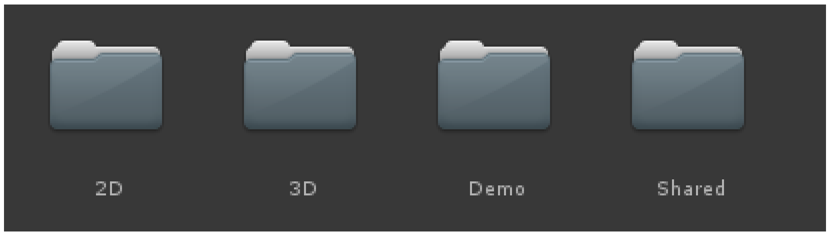
Force Field User Manual

Index

1 Basic Setups

1.1 Folders

After importing the asset, you will see a folder called **ForceFieldPro.** It contains everything you need to do the job, and you can put it everywhere you want. Inside that, you will find:



2D: Everything in this folder is for the 2D physics version.

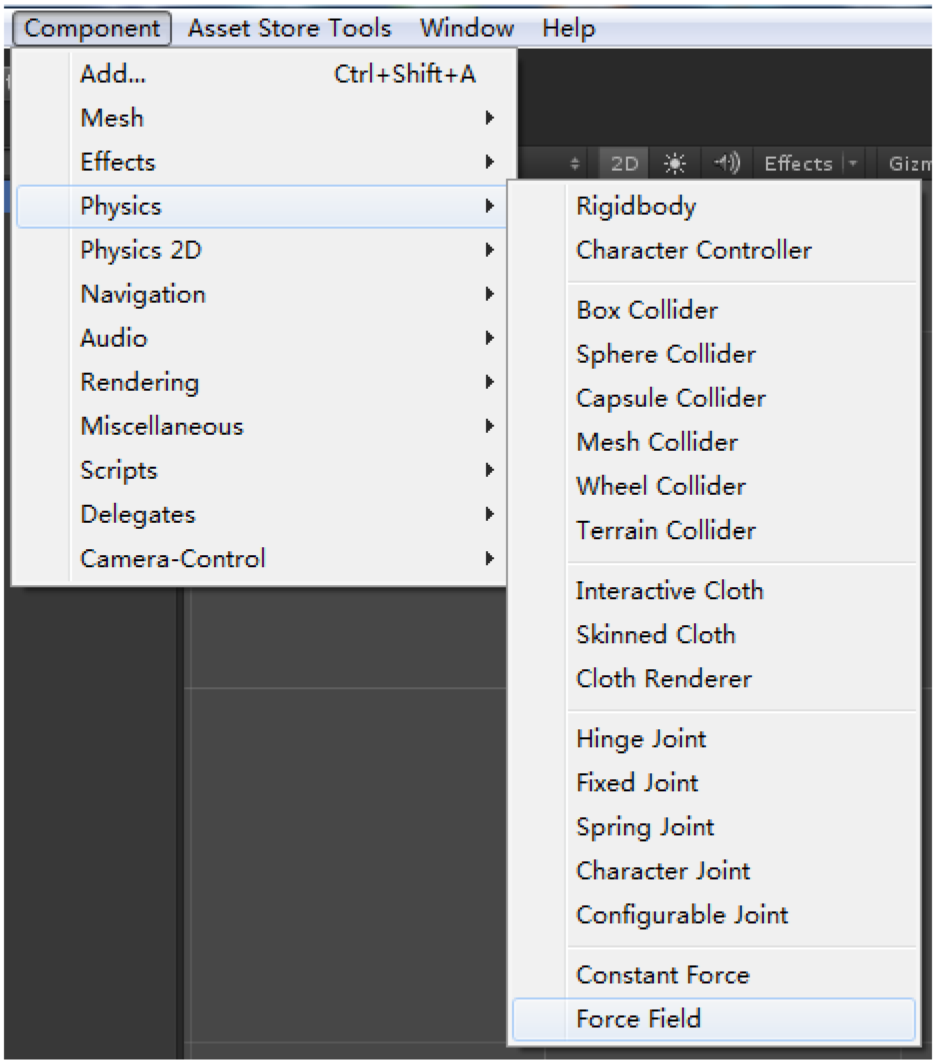
3D: Everything in this folder is for the 3D physics version.

Demo: Everything in this folder if for demos. You don't need it to run the force field.

Shared: This folder contains the supportive scripts that both 3D and 2D version needed.

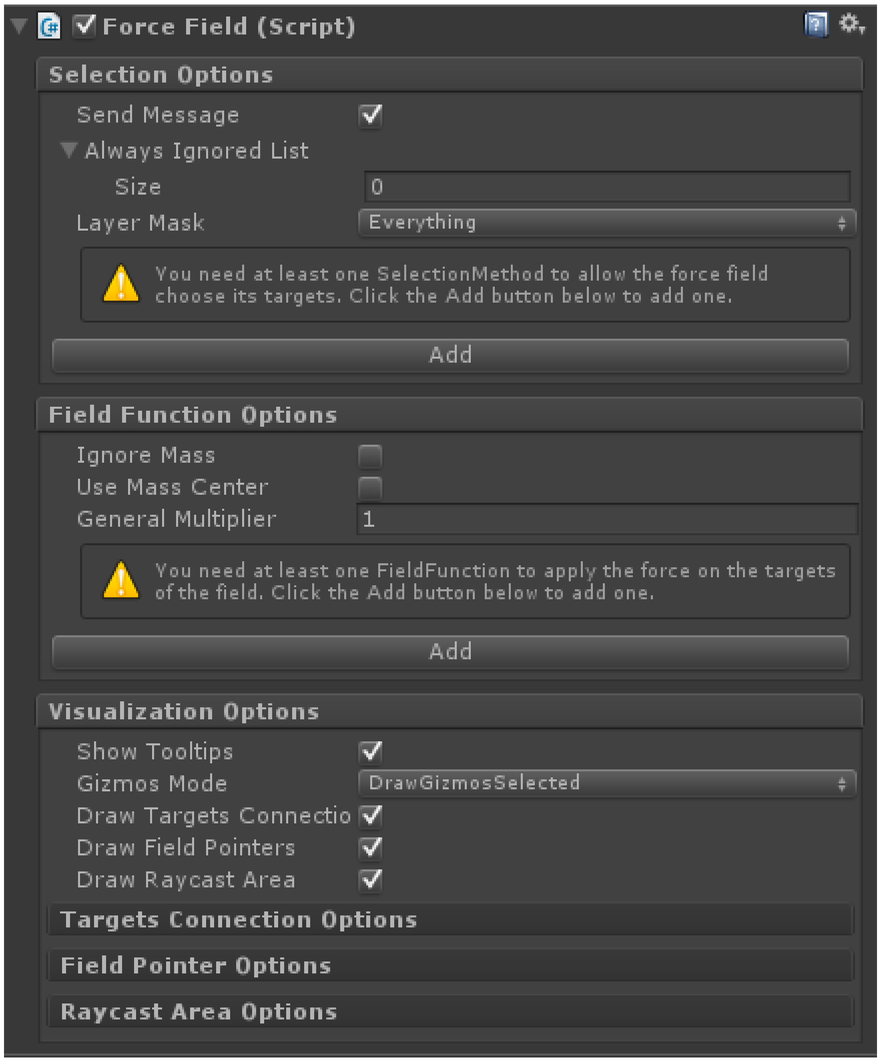
1.2 Add Component

To use the force field, you can simply add it to a gameobject through **Component->Physics->Force Field** or **Component->Physics 2D->Force Field 2D** if you are using the 2D version.



