

# Introducing Splash!

## MAX™ 1.0

**C**ongratulations on your purchase of Splash! MAX™, the world's first fluid mechanics plug-in for 3D Studio MAX™.

Splash! MAX is a true breakthrough in fluid animation - simultaneously simplifying the animator's job and raising the standard of quality in vessel wakes and splashing fluids. Whether you're a beginning MAX user or an advanced pixel-hound, you will find Splash! MAX to be easy to use and extremely powerful. You will soon be creating wakes and splashes of unprecedented realism, and in far less time than the old space warp and texture-mapping 'approximation' techniques.

Instead of simulating fluid behavior with canned ripple profiles, Splash! MAX uses actual principles of fluid mechanics to calculate fluid behavior. The only thing the user must do is link 'stones' to their splash and wake-inducing objects, and tweak the parameters to their liking. Everything else is automatic - the fluid mechanics model handles the rest.

**It is recommended that you spend some time and go through all of the tutorials in order to more quickly acquaint yourself with the various components, features, and techniques involved in creating a scene with Splash! MAX. This will eliminate many of the questions that you might otherwise have if you attempt to forge ahead on your own.**

# Getting Started

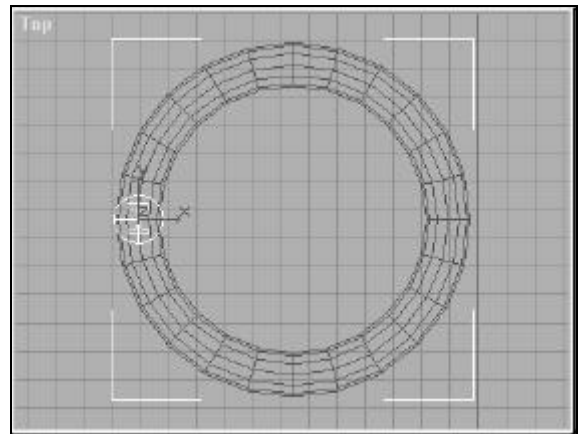
The purpose of this section is to help you to hit the ground running with Splash! MAX and introduce you to the primary techniques used to create wakes and splashes.

## ◆ QUICK-START TUTORIALS


### Quick-Start Tutorial 1 - Impact Stones

This quick-start tutorial illustrates the use of Impact stones for creating splashes in your scene. When you are finished with this tutorial, you will have an animation of a ring (torus) tumbling into a square pool of liquid.


- 1.) Load file **quiktut1.max** from your '3dsmax\scenes' folder.
- 2.) Activate the Top viewport and maximize it.
- 3.) In the Helpers section of the Create panel, select 'Fluid Mechanics' from the drop list. Then click the 'I-Stone' button (the 'I' is for 'Impact' Stone).
- 4.) Place the cursor in the center of the left side of the torus, and drag out an impact stone, just slightly larger than the side diameter of the torus.

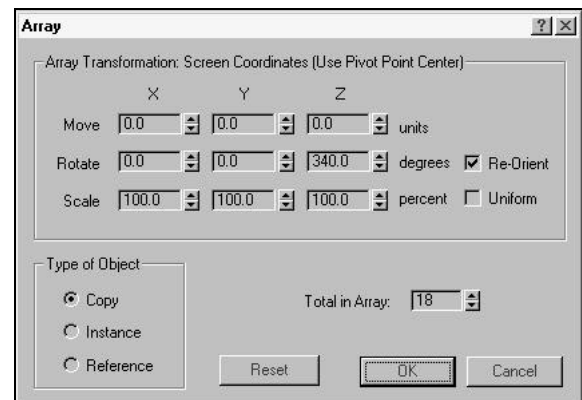


- 5.) With the impact stone selected,

activate the  Hierarchy tab of the command panel, Pivot section, and select 'Affect Pivot Only'. With the move tool, move the stone's pivot to the center of the torus.

- 6.) De-activate 'affect pivot only' and

select the  Array tool. Place 340 degrees in the rotate Z transform box, and 18 in the 'Total in Array' box. Click 'OK' to create a ring array of impact stones.



- 7.) Switch to the Front viewport and select all of the stones. Link the selected stones to the torus with the




Link tool.

- 8.) Remaining in the Front viewport, move all of the stones up so that they coincide with the torus.
- 9.) If they're not already, make all 4 viewports visible. The origin should be visible in the Perspective viewport. If not, use the zoom tool until it is. Zoom the Top viewport until the origin is visible there as well.



- 10.) Activate the 'Create' tab in the command panel, and select the 'Geometry' button. In the drop list select 'Fluid Mechanics'. Click the 'Splash! MAX' button.

- 11.) In the Top viewport, click near the origin and drag out a rectangle of approximate dimensions 500 x 500. This is your pool surface. Adjust the mesh density setting of the pool to 14.

- 12.) Right-click in the same viewport to unload the pool creation command mode, then activate the Perspective viewport and click the Zoom Extents tool. Use the  'Arc Rotate' tool to get a view of the torus and pool that you like.

- 13.) Make sure the pool is selected and select the Modify panel. Click the 'Setup' rollup tab in the Splash! MAX panel to open it. Click the 'Select Stones' button to activate the stone selection command mode.

There are a couple of ways to select stones in your scene. One way is to select click on them individually. This requires you to click the 'Select Stones' button each time, and can get tedious quickly. Single selection is useful in some cases where you need to add single stones to an existing stone list.

A better way for our needs is to click on the stones' parent object. The stones will then be sifted out of the hierarchy and placed in the pool's stone list. This method works regardless of how deep the stones are in the hierarchy.

- 14.) Click on the torus, or press the 'h' key and select the torus from the list.

The stones should now be added to the pool's stones list and your list should look similar to the example shown.



- 15.) Access the Pool and Spray rollups and change the default settings of the following parameters to the values shown:

Pool Properties	
Ripple Speed:	55
Ripple Damping:	55

<u>Spray Properties</u>	
Amount:	25
Threshold:	60
Gravity:	60
Size:	60
Velocity:	43
Stretch:	60
D Scatter:	60


**16.) Save the scene as quiktut2.max**

**17.) Open the material editor and assign the pre-made material in slot 1 to the pool. Render the animation from the Perspective Viewport to an avi file, and play it.**

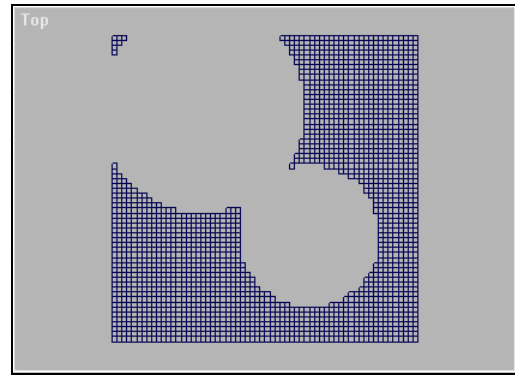
## **Quick-Start Tutorial 2 - Pool Masking**


Rectangular pools are nice, but not every body of fluid is rectangular. It would be helpful if we could create a pool with arbitrary shape, and if desired, maintain proper ripple reflection from the arbitrary edges. Let's take a look at how we can achieve pools of arbitrary shape.

Arbitrary pool borders are achieved by applying a Mask to the pool. A pool mask can be any geometric object that contains faces. Depending upon your masking needs, it is sometimes most convenient to just shift-drag a copy of the pool and use the copy as the mask for the original pool. Here's how this works:

**1.) Make sure quiktut2.max is loaded. In the Front viewport, with the**  
 **move tool, shift-drag a copy of the pool so that it floats above the original pool. The distance that you drag it does not matter.**

**2.) Hide everything in the scene except this new copy of the pool. Apply an Edit Mesh modifier to this pool and delete faces so that it looks somewhat like the following:**



This example was achieved by selecting two regions of faces with the  circular selection tool and deleting them.

***Tip:** Your scene will process considerably faster if you collapse the mask object to an editable mesh after you finish editing the mask.*

**3.) Collapse the stack into an editable mesh.**

**4.) Now unhide the original pool, select it, and open the Modify panel to access the Splash! MAX interface. Open the Setup rollout, if not already open.**

**5.) Click the 'Select Mask' button to load the mask selection pick mode. Click on the mask object that you just created. Click the 'Use Mask' button to apply it to the pool.**

After a few seconds the masked pool is redrawn with only the unmasked grid divisions showing.

