



Integrating Water Elements into Architectural Renderings Using Particle Flow - Step-by-Step

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VI5194-L Many architectural structures incorporate a water feature as a prominent visual component of the structure. This exciting class explains how to implement 3ds Max Particle Flow for architectural use. This class takes you through the creating water fountains, waterfalls, and other water features architects like to use. We will cover creating particle flow networks to simulate water flow and using space warps to affect the motion of the particles. We will also cover the point cache and particle rendering.

Learning Objectives

At the end of this class, you will be able to:

- Create particle flows to simulate fountains and other water features.
- Use space warps to create custom effects with particle flows.
- Add point cache to effectively work with large numbers of particles.
- Apply materials and render particle systems using the mental ray® renderer.

About the Speaker

Steven attended R.I.T.'s film/animation in 1989 & A-B Tech's Entrepreneurship in 2011. Opened Spectralight Images in 1989 to deliver 3D training and animation. Moved to Orlando, FL in 1990. As VP of Computer Animators Plus (1995) began teaching 3D at Seminole State College. With a love of art, opened Gallery 611 in 1997, and formed the Orlando Visual Artists League in 2000, president until 2004. In 1998 he became an Autodesk® training specialist, and has contributed to Autodesk's certified training material for 9 releases of 3ds Max®. He was a co-developer of Autodesk's ACI Program, and Autodesk's 3ds Max® fundamental standards. Now he develops 3ds Max / Maya training courseware for CAD Learning's online training. Spectra3D Technologies provides 3ds Max, Maya & AutoCAD training. Steven teaches classes for end users, companies, Autodesk University, & others. Past trainees: Disney, Guess, US Army, and more. In 2014 Spectra3D Technologies expanded into 3D printer sales and support offering an array of 3D printers, design services and 3D printing training.

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Step by Step

Configuring the Collision Objects

1. Open **09_Pflow_Fountain_01.max**.
2. Select the **Granite Sphere** object in the middle of the fountain.
3. In the Command panel, click the Modify tab.
4. Expand the Modifier List drop-down and choose the **PFlow Collision Shape World Space** Modifier.
5. Set the **Restitution** to a value of 0.5.
6. Keep the friction extremely low; set the value for the **Static Friction** to 0.1.
7. Set the **Dynamic Friction** to 0.1 as well. This will allow particles to gently slide along the surface of the sphere.
8. Before activating this modifier, make sure the Shape is set to **Sphere**. This will use a mathematically defined sphere to calculate the collisions.
9. Once those options are set, click **Activate** to turn this into an active Particle Flow simulation object.
10. Click the **Create Panel, Spacewarps**, then select **Deflectors** from the Spacewarps dropdown.
11. Select the **UDeflector** object type.
12. In the **Fountain_Cam** viewport, click and drag to create a **UDeflector** Object.
13. Change the **Modify** panel..
14. In the **UDeflector Basic Parameters**, Click the **Pick Object** button and select the **Fountain Water** object that is in the fountain.
15. Set the **Bounce** value to 0.3.
16. Change the **Friction** value to 0.6.

Creating a Particle Flow

To start here use: **09_Pflow_Fountain_02.max**

Add a PFlow object

1. In the **Command** panel, click the **Create** tab.
2. In the **Create Geometry** drop-down, choose **Particle Systems**.
3. Expand the **Object Type** rollout and select **PF Source**.

4. In the **Fountain Cam** viewport, click and drag on the **upper left side** to create a small **Particle Flow Source** object. In this case, the size does not make any difference.
5. Now in the **Command** panel, switch over to the **Modify** panel.
6. With the particle flow **Source Object** selected, click **Particle View** in the **Setup** rollout to open the **Particle View** dialog box.

Event setup

Editing events

7. Click the **Birth** operator in the first event.
8. Set the **Emit Start** to **frame 0**.
9. Then, set the **Emit Stop** to **frame 500**.
10. Since this particle system will be a fountain, you use a particle rate instead of the total amount of particles.
11. Under **Options**, select **Rate**, then set the Rate **value** to **300**.
12. Make sure the **Subframe Sampling** option is selected. This will cause 3ds Max to sample the particles between frames, making the birth of the particles more consistent.

