

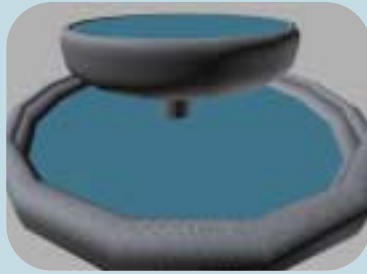
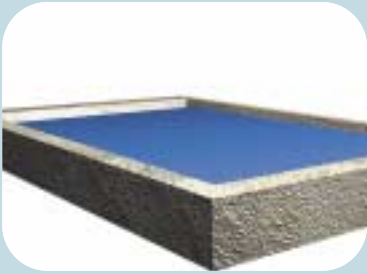
MAKING A WATERFALL OR FOUNTAIN

Objective:

To produce a rendered image of a water feature with flowing/falling water, such as a fountain or fall.

Inputs:

- 3D geometry of basin, container or topography
- Digital images of textures for surfaces, including water
- a Particle animation system



Step 1.

Assemble source material.

1a. Acquire or generate 3D geometry. For natural water features, this is just the topo map or grading plan, but it may be augmented with cross sections or specific 3D models of boulders, basins, cast-concrete features, etc

1b. If the water feature involves a basin, or pool, etc, you should be careful to generate the void, possibly by using boolean subtraction operations. You will also want to create a solid volume of water to fill the basin. This may also be done with boolean operations. You will have to specify the top elevation of the water volume, keeping it at a specific depth, just below the lip of the basin, or as needed.

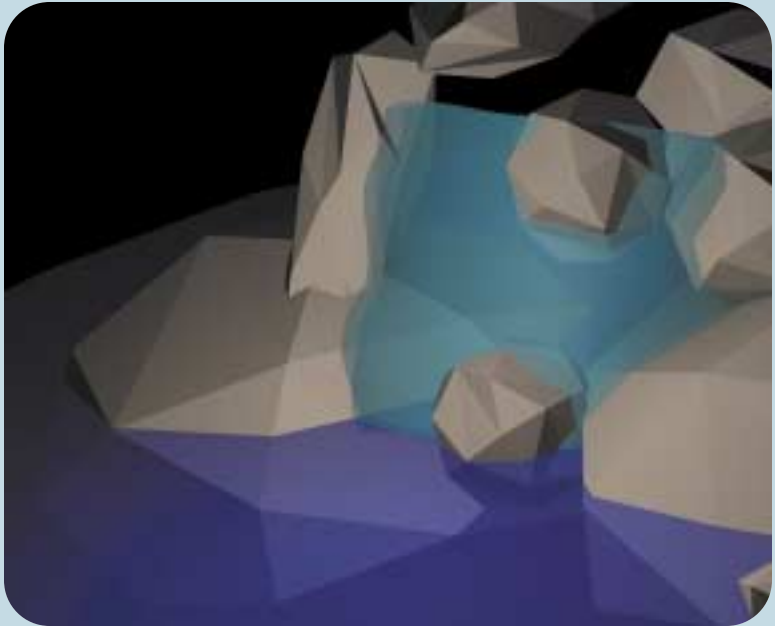
1c. Acquire digital images of textures by scanning or by capturing with a digital camera, etc. Water images may be useful for textures of water surfaces.

Step 2. Apply textures to geometry for all the non-water elements.

Step 3. Apply water textures, colors, transparency, and reflectivity to water elements. Reflection is an “expensive” (time-consuming) operation in ray-tracing, so it is best to limit its use to those areas or elements where its visual effect is essential, such as the basin or pool at the bottom of a fountain or fall. Two-layer surfaces may be effective for water surfaces, with a top layer more transparent, revealing a second more colorful layer.

Step 4. Make a test rendering, and adjust eye position, camera, and lighting parameters for best visual effect, highlighting desired features and providing sufficient detail in areas of interest.

Step 5. Adjust 3D geometry if needed, to align surfaces, obscure or reveal views, etc. Often the addition of a few boulders at the foot of a natural water feature adds realism.