**6.) Hide the mask to get it out of your way. Don't delete it or you will lose your masking of the pool. Hiding it is OK, however.**

**7.) Unhide the torus.**

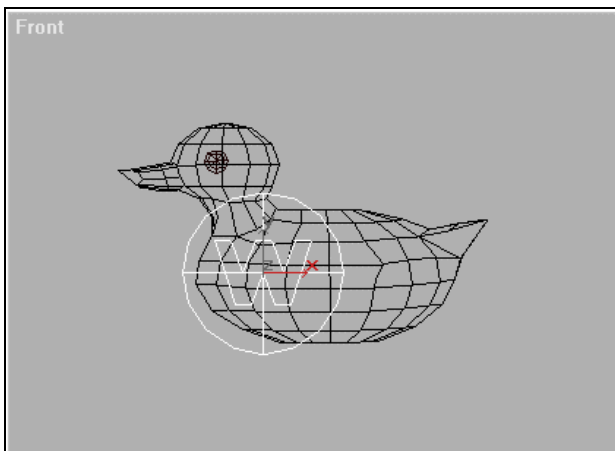
**8.) Render the animation again to an avi file from the Perspective viewport.**


### Tutorial 3 - Wakes

This tutorial introduces you to Splash! MAX's wake capabilities. You will produce a wake which emanates from the MAX duck doing a water landing.

**1.) Open quiktut3.max.**

**2.) In the Create/Helpers/Fluid Mechanics panel, select 'W-Stone'. Drag out a wake stone in the Front viewport, positioned on the duck's body approximately as shown.**



**3.) Link the wake stone to the duck using the  Link tool.**

**4.) Select the pool in the Perspective viewport and open the Modify panel. Open the Setup panel and click the 'Select Stones' button.**

**5.) In the Front viewport, pick the duck. This places all stones that are linked to the duck in the pool's stone list (in this case just one).**

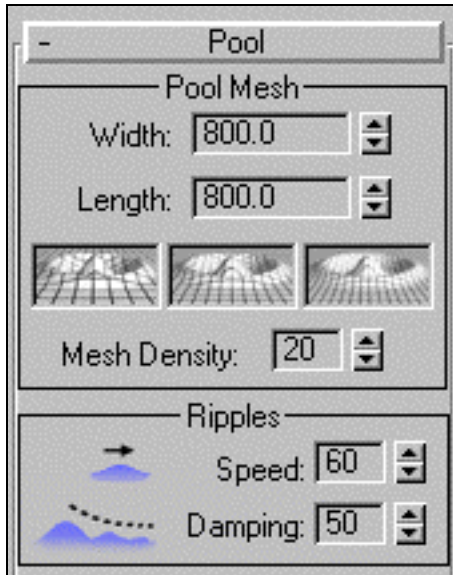
**6.) Activate the Perspective viewport and select 'make preview' from the Rendering menu. Make a preview of the current active time segment in smooth/highlighted mode. Take a break while this renders.**

**7.) After preview rendering completes, play it.**

The duck flies in and slides to a stop on the pond. A light wake is created and fans out behind the duck.

This is perhaps not as we would like it. The ripples propagate too slowly, and they dampen out too quickly. Let's tweak some settings.

**8.) Select the pool if not already selected, and open the Modify panel. Open the 'Pool' rollup and set the 'Ripple Speed' setting to 60, and the 'Ripple Damping' setting to 50 as shown.**



**9.) Render the Perspective viewport to an avi and play it.**

As you can see, the wake is more dramatic and doesn't dampen out as quickly.

You could further perfect this scene by adding a couple more wake stones to the duck of different sizes to give the wake some variation.

**Important Note:** *The occurrence and appearance of spray in your scene is highly dependent on the relative size of the stones in your scene and the size of your pool's mesh divisions. As such, your spray characteristics might differ significantly from those of the author. You may wish to adjust your spray parameters accordingly.*

Also, if you want to capture smaller, more subtle ripples, you could give the pool a higher mesh density setting.

Another option which would lend additional realism to this scene would be to link an impact stone to the duck so that a splash is made when the duck first contacts the water.

Congratulations! You made it through the quick-start tutorial set. You have used the basic methods for creating splashes and wakes with Splash! MAX. More tutorials are available in the Tutorial section of this guide. These take you through some of the finer details. It is recommended that you go through these tutorials in full before marching off on your own, as this will likely answer many questions before you have to ask them.

# Overview of Splash! MAX

Splash! MAX is a fluid mechanics-based procedural object plugin for 3D Studio MAX which automates the creation of fluid splashes and wakes in your scene. There are two basic components which interact in the scene to produce these fluid effects: the ‘Pool’, and the ‘Stones’.

Stones are the only objects in the scene which can have any effect on the pool. They do this by exerting a pressure on the pool surface. The pressure information is fed to a fluid mechanics model at the core of the program, which calculates the pool’s reaction to this pressure. The fluid mechanics model then feeds this reaction information back to the pool mesh in the viewports.

## The Pool

The pool is a planar mesh object which represents the surface of the body of fluid in your scene. The pool object contains all of the customizable settings which control the characteristics of the fluid effects.

You create a pool object in your scene by accessing the Splash! MAX button in the Create/Geometry panel under the ‘Fluid Mechanics’ sub-category.



This places you in the mode to create the pool in your scene. Clicking and dragging in a viewport produces a rectangular pool mesh. Thus far the pool is inactive, and won’t become active until we start throwing ‘stones’ at it...

## Stones

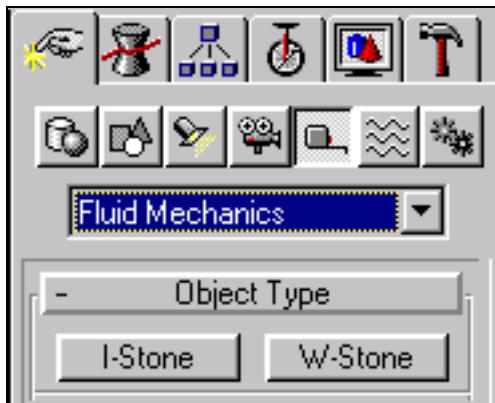
The term ‘stones’ refers to the non-rendering helper objects which interact with the pool to create fluid effects. These helper objects are linked to rendering objects in your scene which you want to have **the appearance** of affecting your pool.

For example, if we have a shark swimming along with its dorsal fin above the water surface, and we want a wake to be produced by this fin, we could link a ‘**Wake Stone**’ (perhaps more than one) to the fin.



Similarly, if we wanted to produce splashing from a whale's tail slapping the surface, we would link '**Impact Stones**' to the tail.

These two types of stones are accessed via the Create/Helpers panel under the 'Fluid Mechanics' sub-category.



As you might have guessed, I-Stones are the impact-type stones, and W-Stones are wake-producing stones. These stones do nothing except affect the pool (they don't even render), and conversely, the pool can only be affected by stones.

But the pool does not know which stones to react to and which to ignore, unless we tell it...

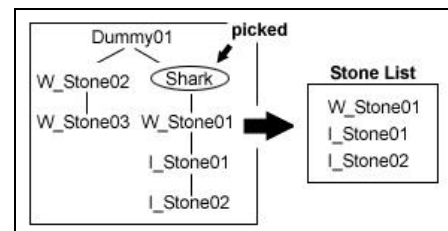
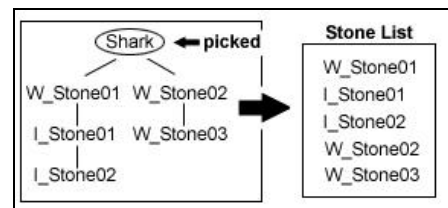
### Building the pool's stone list

You select which stone objects in your scene that you want to have an effect on a given pool. This is done in the pool's 'Setup' rollup panel by clicking on the 'Select Stones' button. This enables a single-object pick mode.



At this point you pick an object in the scene. Splash! MAX will sort down through this object's linked hierarchy and add all of the stones that it finds to the pool's stone list.

If the object that is picked is a stone, then it too will be added to the list, along with any stones lower in its hierarchy.