Adding Operators

13. From the **Operator** toolbox, click and drag the **Position Object** operator on top of the **Position Icon Operator** in the event. You'll see a red line going through that operator, which means that operator will be overwritten.
14. Click the **Position Object** operator you just added.
15. In the **Position Object** rollout, you need to add emitter objects.
16. Click **By List** just under **Emitter Objects**.
17. In the **Select Emitter** objects list, hold **CTRL** and choose both the **Pillar 1** object and the **Pillar 2** object, and then click **Select** in the lower right corner of the dialog.
18. That adds these two objects into the **Emitter Objects** list.
19. Check the **Subframe Sampling** checkbox to make the particle emission smoother and more consistent.
20. In the **Location** group, expand the **Location** drop-down and choose **Selected Faces**.
21. Next, click and drag the **Speed By Surface** operator on top of the **Speed** operator in the **Event** and overwrite it.
22. Now click the **Speed By Surface** operator in the event. Here, you set the speed of the particles that will be emitted from each pillar.
23. In the **Speed By Surface** rollout, expand the **Set Speed** drop-down and choose **Set Speed Once**.
24. Set the **Speed** to a value of **10 feet** and the **Variation** to a value of **1 foot**.

25. Click **By List**.
26. From the **Select Surface Objects** dialog box, press **CTRL** and select both **Pillar 1** and **Pillar 2**, and then click **Select**. This adds the two pillars to the Surface Geometry list.
27. Check **Subframe Sampling**.
28. In the **Direction** group, expand the **Direction** drop-down and choose **Surface Normals**.
29. Set the **Divergence** value to **3.0**.
30. Now select the **Rotation** operator in the event.
31. In the **Orientation Matrix** drop-down, change the **Orientation Matrix** option to **Speed Space Follow**.
32. Change the **Z** value to **1.0**.
33. Select the **Shape** operator from the **Event**.
34. In the **Shape Operator** parameters expand the **3-D Shape** drop-down and choose **Diamond Long**. This is a simple shape with eight faces, which will help reduce the polygon overhead when the scene is rendered.
35. Change the **Size** to **0.5 inches**.
36. Select the **Scale** checkbox and leave the **Scale** value at **100%**, but change the **Variation** to **5%**.
37. Now click the **Display** operator in the **Event**.
38. Expand the **Type** drop-down and select **Lines**.
39. Click the color swatch and set the color to a light cyan by setting the **Red** value to **9**, the **Green** value to **215**, and the **Blue** value to **180**.
40. Then click **OK** to accept the color.

Particle Simulation and MassFX

To start here use: **09_Pflow_Fountain_03.max**

1. From the **Operator** list, click and drag the **MP Shape** operator beneath the shape operator in the particle flow **Event**; you will see a blue line appear at the bottom of the shape operator.
2. Make sure the **MP Shape** operator is selected, and from the **Collide As** drop-down, make sure **Convex Hull** is selected.
3. Next, set the bounce and friction values.
4. Set the **Restitution** value to **0.2**.
5. Set the **Static Friction** to **0.1**, and the **Dynamic Friction** to **0.1** as well.
6. Click and drag the **MP World** operator to the bottom of the event.

7. Select the **MP World** operator.
8. If the option in the **MP World Driver** says "**None**," click the **Create New Driver** button.
9. Once a **New World Driver** has been created, click the **arrow** icon, which is the **More** button, to the right of the world driver name.
10. In the **mP World** parameters, make sure the **Apply Gravity** option is checked.
11. Minimize the **Particle View** dialog box.
12. Click the **Play** button and watch the particle flow as it is currently configured.
13. **Stop** the animation, and go to **frame 0**.

