FSM AI Template (v1.0.1 - 14/08/2019)

Thank you for supporting this asset, we develop this template because a lot of developers have good ideas out there but creating an AI system is really complex takes too much time.

The goal of this project was always to deliver a top quality AI that is easy to use for new developers and expandable and customizable for advanced users.

It comes with Civilian, Melee Combat and Shooter AI examples, and also with several examples of different FSM Behaviours.

With this template, you can set up a 3D Model in just a few seconds, without the need of knowing hardcore code or wasting time dragging and drop gameobjects to the inspector, instead you can just focus on making your game.

The template works great in your own project using VR or FPS and it works even better when using together with the Invector Third Person Template with all of our features.

- Invector Team

USING THE FSM AI AND THE THIRD PERSON TEMPLATE

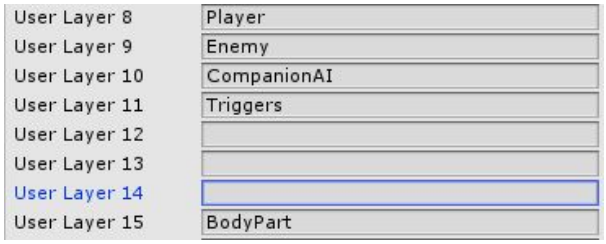
If you're using our **Third Person Controller Template** (*Basic Locomotion, Melee Combat or Shooter*) make sure that you're using the **latest version** available for both templates, otherwise it will not work.

Basic & Melee 2.4.2 - Shooter 1.3.2 goes with FSM AI v1.0.1
Basic & Melee 2.4.1 - Shooter 1.3.1 goes with FSM AI v1.0
Basic & Melee 2.4.0 - Shooter 1.3.0 goes with FSM AI v0.3
Basic & Melee 2.3.3 - Shooter 1.2.3 goes with FSM AI v0.2

LAYERS AND TAGS

After you import the AI Template on a Clean New Project, you will notice that the AI prefab is actually missing the layers.

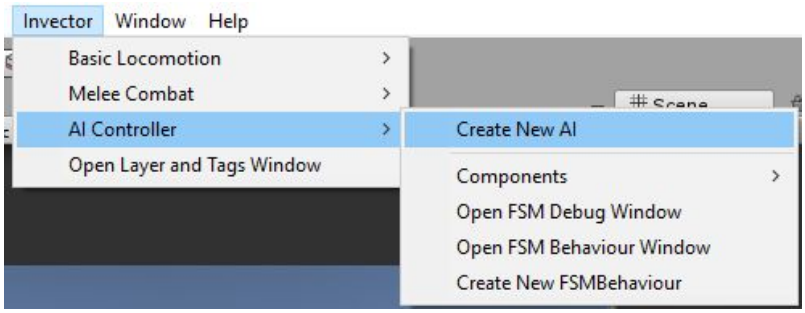
This will not prevent you from testing the demo scenes or cause any errors, but you must add the Layers in a specific order if you want to display correctly.



If you do not add the layers in this specific order, the layers will be display but with the wrong layer in the prefab, you can also use the layers of your going on Project or add it separately.

CREATING A NEW FSM AI CONTROLLER

To create a new AI Controller, go to:

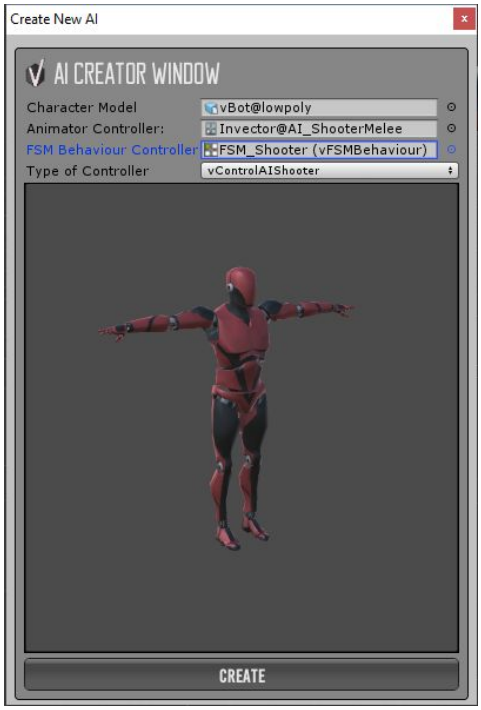


This window will pop up and you need to select:

1- Your 3D Rigged FBX Model

2- The Animator Controller (we provide 3 examples, Basic Locomotion (for passive civilians), Melee Combat and Shooter)

3- The FSM Behaviour you want to use, we provide several examples in the package but you can (and must) create your own once you learn how to use the tool.



Once you hit the "Create" button, the Character Creator Window will add every necessary component to your Character like:

- Animator Controller
- Rigidbody
- Capsule Collider
- NavMesh Agent
- FSM Behaviour Controller
- AI Controller
- Melee Manager (If you choose to create a Melee AI)
- Shooter Manager (If you choose to create a Shooter AI)
- Headtrack is automatically added to the Shooter AI, but you can also add it manually on both Civil or Melee to look at the target or at a specific object.

HOW TO BAKE A NAVMESH

The AI Template uses the NavMesh & NavMesh Agent to navigate, so you need to bake the navmesh in your scene for the AI to actually move and find path to navigate.

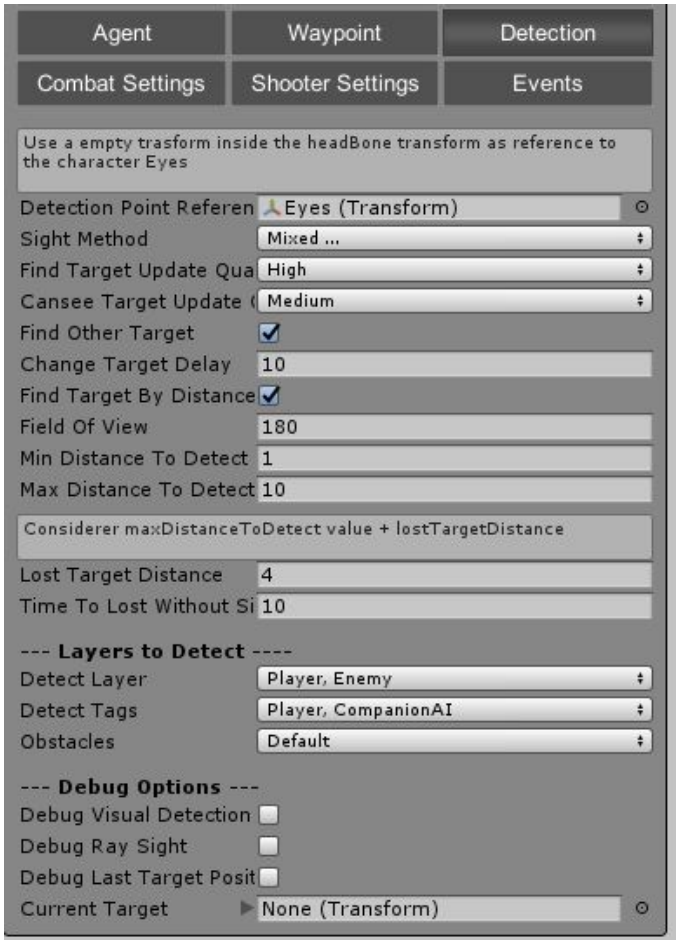
There is plenty of tutorials teaching how to Bake the Navmesh, here is one by Unity:

(Unity 5.x) https://unity3d.com/learn/tutorials/topics/navigation/navmesh-baking

(Unity 2017+) https://docs.unity3d.com/Manual/nav-BuildingNavMesh.html

HOW TO DETECT A TARGET

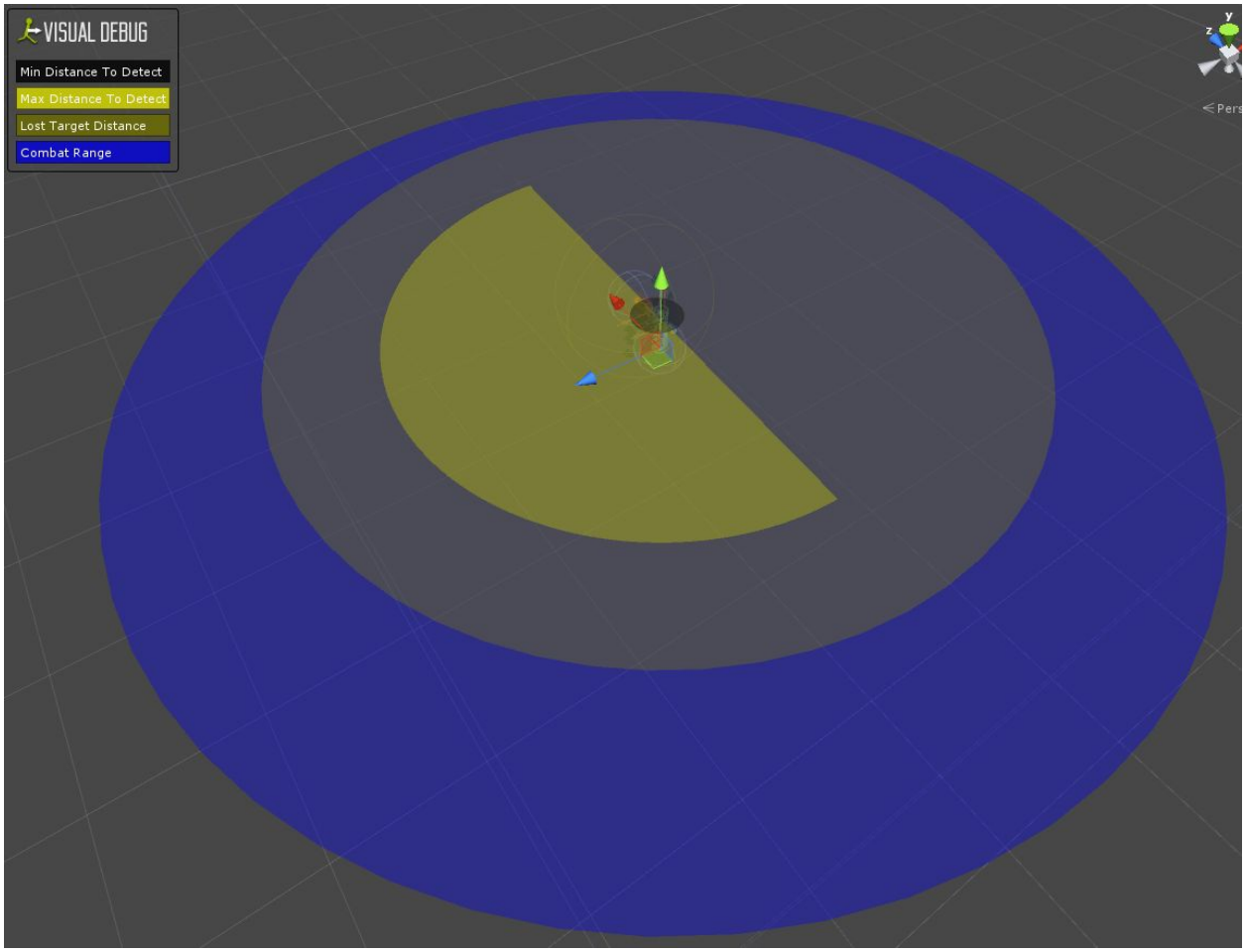
The most important settings here are the Layers to Detect, make sure to add the Layer and Tag of the target you want the AI to Chase.