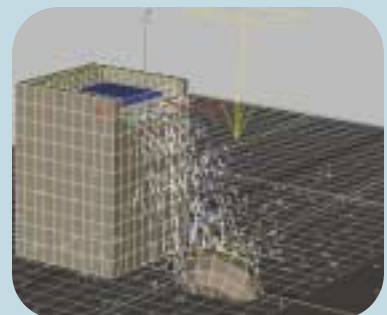
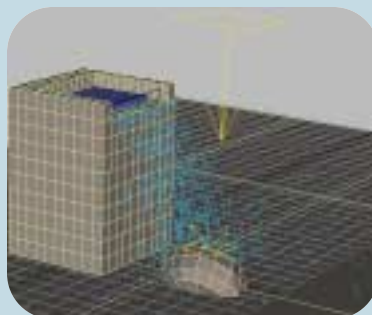
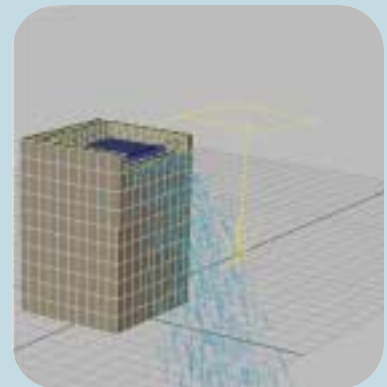
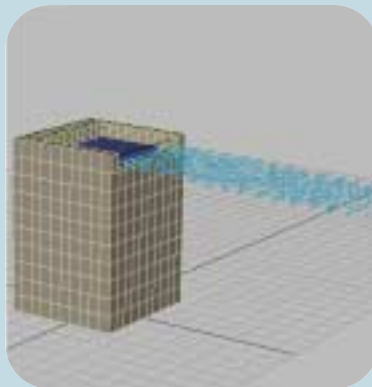
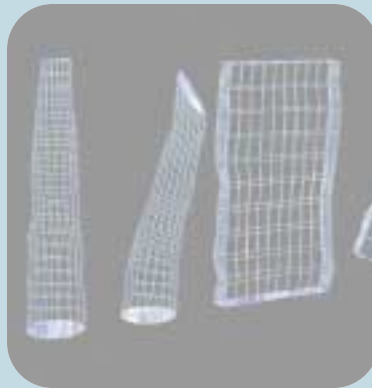
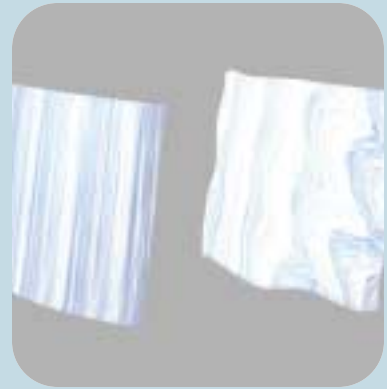
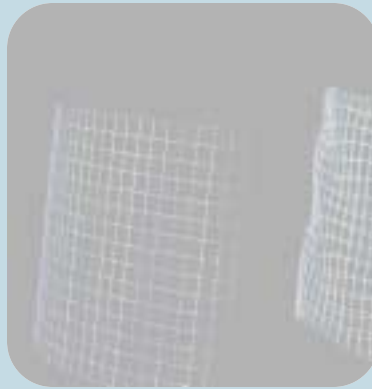
Step 6. Add falling water. This may take the form of solids and/or particles.

