

[Tutorial: Reactor Basics]



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1. Introduction

Have you ever heard of **Reactor**? Reactor is a great and powerful tool that comes with 3dsmax. Without it, you would not be able to do very complex and physically correct animations. This tutorial is a short introduction to Reactor.

With the help of two little examples I will illustrate Reactor works.

The picture above represents a small scene I did in 3dsmax 6 without any other plugins. The idea behind the animation is quite simple: Just imagine standing in an old church tower; it's sunrise

and the bells start to ring, and all the mechanical parts start to move.

Hard to make without the help of reactor, isn't it?

Okay, to disappoint you: I am not going to explain how to recreate the above scene at this moment. For now you must be satisfied

with a short introduction to reactor, and be patient, for the other parts will come soon.

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2. Reactor Basics

What the hell is he talking about?
What is **Reactor**?

Let us think back to the year 1998. One of my favourite movies came to the cinemas: "The Big Lebowski".

I really hope that every one of you knows that movie! If you don't shame on you. Go to your local video store, get that movie and watch it before you read on ;) Alright, the Dude had one big passion: he loved to bowl. When I saw that, I said to myself: lets go and create a small bowling-scene in 3dsmax.

I wanted to model the pins and animate them when they were hit by the ball. Sounds easy, BUT after hours of tweaking and setting every single Key, I got a nervous breakdown as I realized

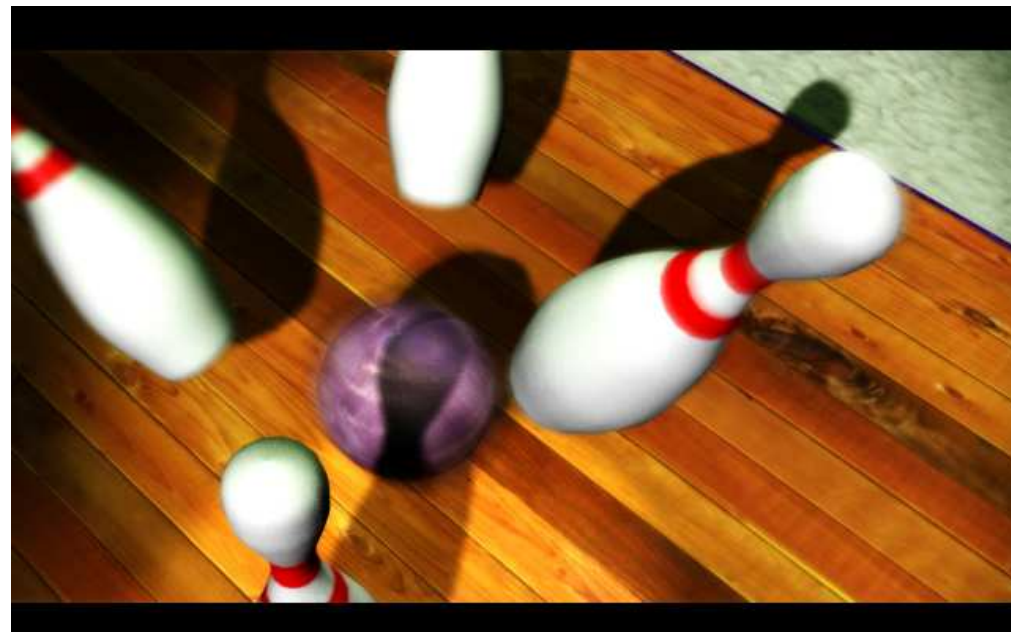
that it is not possible to animate (physically correct) the whole scene by hand.

I closed the file and waited almost 7 years, before I restarted the project.

But why? What has changed?

Besides the first gray hair and a faster computer, 3dsmax 6 came out. Included with it was a small but powerful plugin called **Reactor**. I could not believe my eyes when I saw the results of my bowling scene. Since that day some of my friends call me Gollum as I start to quote him as soon as someone talks about Reactor. "...my precious!" (just joking ;))

Alright, if you open 3dsmax help (by pressing F1) and search for Reactor you will find the following sentence:



"**Reactor** is a plugin for 3ds max that allows animators and artists to easily control and simulate complex physical scenes."