*Notice that the Detection Settings is to detect a target only, tin order to apply damage to a target you need to set this information at the MeleeManager or ShooterManager.

- Detection Point Reference: You can create an empty gameObject, place it in the character's head bone and use the forward direction as a reference for the 'eyes', this way if you have an Idle Animation were the character is looking around searching a target, it will be more believable.
- Sight Method: You can choose between Top, Center, Bottow or All. This will trigger raycast to the target when close enough, you can debug this option by checking the Debug RaySight
- Find Target Update Quality: Frequency to update the find target method, the higher you choose more precise will be the detection, also it will be more expensive on performance.
- CanSee Target Update Quality: Frequency to update the CanSee method, to know if you still can see the target, the slower it is, the slower he will see or loose the target.
- Find Other Target: Can still find other targets even if already has one.
- **Change Target Delay**: Delay to change target.

- Find Target By Distance: If uncheck, the AI will get the first target he sees, and not the closest one.
- Field of View: Check the "Debug Visual Detection" option to see ingame.
- Min Distance To Detect: Min distance for the AI to detect the target, even without seen it. Leave it to 0 if you want to do stealth attacks.
- Max Distance To Detect: Max distance to detect the target
- Lost Target Distance: This value will be the MaxDistanceToDetect+LostTargetDistance to lose the target.
- Time to Lost Without Sight: How long it will take to actually loose the target if you can't see it.



- Detect Layer: Layers to detect a target (Target must have a Capsule Collider)
- Detect Tags: Tags to detect a target
- Obstacles: Usually set to "Default"

HOW TO APPLY DAMAGE TO A CUSTOM TARGET

The target must have a vHealthController and a Capsule Collider so the AI can actually apply damage to it.

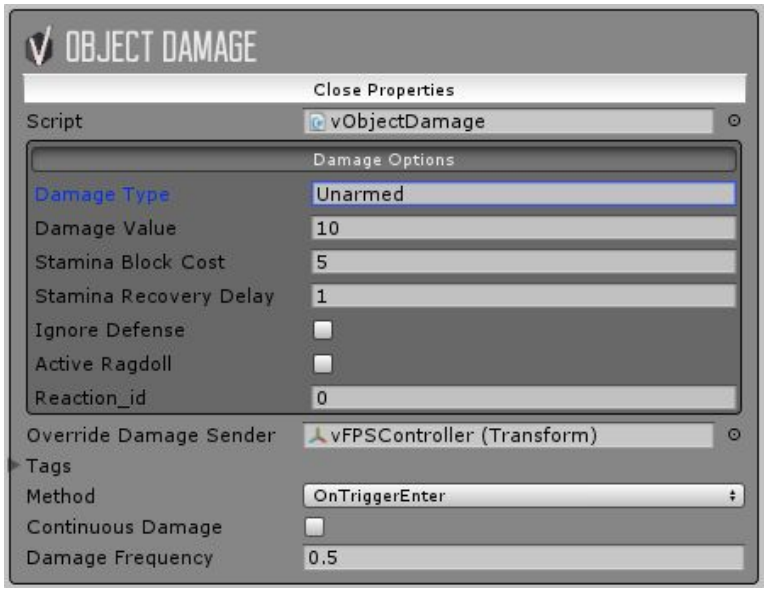
Shooter: You need to set the Layer of your target in the ShooterManager.

MeleeCombat: You need to set the Tag of your Target in the MeleeManager / HitDamageTags field, you can assign several tags to hit different targets.


MELEE MANAGER
Close
Script
vMeleeManager
Open Default Info
Open Events
Add Extra Body Member
Body Members
LeftLowerArm
RightLowerArm
LeftLowerLeg
RightLowerLeg
Who you can Hit?
Hit Properties
Hit Damage Tags
Size
1
Element 0
Enemy
Use Recoil
Draw Recoil Gizmos
Recoil Range
90
Hit Recoil Layer
Default
Weapons
LeftWeapon
None (V Melee Weapor
RightWeapon
None (V Melee Weapor

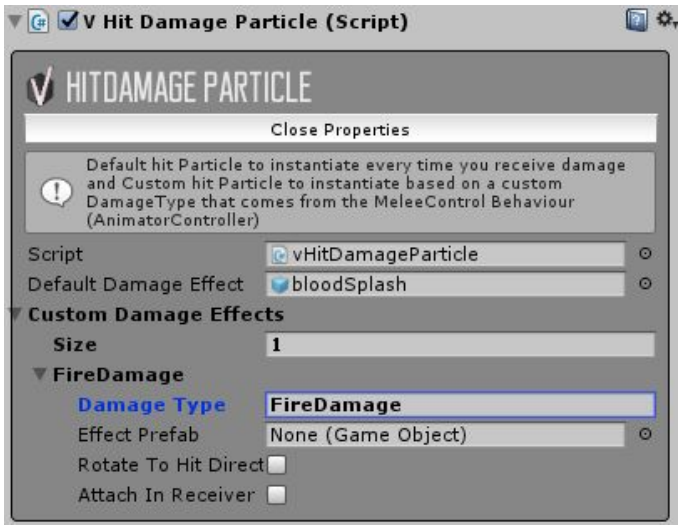
HOW TO APPLY DAMAGE TO THE AI

We have a few examples on how to apply damage to an AI Controller, basically you need the vObjectDamage script which is attached to the Pendulum or Hitboxes in the "AI_Examples" demo scene.



- **DamageType**: Used together with the HitParticleDamage component, you can trigger different particles for different type of damage.

For example, if you have an area with fire, you can add a **vObjectDamage** there and add a DamageType of "FireDamage", then add a Custom Damage Effect with the same DamageType to your HitDamageParticle on your AI Character and add the particle effect to burn your character.

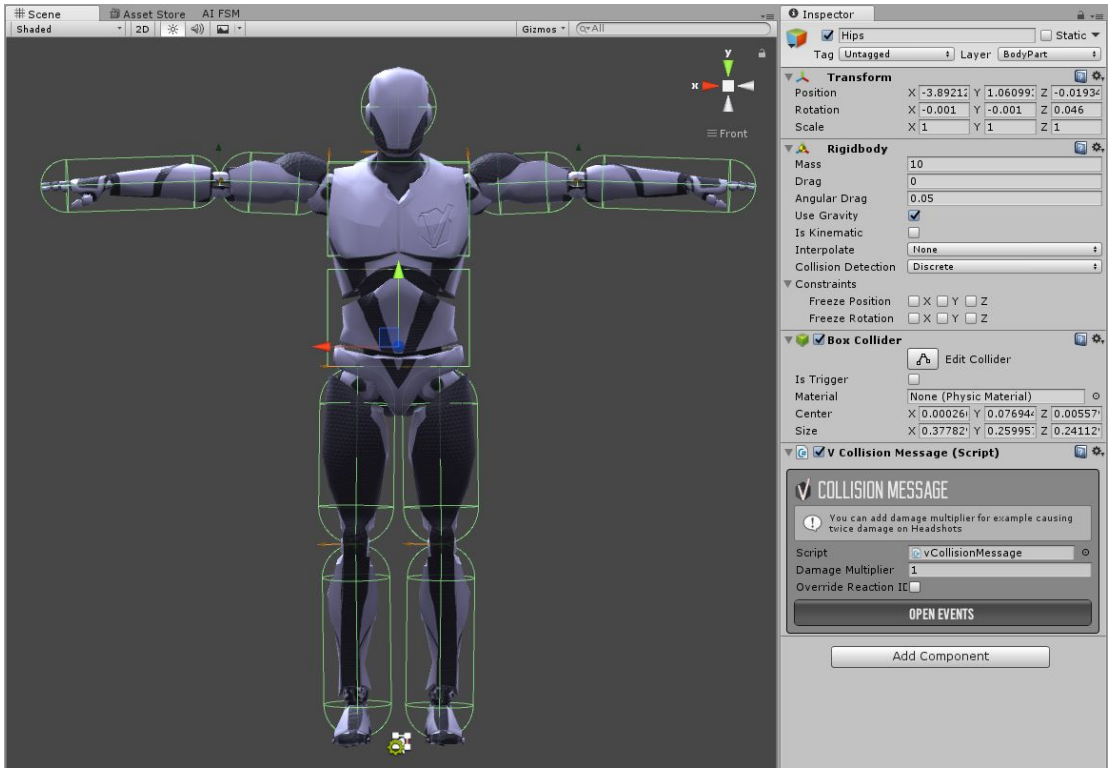


This component is attached to the AIController or any object that contains the **HealthController*

- **DamageValue**: How much damage it will be applied to the vHealthController of the target.
- **Stamina Block Cost**: You can ignore that option, it's only for the ThirdPersonController.
- **Stamina Recovery Delay**: You can ignore that option, it's only for the ThirdPersonController.
- **Ignore Defense**: If you're using a MeleeCombat Controller, it will ignore the defense and apply damage anyways.
- **Active Ragdoll**: It will active the ragdoll on your character, if it has one.
- **Reaction ID**: You can trigger specific hit reaction animation, you can use -1 if you don't want to trigger any animation.
- **Override Damage Sender**: Assign the root object otherwise the AI will target the object that has this component instead. For Example: If you apply the vObjectDamage to be a Hitbox of a LeftHand of a character, the vHealthController or AI will have the LeftHand as the target instead of the GameObject parent.
- **Tags**: What tags you will apply damage to
- **Method**: OnTriggerEnter or OnCollisionEnter
- **Continuous Damage**: Useful for fire damage for example
- **Damage Frequency**: Frequency to apply the damage, if Continuous Damage is enabled.

Using the **Ragdoll Colliders** as **BodyParts** to inflict precise damage.

SHOOTER > If you want to cause damage for each body member using the ragdoll colliders, UNCHECK the “Disable Colliders” and you can add damage multiplier on each member.



* You must use a different Layer in the Ragdoll Colliders like “BodyPart” and another for the main capsule collider like "Enemy", this way the Detection will detect the Enemy object as a target, but the ShooterManager will actually apply damage to the "BodyPart".

Body Parts use the Damage Receiver to receive damage.