1.3 Basic Introduction

After you add the component, you will see this:



Force Field (Script) ✓

Selection Options

Send Message ✓

Always Ignored List

Size: 0

Layer Mask: Everything

You need at least one SelectionMethod to allow the force field choose its targets. Click the Add button below to add one.

Add

Field Function Options

Ignore Mass ☐

Use Mass Center ☐

General Multiplier: 1

You need at least one FieldFunction to apply the force on the targets of the field. Click the Add button below to add one.

Add

Visualization Options

Show Tooltips ✓

Gizmos Mode: DrawGizmosSelected

Draw Targets Connectio ✓

Draw Field Pointers ✓

Draw Raycast Area ✓

Targets Connection Options

Field Pointer Options

Raycast Area Options

The force field is cut into three sections.

Selection Method Options: Those options controls how the force field choose its targets, which are the rigidbodies that the force field will interact with.

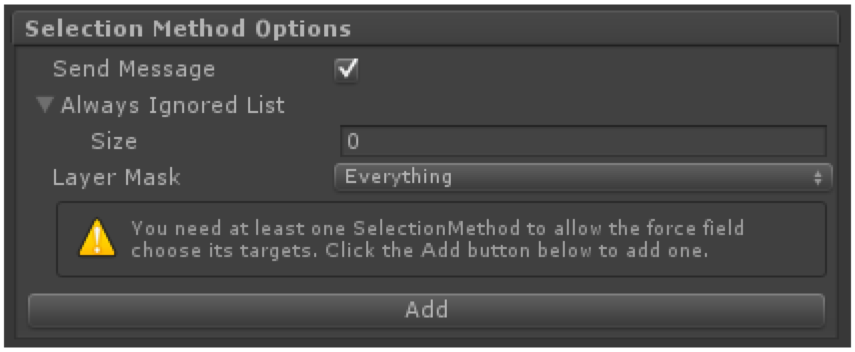
Field Function Options: Those options controls the force that the force field will apply on its targets every fixed update.

Visualization Options: Those options controls how the gizmos is drawn.

2 SELECTION METHOD

2.1 GENERAL OPTIONS

Those options controls how the force field select its targets.



Selection Method Options

Send Message ✓

Always Ignored List

Size 0

Layer Mask Everything

You need at least one SelectionMethod to allow the force field choose its targets. Click the Add button below to add one.

Add

Send Message: If this is checked, the force field will send messages to its targets and itself. There are 6 messages:

OnForceFieldEnter (ForceField): This message is send to the target when it being selected.

OnForceFieldStay (ForceField): This message is send to the target when it stays in the field on every FixedUpdate.

OnForceFieldExit (ForceField): This message is send to the target when it being deselected.

OnForceFieldEntered (Rigidbody): This message is send to the force field object for every target enters it (being selected).

OnForceFieldStayed (Rigidbody): This message is send to the force field object for every target stays in it, on every FixedUpdate.

OnForceFieldExited (Rigidbody): This message is send to the force field object for every target exits it (being deselected).

For the ForceField2D, those messages are:

OnForceField2DEnter (ForceField2D)

OnForceField2DStay (ForceField2D)

OnForceField2DExit (ForceField2D)

OnForceField2DEntered (Rigidbody2D)

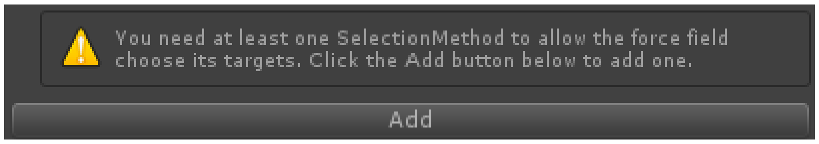
OnForceField2DStayed (Rigidbody2D)

OnForceField2DExited (Rigidbody2D)

Always Ignored List: The rigidbodies in this list will always ignored by the all the selection methods. You may want to add the force field object's parents in this list if they have a non-kinematic rigidbody attached. The force field will always ignore itself.

Layer Mask: The layers that the selection methods will select their targets.

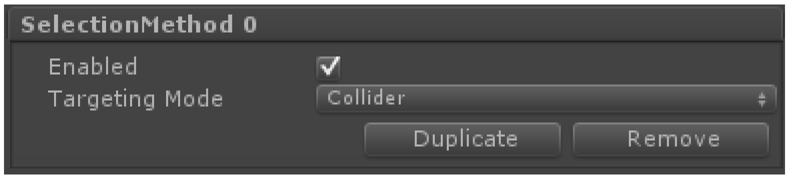
Selection Methods: Selection Method is a function that choose targets for the force field. The final targets set will be the union of the targets set of every selection method. No target will be select twice, so don't worry about the overlapping of the selection methods.



You need at least one SelectionMethod to allow the force field choose its targets. Click the Add button below to add one.

When you just add the force field component, you will see this warning because there is no selection method exist, and the force field need at least one to select its targets. Just simply click the **Add** button to add one.

2.2 Collider Method


SelectionMethod 0

Enabled ✓

Targeting Mode: Collider

The collider method will select every rigidbodies inside the trigger collider that is attached to the field object.

Note1: You NEED to set the collider as a trigger.

