The Complete Guide to Blender Graphics

Supplement-01

Object Fracture

Fracturing in Blender is the process of breaking an object into multiple pieces.

In video clips or games you will inevitably want to smash or break something into pieces. To achieve this simulation in Blender the object being smashed has to be prepared. Think of the preparation, as if you had a pane of glass and had cracked it producing invisible hair line fractures, such that when the pane was touched it shatters. The broken pieces of glass are called shards. In Blender the fractured pieces of the object are named **Shards**.

Blender has two tools in the **User Preferences** window, **Add-on** listing, under the **Object** category named **Object Fracture** and **Cell Fracture**.

Object Fracture

This is the simplest of the two options but it requires an explanation to understand its function.

To demonstrate this tool activate the **Object: Fracture Tool**, **Add-on** in the **User Preferences** window.

In the **3D window** have a Cube positioned above a Plane (Ground Plane) as shown in Figure 1.1.

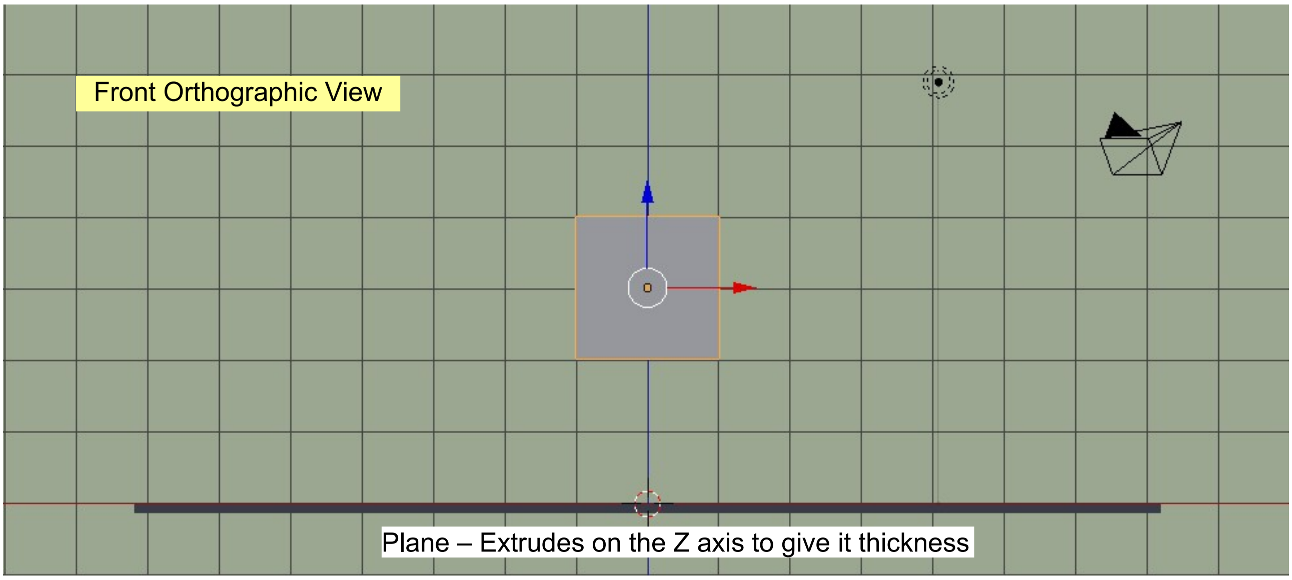


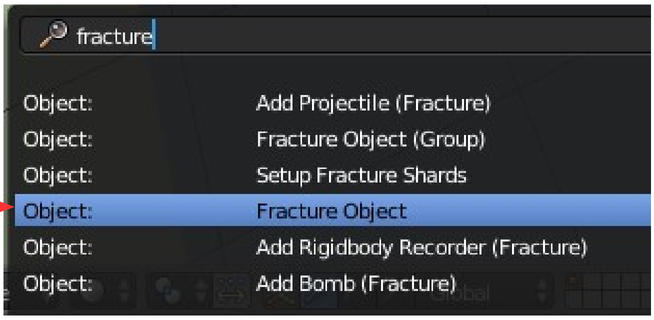
Figure 1.1

Note: The **Cube** object is used since it is the most basic shape to which the Object Fracture Tool may be applied. The tool will not work with a Plane object unless it has been extruded forming a cuboid.

Place the 3D window in **User Perspective** view and zoom in on the Cube.

Select the Cube. Press the Space Bar and type **Fracture** in the search window. Select; **Fracture Object** from the list (Figure 1.2).