A DamageReceiver is attached to each ragdoll collider, this will allow to Player or AI to apply damage to each bodypart instead of the CapsuleCollider.

- **Damage Multiplier**: multiply the damage value
- **Override a Reaction ID**: Check this option to override the hit reaction animation to trigger a specific animation.

For example, if you want to cause 2x damage and trigger a specific reaction animation when shooting in the Head, simple change the values in this component.

HOW TO ALIGN THE RIGHT HAND FOR SHOOTER WEAPONS

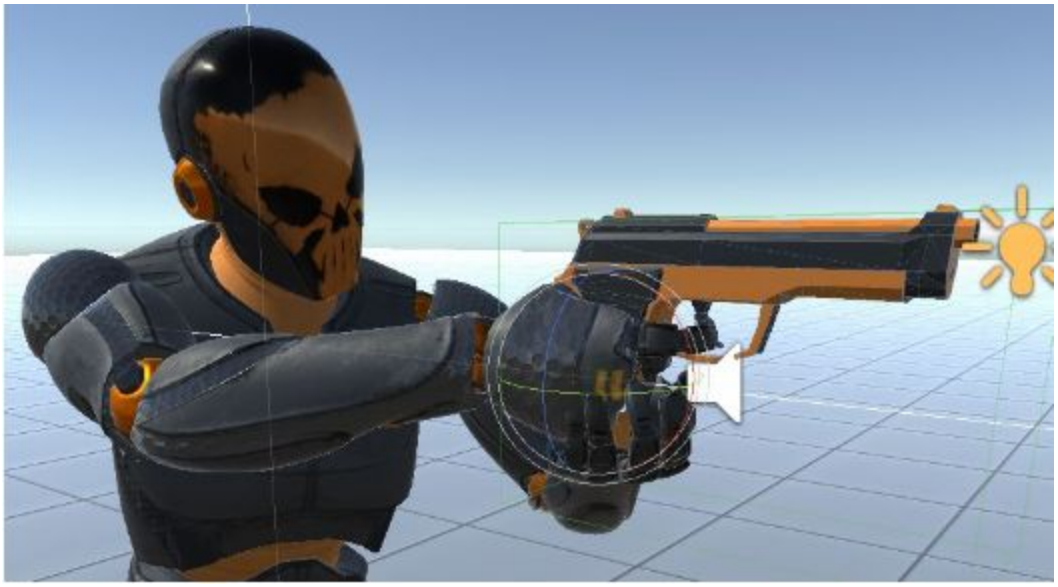
1- Select a Shooter Weapon Prefab in the Prefabs/Weapon folder and drop into your Character RightHand.

2- Create an empty gameObject and name it Handler, drag and drop the weapon inside.

3- Reset the weapon prefab transform to 0, 0, 0 or close enough to the final position

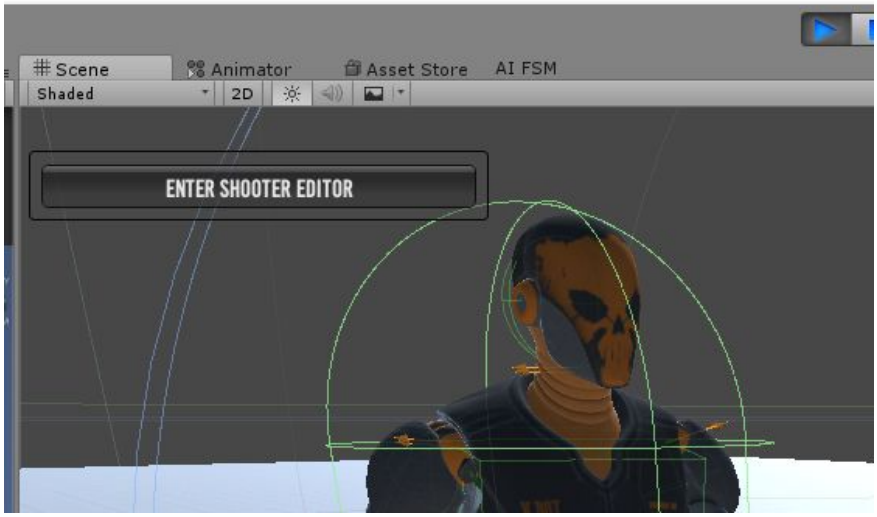
4- Hit Play and open the Shooter Settings tab from your AI Shooter Controller, check the option "Lock Aim Debug"to enter the Aiming mode, now you can Rotate the Handler object to find the correct alignment for your weapon.

5- Before exiting playmode, copy the transform component of the Handler, exit playmode and paste to validate the changes.

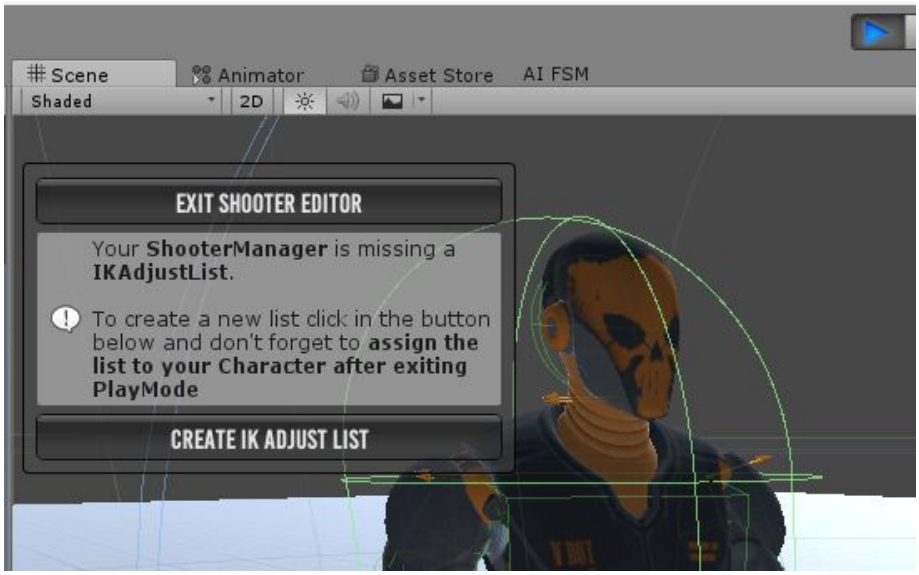


HOW TO ALIGN THE LEFT HAND IK FOR ALL WEAPONS

- Now to adjust the **LeftHandIK or RightHandIK (if you're equipped with the weapon on the LeftHand, ex: Bow) Rotation and Position OffSet** hit Play, equip a Weapon and by selecting the ShooterController a window will appear on the left top corner of your Scene View:

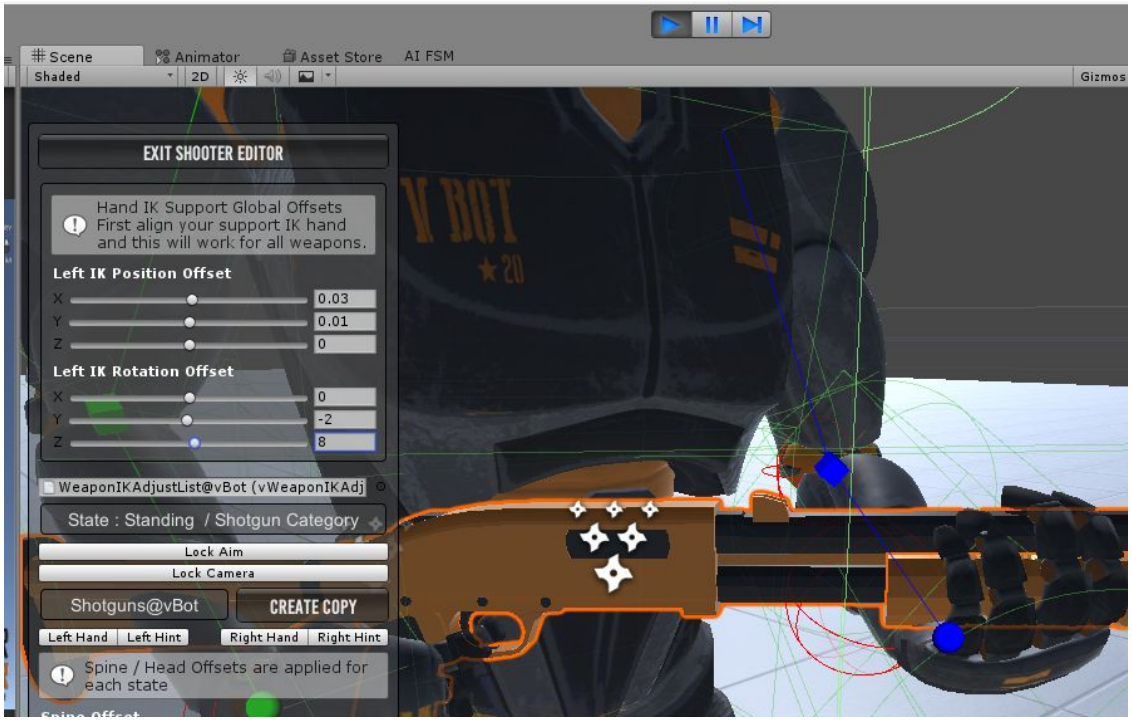


Hit the Button to Enter the Shooter IK Editor and a IKAdjust for your Character will automatically be created:



**don't forget to assign into your ShooterManager IKAdjust slot after exiting PlayMode.*

Now that you have an **IKAdjustList**, we need to align the LeftHand if you're equipped with a Weapon that use IK for a supporting hand, you can use the sliders to align the hand and once you did on this weapon, it will be aligned for all the other weapon prefabs that comes with the template.