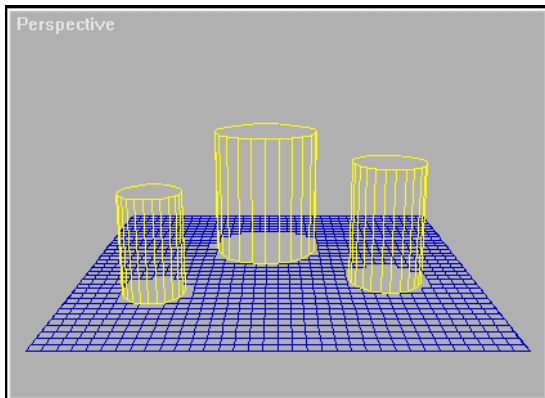


## Pool Masking

Usually, we wish to work with a pool which is of arbitrary shape, instead of rectangular. In addition, we might want to place islands, pier pylons, or other objects in the middle of the pool and have proper ripple reflection from them, instead of ripples appearing to pass right through them. This is accomplished by pool masking.

Masking is the way in which we remove portions of our rectangular pool, producing reflective boundaries of arbitrary shape. The pool is masked by choosing an object, or a group of objects, which will ‘shadow’ portions of the pool. The shadowed areas of the pool are removed.

For example, let’s say we have three cylinders sticking out of the pool, perhaps representing tree trunks in a swamp. If we want ripples to reflect from each of the three trees, we group the cylinders together using MAX’s group function, then assign the group as the pool’s mask.



Masks are assigned to a pool in the Setup rollout:



In certain situations, such as when we are defining the borders of a pond or swimming pool, it is convenient to use a **copy** of the pool as the mask object. You do this by simply shift-dragging a copy of the original pool so that it hovers over the original. You can then use the Edit Mesh modifier to delete faces from the mask copy so that you are left with the faces that you want masked-out of the original pool.

**Tip:** When using a copy of the pool as the mask, collapse it to a simple mesh object after applying the Edit Mesh modifier. This will speed up processing of the original pool.

## Setting up a Splash! MAX! Scene

In order to efficiently set up a scene using Splash! MAX, it is important to follow a fairly structured approach. This will reduce the likelihood of ‘parameter tail-chasing’ and allow you to achieve that ‘just right’ scene much more quickly.

**Tip:** Reduce parameter-tweaking and cut development time by following the approach below when setting up a scene with Splash! MAX!...

Efficient setup of a Splash! MAX scene involves this simple approach:

- I. **SET UP SCENE FIRST** - for example, suppose you are doing a scene with a boat on a pond with two oars in the water with a certain camera angle. In this case you would set up and animate the boat and oars, and place the camera before setting up the pond with Splash! MAX. This way you will have a good idea of what size pool you need, what your mesh density requirements are, etc.
- II. **PLACE STONES** - link all of your stone objects into your scene *first*. This will help define the location, size, and mesh density of the pool that you will require.
- III. **PLACE POOL** - the rule here is ‘don’t create a pool which is any larger than required for the proper effect’.
- IV. **SELECT STONES** - via the Splash! MAX Setup rollout, click the ‘Select Stones’ button to enable stone selection mode. If all of the stones that you want to have an effect on this pool are under one hierarchy, you can simply click on the top parent object. The stones in this hierarchy will then be sifted out and placed in the pool’s stone list.
- V. **SELECT MASK** - If a mask is required, select your mask object or group here.

**Tip:** At this point in the scene setup process, you may wish to ‘test the water’. With large/dense pool meshes, making adjustments and testing the result can be time consuming. Therefore it is sometimes advantageous to test with a smaller ‘test pool’. See the tutorial “[Testing the Water](#)” for information on how to do this.

**VI. SET POOL’S MESH DENSITY** - Your mesh density needs to be sufficient to meet the minimum density requirements for your needed level of ripple detail, as well as for your minimum stone size.

If we use a mesh density which is too low, we may not achieve the needed level of ripple detail, simply because there are not enough mesh divisions to resolve this detail. Similarly, with a low mesh density small stones might go undetected by the pool, thereby having no effect.

You are looking for a mesh density which is high enough to satisfy both of these requirements, but not so high that we get unnecessarily long processing times.

The best way to settle this is to:

Set the mesh density such that the *diameter of the smallest stone in your scene equals approximately 2-4 pool mesh divisions*.

Render a preview of the scene over a sufficient range of frames. If the level of ripple detail is insufficient, adjust the mesh density higher, and preview again.

Realize that ripple detail is not the same as ripple speed, or ripple amplitude. These are controlled by other parameter settings which are discussed in the **Splash! MAX Interface** section.

**VII. ADJUST THE RIPPLE SPEED** - This has a strong effect on the *feeling of scale* that your scene will have. For a puddle, use a high ripple speed. For a lake, use a low ripple speed setting. It is important to set this parameter before doing the final adjustments of the impact

and wake strength settings since it will affect ripple amplitudes.

### VIII. ADJUST THE IMPACT/WAKE

**STRENGTH** - This directly affects the amount of pressure that the stones exert on the pool surface, and therefore the amplitudes of the ripples that result.

**IX. ADJUST THE DAMPING** - The damping setting controls how quickly the ripple amplitudes decay. But it has a secondary function as well. Inherent in time-stepping solution methods of fluid mechanics models is the possibility that the amplitudes could grow without bound and become chaotic. This is known as the model becoming 'unstable'. This occurs when there is insufficient damping in the model. If you see this behavior in your model, simply increase the damping setting.

***Tip:** If your amplitudes grow with time and become increasingly chaotic, your model is insufficiently damped. Simply increase your damping setting.*

### X. ADJUST REMAINING IMPACT/WAKE

**SETTINGS** - If needed there are adjustments for the size and duration of impacts, and size of wake effects. Since the sizes of these effects are tied directly to the size of the stones that created them, this setting can usually be left alone. But the option is there if adjustments are needed. Similarly for the impact duration setting, the duration of the pressure applied to the pool surface is tied directly to the speed of impact, but can be adjusted.

**XI. ADJUST SPRAY SETTINGS** - If you need spray in your scene, it can be adjusted in

the Spray Settings rollup. This should be done last since the occurrence of spray is highly dependent upon what the surface of the pool is doing. Therefore the pool surface behavior should be established first, and spray adjustments made only after the pool is as you want it.

#### Summary of Splash! MAX Scene Setup

1. Set up other scene components first
2. Place and Link Stones
3. Place Pool
4. Select Stones
5. Select Mask (if needed)
6. Set Pool's Mesh Density
7. Adjust Ripple Speed
8. Adjust Impact/Wake Strength
9. Adjust Damping
10. Adjust Remaining Impact/Wake Settings
11. Adjust Spray Settings (if needed)

### Viewports

Since Splash! MAX uses a time-stepping solution technique, the pool's condition at a given frame is dependent upon its condition the frame before. This can cause lengthy recalculation times in certain situations.

For example, let's say you have the frame slider positioned at frame 50, and the first stone interaction occurs at frame 20. You decide that the ripple speed setting is too low, so you increase the setting.

The system now needs to calculate the new pool condition based upon this new ripple speed setting. But it must do so starting at the moment of the first stone interaction. This means it must recalculate starting at frame 20. So to make the pool current at

frame 50 where the slider is positioned, the solution must take place over 30 frames. This can be a nuisance. Controls are provided in Splash! MAX's Setup panel which solve this problem.

First, you have the option of **skipping the pool processing** if the update would have to take place over a definable threshold number of frames. This causes the pool to 'flatten' in the viewports and skip processing.

Secondly, you can hide the stones and check the '**disable hidden stones**' control.

This causes the pool to ignore the hidden stones for the purpose of updating the viewports.

A third option is to disable the pool in the viewports completely. This is accomplished with the '**disable viewports**' control.

If you want to force the pool to update at a given frame you can do this with the '**Update Pool**' button. These controls affect only the viewports and previews, and have no affect on rendering.

**"Why isn't my pool responding in the viewport when I click the 'play' button?"**

Sometimes we expect the pool to be responding to a stone when we play the animation in the viewports, but nothing happens. If this occurs, check three things:

- **Real Time must be unchecked in MAX's Time Configuration dialog. Splash! MAX disables the pool during real time playback.**
- **Verify that the "disable viewports" and the "disable hidden stones" are not checked in the Setup panel.**
- **Make sure that the stone(s) are in the pool's stone list (below the 'Select Stones' button).**
- **Make sure that the pool's mesh size is small enough for the stone(s). If a stone is small enough to slip through a single mesh division, it will do so undetected.**

# The Splash! MAX Interface

In this section we will dissect Splash! MAX's user interface, and discuss in detail each parameter and how it affects the appearance of the fluid effects in your scene.