And that was exactly the type of thing I needed to animate my bowling scene. In fact the bowling example is really easy to handle

compared to the complex animation we will get to at the end of this tutorial.

But enough of my anecdotes from my early days of 3D. Lets learn something about Reactor and its power.



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2. Reactor Basics

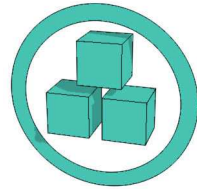
As I said before: Reactor is a plugin that gives you full control over complex physical scenes. It is really easy to use, and with just a few clicks you can create great looking animations.

To get started, open 3dsmax 6. On the left you should see a toolbar with a lot of icons (like the one shown on the previous page) You cannot find the toolbar?

No problem: Go to **Customize – Customize User Interface**. In the window that pops up click on **Toolbars**, select **Reactor** and uncheck the **Hide-Box**.

In this tutorial, we will only need two **Collections**, but I am going to give you a short overview of the most important functions, so that you know “what is what” when you start to create your own animations.

2.1. The Collections



Create Rigid Body Collection

That is the first helper object you will find on the Reactor – toolbar, and it's used the most. The **Rigid Body Collection** is a necessary “small box”, where all of the objects (rigid bodies) that are to be animated get stored.

But what is a *rigid body*?

Every object you have created can be used as a *rigid body*. With the help of Reactor you can assign various physical attributes (like mass) which then effect their behaviour (a heavy ball acts differently than a light one).



Create Cloth Collection

It is the second button on the toolbar, and as the name says it has something to do with cloth.

The **Create Cloth Collection** acts much like the **Rigid Body Collection**. The difference is that all of the objects that have a *cloth modifier* applied (which turns your object into a deformable mesh) get stored here.

It's basically the “small box” for your deformable objects. Only the “cloth” that are stored in the *Cloth Collection* will be animated by Reactor.



Create Soft Body Collection

Soft Body Object have a soft-body-modifier in their stack. All objects that will be flexed, bent, and squashed during the simulation get stored here.

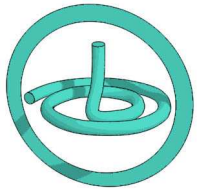
3 questions you should be able to answer now:

1. Where have I stored my pins (from the previous bowling scene)?
2. If you want to animate a towel with the help of reactor, which collection are you going to use?
3. You created a plastic ball and want to animate it. Which collection would be the best?

Answers: 1. RBC; 2. CC; 3. SBC

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2.1. The Collections

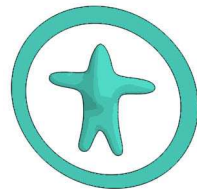


Create Rope Collection

The **Create Rope Collection** is the "small box" for *rope-like* objects.

Every Spline-Objects in your scene that has a rope modifier added to its stack, and will be animated with reactor, gets stored here. With the help of a rope modifier you can turn a spline object into a deforming 2-dimensional chain of vertices.

The *rope modifier* is very helpful when you want to create (and simulate) ropes as well as chains or hair.



Create Deforming Mesh Collection

Deforming Meshes or better "Skin-Objects" are a bit complicated to handle. What is a deforming mesh?

In 3dsmax help you will see that the skin of a character, where any deformation stems from the underlying animated character rig, could be used as a deforming mesh in Reactor.

Skin like objects should get stored in the **Deforming Mesh Collection**.

Alright, that's it for Collections. With the help of those five Collections you should now have a "small box" for every object in your scene, so that it can be animated with the help of reactor.

Before you can start animating with **Reactor** you have to create a mesh and store it in the appropriate Collection. Collections are helper objects (also called **dummies**) that can be placed anywhere in the scene. The placement is irrelevant because they are not rendered. So: The first step is adding your object into a collection.

Afterwards, you have to define some physical variables of the object like mass; which alter the objects behaviour greatly.

In the Reactor Toolbar there is a small button called "**Open Property Editor.**"



By the way, if you do not like to work with the Toolbar you can also use the menu at the top. Just click on **Reactor – Open Property Editor**.