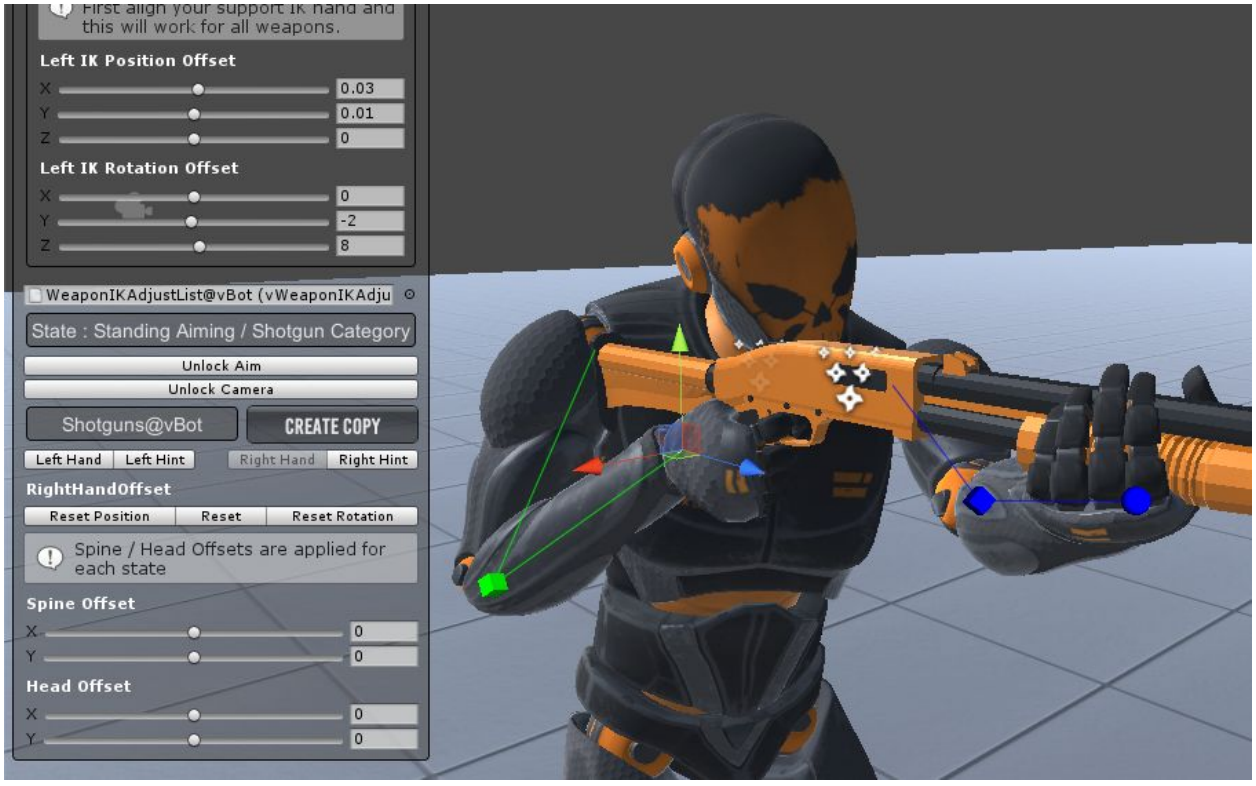
IK ADJUSTMENTS FOR FINE TUNING OR CREATE NEW POSES

Notice that below the LeftIK Pos/Rot Offset we have a lot of options.

The “State” will inform what state you are, there are basically 4 states that you can create unique IK modifications, those are:

- Standing
- Standing Crouch
- Aiming
- Aiming Crouch

You can switch the state by pressing to crouch, and you can hit the button LockAim & LockCamera to help you create poses for aiming.



Simply click on the hand or elbow and place it where you want, you can also rotate.
It’s also possible to create Spine and Head offsets to help you define a better posture.

You can create different IKAdjusts for each weapon or use the same adjust if the weapon share the same **Category**, for example, if you have a large number of Pistols in your game that use the

same pose, you don't need to create an IKAdjust for each weapon, just set the same Category for all the ShooterWeapon prefabs.

You can type any **Category** directly in the **ShooterWeapon** prefab:

- ***This feature was designed to help you better align the weapon into your Character Pose, but if you want the best result as possible the ideal is to replace the animations to animations created using your Character Rig.***
- ***We recommend the use of uMotion to quickly and easily adjust the animations to your character's rig.***

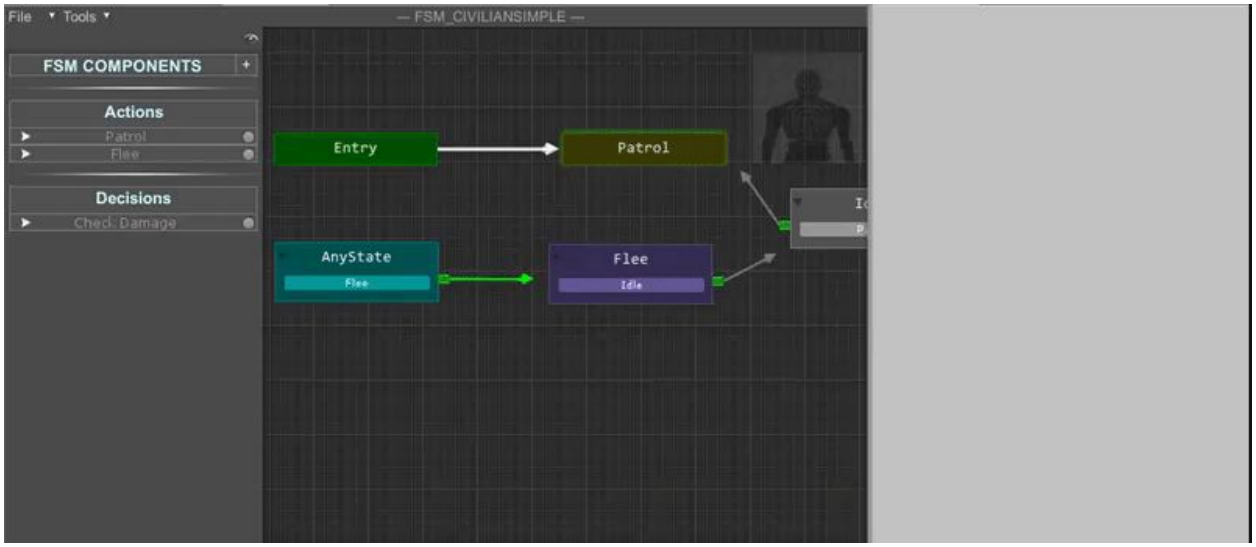
AI SEND MESSAGE / LISTENER RECEIVER

Now that's a pretty cool feature that will allow you to heavily customize your AI.

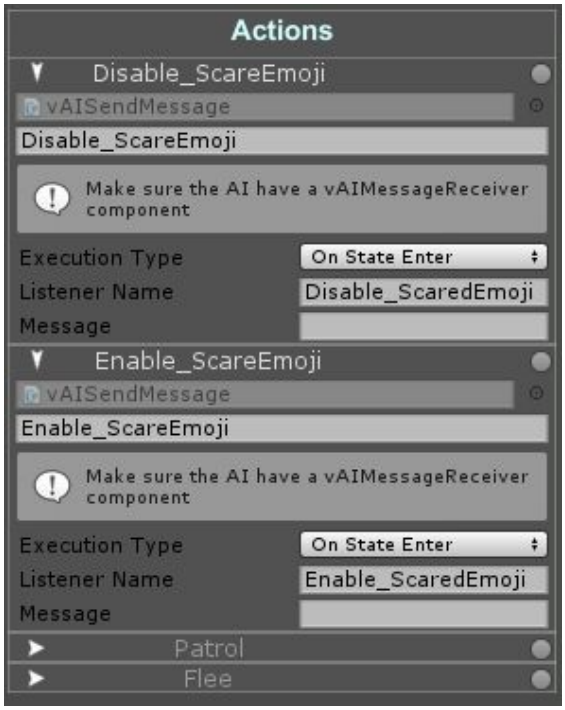
With this feature you can send a message from FSM State to the Controller itself and call a public method, trigger a sound, particle, show/hide a gameObject, etc...

Here is a quick tutorial on how it works:

Let's create a SendMessage Action in the FSM, the message will be "Enable_ScaredEmoji" and assign to our Flee State using the OnStateEnter method.



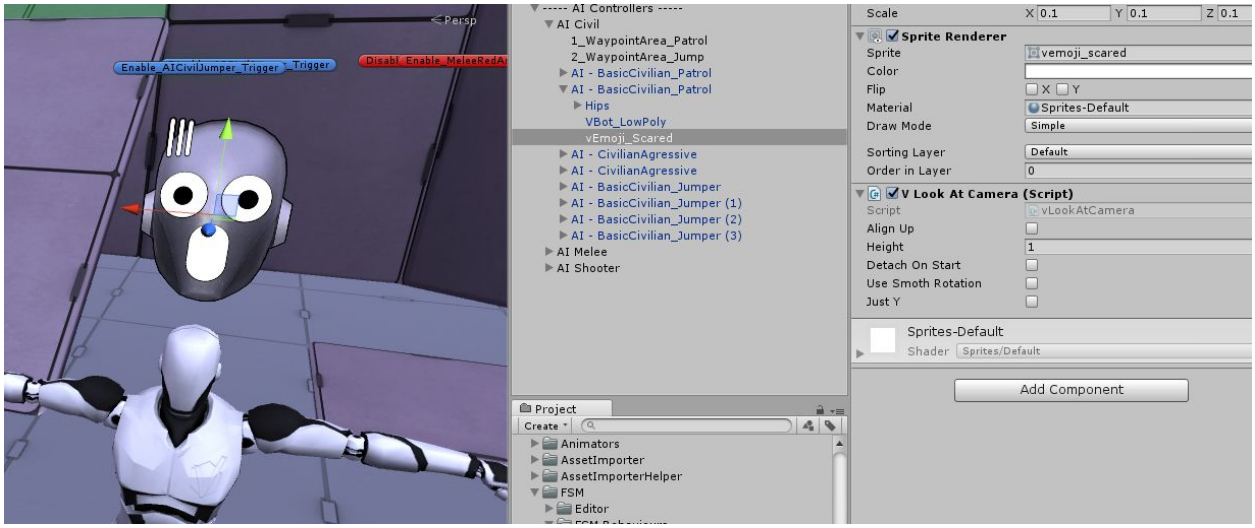
Do the same to "Disable_ScaredEmoji" and assign to the Patrol State.



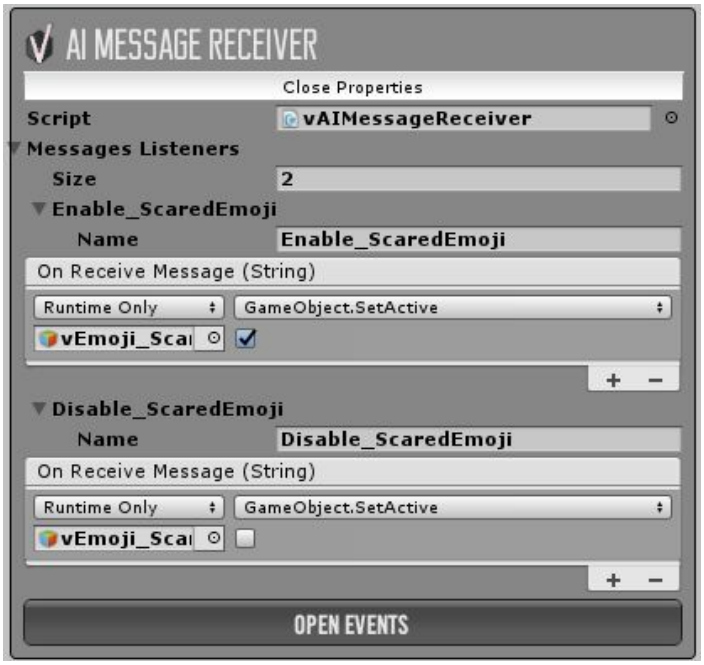
- Listener Name: Name of the MessageListener that you will be called in the MessageReceiver on your AI Controller.