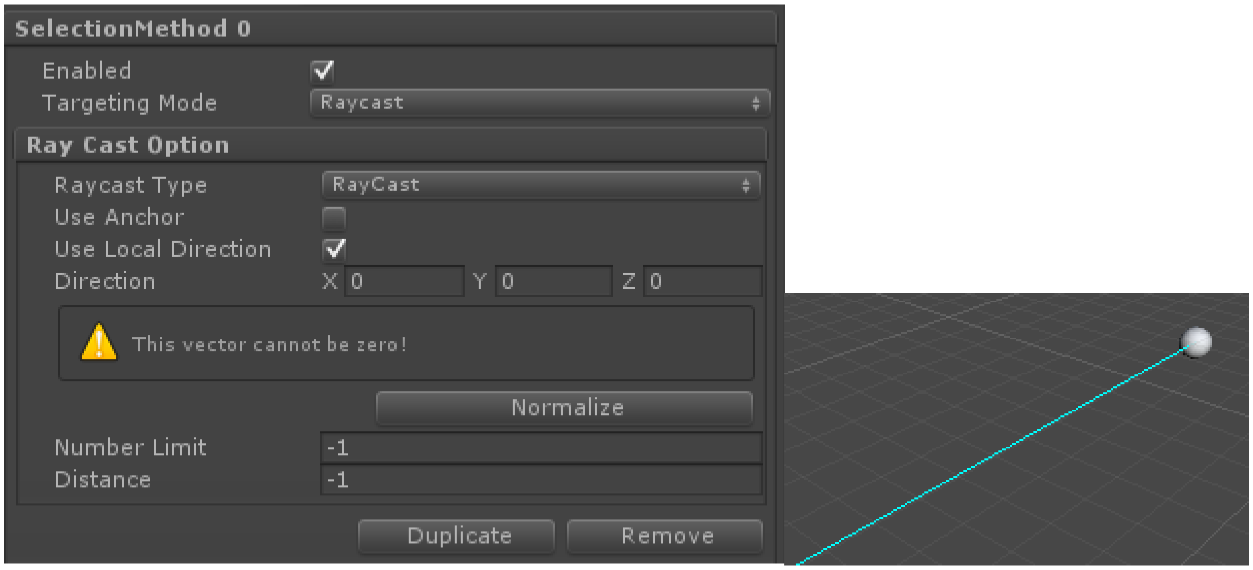
Note2: If you want to use field object's children's collider, you have to attach a rigidbody to the field object.

Note3: If the field object don't have a rigidbody attached, its collider will not interact with the static (sleeping) rigidbodies.

2.3 Ray Cast Method

2.3.1 RayCast

This method use raycast to select targets. It behaves very similar in both 3D and 2D version.


SelectionMethod 0

Enabled ✓
Targeting Mode: Raycast

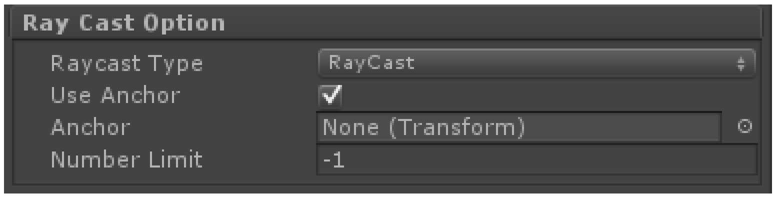
Ray Cast Option

Raycast Type: RayCast
Use Anchor: ☐
Use Local Direction: ✓
Direction: X 0 Y 0 Z 0

This vector cannot be zero!

Number Limit: -1
Distance: -1

Use Anchor: If true, the ray will always point to the anchor transform.


Ray Cast Option

Raycast Type: RayCast
Use Anchor: ✓
Anchor: None (Transform)
Number Limit: -1

Use Local Direction: If true, the direction of the ray will be treat as local direction.

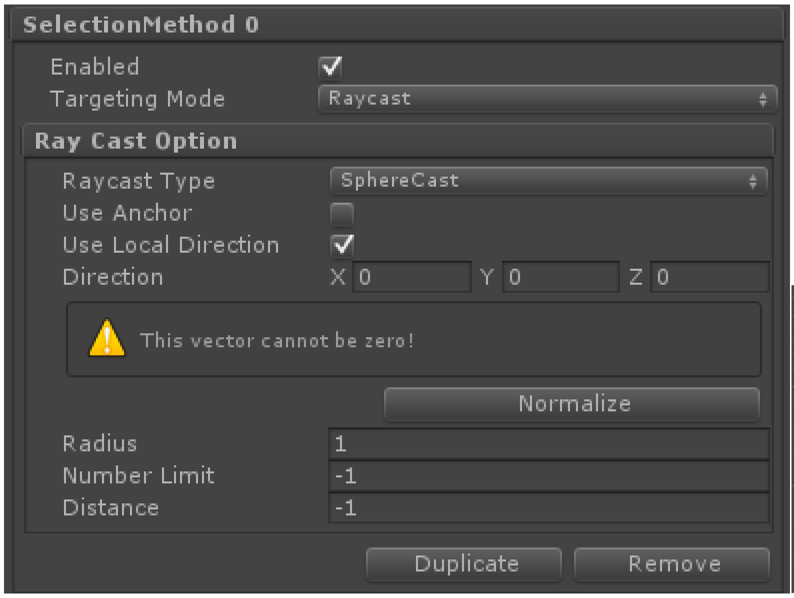
Direction: A Vector3 defines the direction of the ray. It need to be normalized.

Number Limit: The number of the closest targets that will be selected. Negative number is treat as infinity.

Distance: The length of the ray. Negative value is treat as infinity.

2.3.2 SphereCast

This method use sphere cast to select targets. It is for 3D physics.



SelectionMethod 0

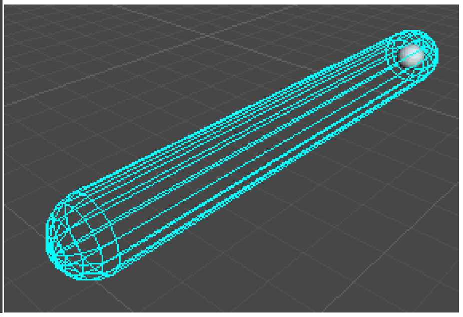
Enabled	✓
Targeting Mode	Raycast

Ray Cast Option

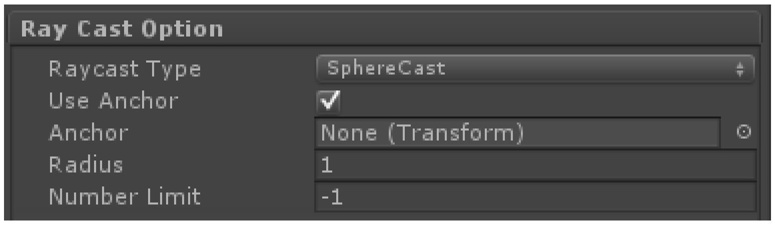
Raycast Type	SphereCast
Use Anchor	
Use Local Direction	✓
Direction	X 0 Y 0 Z 0

This vector cannot be zero!

Radius	1
Number Limit	-1
Distance	-1



Use Anchor: If true, the sphere cast will always point to the anchor transform.