Adding Collisions and Tests

14. Make sure the **Particle Flow** object is selected, and the **Particle View** dialog box is open.
15. From the **Operators** list, click and drag the **MP Collision** operator to the bottom of the **Event** in the particle flow.
16. Click the new **MP Collision** operator.
17. In the **MP Collision** parameters, click the **Add** button.
18. This allows you to click directly on the **Granite Sphere** in the **Fountain Cam** viewport.
19. Click the **sphere**, and it is added to the **Deflectors** list.
20. Select the **Test True If Particles** option, make sure that the **Collides** option is chosen.
21. Click and drag a standard **Collision** operator below the **mP Collision** Operator.
22. Click the second **Collision** operator.
23. This time, click **By List**, select the **UDeflector** object and click **Select**.
24. In the **Test True If Particles** group, make sure the **Collides** option is set and the **Speed** option is set to **Stop**.

To start here use: 09_Pflow_Fountain_04.max

25. Click and drag a **Spawn Test Event** to an **open area** underneath the initial **Event**. This will create a new spawn event that contains a spawn operator, as well as a display operator.
26. Click the **Spawn** operator in the new **Event**.
27. In the **Spawn Rate and Amount** group, select the **Once** option.
28. Set the **Offspring** number to **2**, and set the **Variation** percentage to **40%**. This will create two particles for every one particle that collides with the sphere.
29. Expand the **Sync By** drop-down and select **Particle Age**.
30. In the **Speed** group, choose the **Inherited** option to set the speed to be inherited from its parent particle.

31. Leave the **Inherited** number set to **100**.
32. Set the **Variation** percent to a value of **10%**.
33. And set the **Divergence** to a value of **30**.
34. Click and drag a new **Speed By Surface** operator into the second **Event** beneath the **Spawn** operator.
35. Select the **Speed By Surface Event**.
36. Expand the **Speed By Surface** drop-down and select **Set Speed Once** if it is not already selected.
37. Set the **Speed** value to **4 feet**, and the **Variation** to **6 inches**.
38. Click the **Add** button, and choose the **Granite Sphere** to add it to the **Surface Geometry** list.
39. Check **Subframe Sampling**.
40. From the **Direction** drop-down, choose **Surface Normals**, and set the **Divergence** value to **5.0**.
41. Select the **Display** operator in the second **Event**, and change the **Type** to **Lines**.
42. Choose the **Color** swatch, set the color to a bright yellow.
43. Change the **Red** value to **225**, the **Green** value to **225**, and the **Blue** value to **10**, and then click **OK** to accept the color.
44. To accomplish this, click the **MP World** operator in the first **Event**, then right-click and select **Copy**.
45. In the second **Event**, right-click just below the **Speed By Surface** operator and choose **Paste Instanced**. You should now see that both MP World operators are in italic, indicating they are instances of each other.
46. Left-click the **Collision** for the fountain water in the first **Event**, then right-click and select **Copy**.
47. Right-click at the bottom of the second **Event** and **Paste** the Collision operator.

Adding a delete event.

48. Click and drag **Delete** to an open area below the second **Event**.
49. From the first **MP collision** operator in the first Event for the granite sphere, click and drag from the **Output** of the **Test** to the **Input** of the second **Event**.
50. Then, click and drag from the **Output** of the **Collision** for the fountain water in the second **Event** to the **Input** for the third **Event** in order to delete the particles.
51. Lastly, **drag** from the **Collision** operator for the fountain water in the first **Event** down to the **Input** of the third **Event**. This will delete any stray particles that bounce off of the sphere and hit the water directly.
52. In any viewport, click to select the **PF Source** object.
53. Open the **Modify** Panel, then open the **System Management** rollout.
54. Change the **Integration Steps** for the **Viewport** to **1/4 Frame**, and the **Render** to **1/8 Frame**. This will provide adequate temporal resolution for the current particle flow. Keep in mind that you

don't need the same quality for the viewport, since it is just a preview of the rendered particle system.

55. To see this particle flow in action, **minimize** the **Particle View** dialog box and click **Play**.
56. **Stop** the animation and go back to **frame 0**.