- Message: You can pass a string parameter to the Event OnReceiveMessage(string)

Now go to your AI Controller and create a GameObject Sprite with the EmojiScared texture:



Add the Component vAIMessageReceiver into your AI Controller and set the messages "Enable_ScaredEmoji" and "Disable_ScaredEmoji". Now simple assign the vEmoji_Scared GameObject and use the Events to turnOn/Off the gameObject.



You can trigger particles, sounds, call public methods, enable/disable objects, etc...

FSM BEHAVIOURS - HOW IT WORKS?

The FSM Behavior window is a Node Editor that you can create customizable new behaviours using States.

The AI Template comes with several **Actions** and **Decisions** build in, they are basically small pieces of code that allows you to verify something or do some behaviour.

01. **FSM Behavior** : The behavior is the actual entry point into the AI's behavior. The FSM behavior contains the state flow. There are two important states that will be in every behavior. One is of course the Entry and the other one is the Any State.

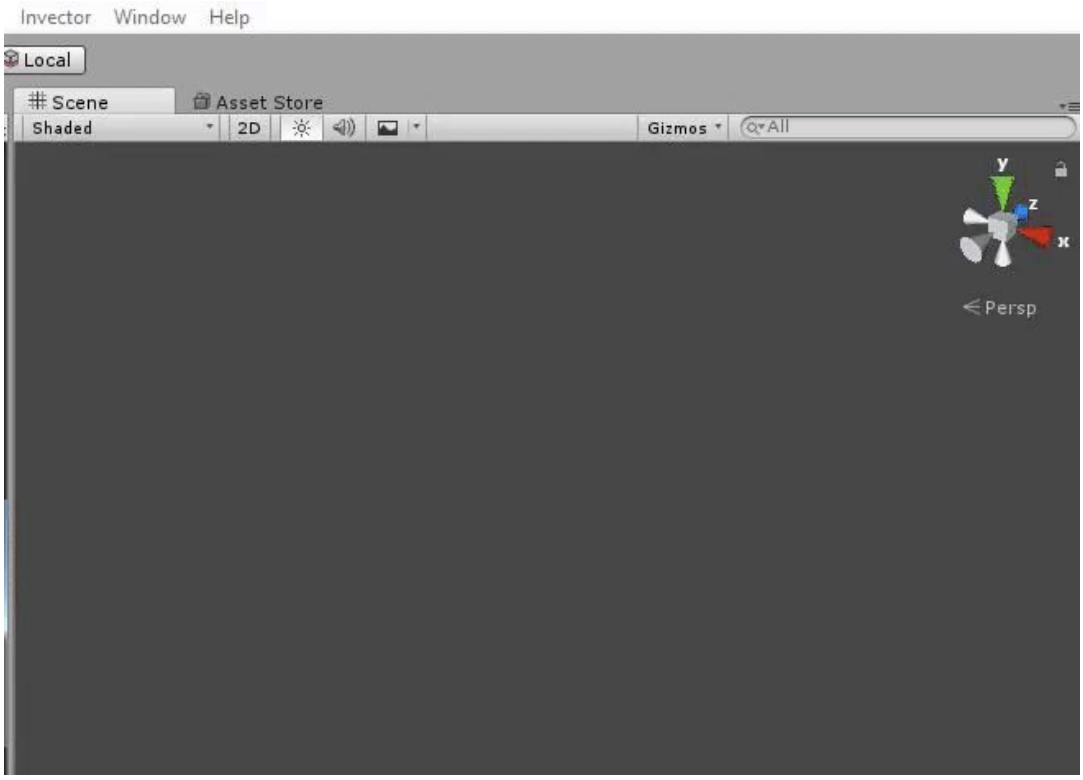
The "**Entry State**" governs the entry point that creates the "current state", just like the Animator Controller does.

The "**Any State**", is the one that does the decision making to go from the current state, to "any state".

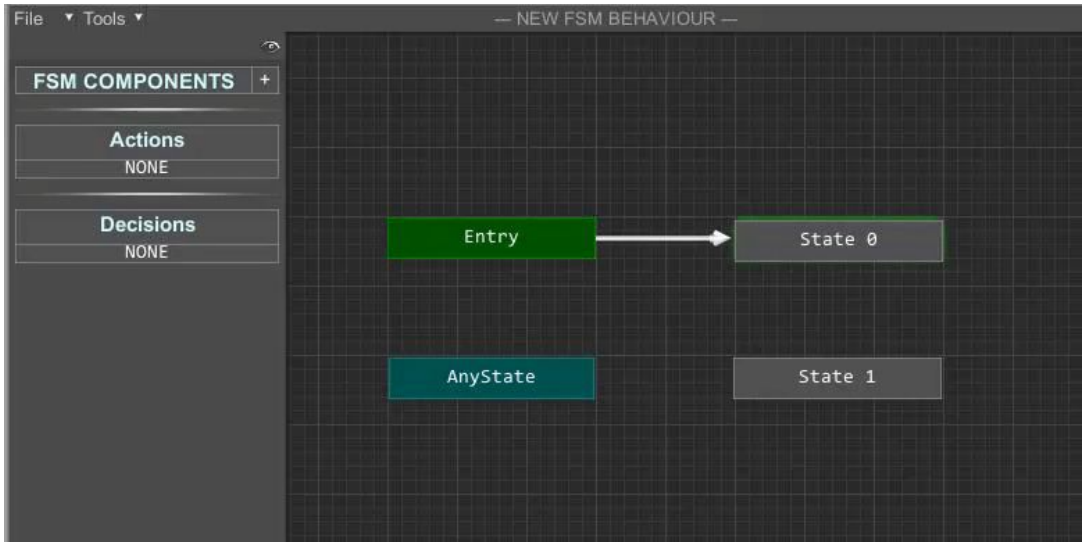
02. **States** (node) : To create a new State or Node right click in the background of the FSM Behaviour Window and hit "New Node". Every state can have Actions and Transitions, every Transition can have Decisions that will return true or false.

We also have **CustomStates** that are basically a state built with a small action, for example the Custom Chase States a simple state calling the MoveTo method from the Controller.

You can create your own Custom Actions and Custom Decisions to create more unique behaviors.



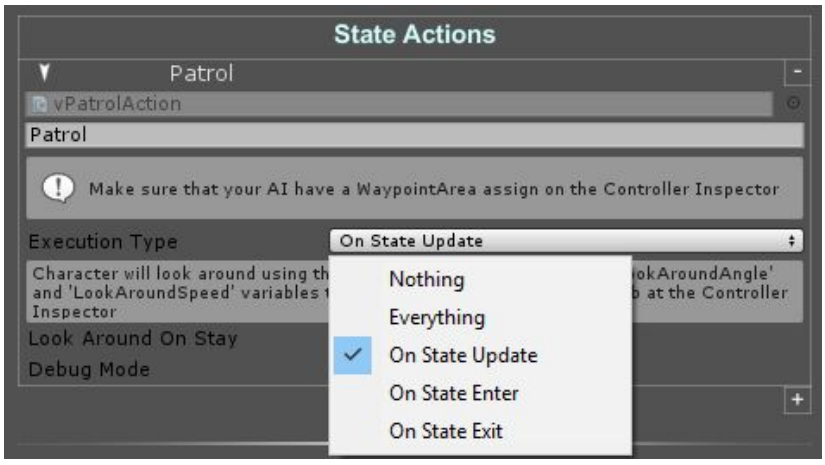
03. **Transitions**: To add a new Transition right click in your State and hit the button "New Transition", them open the state folder and click and hold the from the transition point to the next state.



05. **Decisions**: You can add Decisions in your FSM Behaviour just like you can add several different types of variables in the Animator Controller, and use them to drive your Transitions. A Decision will return a value of True or False and you can also add a Transition Delay for each transition.

You must first add the Action or Decisions in the FSM Components (left panel) and then add it to your State (right panel), just like the example above.

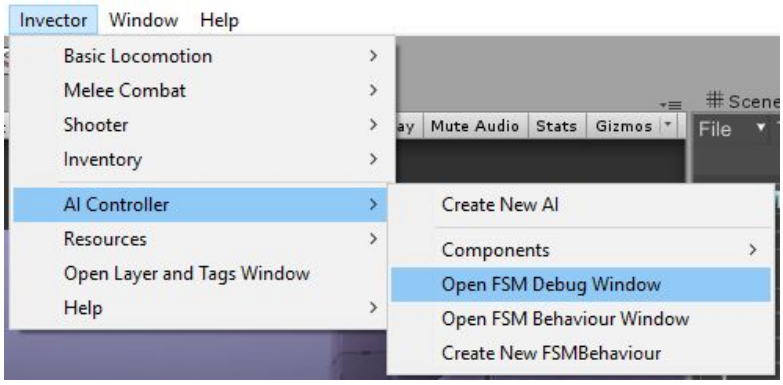
06. **Actions**: They are scripts with an encapsulated behaviour, for example if you open the vPatrolAction script you will see that it contains only the patrol logic but the variables are actually located on the AI Controller itself, so you can assign different WaypointArea's for each controller, this way you can re-use the Patrol behaviour and the FSM on several different AI's but different values assigned to it.



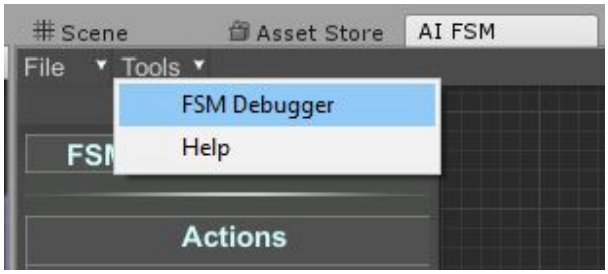
Actions can be executed OnStateEnter, OnStateUpdate, OnStateExit, All or Nothing.