Ray Cast Option

Raycast Type	SphereCast
Use Anchor	✓
Anchor	None (Transform)
Radius	1
Number Limit	-1

Use Local Direction: If true, the direction of the ray will be treat as local direction.

Direction: A Vector3 defines the direction of the ray. It need to be normalized.

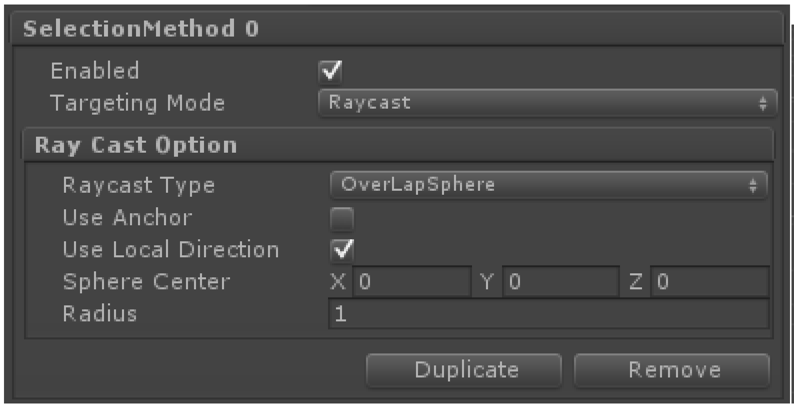
Radius: The radius of the sphere.

Number Limit: The number of the closest targets that will be selected. Negative number is treat as infinity.

Distance: The length of the ray. Negative value is treat as infinity.

2.3.3 Overlap Sphere

This method use overlap sphere to select targets. It is for 3D physics.

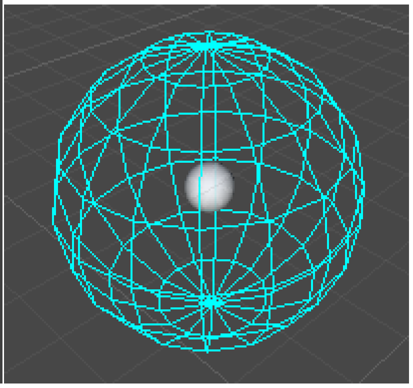


SelectionMethod 0

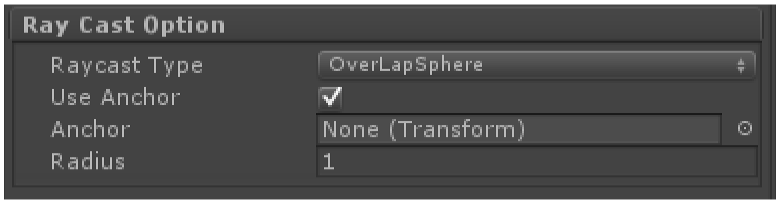
Enabled	✓
Targeting Mode	Raycast

Ray Cast Option

Raycast Type	OverLapSphere
Use Anchor	
Use Local Direction	✓
Sphere Center	X 0 Y 0 Z 0
Radius	1



Use Anchor: If true, the overlap sphere will use anchor transform's position as the center.



Ray Cast Option

Raycast Type	OverLapSphere
Use Anchor	✓
Anchor	None (Transform)
Radius	1

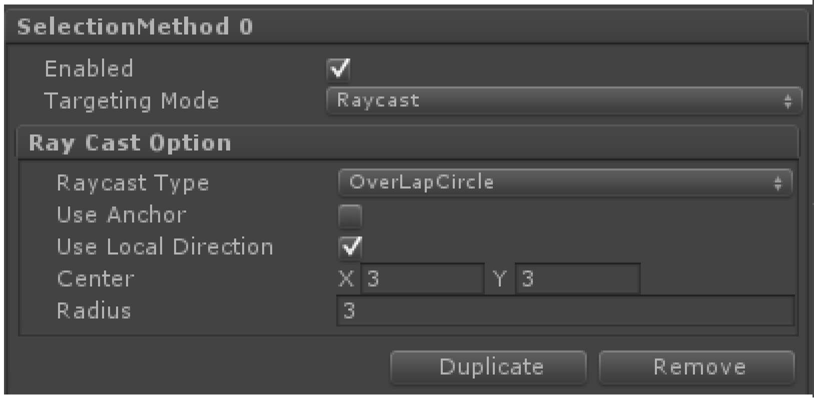
Use Local Direction: If true, the Sphere Center will be in the local direction.

Sphere Center: The center of the sphere.

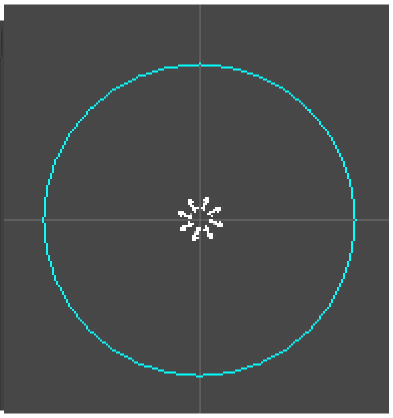
Radius: The radius of the sphere.

2.3.4 Overlap Circle

This method use overlap circle to select targets. It is for 2D physics.



SelectionMethod 0
Enabled ✓
Targeting Mode Raycast
Ray Cast Option
Raycast Type OverLapCircle
Use Anchor
Use Local Direction ✓
Center X 3 Y 3
Radius 3



Use Anchor: If true, the overlap circle will use anchor transform's position as the center.

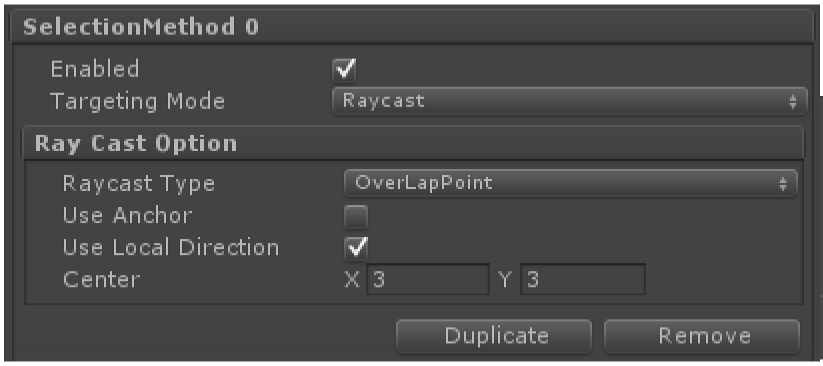
Use Local Direction: If true, the Center will be in the local direction.

Center: The center of the overlap circle.