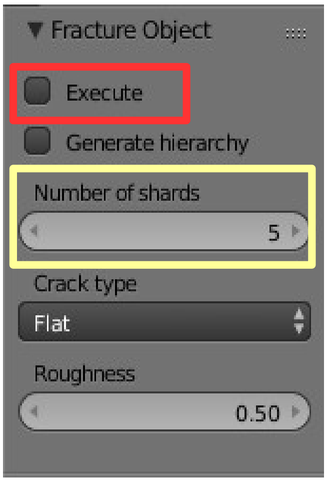
Important: The Object Fracture Add-on must be activated.



fracture

Object:	Add Projectile (Fracture)
Object:	Fracture Object (Group)
Object:	Setup Fracture Shards
Object:	Fracture Object
Object:	Add Rigidbody Recorder (Fracture)
Object:	Add Bomb (Fracture)

Figure 1.2



▼ Fracture Object

☐ Execute

☐ Generate hierarchy

Number of shards: 5

Crack type: Flat

Roughness: 0.50

The **Fracture Tool** will display in the last operator panel at the bottom of the **Tools Panel** (lower left hand side of the 3D window – Figure 1.3). This is where you set parameters and **Execute** the Fracture operation.(for the demonstration use the default parameter settings which are set to produce five **Shards**).

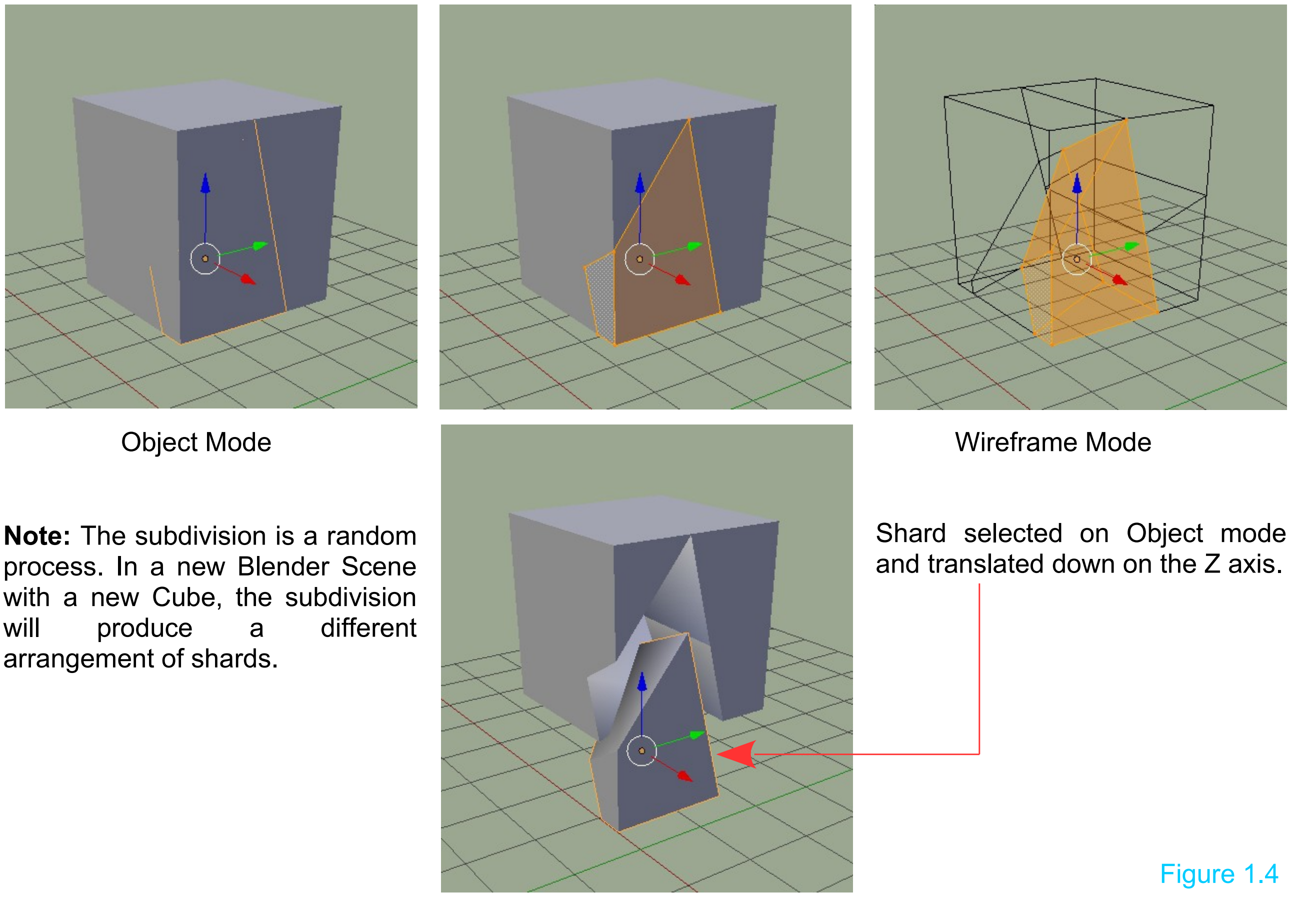
The Fracture Tool divides the Cube into pieces called **Shards**. The pieces are indavidual Objects.