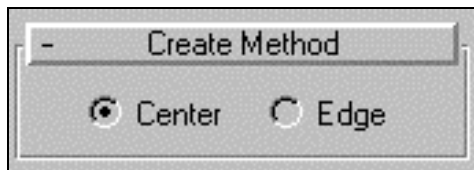
The Splash! MAX user interface is separated into five rollup panels, excluding the 'About' panel. The five panels of the Splash! MAX UI are:

- **Create Method**
- **Pool**
- **Setup**
- **Spray**
- **Presets**

Of these five interface panels, only the Pool, Setup, and Spray panels contain parameters, which directly affect the behavior and appearance of the pool. The other two - Create Method and Presets - control how the pool is created, and allow saving of parameter sets, respectively. Let's take a look at each panel individually.

## Create Method Rollup

This panel simply controls how the pool is created in the viewports. This is identical to many of MAX's built-in primitive objects.

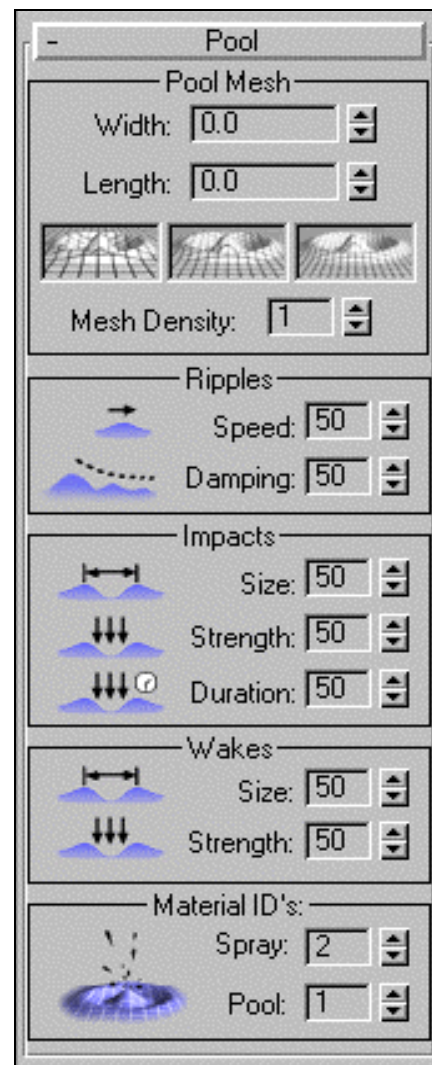


The two choices are **Center** and **Edge**, which specifies whether the pool mesh is dragged from center-to-corner, or corner-to-corner, respectively.

## Pool Rollup

The pool rollup panel is where you define the dimensions, mesh density, and behavioral parameters of the pool. The parameters in the pool rollup apply to the main body of the pool, and not to the spray. Spray parameters are accessed in the Spray rollup panel.

Let's discuss each of the controls in the Pool rollup individually.



In the following parameter descriptions, the parameter range, and animatable status are illustrated as in the following examples:

**[1-100, A]** = range 1-100, animatable  
**[1-200, NA]** = range 1-200, **not** animatable

**Width** - spinner control which specifies the 'x' dimension of the pool mesh.

**Length** - spinner control which specifies the 'y' dimension of the pool mesh.

**Mesh Density [1-100, NA]** - spinner control which controls the total number of divisions in the pool mesh. This parameter should be set before any of the other pool or spray parameters, with the exception of the two described above. This is because the effect that these other parameters will have on pool behavior is highly dependent upon the mesh density setting. See “**Setting Up a Splash! MAX Scene**” in the “**Overview of Splash! MAX**” section.

**Ripple Speed [1-100, A]** - spinner control which specifies the speed of propagation of ripples on the pool. This is independent of the object which creates the ripples, i.e. impact or wake stone.

**Ripple Damping [1-200, A]** - spinner control which specifies how quickly pool ripples diminish. This also controls pool stability. If you see a situation where ripple amplitudes get increasingly large and chaotic, increasing your damping setting will correct this.

**Impact Size [1-100, A]** - spinner control which specifies the size of the impact area where an impact stone strikes the pool. The

size of the impact area is also affected by the size of the impact stone itself.

**Impact Strength [1-100, A]** - spinner control which specifies the magnitude of the impact pressure which is applied to the pool when an impact stone strikes the pool. The magnitude of the impact pressure is also affected by the speed of impact.

**Impact Duration [1-100, A]** - spinner control which specifies the length of time that the impact pressure is applied to the pool when an impact stone strikes the pool. The duration of impact pressure is also affected by the speed of impact.

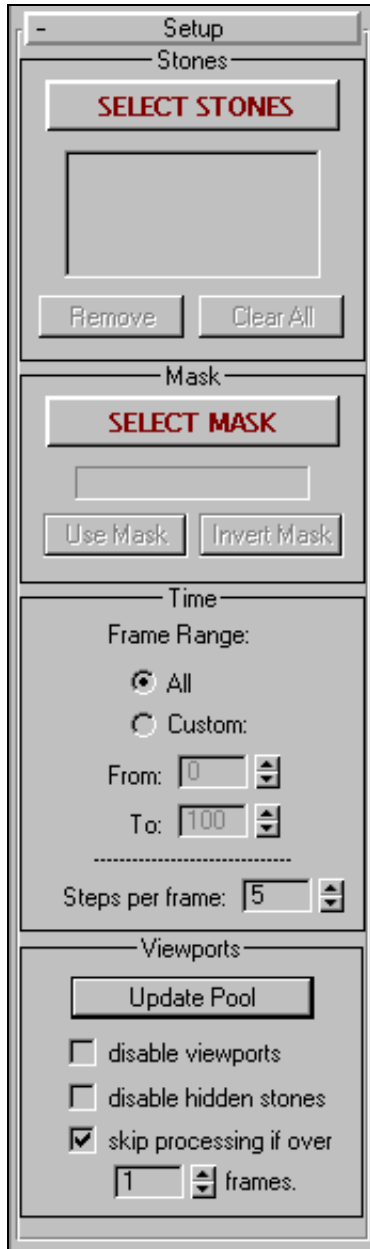
**Wake Size [1-100, A]** - spinner control which specifies the size of the area where wake pressure is applied when a wake stone interacts with the pool. The size of the wake pressure area is also affected by the size of the wake stone itself.

**Wake Strength [1-100, A]** - spinner control which specifies the magnitude of the wake pressure which is applied to the pool when a wake stone interacts with the pool. The magnitude of the wake pressure is also affected by the speed of the wake stone in the plane of the pool.

**Spray and Pool Material ID** - spinner controls which allows you to specify different material ID's to the spray droplets and the pool. This allows you, for example, to assign a darker color to the pool and a lighter color to spray droplets by assigning a **Multi/Sub-Object** material to the pool object.

## Setup Rollup

The Setup rollup panel is where you define stones and mask objects, setup time parameters, and control viewport behavior.



**Select Stones button** - this button enables the stone selection pick mode which allows you to select an object in the viewports. All stones which are linked to this object are then placed in the pool's stone list. If the

object you select is a stone, then it too will be added to the list.

**Select Mask button** - this button enables the mask selection pick mode which allows you to select an object in the scene that you want to 'mask' the pool. Splash! MAX determines the projected area of the mask object onto the pool surface, and eliminates the pool faces which lie inside this area. See **Pool Masking** in the **Overview of Splash! MAX** section for more details.

**All / Custom** frame range radio controls - allows you to specify whether you want the fluid effects to occur over all of the defined frames in the animation, or a custom range of frames.

**Frame Range** - spinner controls which specify the range of frames for the fluid effects to be processed. These are only available when the 'Custom' radio is checked.

**Steps per Frame [2-100, NA]** - spinner control which specifies the number of processing steps for the fluid mechanics model to calculate between each frame. Fewer steps process faster but can sacrifice precision. It's a good idea to start with a low number of steps (say, 5) and increase if necessary.

**Update Pool button** - forces the pool to update itself to the current frame.

**Disable Viewports checkbox** - disables all processing of Splash! MAX effects in the viewports, saving viewport update time. This has no effect on rendering.