FSM DEBUG WINDOW - HOW TO USE IT

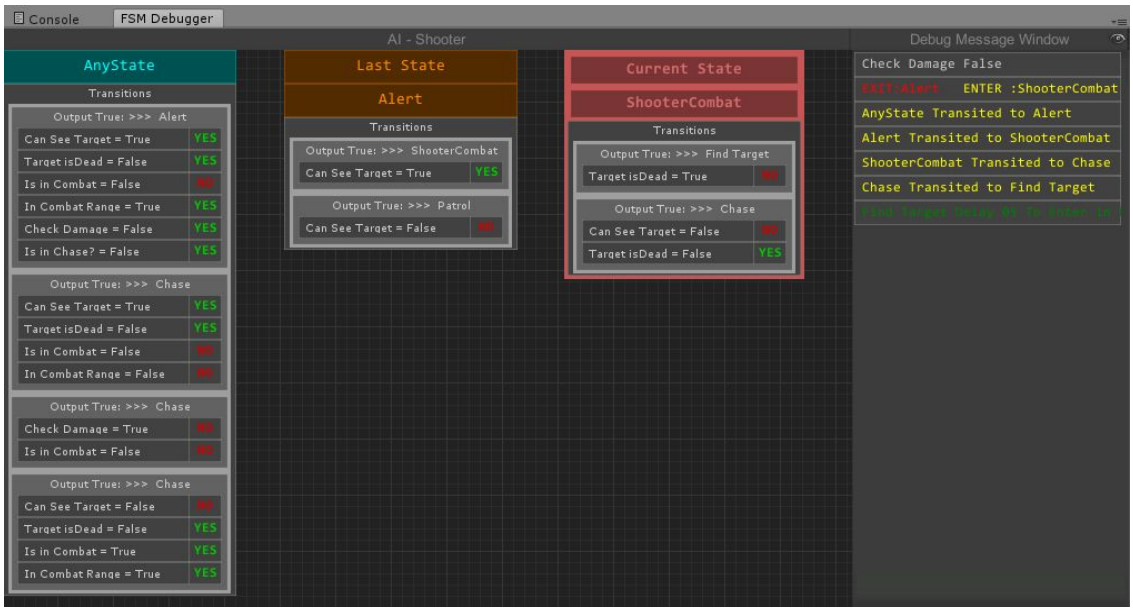
You can open the **FSM Debugger window** by going to:



Or if you have an FSM Behaviour opened, go to **Tools/FSM Debugger.**

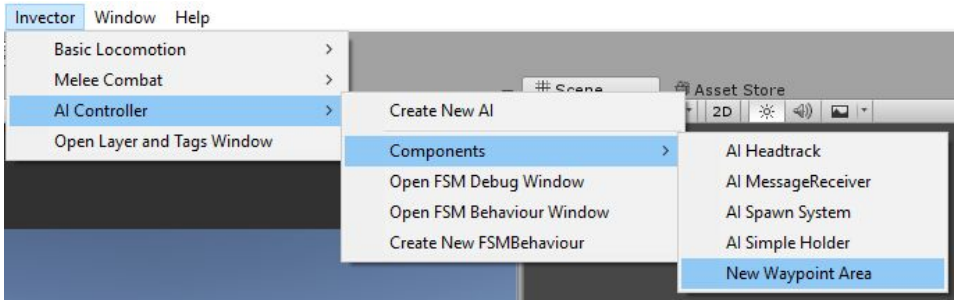


Make sure to Select the AI Controller in the Hierarchy that you want to debug, and hit play to follow in real time the States, Actions, Decisions and Transitions. This will help you debug your FSM logic and quickly find the solution.



WAYPOINT AREA

You can create a new Waypoint Area by opening the Invector > AI Controller > Components > New Waypoint Area.



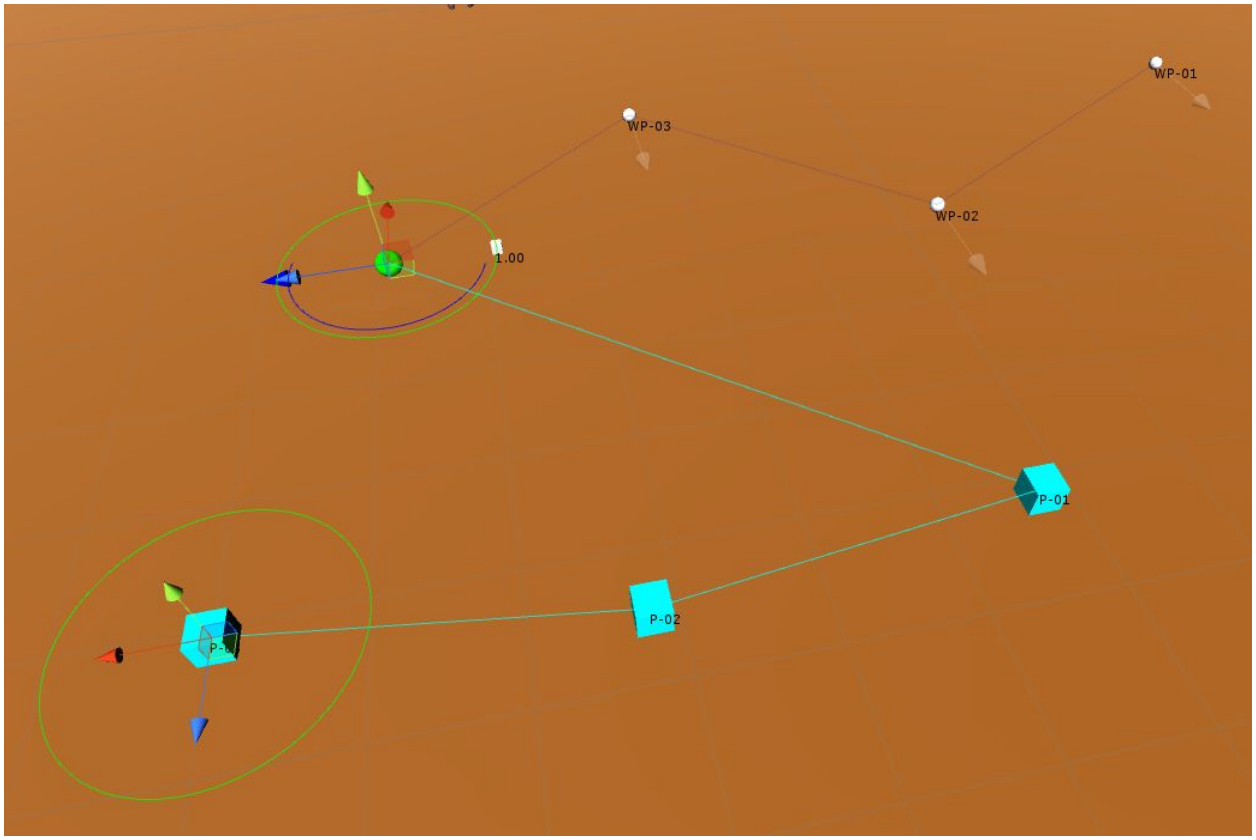
To create a new Waypoint, just hold Shift + Left Click on any surface with a collider, to reposition the same waypoint hold Shift + Right Click.

The same goes to create Patrol Points, but you will hold Ctrl instead of Shift.

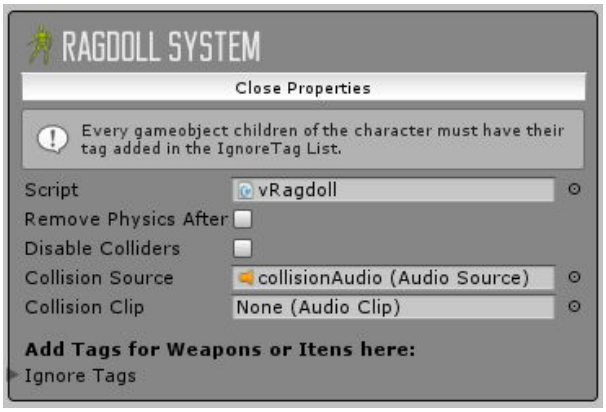
You can assign this Waypoint Area to many AI as you want, and limit the area / limit of AI that will access.

- **Out of NavMesh**: This warning will appear if you have placed the waypoint on a surface that is missing a navmesh, meaning that the AI will not be able to find a path to get there.
- **Patrol Points**: basically, points of interest that one waypoint has, for example if you have a corridor with 3 rooms, you can create 1 waypoint in the middle of the corridor and 3 patrol points with Max Visitors of 1, this means that if an AI is already on a room, the other AI will not come to the same room, he will go to the next one.
- Time to Stay: How much time the AI will stand there.
- **isValid**: Is a bool that you can turn on/off to disable a waypoints/patrol point in real time.
- **Area Radius**: Total area of the waypoint.
- **RotateTo**: The Agent will rotate to that forward direction once he arrives at the waypoint.

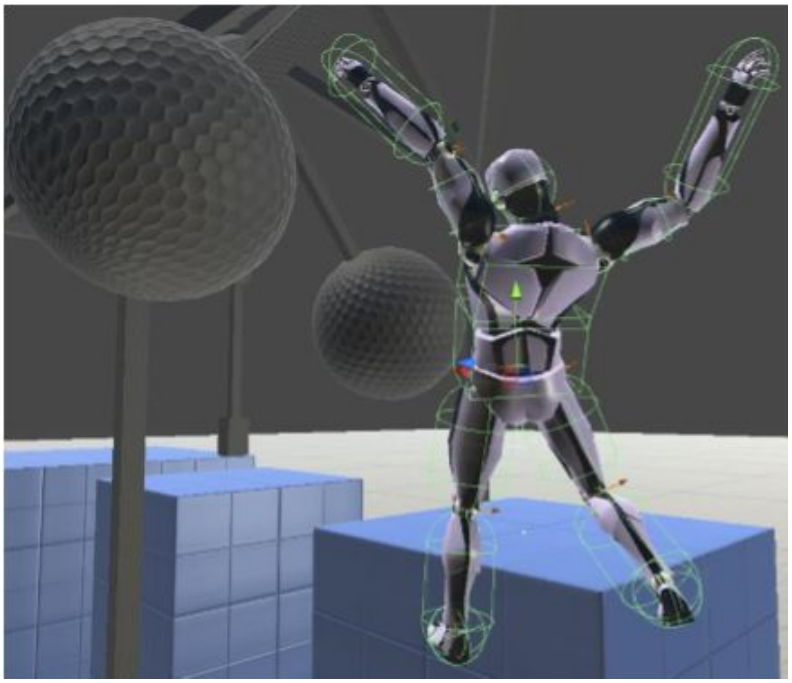
You can make the AI walks randomly at waypoints by selecting the option Random Waypoints on the AI Inspector. To make random patrol points, select the option Random Patrol Point on the Waypoint Inspector.
Waypoints are represented by Spheres and PatrolPoints are represented by Cubes.