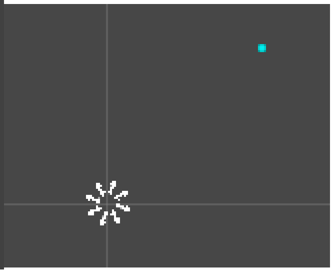
Radius: The radius of the overlap circle.

2.3.5 Overlap Point

This method use overlap point to select targets. It is for 2D physics.



SelectionMethod 0
Enabled ✓
Targeting Mode Raycast
Ray Cast Option
Raycast Type OverLapPoint
Use Anchor
Use Local Direction ✓
Center X 3 Y 3



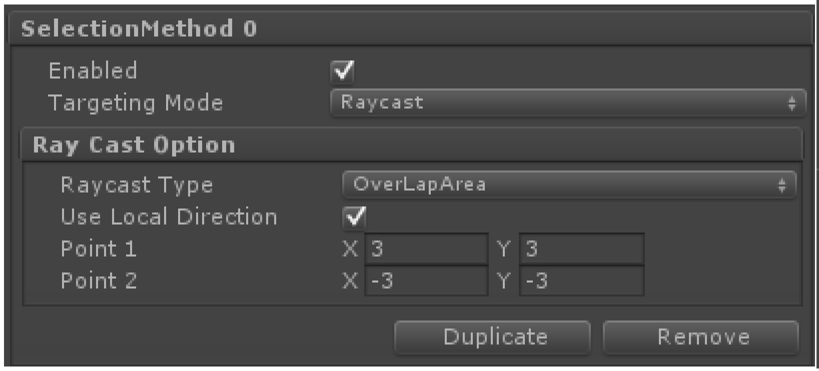
Use Anchor: If true, the overlap circle will use anchor transform's position as the center.

Use Local Direction: If true, the Center will be in the local direction.

Center: The position of the point.

2.3.6 Overlap Area

This method use overlap area to select targets. It is for 2D physics.



SelectionMethod 0

Enabled ✓

Targeting Mode: Raycast

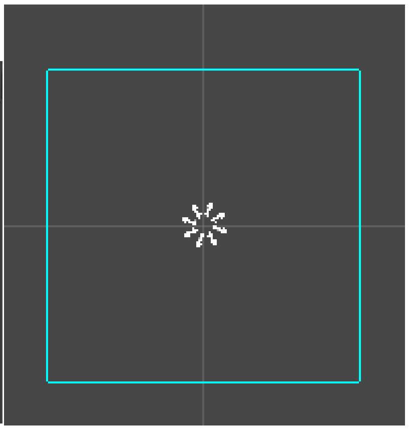
Ray Cast Option

Raycast Type: OverLapArea

Use Local Direction ✓

Point 1: X 3 Y 3

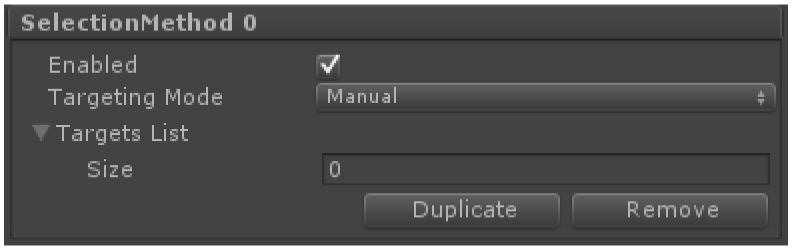
Point 2: X -3 Y -3



Use Local Direction: If true, the Point1 and Point2 will be in the local direction.

Point1, Point2: They define the two diagonal points of the area.

2.4 MANUAL METHOD



SelectionMethod 0

Enabled ✓

Targeting Mode: Manual

Targets List

Size: 0

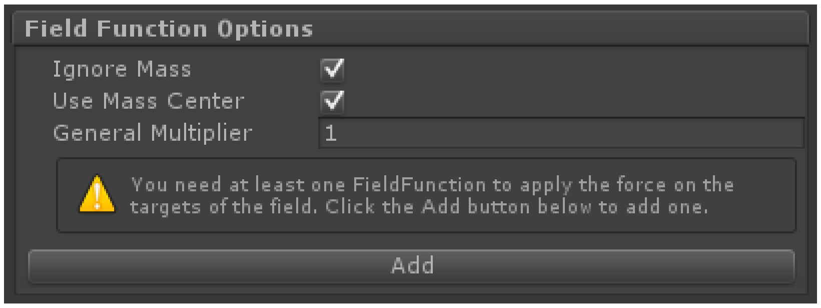
Manual method provides a **Targets List** that you can add or remove targets.

Note: Put a target in many times will NOT cause any problem, because every target will only be called once per FixedUpdate, no matter it is selected by how many selection methods.

3 Field Functions

3.1 General Options

Those options controls how the field interact with its targets.



Field Function Options

Ignore Mass ✓

Use Mass Center ✓

General Multiplier 1

You need at least one FieldFunction to apply the force on the targets of the field. Click the Add button below to add one.

Ignore Mass: If true, the force that the field apply will ignore targets' mass, which change the field into an acceleration field.

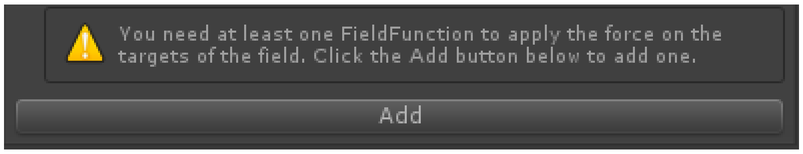
Note: This option is not available in 2D physics.

Use Mass Center: If true, the force will be applied on the mass center of the targets, instead of transform's position.

Note: This option is not available in 2D physics.

General Multiplier: This value is multiplied to the final force. It is useful to get a overall control of the magnitude of the forces.

Field Functions: Field function is a function that calculates the force that the field should apply on it targets. The final force will be the sum of the result from all the field functions.



You need at least one FieldFunction to apply the force on the targets of the field. Click the Add button below to add one.

Similar to the selection methods, you see this warning because you don't have any field functions, and the force field need one to determine what is the force that it should apply to the targets. Just simply click the **Add** button below to add a new one.