The **Property Editor** is divided into three sections:

- Physical Properties
Mass, Friction, Elasticity
- Simulation Geometry
- Display

I will not explain each of them individually, as the 3ds max 6 help does a great job. Just open help (press F1) and search for "**Rigid Body Properties.**"

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Workshop 01

- A simple reactor-animation

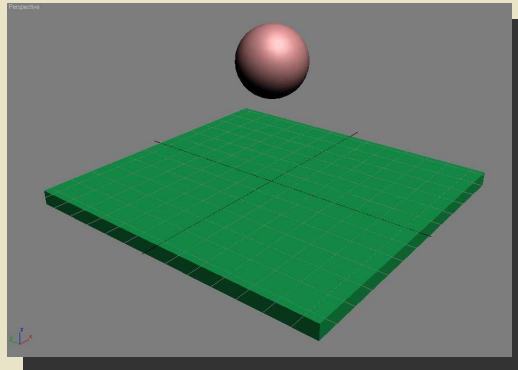
We have learned what **Collections** are and where to change the physical variables of the object. It is time for a little workshop, before you start to get bored.

In this workshop we are going to create 2 objects (a sphere and a box) and let them interact with the help of **reactor**.

In 3ds max 6, create a box and a sphere.

Place the box in the middle (0,0,0) and the sphere over the box (0,0,50) (the value of the z coordinate depends on the size of your object ;)) – Examine the above screenshot of my perspective viewport.

Create (guess what) a **Rigid Body Collection**. Select it from the toolbar and place it somewhere in the scene. As said



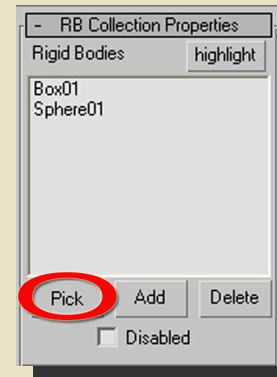
perspective-viewport-screenshot

before: it really does not matter where.

With the *Collection dummy* selected open its modify menu.

(I won't explain where to find it, because you really should know where it is. This is not a tutorial for newbies.)

Click the **Pick** – button and select the Box, then click on it again and select the sphere.



the modify menu

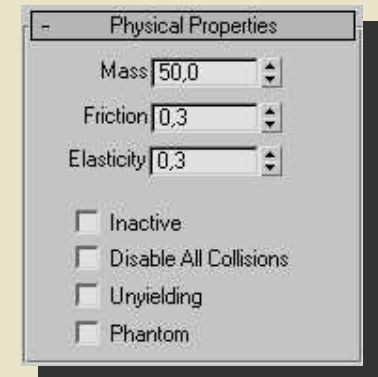
Now that we have added both of the objects into the "small box" we are able to animate them.

No we are not!!

We have to set the physical properties of the objects.

Select the sphere and open the **Property Editor**.

Set the mass to 50. (Hopefully you have checked 3ds max help for an explanation of the parameters.)



the physical properties of the sphere

Select the box and open the Property Editor again. Make sure that the mass is set to 0.

That's all, you have set up your first reactor animation ;)

[Tutorial: Reactor Basics]

Workshop 01

- A simple reactor-animation

Lets try to guess what will happen when we start the animation:

- The sphere has a mass of 50 and will fall as soon as we start the animation.
- A mass of zero means that gravity will not affect the box, so it will not move.
- The sphere will hit the box and will not bounce back up.

Lets see if that is what really happens.

To do so, we need to study the **Preview Animation** button.

Hint: always "Analyse World" (it's a button on the toolbar) BEFORE you start the "Preview Animation". Analyse World will attempt to find any errors in your setup.



The **Havoc** engine should pop-up when you click on the **Preview Animation** button. Here all of the objects stored in the various collections are shown. Hit "P" to start and stop the animation.

If you get an **error** message when clicking on the **Preview Animation** button, make sure that you are using the right **display driver!**

On the main toolbar go to **Customize > Preferences**, click on the **Viewports** tab and click on **Choose Driver**. Make sure that Direct3D is selected! Click on **Advanced Direct3D** and select DirectX 9.0.