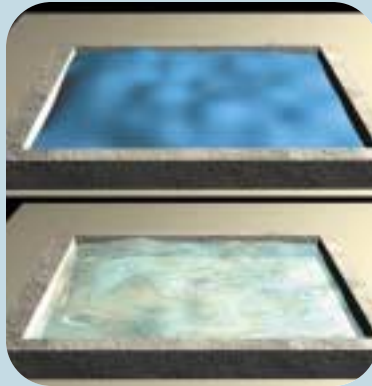
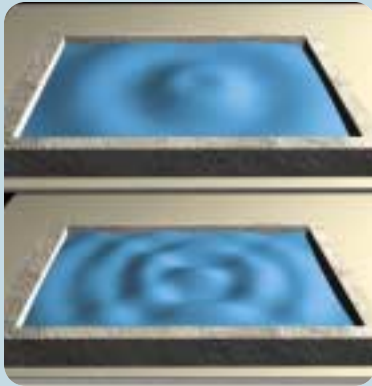
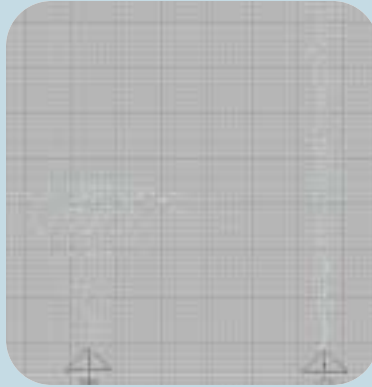
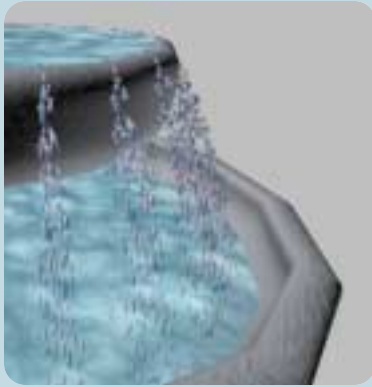
6a. Solids. Use cylinders, sweep operations, and various 3D modifiers to add bends, twists and taper to create realistic rivulets, streams, or sheets of water. Multiple layers and intersecting objects can add realism. Add water textures and transparency.

6b. Solids/Animation: For animations, vary the parameters of twist and taper over time, to give the effect of undulating water.

6c. Particles: Use available particle system to create a stream of particles alone, or in combination with transparent solids. Create several emitters of correct shape and position to generate particle stream, whether a focused spray, or sheet, etc. Use available deflectors or trajectory controls to simulate effect of gravity, pulling stream down. Vary the settings of particle generation and force to achieve desired effects. For most water features, very dense particle generation is appropriate.

6d. Particles/Deflectors: Use deflectors located along with 3D geometry to cause rocks, boulders, ledges, and basin lips to splash or deflect water for most realistic effects.



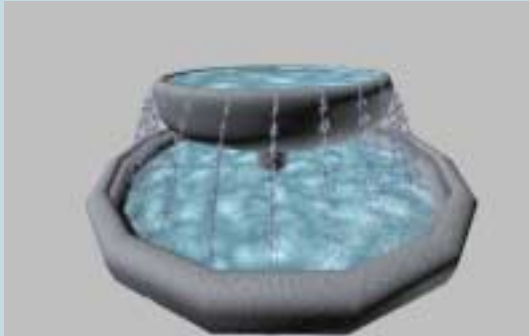


6e. Particles/Animation. Use available particle generation parameters, varied over time, to give realistic effects of undulation. Use random emissions if possible, and take advantage of any special water effects such as pulsing or swirling, etc. Some particle systems may have additional effects such as motion blur which can be added.

Step 7. Add ripples and waves. You may want to add rippling or wave characteristics to surfaces and solid streams of water, to add to their dynamic appearance over time in animation. Any sheets of water, or pools, etc., should have some surface undulation. You should add one or more concentric waves emanating from the point of contact of any water falling into the pool.

Step 8. Add bubbles and foam. You may be able to use particle systems for bubbles, associated with the streams of water or their point of impact. Foam can be added as a photographic texture on organic shaped blobs near the point of impact, or along the edges of pools or basins.

Step 9. Add background imagery as desired and, after creating animation, add water sounds if appropriate.



A two-tiered fountain with curved basins created by solids of revolution; surfaces of water in the basins; and particle system sprays falling from upper basin to lower.



A fountain with a large rectangular basin below, and a water spout coming from a channel set into a brick wall above. The water stream is a modified-cross-sectional sweep; the water in the basin below is several layers with transparency and rippling.



Waterfall created with large boulders and solid water; water is created as a curved nurb surface, with a streaky water texture map applied. Water in the pool below is a simple surface of transparent blue, with reflectivity, foam and ripples.



Waterfall created with a particle system providing three separate streams falling from a rocky precipice above; deflectors around several boulders at the base cause the water stream to separate and splash.

All these fountains and waterfalls modeled and rendered in 3DStudio Max.

See the CD for an animation of the waterfall at left created with a particle system.