

# Section 3: Animator Controllers and You

This page is a **WORK IN PROGRESS** and it is not finished!

How does an Avatar come to life? What sorcery must be done to make things that look so simple actually work?

That my friend is the power of Unity Animators, the driving heartbeat of every Avatar that exists in VRChat! We use Animator Controllers to organize, sort, and determine how an Avatar behaves and looks at runtime. In this section, we'll be looking at the many different Layers that allows an Avatar to come to life!

## 3.1 - What does each Animator do?

By default, VRChat uses 5 Playable Layers. Each of them serve their own purpose. If your Avatar is set to use any of the defaults, then it will always play the default Animator Controller for that specific Layer.

In most cases, you will not need to make each one separately by yourself. Most likely, you'll only edit 2. I'll explain more what are most commonly modified further below. But either way, it is pretty important to get an understanding of what each of them does and how it will affect your Avatar.

All example Animator Controllers and it's sister .anim files that VRChat uses are included in all versions of the VRChat SDK for Avatars 3.0. To find them in projects created using Creator Companion, they will all be located in: `Packages/VRChat SDK - Avatars/Samples/AV3 Demo Assets/Animation`.

Note that `Packages/VRChat SDK - Avatars` folder may show as `com.vrchat.avatars` if viewing it's files through Windows Explorer.

### 3.1.1 - Base

*Default Animator Controller:* `vrc_AvatarV3LocomotionLayer.controller`

Commonly referred to as "Locomotion," this Layer is the sole heartbeat behind all kinds of Avatar Movement! This includes things such as Walking, Running, Falling, Crouching, Sitting, and Jumping! If you ever wanted to know where all of that movement happens from, this is the Controller that is

responsible for all of that!

In many cases, this layer is rarely edited by the end-user because this Layer is very complex! It contains a vast amount of Blendtrees, Transitions, and animation states that reference to Humanoid Animations. These Humanoid .anim files are far different than any kind of Animation! They specifically control the IK (aka Inverse-Kinematics) of a Humanoid Avatar Rig.

**Due to the complexity and unique behavior of the Base controller, it is aimed towards Advanced Users only!** Do not add any of your own Controllers to Base unless you know exactly what you are doing!

Be extremely careful when editing and/or adding Animations to Base! Any mistake you make could end up creating wild and unintentional Locomotion behavior with your Avatar! We recommend copying the default Animations so that the original files aren't affected.

Humanoid Animations are VERY HARD TO EDIT on your own without the right plugins! You'll see why if you attempt to look at the keyframes of those .anim files.

Use a plugin such as **Muscle Animation Editor** or **Very Animation** to edit them, as they are designed to create and/or edit Humanoid Animations. They can be found on the **Unity Asset Store**.

### 3.1.2 - Additive

Default Animator Controller: `None (User Dependent)`

Additive is a special layer. It is added on-top of the Base controller for animations that should "add-on" in addition to an existing Humanoid Bone affected by IK. This can be used for things such as a "breathing" animation that uses Bones to make that happen.

This Layer is rarely used in most cases.

Animations in Additive SHOULD ONLY AFFECT Humanoid Bones that are driven by IK! If you have non-humanoid bones such as Ears or a Tail, use the Gesture Controller! More info on Gesture in Section 3.1.3.

### 3.1.3 - Gesture

Default Animator Controller: `vrc_AvatarV3HandsLayer.controller`

The Gesture Layer is used for Animations that require to act on individual body parts while still playing the underlying Animations for the rest of the body

This is an important layer. Gesture is used to determine how Fingers on an Avatar's Hand should animate depending on which Hand Gesture the user is attempting to pose. They would be either Fist, Open, Point, Peace, Rock N' Roll, Finger Gun, or Thumbs Up.

**If you have an Avatar that will have Idle or Puppet Animations on non-Humanoid Bones such as Ears or a Tail, use the Gesture Layer!** In addition, it is highly advised that any kind of non-Humanoid Bone that will have it's Transforms animated to go into the Gesture Layer!

