<http://docs.unity3d.com/540/Documentation/Manual/CollidersOverview.html>

**Colliders**

**碰撞器**

**Collider** components define the shape of an object for the purposes of physical collisions. A collider, which is invisible, need not be the exact same shape as the object’s mesh and in fact, a rough approximation is often more efficient and indistinguishable in gameplay.

碰撞器（**Collider** ）组件决定了能够物理碰撞的对象的外形 。碰撞器是不可见的，使用近似原始模型形状的碰撞器能够得到更高的效率，且碰撞计算结果几乎没有什么区别。

The simplest (and least processor-intensive) colliders are the so-called *primitive* collider types. In 3D, these are the [Box Collider](http://docs.unity3d.com/540/Documentation/Manual/class-BoxCollider.html), [Sphere Collider](http://docs.unity3d.com/540/Documentation/Manual/class-SphereCollider.html) and [Capsule Collider](http://docs.unity3d.com/540/Documentation/Manual/class-CapsuleCollider.html). In 2D, you can use the [Box Collider 2D](http://docs.unity3d.com/540/Documentation/Manual/class-BoxCollider2D.html) and [Circle Collider 2D](http://docs.unity3d.com/540/Documentation/Manual/class-CircleCollider2D.html). Any number of these can be added to a single object to create *compound colliders*.

最简单(最少的运算复杂度)的碰撞器类型称为原始的碰撞器类型.在3D中,这些是[Box Collider](http://docs.unity3d.com/540/Documentation/Manual/class-BoxCollider.html), [Sphere Collider](http://docs.unity3d.com/540/Documentation/Manual/class-SphereCollider.html) 和 [Capsule Collider](http://docs.unity3d.com/540/Documentation/Manual/class-CapsuleCollider.html).在2D中，您可以使用[Box Collider 2D](http://docs.unity3d.com/540/Documentation/Manual/class-BoxCollider2D.html) 和 [Circle Collider 2D](http://docs.unity3d.com/540/Documentation/Manual/class-CircleCollider2D.html)。可以将任意数量的此类碰撞器添加到对象上组成复合碰撞器。

With careful positioning and sizing, compound colliders can often approximate the shape of an object quite well while keeping a low processor overhead. Further flexibility can be gained by having additional colliders on child objects (eg, boxes can be rotated relative to the local axes of the parent object). When creating a compound collider like this, there should only be one Rigidbody component, placed on the root object in the hierarchy.

通过仔细的定位和缩放，复合的碰撞器可以在十分近似于对象的形状同时保持处理器的低消耗。此外，为子物体添加碰撞器可以更灵活地处理碰撞（例如，盒状碰撞器可以相对其父物体坐标系做旋转操作）。如果您创建了类似这样的复合碰撞器，则该物体应仅在其结构视图中的根节点上放置一个刚体组件。

Note, that primitive colliders will not work correctly with shear transforms - that means that if you use a combination of rotations and non-uniform scales in the tranform hierarchy so that the resulting shape would no longer match a primitive shape, the primitive collider will not be able to represent it correctly.

注意，原始碰撞器在与经过裁切的Transform组件配合使用时将会产生错误的结果 —— 也就是说如果您在Transform结构树中调整了旋转的同时使用了非统一的缩放尺寸，导致的结果将是原始碰撞器的形状无法和物体本身相匹配。

There are some cases, however, where even compound colliders are not accurate enough. In 3D, you can use [Mesh Colliders](http://docs.unity3d.com/540/Documentation/Manual/class-MeshCollider.html) to match the shape of the object’s mesh exactly. In 2D, the [Polygon Collider 2D](http://docs.unity3d.com/540/Documentation/Manual/class-PolygonCollider2D.html) will generally not match the shape of the sprite graphic perfectly but you can refine the shape to any level of detail you like. These colliders are much more processor-intensive than primitive types, however, so use them sparingly to maintain good performance. Also, a mesh collider will normally be unable to collide with another mesh collider (ie, nothing will happen when they make contact). You can get around this in some cases by marking the mesh collider as**Convex** in the inspector. This will generate the collider shape as a “convex hull” which is like the original mesh but with any undercuts filled in. The benefit of this is that a convex mesh collider can collide with other mesh colliders so you may be able to use this feature when you have a moving character with a suitable shape. However, a good general rule is to use mesh colliders for scene geometry and approximate the shape of moving objects using compound primitive colliders.