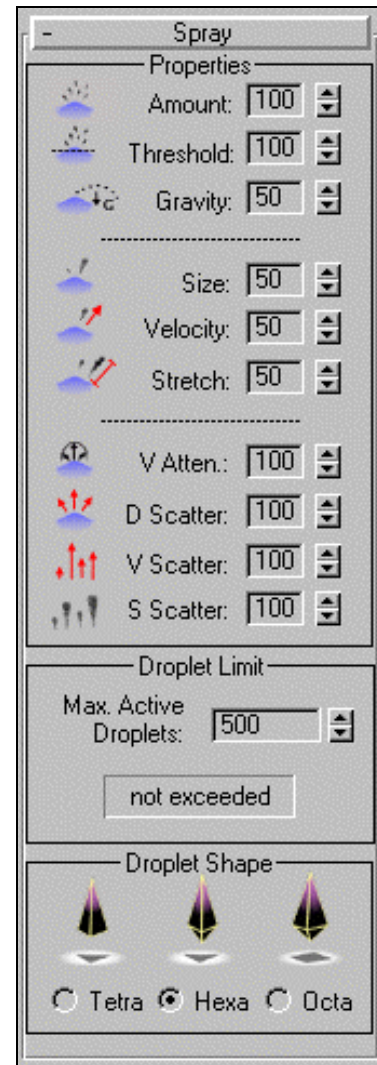
**Disable Hidden Stones** - disables the effect of stones which are in the pool's list, but are hidden. This also saves viewport update time.

### Skip Processing if Over [ ] Frames

**[1-100, NA]** - this control offers the option to automatically skip pool processing when conditions are such that it must process over a large number of frames. For example, if you arbitrarily jump from frame zero to frame 100, the pool would have to process its behavior over 100 frames. This could be time consuming, with no way to abort. This control allows you to specify a threshold, say 5 frames, beyond which the pool will automatically skip processing. This has no effect on rendering.

### Spray Rollup

The Spray rollup panel contains all of the parameters which control the appearance of spray in your scene.



The spray parameters for your Splash! MAX scene should be configured only after the body of the pool is behaving to your liking. This is because the occurrence of the spray is highly dependent upon the behavior of the pool. If you later change the pool behavior parameters, this will change your spray occurrence as well.

**Tip:** Configure your spray settings last. If you change pool settings after configuring your spray settings, spray occurrence will be affected.

### **Spray Panel Controls:**

**Spray Amount [0-100, A]** - Spinner control which adjusts the number of spray droplets created in your scene. The number of droplets is also affected the Spray Threshold setting, and the vertical velocity of the pool surface.

**Spray Threshold [1-100, A]** - Spinner control which defines the minimum vertical velocity of the pool surface necessary for ejection of spray droplets. The number of droplets created will depend on the margin by which this threshold is exceeded by the pool surface's vertical velocity, and the Amount spinner control described above. Here, 'vertical' refers to the direction perpendicular to the pool, i.e., the pool object's local 'z' axis.

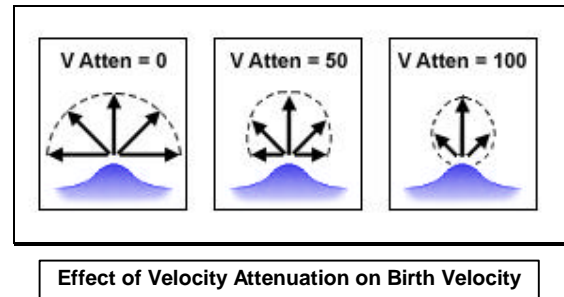
**Spray Gravity [0-100, NA]** - Spinner control which defines the gravitational pull on the spray droplets. Gravity always acts perpendicular to the pool surface (local -z direction).

**Droplet Size [1-100, A]** - spinner control which defines the average size of the spray droplets.

**Droplet Velocity [1-100, A]** - spinner control which defines the velocity of the spray droplet when it is first ejected.

**Droplet Stretch [1-100, A]** - spinner control which defines the degree to which the droplet is stretched in proportion with

its velocity. This causes the droplet to elongate when first ejected (high velocity), then to shorten as it reaches it's apex of travel (lowest velocity point), then to elongate again as it re-enters the pool (high velocity).



**Velocity Attenuation [1-100, A]** - spinner control which defines how much the birth velocity of a spray droplet is reduced with direction. This allows you to give droplets which are ejected horizontally a low birth velocity compared with those which eject vertically. For example, if this setting is 100, the birth velocity will be maximum for droplets which travel straight up, zero for droplets which travel parallel to the pool surface, and between these two extremes otherwise.

**Directional Scatter [1-100, A]** - spinner control which defines how much randomness there is in the **direction** of the ejected particles. The minimum setting will cause all droplets to be ejected vertically.

**Velocity Scatter [1-100, A]** - spinner control which defines how much randomness there is in the **velocity** of the ejected particles.

**Size Scatter [1-100, A]** - spinner control which defines how much randomness there is in the **size** of the ejected particles.

**Max. Active Droplets [10-100000, NA]** - spinner control which defines the maximum number of droplets which can be seen at any given time. This provides a way to avoid creating huge numbers of droplets unintentionally by setting improper spray parameters for a given scene. The small window below this control displays a notice if this limit is exceeded. When the limit is exceeded, production of new droplets is suspended until a sufficient number of droplets have expired.

**Droplet Shape [NA]**- three radio controls which allow you to specify how much detail you want in the construction of droplets. This lets you choose between **tetrahedron**, **hexahedron**, and **octahedron** construction. Tetrahedron droplets process slightly more quickly, while octahedron droplets most closely represent the shape of an actual droplet.

## Presets Panel

The Presets panel allows you to store up to four complete Splash! MAX parameter sets for later use.



The Presets panel contains controls to save an identifying note with each set of parameters, a 'set' button which initiates storage of the currently defined parameters, and a 'Get' button which retrieves the preset and overwrites the currently defined parameters.

# Splash! MAX

## Tutorials

The first thing we need to accomplish is to become familiar with the behavior of the pool object. Splash! MAX offers the animator/artist a wide range of freedom with the parameter settings which control how the pool behaves in our scene. This gives the artist a wide variance in attainable pool behavior. With this freedom comes the ability to create both pool objects of great realism, and pool objects which behave downright wacky. It is up to the artist to achieve the proper settings for the desired look.

Let's see how we deal with the common problem of **divergent ripple amplitudes**. The following Pre-Tutorial Exercise illustrates the steps involved in dealing with this phenomenon.

### Pre-Tutorial Exercise - Controlling Your Ripples

In certain situations the pool parameter configuration can produce ever-increasing and chaotic ripple amplitudes. This is caused by the wrong combination of ripple speed and ripple damping settings for a given mesh density.

Usually, your required mesh density and ripple speeds are somewhat fixed. The only thing you need to do in this case is to adjust the damping setting so that proper ripple decay is achieved. Let's see how this works.

**1.) Start MAX and load pre\_tut1.max from your 3dsmax\scenes directory.**

**2.) Activate the Perspective viewport, and click the play button.**

As you can see, the ripple amplitudes continuously grow in amplitude, instead of a realistic gradual decrease.

**3.) Adjust the pool's damping setting to 75. Rewind the frame slider, and click play.**

Notice that the ripples now gradually decrease in amplitude. Increasing the pool's damping is the most direct way to deal with divergent ripple amplitudes.

It's a good idea to get a feel for how mesh density and ripple speed affect ripple behavior, even though these parameters are normally fixed for a given project.

**4.) Leave the damping parameter at 75, and increase the mesh density to 15. Play in Perspective viewport.**

We can see that the increase in mesh density causes divergent ripples again.

**5.) Rewind the frame slider, increase the damping to 85, and play.**

The ripples are stable again. Now let's see how ripple **speed** affects ripple divergence.

**6.) Set the mesh density back to 10, and the damping back to 50.**

This returns us to our original unstable ripples. Play if desired.

## 7. Decrease the ripple speed setting to 35, and play.

We can see that the ripples travel more slowly, but decay naturally. You may also notice that the impact does not produce as much surface deflection as with the higher ripple speed setting. This could be countered with an increase in impact strength, if needed.

