language
  - Subset of C
  - Controls behaviour of virtual sheep
- Using The "Crossbow Engine":
  - Provides environment for sheep
  - Uses modern game techniques



## Graphical Features

- High dynamic range lighting with automatic exposure control
- Sky simulation system with user-adjustable dynamic weather and haze levels
- Surface effects include: normal mapping, parallax mapping, fog/haze, water puddles in gaps between stones
- Post-processing effects: vignette, saturation, HDR-bloom, depth of field, motion blur
- For high-end graphics hardware: floating point frame buffer, and volumetric sun-beams