在某些情况下，即使复合的碰撞器也不够精确。在3D中，您可以使用精确匹配物体网格形状的MeshCollider。在2D中，Polygon Collider2D并不会完全按照精灵图素生成合适的形状，但可以完善到您想要的程度。这些碰撞器要比元类型的碰撞器处理器开销要大，所以谨慎的使用它们来保持良好的性能。此外，一个网格碰撞器通常不能和另外一个网格碰撞器发生碰撞(也就是说,它们互相之间的碰撞不会有任何事情发生). 某些情况下，您可以在检视面板中将网格碰撞器标记为Convex 来绕开这种情况。这会生成一个新的“凸包”碰撞形状——即以原有的网格为基础，对网格的凹进部分进行填充。这样做的好处是类似这样的凸面碰撞器可以同其他网格碰撞器进行交互。因此如果您的可移动角色拥有适当的形状，您就可以考虑使用该特性。

Colliders can be added to an object without a Rigidbody component to create floors, walls and other motionless elements of a scene. These are referred to as **static**colliders. In general, you should not reposition static colliders by changing the Transform position since this will impact heavily on the performance of the physics engine. Colliders on an object that *does* have a Rigidbody are known as *dynamic* colliders. Static colliders can interact with dynamic colliders but since they don’t have a Rigidbody, they will not move in response to collisions.

碰撞器可以添加在一个无刚体组件的对象上，当做地板，走廊和其他在场景中不动的元素。这些被称为静态碰撞器。一般来说,您不应该重设静态碰撞器的坐标，改变静态碰撞器的坐标将严重影响物理引擎的性能。在一个有缸体的对象的碰撞器被称为动态碰撞器。静态碰撞器可以影响动态碰撞器，但因为他们没有一个缸体碰撞器组件，他们在碰撞时将不会移动。

The reference pages for the various collider types linked above have further information about their properties and uses.

这些页面为几种碰撞器的的属性和使用提供进一步的信息。

**Physics materials**

**物理材质**

When colliders interact, their surfaces need to simulate the properties of the material they are supposed to represent. For example, a sheet of ice will be slippery while a rubber ball will offer a lot of friction and be very bouncy. Although the shape of colliders is not deformed during collisions, their friction and bounce can be configured using **Physics Materials**. Getting the parameters just right can involve a bit of trial and error but an ice material, for example will have zero (or very low) friction and a rubber material with have high friction and near-perfect bounciness. See the reference pages for [Physic Material](http://docs.unity3d.com/540/Documentation/Manual/class-PhysicMaterial.html) and [Physics Material 2D](http://docs.unity3d.com/540/Documentation/Manual/class-PhysicsMaterial2D.html) for further details on the available parameters. Note that for historical reasons, the 3D asset is actually called **Physic Material** (*without* the S) but the 2D equivalent is called **Physics Material 2D**(*with* the S).

当碰撞器相互接触时，它们的表面应模拟出其材质应具有的特性。。举个例子，一块冰是滑的，而橡胶球具有高摩擦力和很大的弹性。尽管碰撞器的形状在碰撞时不会产生形变,但它们的摩擦和反弹特性可以使用物理材质配置。想要把这些参数调整到满意的状态可能需要花一些时间来测试，不过对于模拟冰的材质来说，我们科技将它的摩擦力设置为零（或很低），而橡胶材质就可以有着很高的摩擦力以及几乎完美的弹性。参见 [Physic Material](http://docs.unity3d.com/540/Documentation/Manual/class-PhysicMaterial.html) 和[Physics Material 2D](http://docs.unity3d.com/540/Documentation/Manual/class-PhysicsMaterial2D.html) 了解进一步的有效参数信息。注意由于历史原因，3D的资源通常称为**Physic Material**  (不带S)，而对应的2D材质称为**Physics Material 2D**(带S)**。**

**Triggers**

**触发器**

The scripting system can detect when collisions occur and initiate actions using the OnCollisionEnter function. However, you can also use the physics engine simply to detect when one collider enters the space of another without creating a collision. A collider configured as a **Trigger** (using the **Is Trigger** property) does not behave as a solid object and will simply allow other colliders to pass through. When a collider enters its space, a trigger will call the OnTriggerEnter function on the trigger object’s scripts.