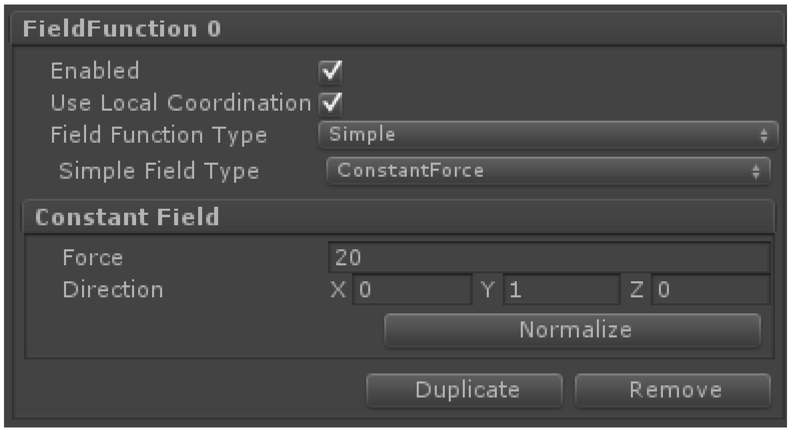
3.2 SIMPLE FIELD FUNCTIONS

A simple field function is very easy to set up, and you can combine many of them together to form a rather complex one.

Enabled: Enable this field function.

Use Local Coordination: If the true, the field will calculate in the local space.

3.2.1 Constant Field



FieldFunction 0

Enabled ✓

Use Local Coordination ✓

Field Function Type: Simple

Simple Field Type: ConstantForce

Constant Field

Force: 20

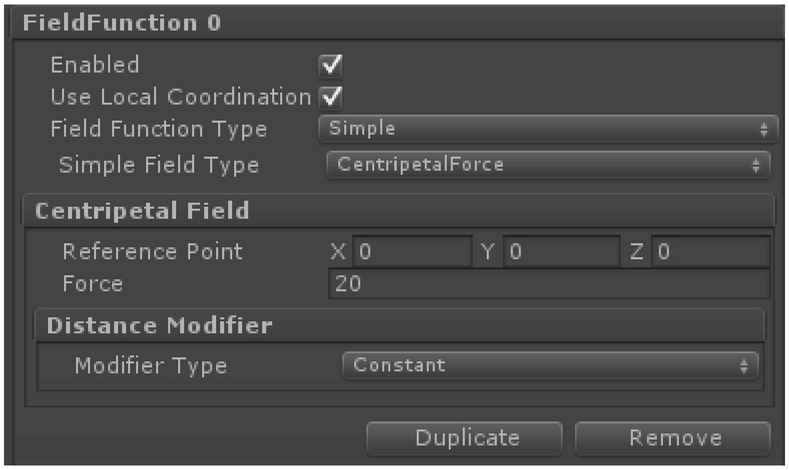
Direction: X 0 Y 1 Z 0

The Constant Field will return the same vector at any position.

Force: The magnitude of the force.

Direction: The direction of the force.

3.2.2 Centripetal Field


FieldFunction 0

Enabled ✓
Use Local Coordination ✓
Field Function Type: Simple
Simple Field Type: CentripetalForce

Centripetal Field

Reference Point: X 0 Y 0 Z 0
Force: 20

Distance Modifier

Modifier Type: Constant

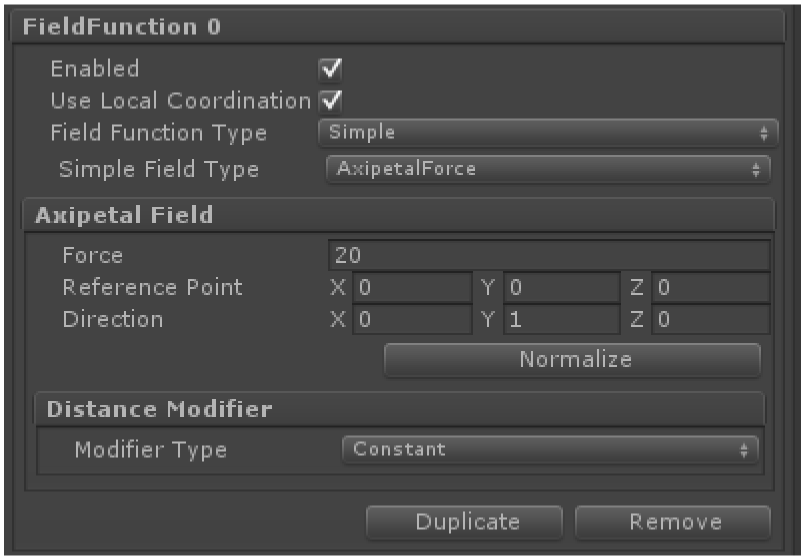
The Centripetal Field will return a vector that always point to the reference point.

Reference Point: The reference point.

Force: The magnitude of the force, note that positive value point outward.

Distance Modifier: A function controls how the force change against the distance to the reference. See Section 4.2.5 for details.

3.2.3 Axipetal Field


FieldFunction 0

Enabled ✓
Use Local Coordination ✓
Field Function Type: Simple
Simple Field Type: AxipetalForce

Axipetal Field

Force: 20
Reference Point: X 0 Y 0 Z 0
Direction: X 0 Y 1 Z 0

Distance Modifier

Modifier Type: Constant

The Axipetal Field will return a vector that always point to the reference line.

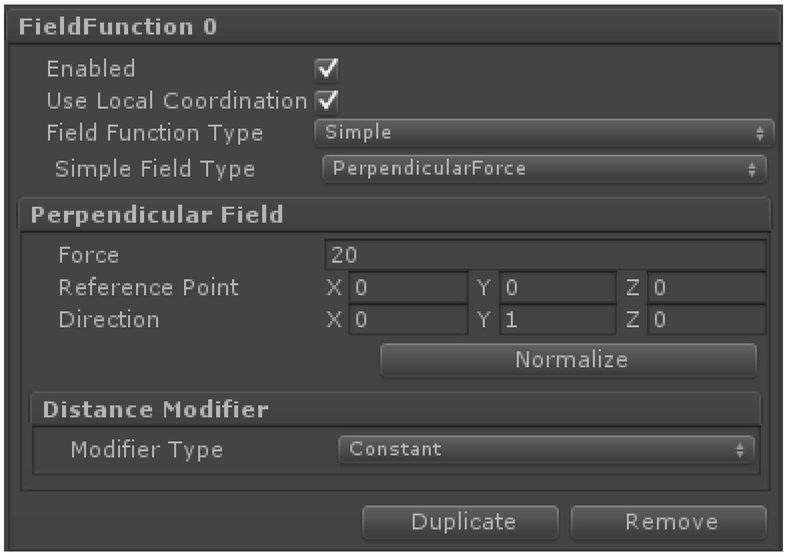
Force: The magnitude of the force, note that positive value point outward.

Reference Point: The reference point that the reference line will pass.

Direction: The direction of the reference line. It need to be normalized.

Distance Modifier: A function controls how the force change against the distance to the reference. See Section 4.2.5 for details.