The first 3 Layers are mainly important. They require the usage of **Masking** in order to direct the Animations to affect a certain part of your Avatar. For VRChat, the default Masks for these are located in `Packages/VRChat SDK - Avatars/Samples/AV3 Demo Assets/Animation/Masks`.

**Here are the Masking Requirements to follow for the first 3 Layers of the Gesture Controller:**

- AllParts: `vrc_HandsOnly`
- Left Hand: `vrc_Hand Left`
- Right Hand: `vrc_Hand Right`

*To use Hand Gestures in VRChat using an **Oculus** or **Vive Controller**, please refer to the image chart shown on VRChat's Documentation [here](#).*

*Desktop Users will use Keyboard Shortcuts to use Hand Gestures in VRChat. For more information, see the Keyboard & Mouse bindings on VRChat's Documentation [here](#).*

When making your own Gestures, refer to the VRChat Documentation on when the `GestureLeft` and `GestureRight` Int Parameters are triggered [here](#). These Parameters are already synced across the Network using the IK solver, so you only need to add these to your Gesture Controller. Do not add them to your Expression Parameters!

**Valve Index Controllers** will most likely at times never play the finger animations as those are overridden by it's native Finger Tracking (obviously).

### 3.1.4 - Action

Default Animator Controller: `vrc_AvatarV3ActionLayer.controller`

The Action Layer is for Humanoid Animations that should override all other Layers, for times when you would want to play an "Animated Emote."

**If you have a Dance Emote, this is where you would want to put it!** Some other Animations can be found here as well, such as the AFK Animation (triggered by the `AFK` Bool).

Before adding your own Animations to Action, make sure to use the `VRC Playable Layer Control` component! Since the Action Layer is Weighted to 0 by Default, you need to override it's Weight before an Animation is played!

In addition, you will need to make use of the `VRC Animator Tracking Control` as well. This animation state component allows you to filter out any of your own movements before and after an Animation plays!

### 3.1.5 - FX

Default Animator Controller: `None (User Dependent)`

The FX is a special layer! What's so unique about this Layer is that **everything in the FX is copied over!** In other words, Animations that DO NOT affect Transforms whatsoever shall be put into this Layer!

**The FX is the most common Layer to be edited by the end-user. This is where the majority of the Toggles and other magic that you add to your Avatar should be animated from!**

*Want to put an Animation that changes a Material? Put it in the FX!*

*What about Object Toggles? Yes! Put it in the FX!*

*Blendshape Animations? Absolutely!*

*Wanna enter the battlefield with that cool Lightsaber you got for Christmas that can be thrown like a true Jedi? This is where you put those Animations in!*

**To put it simply, this is the Layer that your Object Toggles and other magical things that would impress Gandalf should go to!** Many of the magical things that users show off to "wow" the whole audience were primarily Animated in the FX! If you ever watched a Tutorial somewhere on how to make a simple object Toggle, it is super often to see the FX being used to create those Toggles!

On some Avatars, you may also see the first few Layers to be labeled similarly to how Gesture labels them. Things like `Left Hand`, `Right Hand`, or `Both Hands`. **The Animations used on these are NOT like the ones seen in Gesture!** In the FX, they are used for Facial Expressions that are driven by Blendshapes on a Skinned Mesh, for example. They also never use Masks in the FX as they are driven entirely by the `GestureLeft` and `GestureRight` Int Parameters. So if you want to have your Avatar have Facial Emotions triggered by your Hand Gestures, this is where you should animate them!

Try to avoid transitioning from "Any State" for your Facial Expressions driven by your Hand Gestures and instead use a transition pattern such as `Entry -> Idle -> [your Expression here] -> Exit`, for example. This is because any Condition that is from an "Any State" is checked for every frame, which can be expensive to your CPU compared to a normal transition pattern.

**DO NOT USE MASKS ANYWHERE IN THE FX!** As of the latest VRChat SDK versions, any Mask used in the FX will greatly conflict (and possibly break) any Finger Animation used with the Gesture Controller! **This is especially important to know as it mainly affects users with Oculus or Vive Controllers!**

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