当碰撞发生时脚本系统可以检测并使用OnCollisionEnter 方法采取行动。然而您也可以使用物理引擎简单的检测一个碰撞器进入另外一个空间而不发生碰撞。一个碰撞器可配置为一个触发器（使用Is Trigger属性）不表现为一个实体对象并且将仅仅允许其他碰撞器穿过。当一个碰撞器进入一个触发器的空间时，将调用在触发对象的脚本中的OnTriggerEnter方法。

**Script actions taken on collision**

**碰撞的脚本动作**

When collisions occur, the physics engine calls functions with specific names on any scripts attached to the objects involved. You can place any code you like in these functions to respond to the collision event. For example, you might play a crash sound effect when a car bumps into an obstacle.

当碰撞发生时，物理引擎会调用任何被卷入对象上脚本的一些具体名字的方法。像这些方法相应的碰撞事件。举个例子，您可能需要当一辆汽车撞倒一个障碍物时播放一个碰撞声效果

On the first physics update where the collision is detected, the OnCollisionEnter function is called. During updates where contact is maintained, OnCollisionStay is called and finally, OnCollisionExit indicates that contact has been broken. Trigger colliders call the analogous OnTriggerEnter, OnTriggerStay and OnTriggerExitfunctions. Note that for 2D physics, there are equivalent functions with **2D** appended to the name, eg, OnCollisionEnter2D. Full details of these functions and code samples can be found on the Script Reference page for the [MonoBehaviour](http://docs.unity3d.com/540/Documentation/ScriptReference/MonoBehaviour.html) class.

在检测到碰撞的第一次物理更新中，OnCollisionEnter方法会被调用.在碰撞持续更新的过程中,OnCollisionStay会被调用，并且最后的OnCollisionExit方法表示碰撞状态已经被打破。触发碰撞器会调用OnTriggerEnter,OnTriggerStay和OnTriggerExit等相似的方法.注意2D物理,2D被追加到名字的同等的方法,如,OnCollisionEnter2D。这些方法的完整信息和代码示例可以在脚本页面[MonoBehaviour](http://docs.unity3d.com/540/Documentation/ScriptReference/MonoBehaviour.html)类中找到。

With normal, non-trigger collisions, there is an additional detail that at least one of the objects involved must have a non-kinematic Rigidbody (ie, *Is Kinematic* must be switched off). If both objects are kinematic Rigidbodies then OnCollisionEnter, etc, will not be called. With trigger collisions, this restriction doesn’t apply and so both kinematic and non-kinematic Rigidbodies will prompt a call to OnTriggerEnter when they enter a trigger collider.

在普通,非触发器碰撞时，有一个额外的细节是卷入的对象至少有一方是非-kinematic刚体(那就是说Is Kinematic必须关闭)。如果两者对象都是kinematic刚体，那OnCollisionEnter都不会被调用。带触发器的碰撞，这种限制将不会适用所以kinematic和非kinematic的刚体在进入一个触发碰撞器时将调用OntriggerEnter方法。

**Collider interactions**

**碰撞器的相互作用**

Colliders interact with each other differently depending on how their [Rigidbody components](http://docs.unity3d.com/540/Documentation/Manual/RigidbodiesOverview.html) are configured. The three important configurations are the *Static Collider* (ie, no Rigidbody is attached at all), the *Rigidbody Collider* and the *Kinematic Rigidbody Collider*.

碰撞器相互作用的不同依赖于他们的Rigidbody 的配置。有三个重要的配置是静态碰撞器(换句话说,没有任何刚体)，刚体碰撞器和Kinematic刚体碰撞器。

**Static Collider**

**静态碰撞器**

This is a GameObject that has a Collider but no Rigidbody. Static colliders are used for level geometry which always stays at the same place and never moves around. Incoming rigidbody objects will collide with the static collider but will not move it.