Click the **Execute** button (places a tick) in the last operator panel. With the number of Shards set at five the subdivision is instantaneous but a higher number may take a few seconds to calculate. The subdivisions are called **Shards**. The exact time to subdivide will depend on the number of Shards you have set and the speed of your computer.

Figure 1.3

Warning: Limit the number of Shards to a reasonable value.

When the subdivision is completed the Cube is divided into pieces which are indavidual objects (Shards) clustered in the shape of the original Cube. The edges of the last subdivision computed are highlighted in orange. By clicking RMB on a different part of the Cube you may select any of the other Shards. You will see a better representation in **Wireframe** display mode (Figure 1.4).



Object Mode

Wireframe Mode

Note: The subdivision is a random process. In a new Blender Scene with a new Cube, the subdivision will produce a different arrangement of shards.

Shard selected on Object mode and translated down on the Z axis.

Figure 1.4

Understanding the Subdivision

The fracture subdivides the object internally into parts which are separate objects. The objects are clustered together maintaining the physical exterior shape of the original object. The parts are called **Shards**. The number of new objects is determined by the number of Shards requested when entering the parameters in the **Fracture Tool panel**.

In the **Outliner window**, you will see the new objects listed such as Cube.006, Cube.008, Cube.009, Cube.011, Cube.012 (Figure 1.5).

Blender, in fact, creates more Shards than required then randomly selects the number requested.

Outliner Window

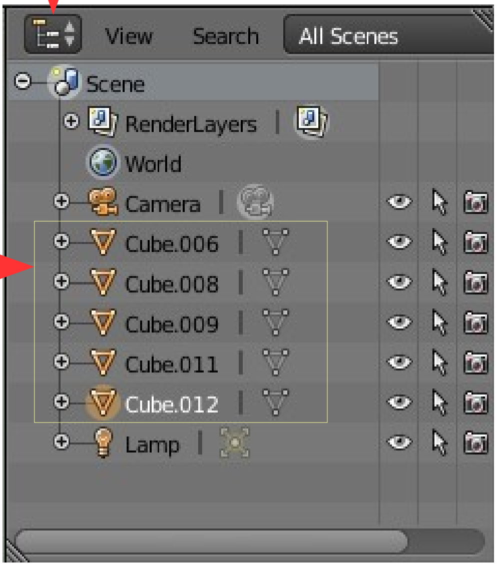


Figure 1.5

This can be seen by comparing the list in the **Outliner** window and the list in the **Properties window, Object button, Browse Object to be Linked** menu (Figure 1.5, 1.6).

Properties Window Object button

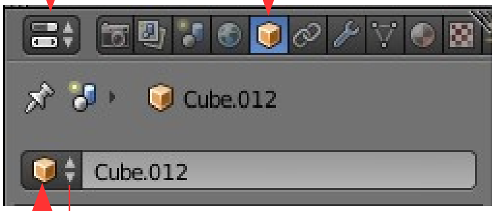


Figure 1.5

Browse Object to be Linked

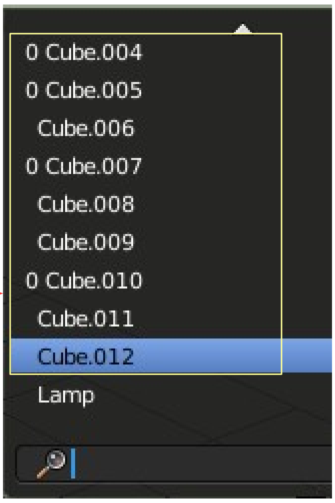


Figure 1.6

The **Object Fracture** tool may be used to simply divide an object into multiple pieces which you grab (LMB click, G key or use the Manipulation Widget) to position in a Scene.

The tool is, however, primarily designed to be used when animating in a **Blender Scene** or in the **Blender Game Engine**. In either case, **Rigid Body Physics** has to be applied to each Shard and to any object in the Scene with which the shards interact.