In the following series of tutorials we will be constructing a scene of a rowboat paddling across a pond. Since this scene requires many different capabilities of Splash! MAX to be utilized, it will be broken into several steps. Each of these steps will be covered in its own tutorial.


## Tutorial 1 - Stone Placement

Let's get started:


- 1.) Open 3DS MAX, if not already.
- 2.) Open `spl_tut1.max` from your `3dsmax\scenes` directory.
- 3.) Activate the Camera viewport and click the play button. Observe the motion of the oars and boat.

We will be setting this scene up so that the boat creates a wake, and the oars create small splashes when they enter the water, and wakes when they are forced *through* the water. The first step in accomplishing this is to strategically place the stones that we need to achieve these effects.

Deciding where to place stones in our scene requires first deciding where the pool mesh will be. Notice in the Front viewport that the boat is about 40% submerged below the ground plane. We will be placing the pool mesh on this ground plane, so the boat will also be 40% submerged below the pool surface.

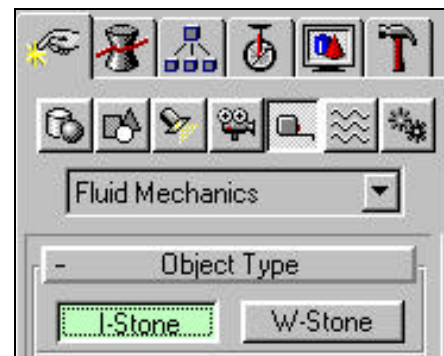
- 4.) Activate and  maximize the Front viewport, then click the play button.

Notice how much of the oars are submerged below the ground plane during each stroke. Knowing this allows us to properly place the impact and wake stones for the desired effect.

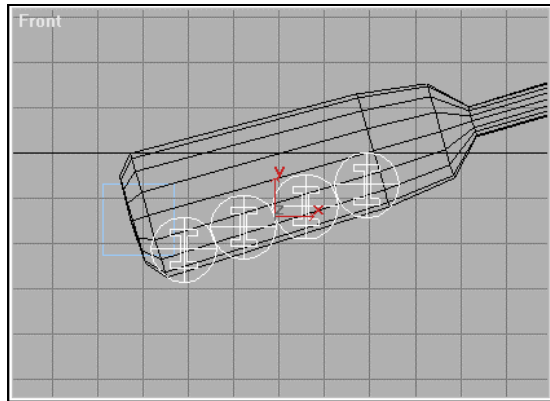
- 5.) Rewind the frame slider to frame zero and use the  Region Zoom tool and zoom in on the oar to the left (starboard oar).

We want the oars to create both splash and wake behavior on the pool, so we will need both impact and wake stones.


- 6.) Go to the Create/Helpers/Fluid Mechanics panel, and select I-Stone.





- 7.) In the Front viewport, create four impact stones as shown.

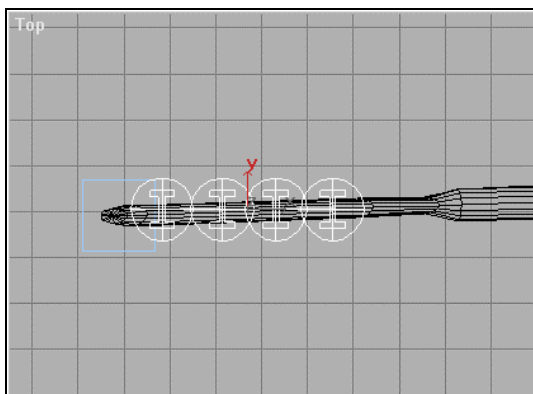



- 8.) Go to the Top viewport and maximize it.

- 9.) Use the  Region Zoom tool to zoom in on the starboard oar and the new impact stones.

- 10.) Using the  Select and Link tool, select all four impact stones and link them to the starboard oar.

- 11.) Still in the Top viewport, use the  Move tool with movement restricted to Y ('view' coordinate system), and move the four impact stones so that they coincide with the oar as shown.

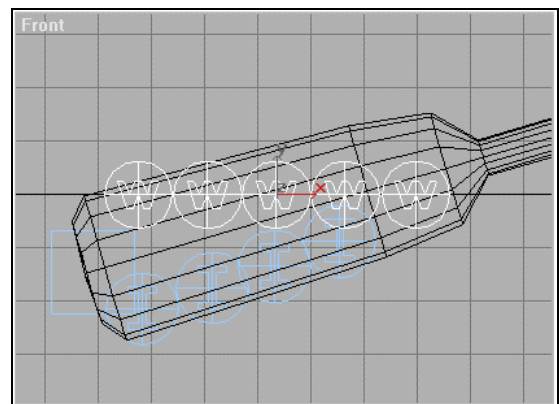


- 12.) Go to the Front viewport, maximize it, and click the  Zoom Extends tool. Click the Play button.

You can see the action of the impact stones, passing through the ground plane (where the pool surface will be). This will create the oar's splash as it enters the water. Now let's take care of the oar's wake effects as it is forced through the water.

- 13.) In the Front viewport, use the Region Zoom tool to zoom in on the starboard oar again. Make sure the frame slider is at frame zero.

- 14.) Go to the Create/Helpers/Fluid Mechanics panel and select W-Stone. Create five wake stones which are bisected by the ground plane as shown.





*Note: Wake stones must straddle the pool surface in order to have any effect on the pool.*

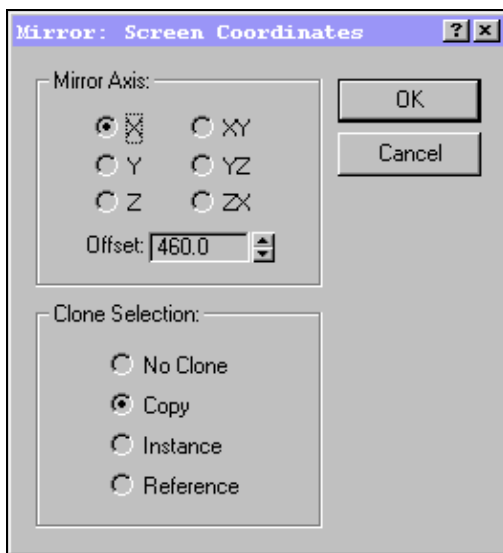
- 15.) Go to the Top viewport, link the 5 wake stones to the oar, and move them to coincide with the oar.


At this point we have set up the starboard oar with its complete set of impact and wake stones. We need to set up the port-side oar the same way.

- 16.) Make both oars visible in the Top viewport by clicking the Zoom Extents tool.**

- 17.)** Using the  **Select By Name tool, select all of the impact and wake stones in the scene.**

- 18.)** Select the  **Mirror Selected Objects tool, and select the options shown. Be sure to place '460' in the 'Offset' control.**



- 19.) With the newly created stones selected,**  **unlink them from the starboard oar, and link them to the port-side oar (right oar in Top view).**

This completes the linking of stones to the oars. Let's now take care of the boat wake.

- 20.) Hide everything in the scene except the boat.**

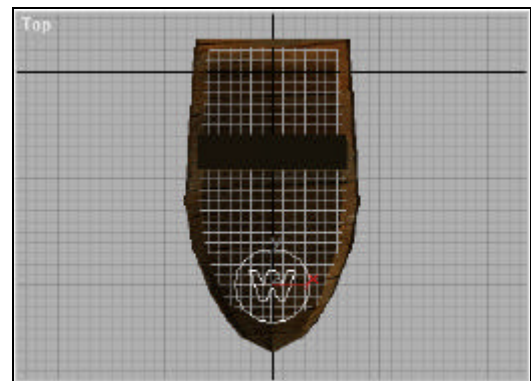
- 21.) In the Top viewport, click Zoom Extents. Maximize the Top viewport.**

- 22.) Make sure the grid is showing, and select "Smooth + Highlight" from the Top viewport drop menu.**

This allows you to observe where the ground plane (the grid) intersects the boat.

- 23.) Go to the Create/Helpers/Fluid Mechanics panel and select 'W-Stone'.**

- 24.) Create a single wake stone at the bow of the boat as shown.**



- 25.) Switch to the Left viewport and link this wake stone to the boat.**

The stone setup in your rowboat scene is now complete. All we need to do now is create the pool and adjust some parameters.

- 26.) Go to File/SaveAs and save your scene to a filename of your choice.**



## Tutorial 2 - Testing the Water

This tutorial requires the scene file that you saved at the end of Tutorial 1.