这是一个有碰撞器但是没有刚体的游戏物体。静态碰撞器用在静止的平面几何。进来的刚体对象将会发生碰撞，但是静态碰撞器不会移动。

The physics engine assumes that static colliders never move or change and can make useful optimizations based on this assumption. Consequently, static colliders should not be disabled/enabled, moved or scaled during gameplay. If you do change a static collider then this will result in extra internal recomputation by the physics engine which causes a major drop in performance. Worse still, the changes can sometimes leave the collider in an undefined state that produces erroneous physics calculations. For example a raycast against an altered Static Collider could fail to detect it, or detect it at a random position in space. Furthermore, Rigidbodies that are hit by a moving static collider will not necessarily be “awoken” and the static collider will not apply any friction. For these reasons, only colliders that are Rigidbodies should be altered. If you want a collider object that is not affected by incoming rigidbodies but can still be moved from a script then you should attach a *Kinematic*Rigidbody component to it rather than no Rigidbody at all.

物理引擎会基于假定静态碰撞器的永不移动和改变而作优化。因此，静态碰撞器在游戏中不可以开启或者关闭，移动或者缩放。如果您改变了静态碰撞器则会导致物理引擎性能大幅的下降。更糟糕的是，这些改变有时会使碰撞器处在一个不确定的状态下产生错误的物理计算。例如。一条射线不能发现改变的静态碰撞器，或发现他处在空间的一个随机位置。此外，刚体碰撞了一个移动中的静态刚体将不会必然被唤醒并且静态碰撞器不会受到任何摩擦力。由于这些原因，所以只有是刚体的碰撞器应该发生改变。如果你希望一个碰撞器对象不受到将要碰上的刚体的影响，但仍然可以被脚本移动，添加Kinematic刚体组件要比没有刚体组件要更合适。

**Rigidbody Collider**

**缸体碰撞器**

This is a GameObject with a Collider and a normal, non-kinematic Rigidbody attached. Rigidbody colliders are fully simulated by the physics engine and can react to collisions and forces applied from a script. They can collide with other objects (including static colliders) and are the most commonly used Collider configuration in games that use physics.

这是一个带碰撞器的和一个普通非运动的刚体组件的游戏物体.刚体碰撞器是完全由物理引擎模拟并且响应从脚本中的碰撞和和力。他们可以碰撞其他对象（包括静态碰撞器）并且是游戏中最常用的使用物理的碰撞器的配置。

**Kinematic Rigidbody Collider**

**运动学(Kinematic)缸体碰撞器**

This is a GameObject with a Collider and a kinematic Rigidbody attached (ie, the IsKinematic property of the Rigidbody is enabled). You can move a kinematic rigidbody object from a script by modifying its Transform Component but it will not respond to collisions and forces like a non-kinematic rigidbody. Kinematic rigidbodies should be used for colliders that can be moved or disabled/enabled occasionally but that should otherwise behave like static colliders. An example of this is a sliding door that should normally act as an immovable physical obstacle but can be opened when necessary. Unl Rigidbody colliders are fully simulated by the physics engine and can react to collisions and forces applied from a scripike a static collider, a moving kinematic rigidbody will apply friction to other objects and will “wake up” other rigidbodies when they make contact.

这是一个带一个碰撞器和一个kinematic刚体组件的游戏对象(就是IsKinematic属性开启的刚体的游戏对象)。您可以从脚本中移动kinematic的刚体的Transorm组件，但它不会像一个非kinematic刚体那样响应碰撞和力 。kinematic刚体应该偶尔用于移动或者关闭/开启的碰撞器但其他行为表现的像静态碰撞器。举个例子，滑动的门通常情况下作为一个不可移动的物理遮挡物存在，但在必要的时候可以被打开。不像静态碰撞器，一个移动的kinematic刚体将对其他对象产生摩擦力，并且在他们碰撞时会唤醒其他刚体。

Even when immobile, kinematic rigidbody colliders have different behavior to static colliders. For example, if the collider is set to as a trigger then you also need to add a rigidbody to it in order to receive trigger events in your script. If you don’t want the trigger to fall under gravity or otherwise be affected by physics then you can set theIsKinematic property on its rigidbody.