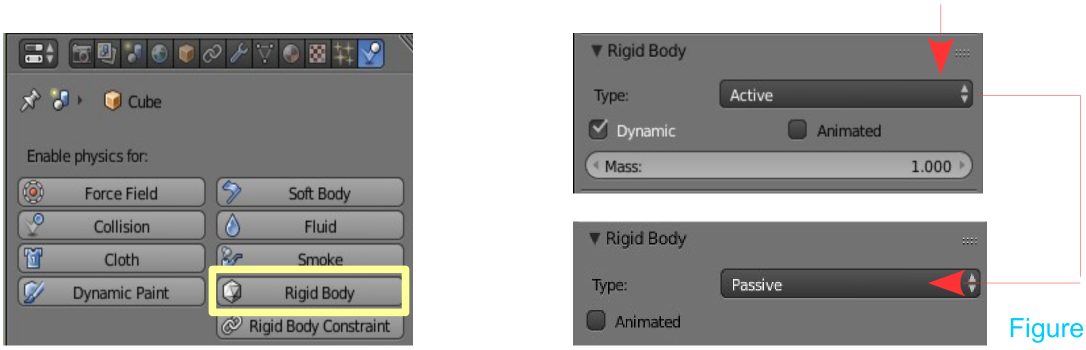
To demonstrate, the Shards from the Fractured Cube will be animated to fall under the influence of Gravity and land on the Ground Plane. The Shards, therefore, interact with the Plane.

Physics Application

When Fracturing and applying Physics the distinction has to be made between working in a Blender Scene with the **Blender Render Engine** active and working in the **Blender Game Engine**. The method of applying Physics is different depending on where you are working. At this stage, it is not recommended that Fracture and Physics be applied in Blender Render and then switch to Blender game or vice versa. Unexpected results can be experienced.

Physics in Blender Render

Select the Ground Plane and in the **Properties window, Physics buttons**, select **Rigid Body Physics**. By default the **Physics Type** is **Active** and the **Actor button** will be checked (ticked). The outline of the Plane turns green indicating that Physics is applied. This means, in an animation, the Plane will fall under the influence of Gravity and disappear from view. To prevent this happening change the **Physics Type** to **Passive** (Figure 1.7).



Click and select Passive from the menu

Type: Active

☑ Dynamic

□ Animated

Mass: 1.000

Type: Passive

□ Animated

Figure 1.7

Remember: By default Gravity is active in the Blender Scene (see: Properties window, Scene buttons, Gravity tab – Gravity is checked).

Deselect the Plane (press the A key).

With the Cube Fractured, select one of the Shards (Figure 1.8). In the **Properties window, Physics buttons** click on **Rigid Body** to apply the physics to the selected Shard. The outline of the Shard turns green Figure 1.9). Note that the **Physics Type** is **Active** and that the **Dynamic button** is checked (ticked). Box select all the shards in the 3D window being careful not to select the Plane or anything else in the Scene (B key drag rectangle – Figure 1.10, 1.11). In the **Tools Panel** at the left-hand side of the 3D window go to the **Physics tab** and in the **Rigid Body Tools panel** click on **Copy From Active** (Figure 1.12). This applies the **Rigid Body Physics** from the original Shard to each Shard (Figure 1.13).

