Computer Animation I

Assignment 2: Animating with basic expressions

In this assignment, you are to animate a simple camera move using a Maya ***expression***. An expression is a small computer program written within Maya that can set transformation values ***procedurally***. Using the same project folder as was used in assignment 1, you are to pick a starting and ending camera position then write an expression to animate the camera's transformation values over time. Your starting camera position should appear on frame 1, your ending position on frame 100.

This assignment is intended to give you experience with:

- the mathematics of interpolation,
- writing basic expressions within Maya, and
- setting the start and end frame of a Maya scene file.

The relevant sections of the Maya PDF manual (available on the handout folder on urza) for this assignment are in the book "MEL and Expressions," chapter 9 (the beginning) and chapter 17 (for expression function reference).

Step 1: get a local copy of the project folder from urza, run Maya, set the project folder, and load the scene file

- This is the same as steps 0-3 from assignment 1.

Step 2: set the scene's frame range

- At the bottom of the Maya window is the timeline. There are two boxes on the left (with 0.0 in them) and two on the right (both have 10.0 in them). Change the 0s to 1's in the left boxes, and change the 10s to 100s in the rightmost boxes.

Step 3: pick a starting camera station and take note of the camera's transformation values

- Tumble and move the camera however you like until you like what you see.
- Go to **Window->Outliner** and the scene outliner will appear. Click on the **main_camera** node, then go and show the channel box for the camera by clicking the icon in the upper right corner of the Maya interface.
- Write down the Tx, Ty, Tz, Rx, Ry, Rz values for the camera.

Step 4: pick an ending camera station, too

- This assignment will be easier if you vary only one degree of freedom of the camera between your starting and ending stations. If you are feeling ambitious, you can change all 6 degrees of freedom.
- An easy way to change only one degree of freedom is to manually enter the new value into the appropriate camera channel.
- Another way would be to look at the scene through the persp window, select the move or rotate tool, and grab only one of the red, green, or blue manipulator curves surrounding the camera.
- Write down the Tx, Ty, Tz, Rx, Ry, and Rz values of the ending camera.

Step 5: open the expression editor

- Open the expression editor by going to **Window->Animation Editors->Expression Editor**.
- In the upper left of that new window, go to **Select Filter->By Object/Attribute Name**.
- You should see the main_camera listed under "objects."
- The big open box at the bottom of that window, labeled "Expression:" is where you write.

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Step 6: do the math on paper

- You know that the camera has to have its starting xform values at frame 1, and its ending xform values at frame 100.
- The equation of a straight line is

$$y = mx + b$$

- Since you will be animating a channel value (or values) over ***time***, your dependent variable y is simply the appropriate channel value, and the independent variable x is the frame number.
- Given a starting y, ending y, starting time, and ending time, derive an equation for m and an equation for b.
- One way of doing that is to use the fact that you can write two versions of the above equation that must be valid, namely, the equation for when x = 0 and the equation for when x = 100. You know those answers because you wrote down the xformation values at those times.
- The two resulting equations will have two unknown variables in them (m and b). You can rearrange one equation for either m or b, then plug that answer into the other equation.

Step 7: write the expression that does what you want

- To refer to main_camera's y rotation, for example, you use **main_camera.rotateY** in the expression editor.
- To access the current frame number, you use the predefined variable **frame**.
- Here's an example of what a simple expression would look like for the y rotation:

```
main_camera.rotateY = 2.5 * frame + 10.0;
```

- This is just y = mx + b, with a slope (m) of 2.5, and a y-intercept (b) of 10.0.
- The semicolon is required to mark the end of an expression in Maya.
- Once you've typed in your expression, you hit "create" at the bottom of the window and, if you didn't make a mistake, your expression will be applied!
- Note that you can use variables within the expression editor. Here is another expression that does the same thing as above, but it's broken down into multiple lines for clarity:

```
float $slope = 2.5;
float $yintercept = 10.0;
main_camera.rotateY = $slope * frame + $yintercept;
```

- Use parenthesis to explicitly control the order of operations. Here's an example that adds 3 and 5 before multiplying by 2 (if there weren't any parentheses, the answer would be 13):

```
main_camera.rotateY = (3 + 5) * 2;
```

- Those of you who want to explore different forms of interpolation or other functions within the expression editor, see the documentation in chapter 17, mentioned above. Functions you might enjoy are **linstep(), smoothstep(),** and **hermite().**

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Step 8: view your resulting procedural curves in Maya's graph editor

- With the main_camera selected, go to **Windows->Animation Editors->Graph Editor**.
- If you have an expression on any of the channels, they should appear on the left under the main_camera name.
- Select the channel(s) you want to graph, and then go to **View->Show Results** from the graph editor menu.
- You may also want to go to **View->Frame Playback Range** so that the view of the graph editor is confined to the playback range.

Step 9: save and hand in your scene file, then clean up.

- Go to **File->Save Scene As** and save your scene named as follows: **yourname**.a2. It doesn't really matter if it's a Maya ASCII file (.ma) or Maya binary file (.mb).
- Drop your finished scene into the handin folder. If you want to save a copy of it (recommended), you should also drag a copy into your shared folder.
- When you're done, please drag any files you left around into the trash.