HOW TO CREATE A RAGDOLL

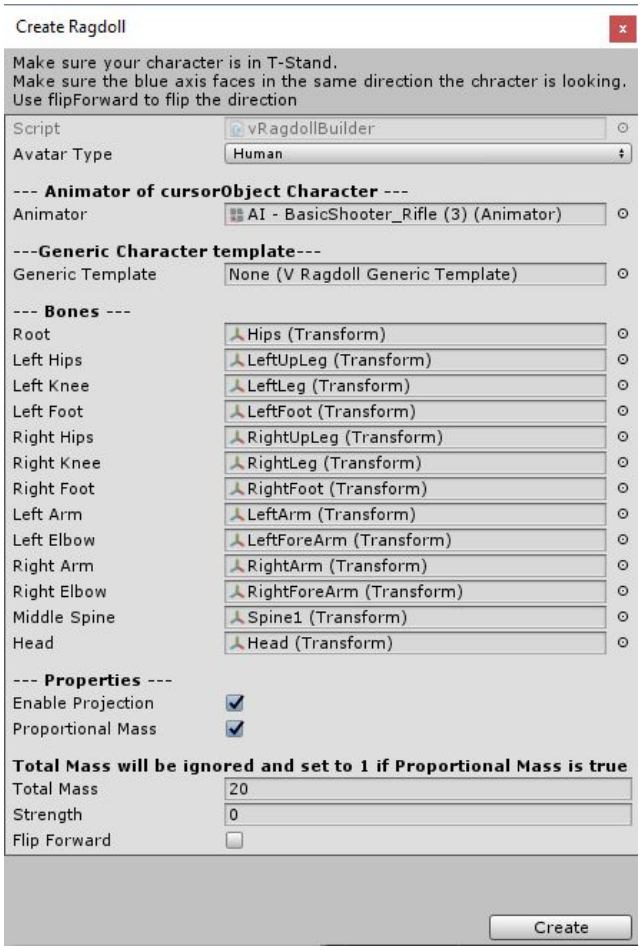


Creating a Ragdoll is just easy as creating your Character, just go to the tab Invector > Basic Locomotion > Components > Ragdoll.



If you have your character using the Rig Type Humanoid, simple select on the Hierarchy and all the fields will autofill, if not, you will need to manually drag the bones to the wizard.

We strongly recommend keeping the Enable Projection and the Proportional Mass enabled, and do not forget to adjust the Scale Factor of your fbx Model. This you provide better behavior of your ragdoll.



If you're using a Generic Rig Type, you can create a Generic Template, allowing you to set the bones only 1 time, this will save you time if you need to add a ragdoll into the same character later on.

Using the Ragdoll Colliders as BodyParts to inflict precise damage.

SHOOTER > If you want to cause damage for each body member using the ragdoll colliders, UNCHECK the “Disable Colliders” and you can add damage multiplier on each member.
* You can use a different Layer on the Ragdoll Colliders like “BodyPart” and a different one for the main capsule collider like "Enemy", this way the Detection will detect the Enemy, but the ShooterManager will actually apply damage to the "BodyPart".

A DamageReceiver is attached to each ragdoll collider, this will allow to Player or AI to apply damage to each bodypart instead of the CapsuleCollider.

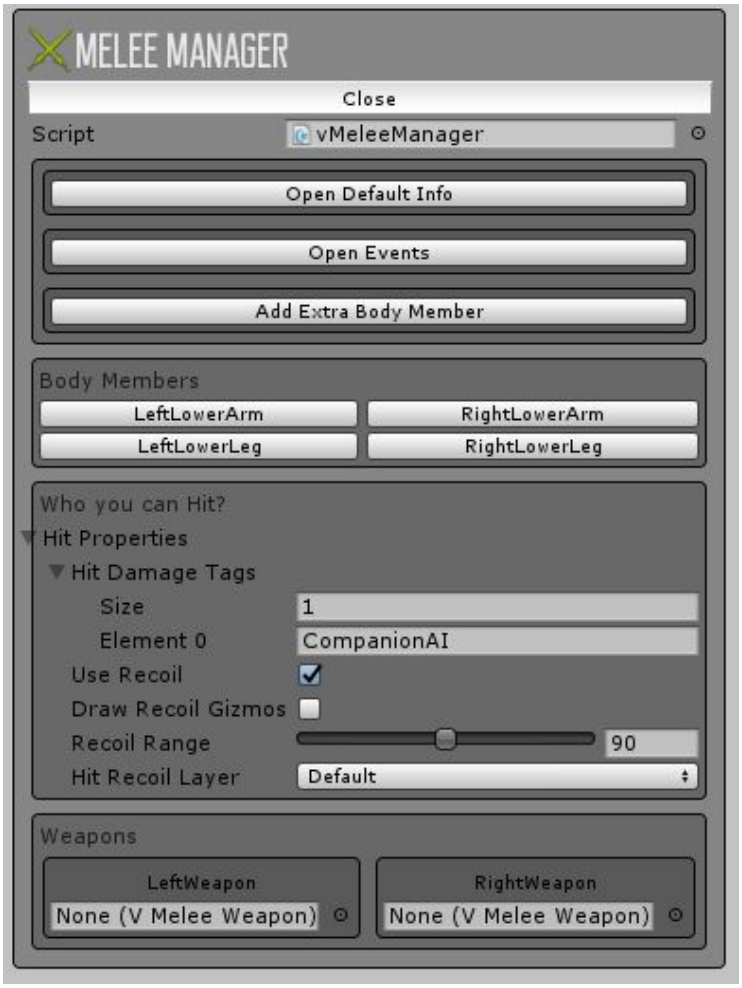
- **Damage Multiplier**: multiply the damage value
- **Override a Reaction ID**: Check this option to override the hit reaction animation to trigger a specific animation.

For example, if you want to cause 2x damage and trigger a specific reaction animation when shooting in the Head, simple change the values in this component.

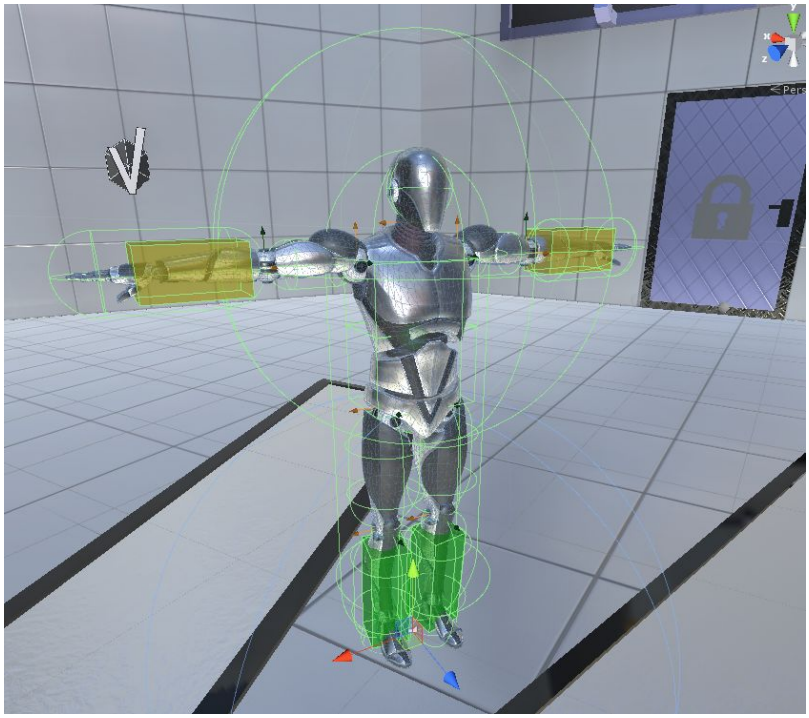
MELEE MANAGER

V2.0 - You can add a **Melee Manager** Component by opening the Invector tab > Melee Combat > Component

Open Default Info: here you can setup the default values for Hand to Hand Combat
Open Events: here you can add generic events like trigger something when you make damage
Add Extra Body Member: If you need an extra hitbox for example a Head Hitbox for a zombie, you can add
Who you can Hit > **Important** this is the tag that will receive Damage, so if you are using this component on the Player, assign the Tags of the gameObjects that you want to apply damage (the receiver need to have the method TakeDamage).
Use Recoil > Check if you want the character to trigger a recoil animation when hit a wall
Recoil Range > max angle to allow trigger the recoil animation
Hit Recoil Layer > the layer that will affect the recoil (usually it's the Default layer)



When you assign the **MeleeManager** component into your character, it will automatically create default hitboxes for both hands and legs, you can add an extra hitbox if you need.

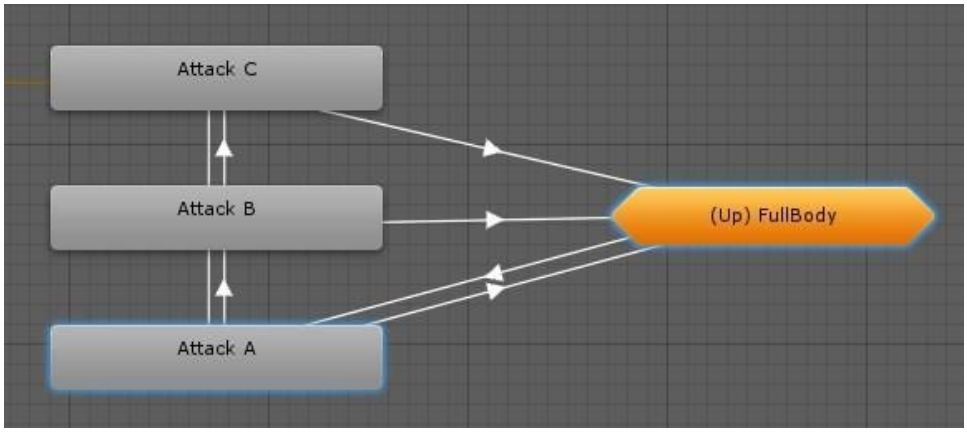


The animations for the hand to hand combat can be set up in the **Unarmed** state machine, trigger by the **ATK_ID 0** and the defense **DEF_ID 1** on the UpperBody Layer**, Default Defense.**

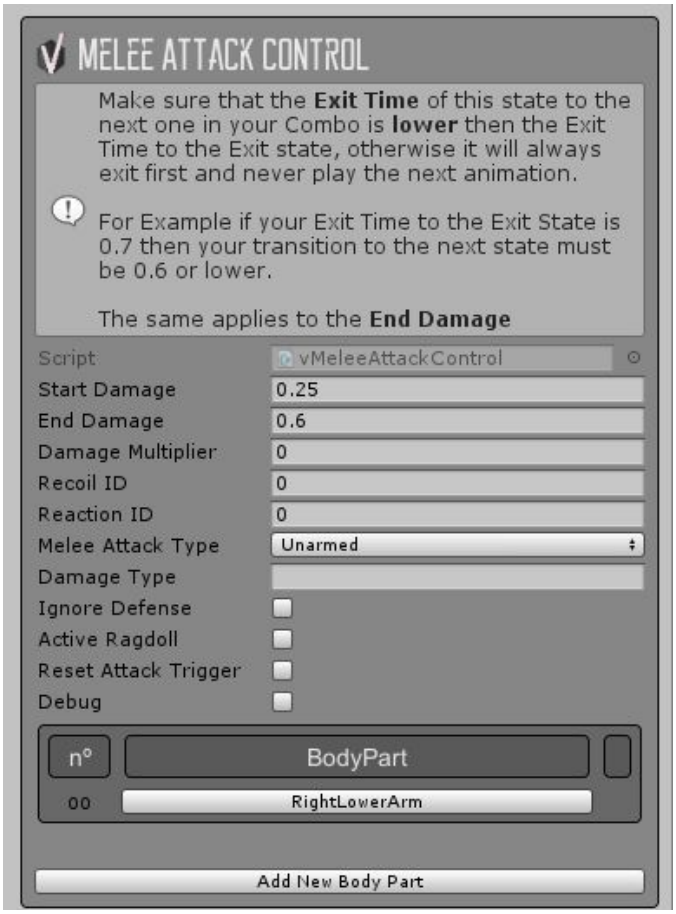
The **Basic Attack** State Machine is just an example, you can have as many State Machines you need, just remember to set up the **ID** to the corresponding weapon.