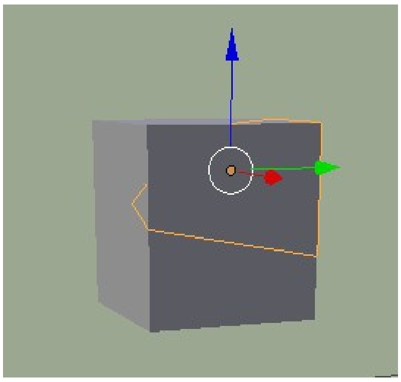


Figure 1.8

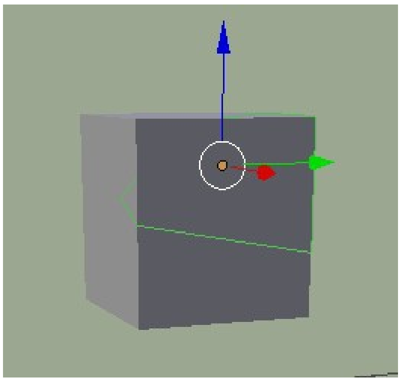


Figure 1.9

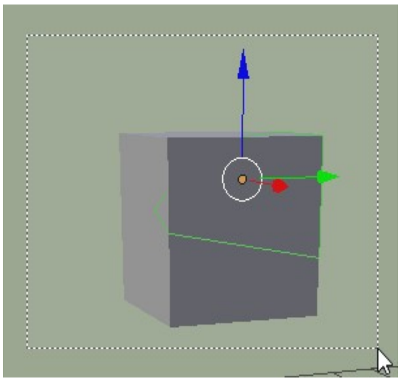


Figure 1.10

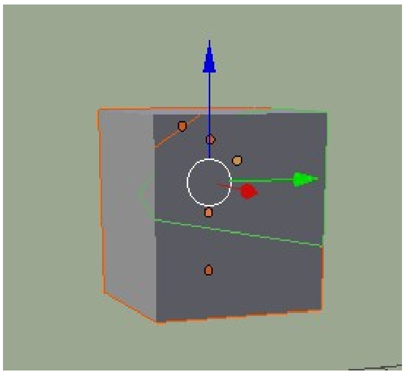


Figure 1.11

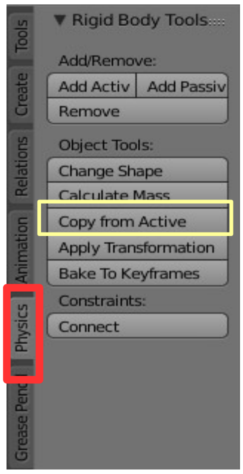


Figure 1.12

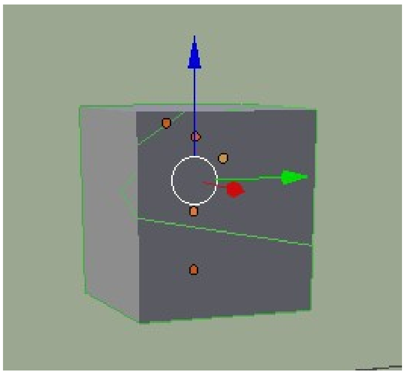


Figure 1.13

Note: If you inadvertently select something else in the Scene it will also have Physics applied.

See the Fractured Cube fall and break apart on impact with the Plane by pressing the **Play button** in the **Timeline window** (Figures 1.7, 1.8). An animation is generated which you can scrub in the Timeline window.

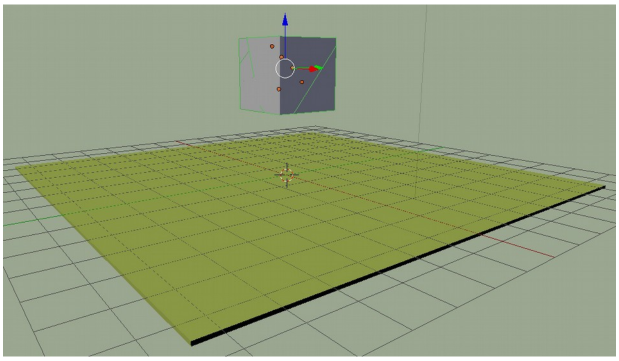


Figure 1.7

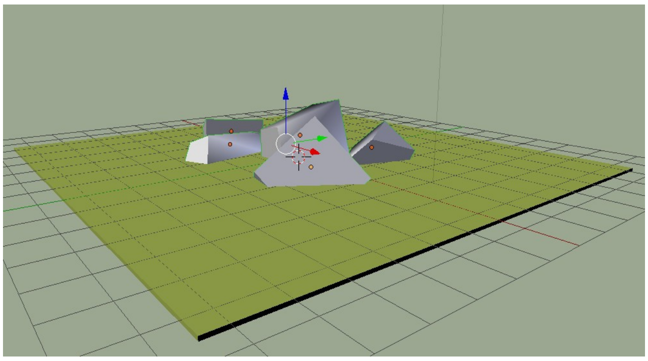


Figure 1.8

Breaking apart on impact may be the effect you want or alternatively, you may want the Object (Cube) to break apart or explode in mid air. To achieve this, apply **Rigid Body Physics** to the Cube **before fracturing**. After fracture, each Shard has Rigid Body Physics. Playing the animation shows the Cube exploding.

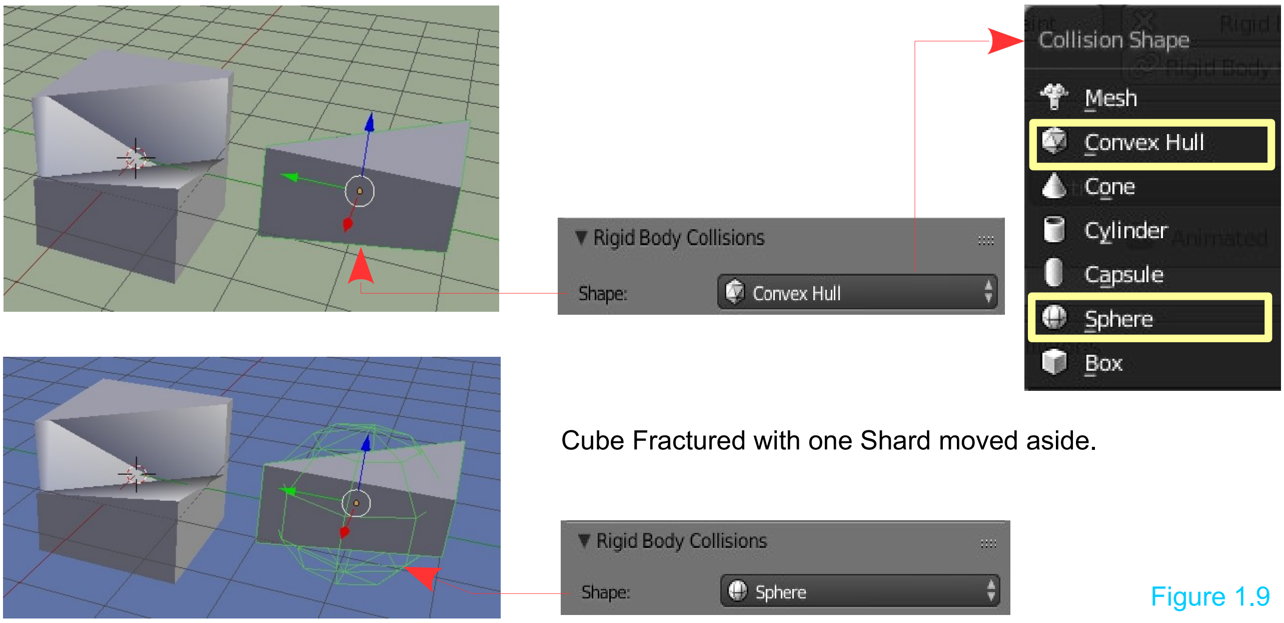
To control the explosion (breaking apart) you should understand why this occurs.