3.2.4 Perpendicular Field



FieldFunction 0

Enabled ✓

Use Local Coordination ✓

Field Function Type: Simple

Simple Field Type: PerpendicularForce

Perpendicular Field

Force: 20

Reference Point: X 0 Y 0 Z 0

Direction: X 0 Y 1 Z 0

Distance Modifier

Modifier Type: Constant

The Perpendicular Field will return a vector that always point to the reference plane.

Force: The magnitude of the force, note that positive value point outward.

Reference Point: The reference point that the reference plane will pass.

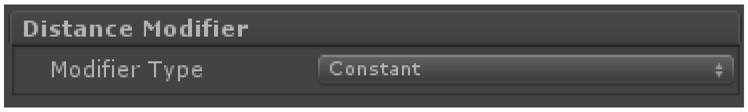
Direction: The normal direction of the plane. It need to be normalized.

Distance Modifier: A function controls how the force change against the distance to the reference. See Section 4.2.5 for details.

3.2.5 Distance Modifier

The Distance Modifier controls how the forces change against the distance to the reference point, line, or plane.

3.2.5.1 Constant

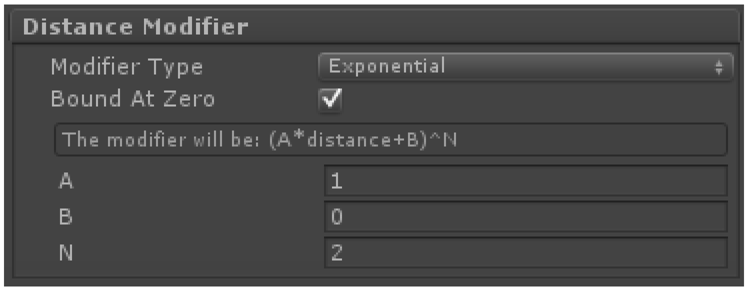


Distance Modifier

Modifier Type: Constant

Constant modifier will always return 1, which means the force does not change against distance.

3.2.5.2 Exponential

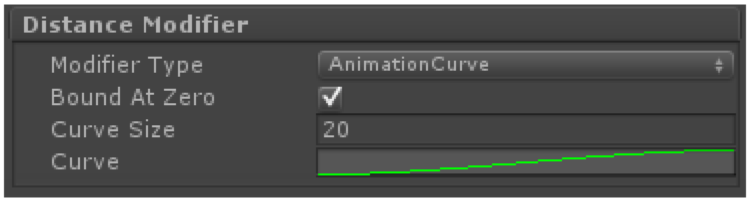


Distance Modifier

Modifier Type: Exponential
Bound At Zero: ✓
The modifier will be: (A*distance+B)^N
A: 1
B: 0
N: 2

Exponential modifier will return the value of$(A * distance + B)^N$. Be careful of this formula, don't let it explode. If **Bound At Zero** is checked, that the returned value will not lower than zero.

3.2.5.3 Animation Curve



Distance Modifier

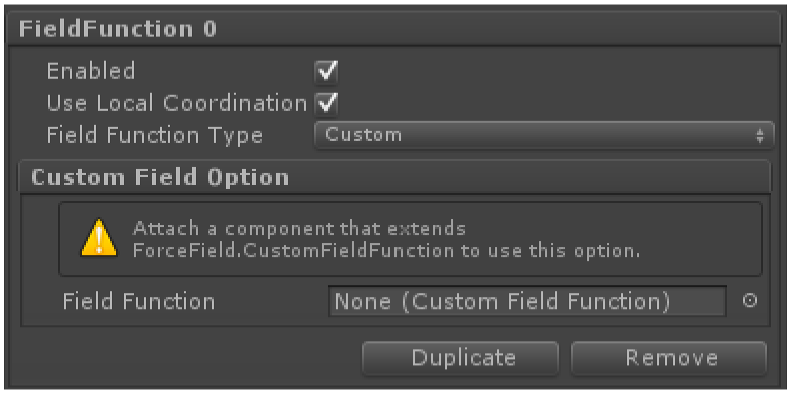
Modifier Type: AnimationCurve
Bound At Zero: ✓
Curve Size: 20
Curve

Bound At Zero: If checked, the returning value will not lower than zero.

Curve Size: The length of one unit length of the animation curve.

Curve: Click to edit, just same as every other animation curve. Note that only the positive distance will be passed in.

3.3 Custom Field Functions


FieldFunction 0

Enabled ✓

Use Local Coordination ✓

Field Function Type: Custom

Custom Field Option

Attach a component that extends ForceField.CustomFieldFunction to use this option.

Field Function: None (Custom Field Function)

Custom Field Function allows you to use your own field function, which could be very flexible. To use this option you need to have a class extends **ForceField.CustomFieldFunction** or **ForceField2D.CustomFieldFunction2D** for 2D physics. Those abstract classes have an abstract function that need to implement. Which are:

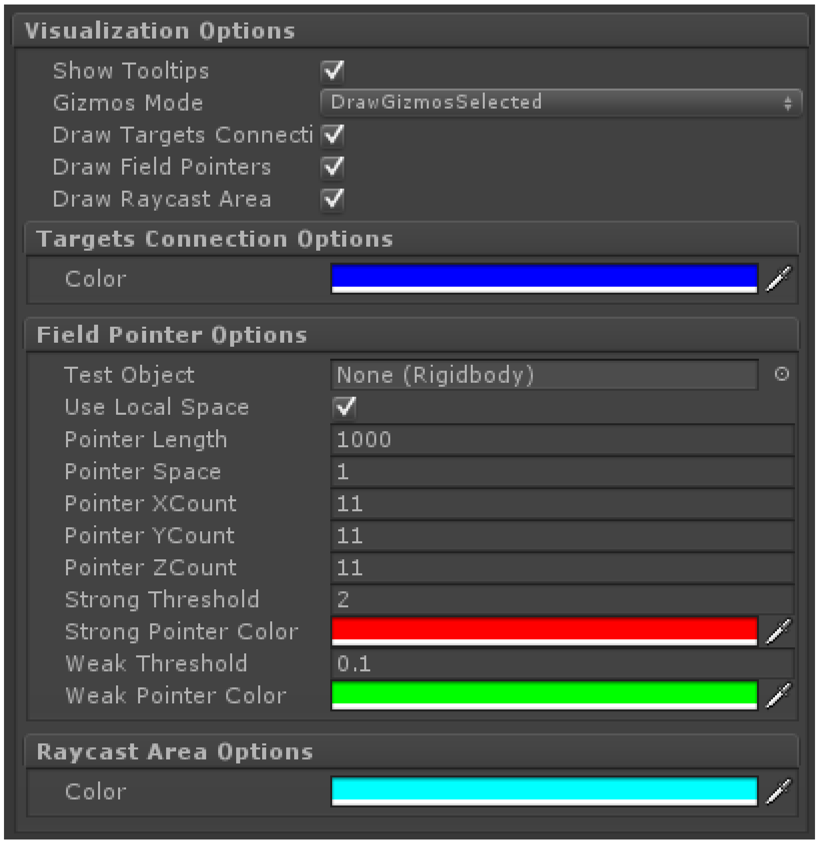
```
public abstract Vector3 GetForce(Vector3 position, Rigidbody rigidbody);

public abstract Vector2 GetForce(Vector2 position, Rigidbody2D rigidbody);
```

The Vector it returns is the force that will applied on the targets. The input vector **position** is the relative to the field object. This position is different than the target's world position. Rigidbody **rigidbody** is rigidbody of the target. It is useful when you want to use other data of the target to determine the result.