You can use **UpperBody** to attack as well, this way you can move the character and attack at the same time.

You can set up as many combos as you want, just put the attack animation and apply a transition.



Every Attack State need to have a **vMeleeAttackBehaviour** script attached.



StartDamage > Time of the animation that you will apply damage
End Damage > Time of the animation that will stop trying to apply damage
Recoil ID > Trigger a Recoil animation if you hit a wall or an object
Reaction ID > Trigger a Reaction animation when you take damage
Melee Attack Type > Select Unarmed or Melee Weapon
Reset Trigger > Check this bool for the last attack, to reset the combo
Attack Name > You can write an Attack Name to trigger different HitDamage Particles on the Target, Ex: If your weapon has electric damage, you can match the Attack Name with the HitDamage Particle and instantiate a different particle for this specific weapon.
Ignore Defense: it will apply damage even if the target is blocking
Active Ragdoll: activate the target ragdoll

Ps* Don't forget to assign the limb member of your BodyPart to match the animation, this will trigger the correct HitBox, you can add new BodyParts if your attack use more than one member.

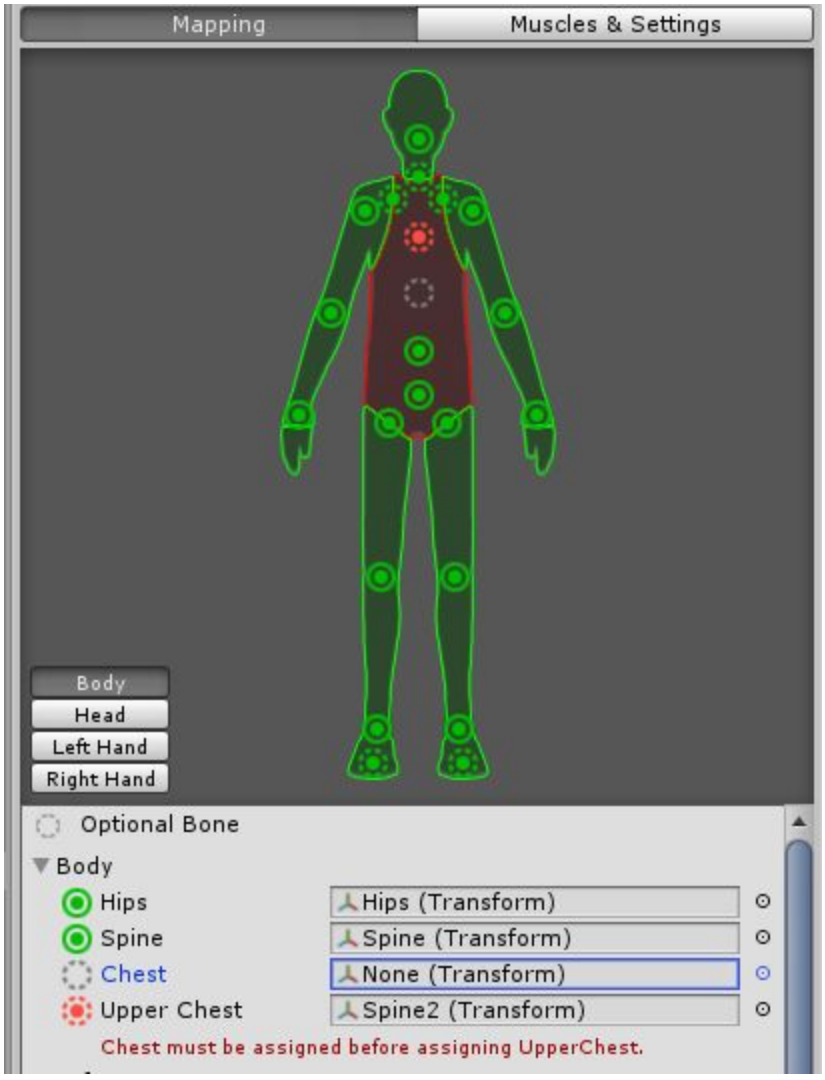
BODY SNAPPING ATTACHMENTS

We created this feature to make it easier to transfer attachments from one controller to another.

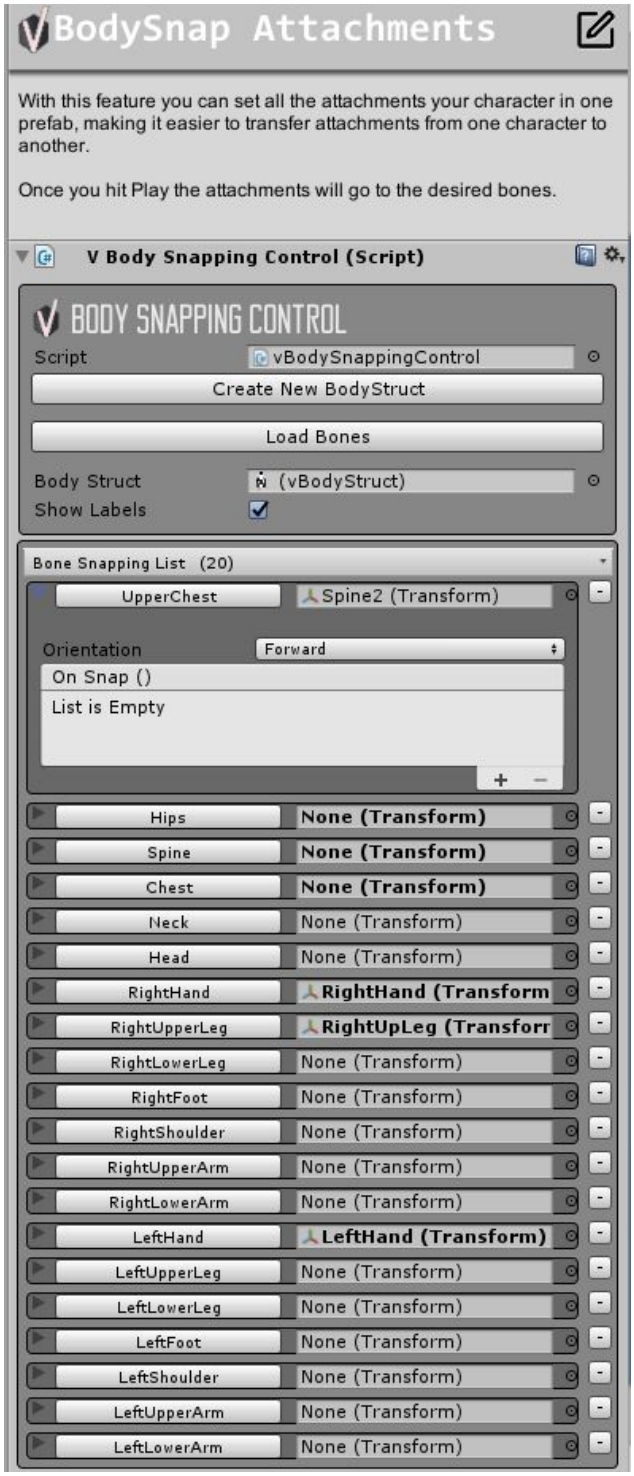
This means that you can create a Prefab of a Character Attachments and quickly add to another character, without the need of adding attachments one by one on each bone.

First, create an Empty GameObject inside your character, add the "**vBodySnappingControl**" and hit the "Create New BodyStruct.

If your Avatar is already set up as Humanoid and all the bones are correctly mapped, it will all be automatically assigned for you, in some cases Unity doesn't recognize a Spine or Chest, so you need to fix by going to your Avatar and assigning the correct Bone, example:



Now going back to our Character BodySnap Control, you can add all your character attachments such as particles that activated on a specific bone, itemManager Handles, anything that you may use and assigned to a specific bone, once you hit Play that GameObject will be attached to the bone you assigned.



ANIMATOR TAG

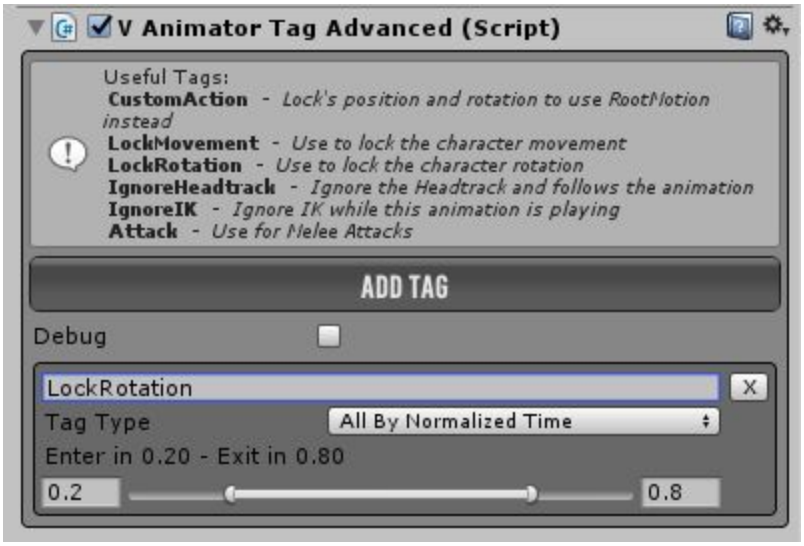
This is an Animator Behavior that you can attach directly on Animation State inside the AnimatorController, it's useful to know what animation is being played and what you can do while this animation is playing.

We have a few useful built in tags such as the image below in the infobox, but you can also create your own tag and verify in code, for example:

First access the **vThirdPersonController** via script so you can call the **method**

```
if(tpController.IsAnimatorTag("MyCustomTag")
{
        //do stuff
}
```

We also have a **AnimatorTagAdvanced** in case you want to check a tag but only during a certain period of the animation, every animation goes from 0 to 1 and you can filter the tag to only run your method during this time.



ANIMATOR EVENT MESSAGE/RECEIVER

Send messages from a AnimationState to any GameObject:
https://www.youtube.com/watch?v=uZn53kKsI0I