When Rigid Body Physics is applied to objects they interact with each other such as colliding or bouncing when the surface of the objects make contact.

With Rigid Body Physics each object, with physics applied, is assigned a **Bounding Volume**. It is, in fact, the periphery of the Bounding Volume which determines the point of contact and interaction.

By default the Rigid Body Physics, Bounding Volume assigned to an object is type **Convex Hull**. You see this in the **Physics, Rigid Body Collisions tab**, Shape: Convex Hull.

Convex Hull is one of seven Bounding Volume shapes which may be selected. Convex Hull is a volume which approximately conforms to the shape of the object itself.



▼ Rigid Body Collisions

Shape: Convex Hull

Cube Fractured with one Shard moved aside.

▼ Rigid Body Collisions

Shape: Sphere

Figure 1.9

To enable the physics to work each Bounding Volume has a **Collision Margin** or overlap. By default, the Margin is 0.040. You see this in the **Rigid body Collisions tab** under **Sensitivity, Collision margin**. By default, Collision Margin is not active but the default Margin: 0.040 is, in fact, in effect. Thus when an animation is played with a Fractured object in the Scene the Bounding Volumes interact, pushing against one and other, forcing the objects apart. The force exerted causes the Shards to fly apart (explode).

If you require a dramatic explosion increase the **Margin** value, remembering to apply this to all Shards. The violence of the explosion may be controlled adjusting the **Margin** value (Margin: 0.000 no explosion, Margin 1.000 maximum).

To prevent Shards flying apart when the animation is played, use the original method, **Fracture the Cube before applying Rigid Body Physics**. After fracture, select a Shard, apply Rigid Body Physics, Check Collision Margin, Change the Margin value to 0.000 then Box select all Shards and in the Tools Panel, Physics tab press **Copy from Active**.

When the animation is played the Shard cluster remains intact until it collides with another object (falls and lands on the Plane).

Note: Use the foregoing procedure. Applying the Collision Margin change to Physics settings before Fracture will not work. Although the margin for each Shard displays as 0.000 the cluster explodes when the animation is played.

Physics in Blender Game

When the **Blender Game Engine** is active all Objects in the Scene automatically have Physics applied. By default the Physics Type is **Static** and instead of the Dynamic button, there is an **Actor** button which is **NOT** checked. This is equivalent to having Rigid Body Physics Type: Passive applied using Blender Render. There is no indication, by a green outline, in the 3D window. You see the **Physics buttons** active in the **Properties window, Physics buttons**.

Note: Physics is applied to every Object in the Scene including the Camera and the Lamp.

To replicate the action previously demonstrated when using Blender Render, that is to simulate a Cube shattering on impact with a ground plane, you Fracture the Cube and apply Physics.

Reconstruct the Scene with the Cube sitting above the Plane. Change **Blender Render** to **Blender Game** in the **Info window** header.

In the **Properties window, Physics buttons, Physics tab** click the bar where you see **Physics type: Static,** to display the Physics Type selection menu.

For the Ground Plane, you leave the Physics Type: Static (the plane will remain stationary when the game is played).

For the Cube consider applying Physics before Fracture or after Fracture.

Scenario – Before Fracture

Have the Cube positioned above the Plane in the Scene with the Cube selected. The Physics Type for the Cube is Static (working in Blender game). In the Properties window, Physics buttons, Physics tab change Static to Rigid Body.

Fracture the Cube and each Shard will have Physics Type: Rigid Body.

Note: If you have fractured an object in the Scene then you add a second object then press the Space Bar and bring up the search window and select Fracture Object, the fracture operation will automatically be executed with the settings you previously employed. You may alter the settings in the Last Operator, Fracture Object panel and they will be immediately applied to the object.