即使不动，kinematic刚体碰撞器表现的也与静态碰撞器有所不同。例如，如果碰撞器被设置为触发器，那么您仍然需要为他添加刚体从而使得它能接收到脚本中的触发事件。如果您不想要触发器受重力影响下落或者受物理法则影响，您可以在刚体上设置其isKinematic属性。

A Rigidbody component can be switched between normal and kinematic behavior at any time using the IsKinematic property.

一个刚体组件可以在随时使用isKinematic属性切换普通和运动学的行为。

A common example of this is the “ragdoll” effect where a character normally moves under animation but is thrown physically by an explosion or a heavy collision. The character’s limbs can each be given their own Rigidbody component with IsKinematic enabled by default. The limbs will move normallly by animation until IsKinematic is switched off for all of them and they immediately behave as physics objects. At this point, a collision or explosion force will send the character flying with its limbs thrown in a convincing way.

一个常见的例子就是 “布偶”效应，当一个角色在动画下正常运动但是突然遭受到爆炸或者重撞的物理影响。这个角色的四肢都给予默认开启isKinematic的刚体组件。普通的四肢运动将由动画处理，直到IsKinematic属性关闭，之后四肢会马上按照物理法则进行动作。此时，一个碰撞或者爆炸力让角色的四肢以逼真的方式飞出。

**Collision action matrix**

**碰撞行为矩阵**

When two objects collide, a number of different script events can occur depending on the configurations of the colliding objects’ rigidbodies. The charts below give details of which event functions are called based on the components that are attached to the objects. Some of the combinations only cause one of the two objects to be affected by the collision, but the general rule is that physics will not be applied to an object that doesn’t have a Rigidbody component attached.

当两个对象碰撞时，许多不同的脚本事件的发生依赖于碰撞对象的刚体配置。下面的图表给出了添加在对象的组件的调用事件方法的详细信息。一些组合只会导致两个对象中的一个受到碰撞的影响，但一般是物理不会应用到没有刚体组件添加的游戏物体上。

| ***Collision detection occurs and messages are sent upon collision*** | | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
|  | Static Collider  静态碰撞器 | Rigidbody Collider  刚体碰撞器 | Kinematic Rigidbody Collider  运动学刚体碰撞器 | Static Trigger Collider  静态触发碰撞器 | Rigidbody Trigger Collider  刚体触发碰撞器 | Kinematic Rigidbody Trigger Collider  运动学刚体触发碰撞器 |
| Static Collider  静态碰撞器 |  | Y |  |  |  |  |
| Rigidbody Collider  刚体碰撞器 | Y | Y | Y |  |  |  |
| Kinematic Rigidbody Collider  运动学刚体碰撞器 |  | Y |  |  |  |  |
| Static Trigger Collider  静态触发碰撞器 |  |  |  |  |  |  |
| Rigidbody Trigger Collider  刚体触发碰撞器 |  |  |  |  |  |  |
| Kinematic Rigidbody Trigger Collider  运动学刚体触发碰撞器 |  |  |  |  |  |  |

| ***Trigger messages are sent upon collision*** | | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
|  | Static Collider  静态碰撞器 | Rigidbody Collider  刚体碰撞器 | Kinematic Rigidbody Collider  运动学刚体碰撞器 | Static Trigger Collider  静态触发碰撞器 | Rigidbody Trigger Collider  刚体触发碰撞器 | Kinematic Rigidbody Trigger Collider  运动学刚体触发碰撞器 |
| Static Collider  静态碰撞器 |  |  |  |  | Y | Y |
| Rigidbody Collider  刚体碰撞器 |  |  |  | Y | Y | Y |
| Kinematic Rigidbody Collider  运动学刚体碰撞器 |  |  |  | Y | Y | Y |
| Static Trigger Collider  静态触发碰撞器 |  | Y | Y |  | Y | Y |
| Rigidbody Trigger Collider  刚体触发碰撞器 | Y | Y | Y | Y | Y | Y |
| Kinematic Rigidbody Trigger Collider  运动学刚体触发碰撞器 | Y | Y | Y | Y | Y | Y |