Caching particles

57. You may have to scroll to the right in the **Operator** list.
58. Click and drag the **Cache Disk** operator to the **PF Source Event** just below the **Render** operator. This will cause the cache to work on the entire flow.
59. Select the **Cache Disk** operator.
60. From the **Sampling** drop-down, choose **Every Nth Frame**.
61. Change the **N** value to **2** and select **Save Cache With File**.
62. For this cache, Click the Select Files button.
63. Navigate to the **Scenes/Cache** folder, enter **Fountain** into the **File Name** and click **Save**.
64. In the Particle Flow Tools dialog, click **Yes** to use the current location at the default cache location.
65. In the **Update and Reset** group, click **Update** to update the cache. At this point a cache generation progress dialog opens to show you the elapsed time and time remaining for the cache process.

Applying materials

Creating and assigning a water material

To start here use: **09_Pflow_Fountain_05.max**

1. Click and drag the **Material Static** operator into the **PF Source** event just below the **Render** operator. This will apply the same material to all the events with in this particle flow.
2. To choose the **Material Static** operator, click the **Assign Material** button on the parameters panel. This will open the Material/Map Browser.
3. From the **Material/Map Browser**, in the **Mental Ray** material rollout choose the **Autodesk Water** material.
4. From the Main Toolbar, open the Slate Material Editor.
5. Click and drag the material from the Material Static operator into the slate material editor.
6. Choosing Instance from the Instance (Copy) dialog. Using the instance option, any changes made will affect the look of the particles.

7. In the Material Editor, double-click the Water material.
8. Set the wave height to 0.0. This will set the water to work better for the particles in the fountain.

Rendering the Fountain

Creating a preview

1. Right click in the camera viewport to make it the active view port.
2. In the **Tools** menu, **Preview - Grab Viewport** option, select **Create Preview Animation** option to open the Make Preview dialog box.
3. In the **Make Preview** dialog, **Preview Range**, keep the **Active Time Segment** selected, and leave everything else at the defaults. You can change the Visual Style to render the viewport using a style like Color Ink or Wireframe.
4. In the **Output** section click on the **Choose Codec...** button.
5. From the **Video Compression** dialog that pops up, use the **Microsoft Video One** codec and click OK. You can choose a different CoDec if desired, depending on what is installed on your particular computer.
6. Make sure the **Render Viewport** is set to **Fountain_Cam**.
7. Click the **Create** button. 3ds Max will take a little while, and you'll see the time slider progressing through the frames while the preview is created.

Rendering with Mental Ray

Setting Motion Blur

8. To setup motion blur, select the **PF Source** object.
9. Right-click on the particle system, and choose **Object Properties** from the right click menu.
10. At the lower right of the **Object Properties** dialog, set the motion blur to **By Object**. This will override the layer settings and use the objects motion blur options.
11. Make sure the **Enabled** checkbox is checked, and the **Object** option is chosen, click OK to close the dialog.

Render a Low Resolution Animation

12. Click **Render Setup** from the Main menu to open the Render Setup dialog.
13. In the **Time Output** section of the Common panel click the **Active Time Segment** option.
14. Set the file location in the **Render Output** section by clicking on the **Files...** button.
15. This opens directly into the render output directory of the current project folder.
16. Navigate to the **renderoutput** folder of the **3ds Max Project** folder.
17. In the file name, type in **Fountain_.png**, then click save.

18. In the **PNG Configuration** dialog, set the colors to **RGB 24 bit**, and since there will be no need to render with an alpha channel, uncheck the **Alpha channel** option and click OK.
19. Switch over to the **Renderer** tab.
20. Make sure the **Sampling Mode** is set to **Unified / Raytraced**.
21. In the **Samples per Pixel** area, leave the **Quality** set to 0.25, set the **Minimum** value to 0.25 and the **Maximum** value to 32.
22. Leave the **Contrast / Noise Threshold** values at 0.2 for all the channels.
23. Open the Camera Effects rollout, ensure that the **Motion Blur** option is enabled.
24. Change the number of **Motion Segments** to 3. This will increase the accuracy of the motion blur at render time. Keep in mind that higher values will increase rendering time.
25. Make sure the Fountain_Cam viewport is the current render view and click the render button.