Scenario – After Fracture

The Cube is automatically assigned Physics Type: Static (when in Blender Game mode). When fractured each Shard has Physics Type: Static applied. You could simply select each Shard in turn and change Physics to Rigid Body. With only five Shards this would be fine but with one hundred Shards this method would be, to say the least, tedious.

To simplify the process perform the following:

Select one of the Shards and change the Physics Type to Rigid Body. With the Shard selected, **Box select all Shards** (the Cube Cluster)**.** Press the Space Bar and delete the entry in the search bar and type **Fracture** again. Select **Setup Fracture Shards** from the menu. This applies **Rigid Body Physics** to all the Shards.

Play the Game

In **Blender Game** press the **P key** to play and see the Cube Cluster fall, hit the Plane and shatter. The Shards remain in position in the Cluster until impact.

Material Assignment

To enhance the visual display, different materials (colors) may be assigned to the exterior and interior surfaces of the Shards.

Material assignment is demonstrated with **Blender Rende**r active.

Have all the Shards selected in the Cube cluster then press **Ctrl + J ke**y to join them together into a single Object. Tab into **Edit** mode and box select the **external faces** of the cluster. Either box select or circle select, **with Limit Selection to Visible active**. Have this active so that you are only selecting external faces. Rotate the Scene to select all external faces.

With the external faces selected, in the **Properties window, Material buttons** select a **Diffuse material** color. Press the **Assign** button to assign the material to the exterior faces.

In the **Material buttons** add a new material slot (Material.001) and select a different Diffuse color. Remember at this point the exterior faces are selected and you are in **Edit mode**.

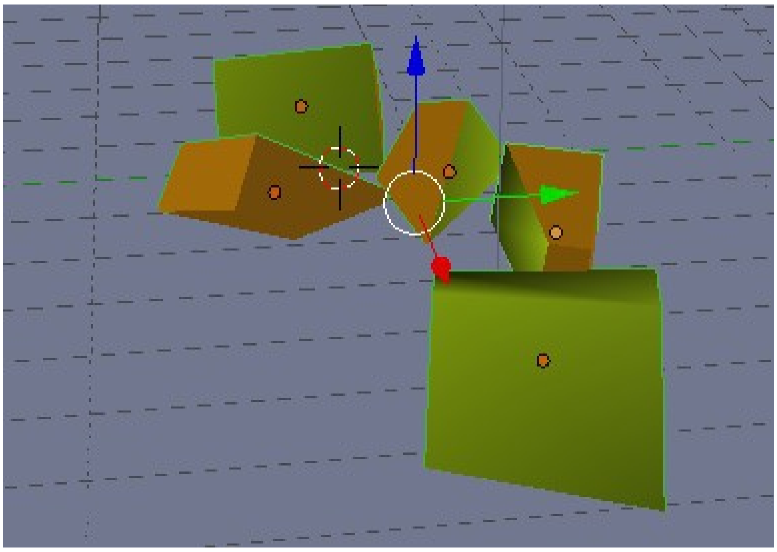


Figure 1.10

Press **Ctrl + I key** to select the interior faces. Click the Assign button to assign **Material 0.001** to the internal faces.

Press **A key twice** to deselect then select all faces. Press the **P key** and select **By Loose Parts**. Tab into **Object mode**.

Note: The **Object Center** or **Origin of Geometry** is located at the center of geometry of the last shard selected. To correct, Box select the Cube cluster then press **Ctrl + Alt + Shift + C key** and select **Set Origin, Origin to Geometry.**

When the animation is played and the cluster disperses you will see the external and internal faces with the different colors (Figure 1.10).

Note: This procedure for assigning material color is similar to assignment to vertex groups and is to be used with the Object Fracture, Add-on. The Cell Fracture, Add-on simplifies the procedure.

Projectile

A projectile may be entered in the Scene to disperse the Shards or interact with any object having **Rigid Body** physics applied.

Any object may be used as a projectile. As an example, have a **Cube** positioned just above a **Plane** with a **UV Sphere** off to one side as shown in the diagram. The 3D window is in **Blender Render** mode.