The Havoc preview will work only with a DirectX 9 compatible video card!

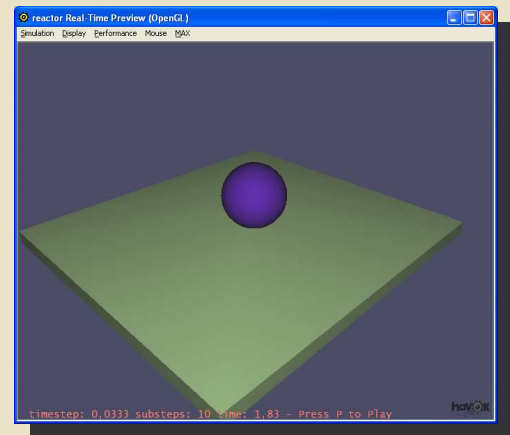
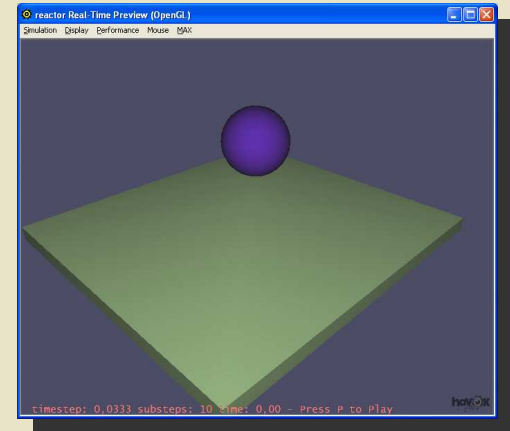
Congratulations! You have successfully finished your first Reactor animation.

If you are satisfied with the results close the preview window and click on the **Create Animation** Button on the toolbar. Reactor will make the animation renderable.

Easy, wasn't it? ;)

Try rotating the plane and see what happens. (I think the ball will roll of the box ;))

Also try changing the spheres physical properties like mass and elasticity and see what happens.



[Tutorial: Reactor Basics]

2. Reactor Basics

As I said before, the workshop is there just to help cement in the lesson. If you feel comfortable with the material, you do not have to do it.

A few more buttons:



Analyse World

Once you set up your Reactor animation use this utility to check if there are any errors in your settings.

If it returns: "World Analysis gave no warnings" you can proceed to the next step.



Preview Animation

Clicking this button will open the *Real Time Preview Window*.

Here you can take a first look at your animation. You can use your mouse to rotate the whole scene and see the effects of doing so. Before you create your animation you should always run the preview to avoid any errors and long renders.



Create Animation

If you are completely satisfied with the results in Preview, you can use this function to have Reactor create keys for every object in the animation

2.2. Reactors – Utilities

By now you should be able to use these common tools to create a simple Reactor animation. What's left?

Gravity!

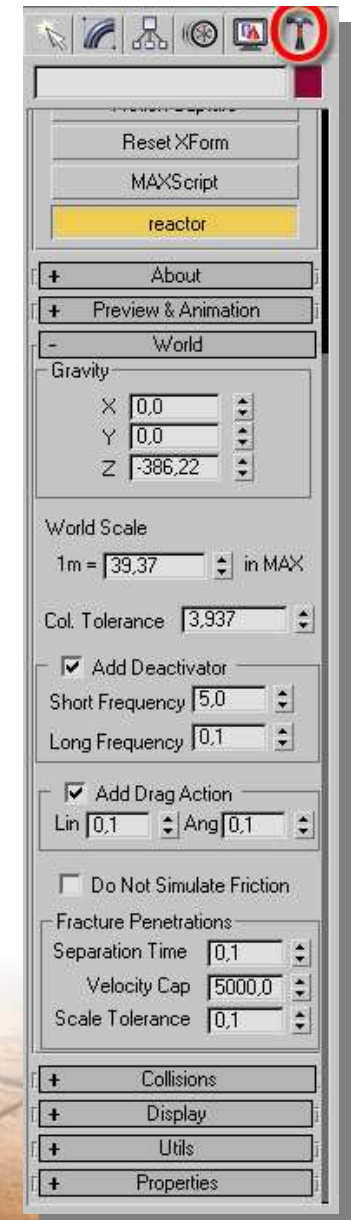
Go to **Utilities** and click on **Reactor** (the picture to the right).

