

March 1, 2011 ~ Lecture 14

Where we are at in the course

- Only one person has a working account in SecondLife – need more! (Consider it part of HW#4)
We will probably do a session next week.
- Math and physics – which we haven't covered yet, but were supposed to – are somewhat important for graphics.

Rabin of the Day (Chapter 4.1, Mathematical Concepts)

- Trig functions: sin is opposite of cos. X comes from sin, Y comes from cos.
Remember, they each have inverse functions and trig identities can be helpful for calculations.
- Mathematicians write vector components with subscripts; programmers would use class fields.
- To convert from coordinate systems (object to world), multiply vectors by square matrices.
- Programmers often use 4x4 matrices to represent rotations and translations – very useful for embedding coordinate systems.
 - The Dot Product can find the angle between two vectors or the projection (shadow) of one vector onto another – useful for lighting.
 - The Cross Product of two 3-D vectors finds another vector perpendicular to both, a.k.a. orthogonal to the plane formed by the two vectors.
 - Transformation is the building block for using multiple coordinate systems.
 - To get a 3-D coordinate from a 4-D vector, divide the first three values by the fourth, called the w-coordinate.
- Many programming languages have a lot of these math concepts built in.

Parallel Concerns, Moving into Virtual Environments

- We would like to expand virtual environment software, which currently can show buildings, to be useful for outside locations.
- In a perfect world, the experts in 3-D modeling would be divided up so groups of students could learn from the experts to avoid a steep learning curve.
- CVE will be used for networking and our logical model.

Dr. Jeffery's Impromptu Lecture Material

Level 1 of modeling: Virtual Physical Model

- actual nuts and bolts of X and Y coordinates, locations in the 3-D viewer = very important for where things will be located in the environment.
- There is room for infinite adjustment to make the environment look more realistic.

Level 2 of modeling: Virtual Logical Model

- application-domain model for the game you're building.

The difference is how text adventures organize their rooms (logical model) compared to how rooms look in physical space. Each room has a role in the game: activity, puzzle, encounter, etc. Physical rooms have polygons and textures that need to be balanced to avoid spending too much time on unimportant graphics calculations. A logical model would not be bogged down with these details.

Raw Data

- Past projects have started modeling Janssen Engineering Building, but we get to work on pirate-themed environments instead.
- Floor plans give X and Y coordinates, and Z coordinates could be added to make a 3-D model. Additional subfeatures could then be added in to refine the model.
- We could spend a whole semester doing graphics for realistic avatars, without ever getting to places or adventures. Instead of starting from scratch, we would like to find and understand some technology that can do it for us.
- In our pirate worlds, each place could have its own coordinate system and origin. Or we could define a standard coordinate system for the whole world to connect the game's world together.

Room Modeling

- In the CVE, the Room class refers to one rectangular area. Its "inventory" describes obstacles and decorations.
- For non-rectangular areas, put some Rooms together with the wall(s) between them cut out as openings.

March 3, 2011 ~ Lecture 15

Rabin: 3D Graphics (Chapter 5.1, Graphics)

- Info about shaders is a bit outdated.
- Hardware may simplify graphics all into triangles, especially in modern graphics cards.
- “Materials” in OpenGL define surfaces by specifying the color, lighting styles, texture, and other elements (more specific than Rabin).
- Meshes are polygons stitched together to represent one object.