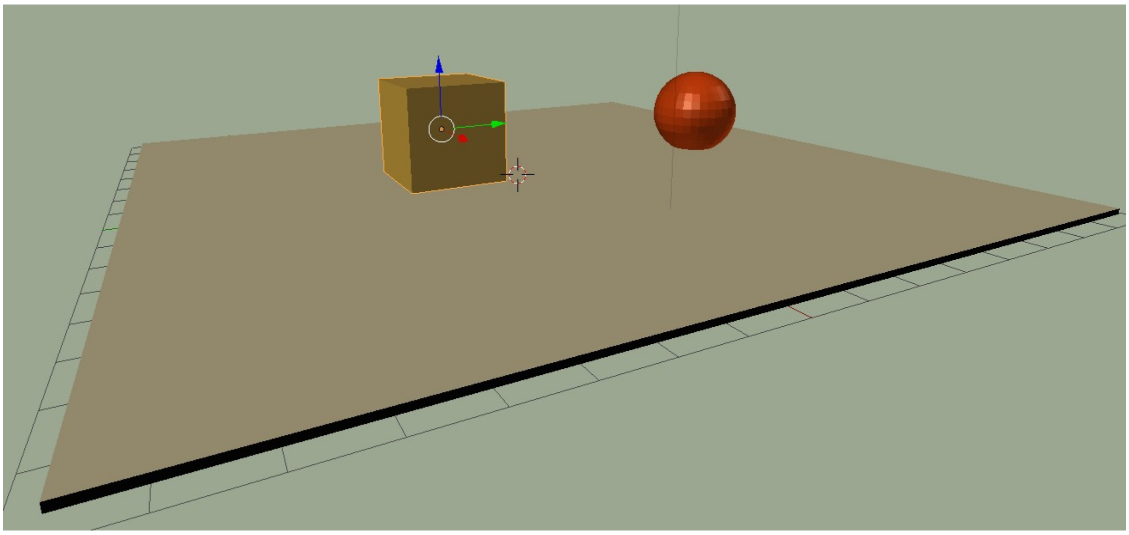


Figure 1.11

Run the **Object Fracture** tool with the Cube selected and create 10 Shards. Select one of the Shards and apply **Rigid Body physics** in the **Properties window, Physics buttons**. Set the **Rigid Body physics type** to **Active** and in the Rigid Body Dynamic tab check **Enable Deactivation** and **Start Deactivation**. Checking these leaves Rigid Body physics in place but the physics will not be active until another object makes contact.

With the single Shard remaining selected Box select the other Shards then in the **Tool Panel, Physics tab** click **Copy From Active** to apply the Physics settings to all Shards.

Have the Plane with Rigid Body physics type Passive.

Select the UV Sphere and animate it, by inserting Keyframes, to move across the Plane in 15 Frames. Make sure the sphere's trajectory intersects with the cube if it moves.

Apply **Rigid Body physics** to the **UV Sphere** type **Active** with **Dynamic** checked and also check **Animated** in the Rigid Body tab. Checking Animated makes the sphere react to the Keyframe Animation rather than Gravity.

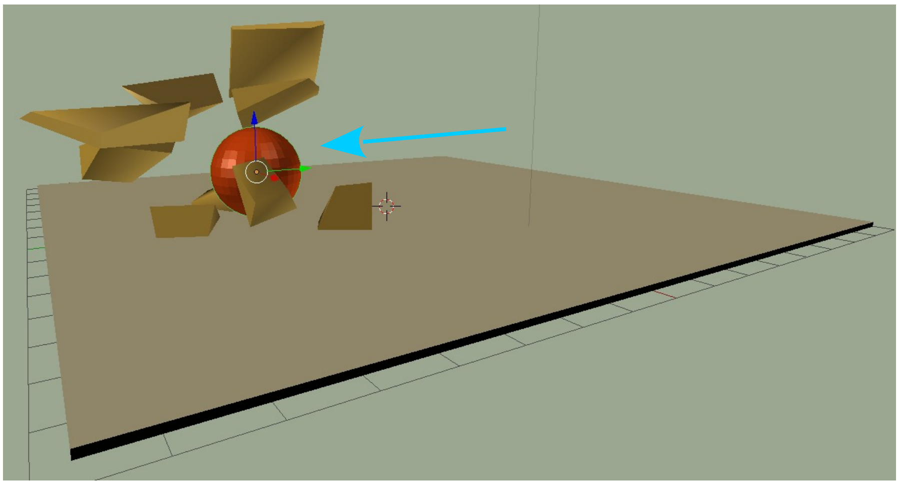


Figure 1.12

Play the animation in the Timeline window to see the UV Sphere shatter the Cube.

Note: With the **Object Fracture** tool enabled you will also find a **Fracture Helper Objects** category in the 3D window **Add** button (Shift + A key). The options in this category are Bomb, Projectile and Rigid Body Recorder.

The Fracture Helper Objects are designed to be used in Blender Game mode. Adding a Bomb helper to the Scene and placing it inside the fractured object causes it to fly apart or explode when the game is played. The violence of the explosion is controlled by adjusting the Radius value in the Properties window, Physics buttons. Have the Physics Type: Dynamic set for the Bomb Helper object. The Projectile Helper introduces a non-renderable projectile object which you position to intersect with the trajectory of the Fracture Shards. The projectile pushes the shards as they fall. The Rigid Body Recorder records an animation sequence of the Game when it is played.