Here you can change a lot of parameters which have a great effect on the environment of your animation.

The most important one can be found in **World > Gravity**. The default is $-386,22$ which is about the strength of Earth's gravity. If you are making an animation in space you should lower the gravity in this menu.

You can also set this to a positive number which would make things float up; useful in an underwater animation.

All of the others are explained in great detail in 3ds max help



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Workshop 02

- An intermediate animation

Lets do another workshop ;) We will create three objects and make them interact.

In the first workshop we created a sphere and let it fall down. It was a very simple animation and easy to make. This time we will go a little bit more in depth with Reactor tools.

Create:

- a torus
- a plane
- a sphere

1. The torus should be in the middle of your scene. (0,0,0). Set Radius 1 to 50 and Radius 2 to 10.
2. The plane should have a length and width of 300 with 16 segments. It should be placed just over the torus (0,0,30).

You do not have to use the same values as it is just an example, so it really does not matter if your plane is just 150x150, but you should create enough length and width segments as this is very important later on!

3. The sphere should have a radius of 15 and be placed over the plane. (0,0,80).

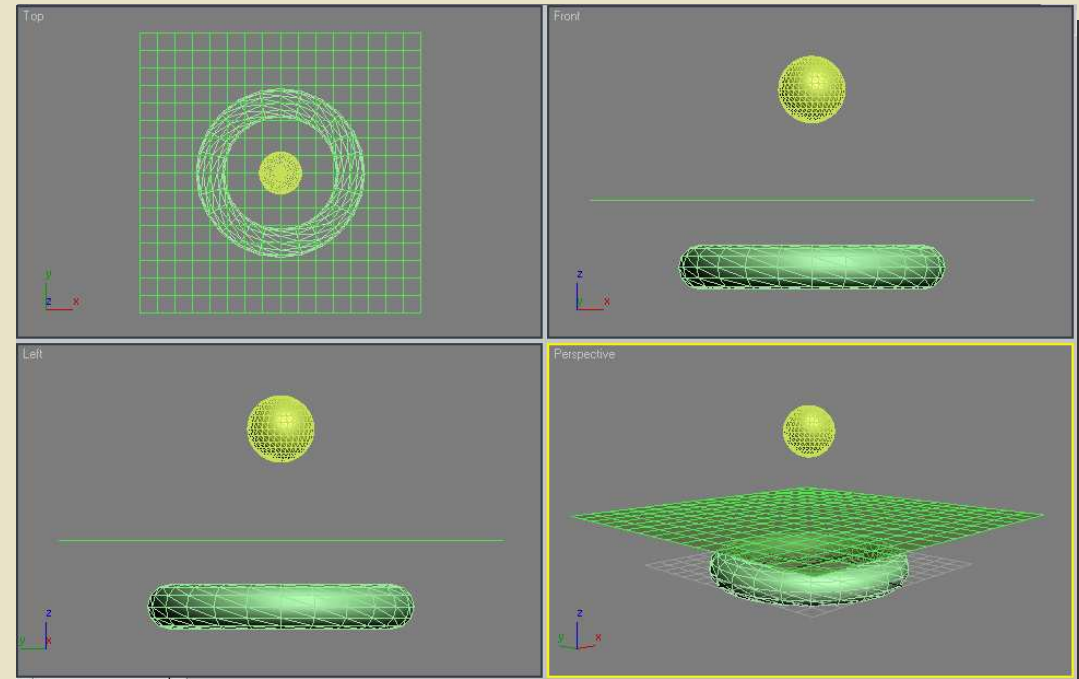
The end result should be like something on the right.

What is the goal of this animation?

The plane should act like a cloth object and fall on the torus (torus will have a mass of 0 so that it will hold its position). The sphere will also fall on both.

Since the plane will behave like a cloth, the sphere will force it through the torus.

