Computer Graphics

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ICL/ITRI

Assignment #2

Geometrical Transformations

Viewing Transformation

Projection Transforms

Requirements

- You are required to use the framework that TA provided to do some transformations, such as geometrical, viewing, and projection, on the input 3D models.
- Interactive control is required. That is, re-display immediately after the control is done.

Requirements

modify boxC.obj to draw floor
need to draw two objects this time

- Design a "world" that can load a specific model
- The "world" should contain a base floor (a cube with y scale is smaller than x and z scales)
- Set the vertex colors so that the cube is displayed with the color you assigned as follows

Requirements

- Design a “world” that can load a specific model
  - Load a specific model like the assignment #1
  - Place the model properly “above” the base floor

  - Switch different model as in assignment #1

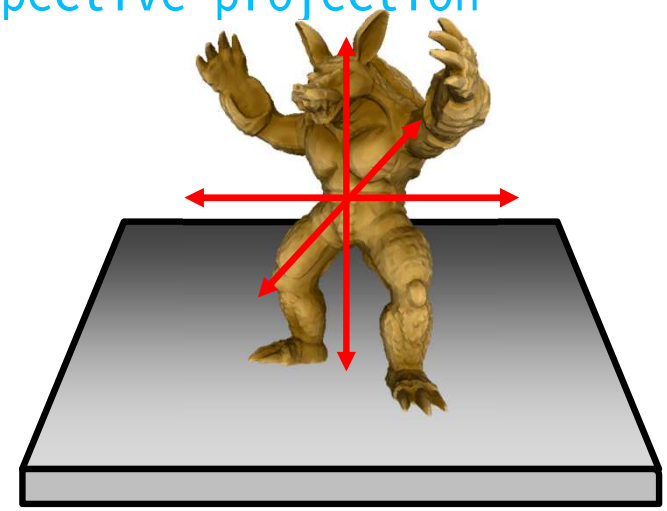
Requirements (cont.)

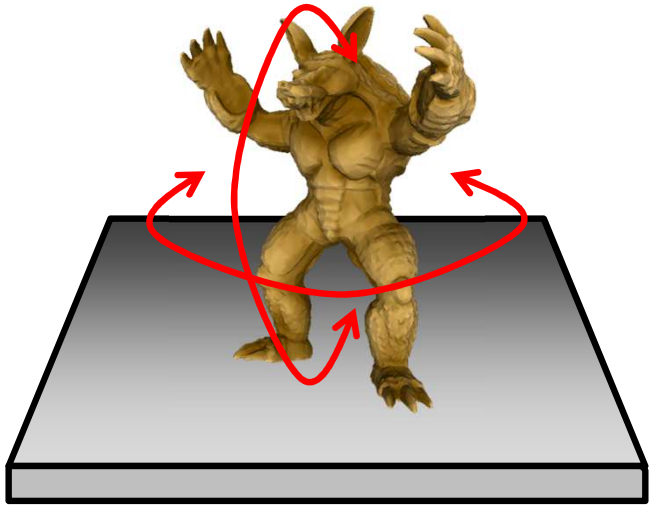
- Set the default viewing direction to view from positive Z to origin
- Set the default projection to parallel projection
- Use keyboard and mouse to do all the required transformations

The floor should not move

In parallel projection, the floor is only a triangle

This is perspective projection





Requirements (cont.)

- **Transformation: use the following keys to switch modes and activate operations**
  - **Mode switch**
    - **“g”: geometrical transformations**
    - **“v”: viewing transformation**
    - **“o”: parallel (orthographic) projection**
    - **“p”: perspective projection**
  - **In geometrical transformation mode**
    - **“s”: scaling factors input (s_x, s_y, s_z)**
    - **“t”: Translation offsets input (t_x, t_y, t_z)**
    - **“r”: Rotation angles input (θ_x, θ_y, θ_z), in degrees**

Requirements (cont.)

- In viewing transformation mode
  - "e": eye coordinates input (e_x, e_y, e_z)
  - "c": center coordinates input (c_x, c_y, c_z)
  - "u": up vector input (u_x, u_y, u_z), in degrees
- In parallel or perspective projection modes
  - input (*left*, *right*, *bottom*, *top*, *near*, *far*)
- "i": Display information such as model name, mode (transformation/projection), active operation (e.g. changing scale factors (1.2, 1.2, 1.2)), etc., in the console window

Requirements (Cont.)

- Use mouse buttons to adjust the values
  - Eg., in geometrical transformation mode, set transformation to translation (by pressing the key “t” first to activate the operation)
    - left mouse button down: drag horizontally for x offset; drag vertically for y offset
    - Middle wheel for z offset
  - Eg., in viewing transformation mode, switch to eye coordinates input (by pressing the key “e” to active the operation)
    - left mouse button down: drag horizontally for eye x coordinate; drag vertically for eye y coordinate
    - Middle wheel for eye z coordinate

Requirements (Cont.)

- Use mouse buttons to adjust the values
  - Eg., in projection transformation mode,
    - left mouse button down: drag horizontally for left-right boundary scaling; drag vertically for bottom-top boundary scaling
    - Right mouse button down: drag horizontally for moving near clipping plane; drag vertically for moving far clipping plane

Requirements (cont.)

- Follow the guidelines that TA provided to write the required transformations codes such as geometrical, viewing, and projection, based on the input controls (keyboard, mouse).
- Apply those transformations into the vertex shader codes to achieve the corresponding operations

Requirements

- All the transformations (geometrical, viewing, projection) should be implemented
  - Geometrical transformation – translation, scaling, rotation
  - Viewing transformation – similar to gluLookAt function
  - Projection – parallel and perspective projection, similar to glOrtho and glFrustum (or gluPerspective)

Input Model Format

- **Wavefront 3D Graphics color models as in assignment #1**

Hints

- Use assignment #1 as the basic foundation to revise and add the functions required in assignment #2
- Use the boxC model and modified it for the base floor
- For geometrical transformation, it should apply to the model only
- For viewing transformation, it should apply to both the model and the base floor

Hints

- You have to illustrate your control clearly so that TA can justified the correctness of your implementation
- You are required to demonstrate the implementation yourself to TA if there is a need
  - Operations incorrect
  - Insufficient documentation for the operations
  - Book the time with TA if you would like to showcase any fancy operations you have done

Due Date

- Two weeks after announcement. (Should be 4/12)
- Submit your assignment, source codes, executable binary on PC, and your documentation, to course webpage at NTHU iLMS system.
- Contact with TA if you don’t know how to submit your work.
- Late submission is allowed with less score
- No score if you don’t submit you assignment
- If you copy from others, your score will be down-graded or become zero.

Q&A