In this tutorial we'll cover how to use small 'test pools' for adjustment of the pool parameters. This enables us to adjust pool parameters repeatedly and to quickly see the results, instead of rendering the full size pool after each adjustment.

Using this technique requires the following steps:

- **Determine what size pool mesh divisions you will need for your final pool. Rule of Thumb: 2 to 4 divisions per diameter of the smallest stone, depending on needed level of detail.**
- **Create a small test-pool mesh with a low mesh density setting, and size the pool such that the mesh divisions are the same size as needed for the final pool.**
- **Choose an area in your scene to test and move the test pool to that location.**
- **Assign necessary stones to the test pool.**
- **Observe pool behavior with method of choice - in viewports, preview, or rendered to a file. Your final judgment should be from the camera or other view that the final rendering will take place in.**
- **Adjust parameters.**
- **Repeat the previous two steps until the desired look is achieved.**

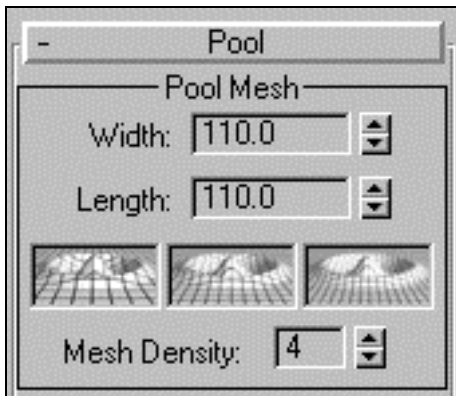
The idea is to determine ahead of time what size divisions you will need for your final pool mesh, then create your test pool(s)

with the same size divisions. This ensures the same behavior between the test pool and the final pool as long as the other settings are identical.

We want the final pool mesh density to be such that the smallest stone in the scene has a diameter of 2 to 4 mesh divisions. If less ripple detail is required, we can go with two divisions. If we need a high degree of ripple detail, we could use a density of 4 divisions per smallest-stone-diameter(SSD). We will use **3 divisions** per SSD here.

Let's go through this to eliminate any confusion.

- 1.) If it's not loaded already, load the scene that you saved at the end of Tutorial 1.**
- 2.) Switch to the Top viewport, make sure the frame slider is at frame zero and the current viewport display mode is wireframe, and zoom in to the stones of the starboard oar (the oar to the left in the Top view).**
- 3.) Go to the Create/Geometry/Fluid Mechanics panel and select Splash! MAX.**
- 4.) In the Top viewport, from the center of the stone group (using 'Center' create method), click and drag a pool mesh of arbitrary size.**
- 5.) In the Pool rollup panel of the Splash! MAX interface, set the pool Width and Length settings to 110, and set the Mesh Density setting to 4.**



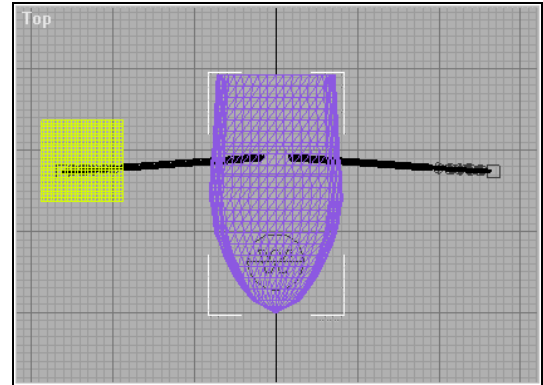
This will be our test pool. Notice that we defined the size of the pool such that there are about three mesh divisions per stone diameter. (If this is not the case for your scene, select all of the stones in the scene except the boat's bow stone and use the uniform scale tool to resize them. You will need to use the 'local' coordinate system.)

It is important to leave the Mesh Density setting as low as possible for the test pool. This allows the pool to process quickly. In this case we set the density at 4, and adjusted the dimensions of the pool to achieve the desired mesh division size.

**Tip:** Leave the Mesh Density as low as possible, and adjust the Width and Length settings to achieve the desired size of the mesh divisions.

We're going to test the area where the starboard oar enters the water at about frame 30.

- 6.) Move the frame slider to frame 30. Move the pool mesh in the Top viewport so that the starboard oar's stones are positioned approximately as shown.



- 7.) Open the pool's Setup panel and click the 'Select Stones' button. Then click on the starboard oar in the Top viewport to place its stones in the pool's stone list.
- 8.) Activate the Camera viewport and switch its display mode to Smooth+Highlight.
- 9.) Open the Material Editor and assign the 3<sup>rd</sup> material in the top row to the test pool.
- 10.) Go to the Time Configuration dialog and make sure Real Time is disabled.

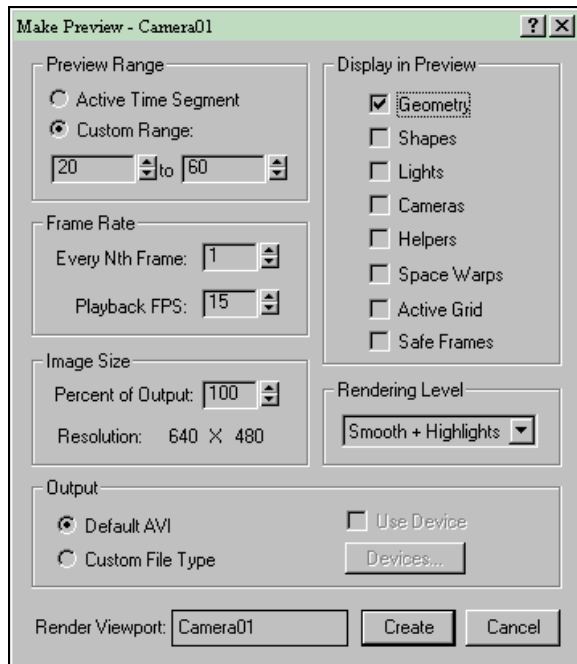
**Tip:** You must uncheck the 'Real Time' control in MAX's Time Configuration dialog in order to see pool behavior in the viewports after clicking the 'play' button.

- 11.) Go to the Camera viewport's drop menu and select 'Configure'. In the 'Adaptive Degradation' tab, enter '0' in the 'Maintain FPS' box.

This will allow the pool to remain in Smooth+Highlight mode during playback in the viewport (this step may not be necessary on high performance systems).

**12.) Turn off the grid in the Camera viewport, rewind to frame 0 and click ‘play’ to observe the behavior in the Camera viewport.**

**13.) Set the frame slider back to frame 0. Make a preview with the settings shown.**



If the test pool is not reacting to the oar, cancel the preview and make sure the ‘disable viewports’ and ‘disable hidden stones’ controls are not checked in the Setup panel. Start the preview again.

**Tip:** If you are rendering a preview and the pool is remaining flat, verify that the ‘disable viewports’ and ‘disable hidden stones’ controls are unchecked in Splash! MAX’s Setup panel.

When the preview is finished rendering, play it and observe the pool behavior.

This first test area that we rendered was slightly out of view in the Camera viewport.

Let’s now move the pool to the starboard oar’s second entry point and see how the test pool’s behavior looks there.

**14.) Move the frame slider to frame 60. In the Top viewport, move the test pool to the starboard oar, as you did at frame 30.**

Since we moved the pool, we need to re-select the stones so that the test pool updates its impact and wake information.

*Note: If you move the pool object, you need to clear and re-select the stones so that the impact and wake information is updated to the proper positions.*

**15.) Go to the test pool’s Setup panel, and clear all stones from the list, then click ‘Select Stones’ and re-select the oar to place the stones back in the list.**

The impact and wake information is now current.

**16.) Render the preview again from the Camera viewport, this time with a frame range of 50-90.**

When preview render is finished, play and observe the test pool’s behavior.

That doesn’t look bad, but it could use some improvement. The ripples travel a little too quickly, and dampen out slightly early. Also, the impacts are a little strong, and the wakes slightly weak. Let’s make some adjustments:

**17.) Adjust the ripple ‘Speed’ to 35, ‘Damping’ to 45, the ‘Impact Strength’ setting to 45, and the ‘Wake Strength’ to 55. Render the preview again.**

That looks about right. Now that we have the pool parameters looking good, we can adjust some spray into the scene.