Since this GetForce function is called exactly once per target per FixedUpdate, it can also be used as a DoSomeThing script.

4 VISUALIZATION

Visualization options is all about the gizmos that make you debug easier.



Visualization Options

Show Tooltips	✓
Gizmos Mode	DrawGizmosSelected
Draw Targets Connecti	✓
Draw Field Pointers	✓
Draw Raycast Area	✓

Targets Connection Options

Color	🟦

Field Pointer Options

Test Object	None (Rigidbody)
Use Local Space	✓
Pointer Length	1000
Pointer Space	1
Pointer XCount	11
Pointer YCount	11
Pointer ZCount	11
Strong Threshold	2
Strong Pointer Color	🟥
Weak Threshold	0.1
Weak Pointer Color	🟩

Raycast Area Options

Color	🟦

Show Tooltips: Every property have a tooltip attached, and you can disable them by uncheck this toggle.

Gizmos Mode: This controls when the gizmos should show up.

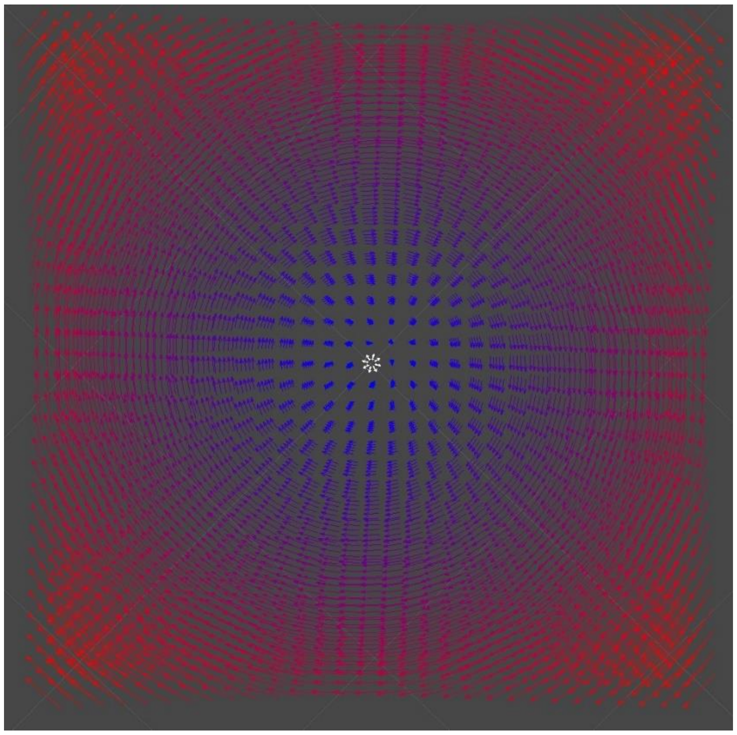
> **DrawGizmosSelected:** Only draw when the field object is selected.
> **DrawGizmosAlways:** Always draw the gizmos.
> **DoNotDraw:** Do not draw at all.

Draw Target Connection: If checked, lines between the targets and the field object will draw.

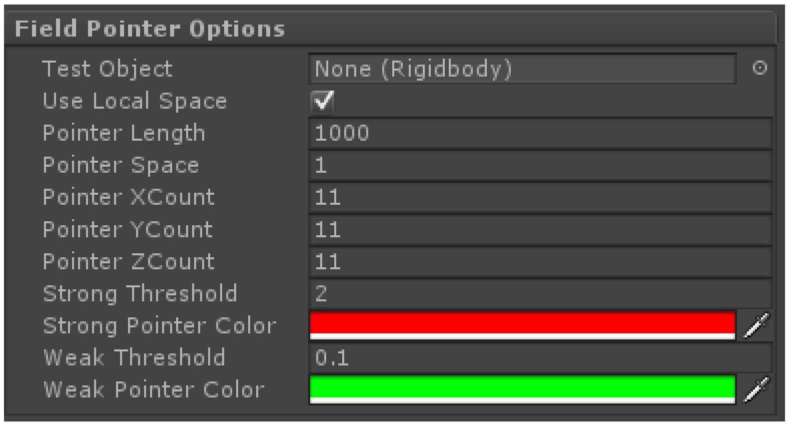
Draw Field Pointers: If checked, field pointers will be draw to indicate the shape of the field.

Draw Raycast Area: If checked, gizmos will be draw to show the areas that are covered by the ray cast methods.

Field Pointers:



Field pointers are the small arrows shown in the picture above. They indicate the direction and the magnitude of the force at the position, and are very useful for debugging.



Field Pointer Options

Test Object	None (Rigidbody)
Use Local Space	✓
Pointer Length	1000
Pointer Space	1
Pointer XCount	11
Pointer YCount	11
Pointer ZCount	11
Strong Threshold	2
Strong Pointer Color	🟥
Weak Threshold	0.1
Weak Pointer Color	🟩

Test Object: When you use custom field function, sometimes you may want access target’s other properties. In that case you need to have a test object that has everything you want to draw the field.

Use Local Space: If checked, the pointers will scale and rotate with the field object.

Pointer Length: The length of the pointers. 1000 is 1 unit length per 1 unit force. Adjust it to get the best outlook.

Pointer Space: The distance between the pointers.

Pointer XCount: The number of pointers on x direction.

Pointer YCount: The number of pointers on y direction.

Pointer ZCount: The number of pointers on z direction.

Strong Threshold: The pointer longer than this will use the Strong Pointer Color, and the rest will use the color that lerp between Strong Pointer Color and Weak Pointer Color.

Strong Pointer Color: The color used by the long pointers

Weak Threshold: The pointer shorter then this will use the Weak Pointer Color, and the rest will use the color that lerp between Strong Pointer Color and Weak Pointer Color.

Weak Pointer Color: The color used by the short pointers