Sounds complicated? With Reactor its done in minutes. ;)



We have to set all the of physical attributes:

Select the sphere, open the **Property Editor** (from Reactor – toolbar) and set the mass to 100. When done, select the plane and set the mass to 1. (Cloth is not very heavy. ;))

The torus should have a mass of 0 because it is a stationary object.

We have set the physical attributes and should be able to create our Reactor collections.

Before doing so, we must make the plane behave like a cloth.

[Tutorial: Reactor Basics]

Workshop 02

- An intermediate animation

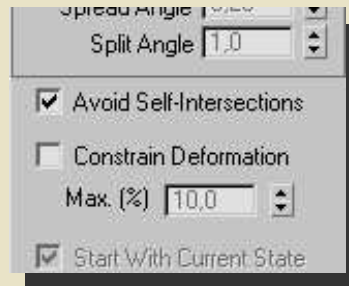
Select the plane, go to Modify and add the **Reactor Cloth** to the stack.



Set mass to 0.01 (as said before: cloth is not very heavy). After that scroll down and activate "**Avoid Self Intersection.**"

(Look at the picture to the right)

If you do not activate it, the simulation will look very unrealistic as the cloth will



intersect itself when falling through the torus.

There is one problem left to fix: Select the torus, open the Property Editor and activate **Concave Mesh**. This makes Reactor use the actual mesh of the object for the animation. Otherwise, Reactor would not recognize the *hole* in the torus!! *(To learn more about it: F1)*

You should only use Concave Mesh if absolutely necessary because it can make the calculation time needlessly long if you use a complex model.

That's it! Unbelievable!

You have created your second Reactor – animation.

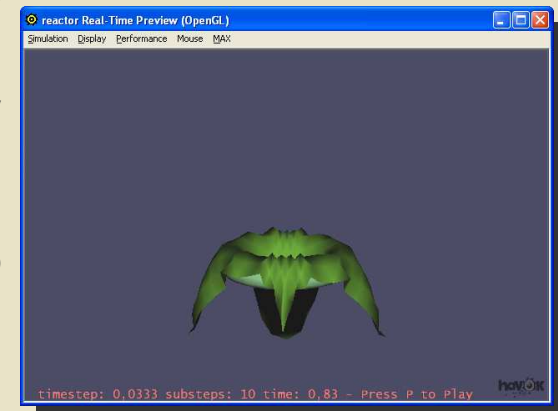
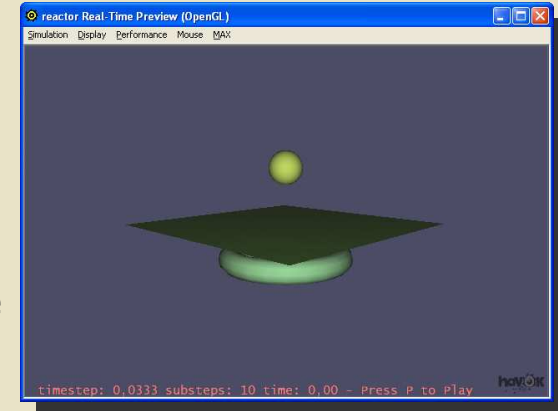
You have created the 3 objects. You have set all of the physical variables and you have added the **cloth modifier** to the Plane.

We still have to create the collections:

Select the **Rigid Body Collection** from the toolbar and add the torus and the sphere to it. Select the **Create Cloth Collection** and add the plane to it.

Now you can "Analyse World" and start the preview. Hit "P" and be astonished ;)

As you can see animating with Reactor is fast and easy to do ;)



After you have created the animation you can add a meshsmooth modifier to the plane stack for better looking results!

3. Conclusion

Well... there is not much left to say. By now, you should be able to create small Reactor animations.

In the next part of the tutorial we are going to model the bell that is shown on the right.

Difficult? Not at all! ;-)

Any questions?
Eumel3d@3dkingdom.org

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- **hp** for correcting my bad english
- **Toni Bratincevic** for allowing me to use one of his pics as background
toni@vizije.hr
<http://www.interstation3d.com>



Picture of the bell that we are going to model and texture in the next part.

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