**Note:** The spray behavior is easily affected by subtle differences in stone position and size, location of impact, etc. Since yours and the author's scenes will differ slightly, you will likely see varying results. You should adjust your settings as is appropriate for your own scene after completing this tutorial.

For this particular scene, we don't want a great deal of spray. We will be adding just a subtle amount to give it a little 'personality'.

**18.) Go to the Spray panel and set the Threshold setting to 60 and preview.**

There are several things that are not right with the spray. There are far too many droplets being ejected, the droplets are too large, and they travel too high.

**19.) Change the following settings to the values shown:**

<b>Spray Amount:</b>	<b>32</b>
<b>Spray Threshold</b>	<b>60</b>
<b>Spray Gravity</b>	<b>60</b>
<b>Spray Size:</b>	<b>40</b>
<b>Spray Velocity</b>	<b>25</b>

That looks pretty good. Remember, we are only after a subtle amount of spray. The remaining spray should appear more or less as droplets falling from the oar at the end of the stroke.

We have adjusted the properties so that the pool behavior from the oar's interaction looks correct. These settings will define the behavior of the entire **final pool** when they are assigned to it. As a result, the behavior

of the **boat wake** is somewhat fixed at this point.

You could create another test pool and test the behavior of the boat wake. You wouldn't want to change any settings, since this would change the oar's interaction that you just perfected. You could, however, add wake stones to the boat, change their arrangement, size, etc., in order to achieve the look you need. For our purposes here, we will leave the boat's single wake stone as it is.

Let's save the settings so that they can be assigned to the final pool later.

**20.) Open the test pool's Presets panel. In the note box of Preset 1, type in an identifying note, such as "Rowboat scene settings", and click on the 'set' button.**

Delete the test pool from the scene.

Since you made no permanent changes to the scene during this tutorial, there is no need to save. We will be using this same scene in Tutorial 3.

## Tutorial 3 - The Pond

In this tutorial we will cover creation of the final pool, and go through the masking process to give the edges of the pond a natural contour.

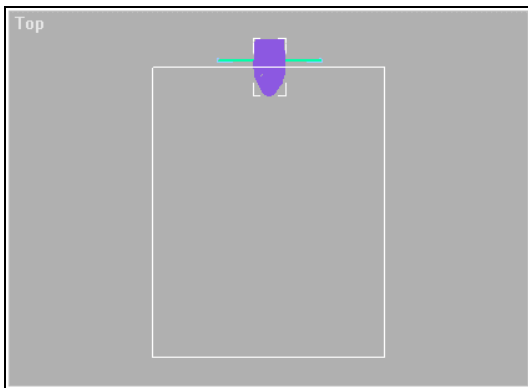
- 1.) If it's not already, load the scene file that you saved at the end of Tutorial 2.
- 2.) Go to the Create/Geometry/Fluid Mechanics panel and select 'Splash! MAX'.

Make sure the 'Mesh Density' setting is set to 1.

- 3.) Open the Setup panel and check 'disable viewports'.

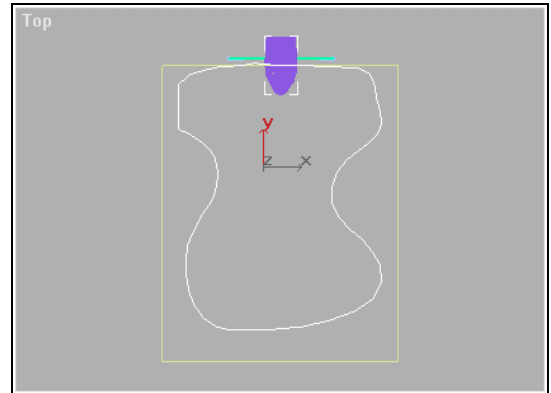
This will allow us to work in the scene without burdening the system with the entire pool mesh.

- 4.) In the Top viewport, create a pool 1200 units wide by 1500 units long, and positioned approximately as shown.
- 5.) Go to the pool's Presets panel and retrieve the settings that you saved in Tutorial 2.



- 6.) Go to the Create/Shapes/Splines panel and select 'Line'.

- 7.) In the Top viewport, create a closed spline of arbitrary shape, keeping within the boundaries of the pool, as shown.



This will define the edge of your pond.

- 8.) Apply an Extrude modifier to the spline. There is no need to give it any thickness - leave it at zero.

We now have a mesh that we can use to mask the pool mesh.

- 9.) In the Front viewport, drag the mask so that it hovers slightly above the pool. The vertical position of the mask is irrelevant, but this makes things more convenient.

- 10.) In the Top viewport, reposition the mask so that the mask's top edge coincides with the top edge of the pool.

**11.) Select the pool object, and open the Modify panel.**

**12.) Access the pool's Setup panel, and click on 'Select Mask'.**

**13.) Select the mask object that we just created.**

The name of the mask object is added to the mask window.

**14.) Uncheck 'disable viewports', and click 'Use Mask'.**

We can see in the Top viewport that the pool mesh divisions which lie either partly or completely within the mask object are omitted.

You might have noticed that the masking is opposite of what we need for this scene. We want the pool mesh divisions which lie within the mask to remain, and those outside the mask to be omitted. This is the opposite of what we have.

**15.) Click the 'Invert Mask' button.**

That's better.

**16.) Hide the mask object. We don't need it in the scene anymore.**


Next, we'll set the pool's mesh density. Remember from the previous tutorials what our mesh density requirement is: 3 mesh divisions per SSD (smallest-stone-diameter).

**17.) Move the frame slider to frame 30 so that the oars are over the pool.**

**18.) Temporarily disable the masking by unchecking the 'Use Mask' control in**

the 'Setup' panel. This will allow us to adjust the density setting without waiting for the pool to re-calculate the mask each time.

**19.) In the Top viewport, zoom in on the starboard oar and associated stones. Increase the pool's mesh density setting so that there are approximately 3 divisions per SSD.**

**20.) Click  'Zoom Extents' for the Top viewport, then go back to the 'Setup' panel and re-check 'Use Mask' to re-mask the pool.**

Recalculation of the pool's masking will take a couple of minutes with this high mesh density setting.

Since general performance is impacted by the high-density pool object, let's disable the pool.

**21.) In the pool's Setup panel, check the "disable viewports" checkbox. This affects the pool in the viewports (and previews) only.**

***Tip:** When working with higher mesh density settings in the viewports, you can avoid the detrimental effect on performance by disabling the pool in the viewports.*

Now, we'll put the stones that are in the boat's hierarchy in the pool's stone list.

**22.) In the Top viewport, click the**



**Zoom Extents button.**

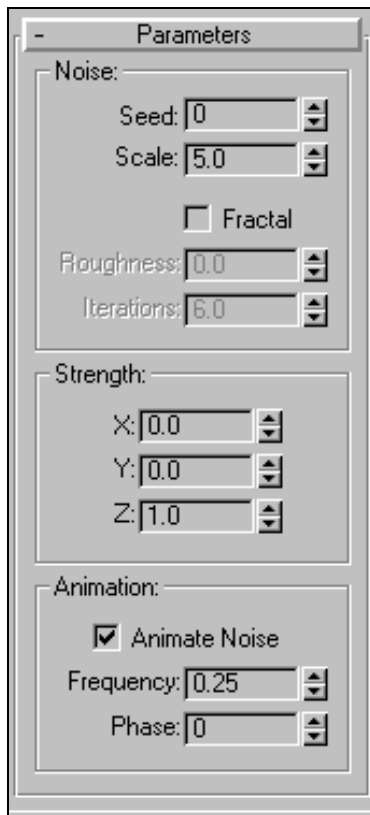
**23.) In the pool's Setup panel, click on 'Select Stones' and select the boat in the Top viewport. This places all of the stones in the pool's stone list.**

Let's assign the pool's material next.

**24.) Go to the Material Editor and select the material in the third window, named 'Pond Material', and assign it to the pool object.**

To add some realism to the pond surface, let's apply an animated noise modifier.

**25.) Add a noise modifier to the pool object with the following settings:**



Our scene is now ready for rendering. Let's save the scene.

**26.) Go to File/Save As and save the scene to a filename of your choice.**

**27.) Render your pond scene from the Camera viewport when it is convenient.**

**Come visit the Rubicon Beach website!**

For updates, news, additional tutorials, and samples of work done with Splash! MAX, please visit:

<http://www.rubiconbeach.com>