RIGGING

What is a rig?

Digital rigs are the virtual bones, joints, and muscles that allow models to move. It's kind of like the strings on a marionette. A good rig has just the right amount of flexibility. Without the right controls, the animators can't create the poses they need. Too much flexibility makes posing the model too time consuming.

What does a rigger do?

Riggers start with a virtual 3D model for a character. They study how a character needs to move based on the story. For example, Randall in Monsters, Inc. moves like a chameleon, but he also walks on two legs. Riggers break down those motions into individual elements and create the hundreds of control points that animators will use to create poses.

What is 3D rigging? how to do it in 4 steps + best softwares

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What is 3D rigging? how to do it in 4 steps + best softwares

As Brian Green, rigging technical director of Pixar, defined, **"rigging is the process of adding control to a digital model."** In this short guide, we talk about everything you should know about the process of rigging, from doing it to the best software and the job of a 3D rigging artist.
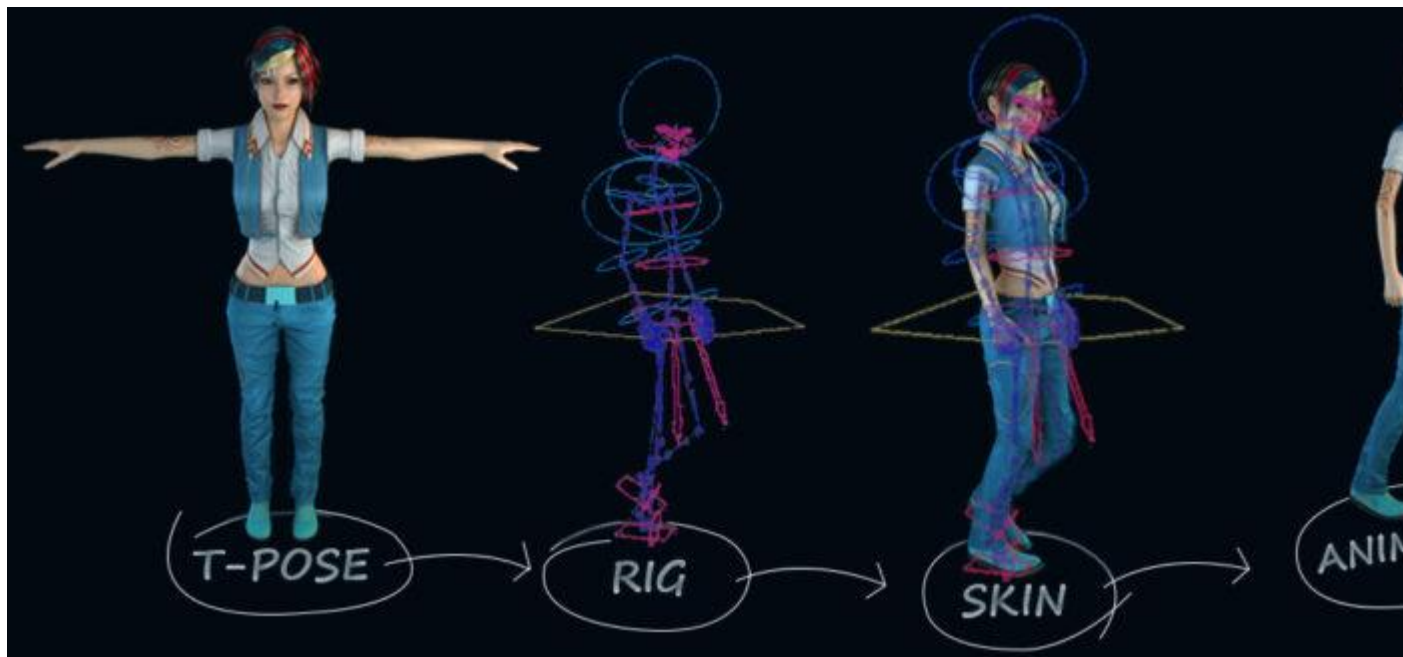

GameYan Studio

What is 3D rigging?

Rigging is also known as skeleton animation, a technique for defining the range of action and gestures of a 3D model character. Rigging artists implement this technique by using a series of interconnected bones. The most crucial point you should consider is that rigging is not a unique feature just for human models; you can rig any object with an action. The most amazing examples are the galaxy, buildings, or even the Pixar lamp, which are among the first 3D models of rigged objects.

Take a look at the video below where we briefly show 3D rigging in one of our latest **3D animation projects**

How to rig a 3D model? (4 step process)

To simplify the description of the rigging process in the **animation production workflow**, we divided it into four main compositions:

1.The first one is called skinning or mesh. It starts by constructing a series of bones that represent models' skeleton (polygonal geometry). It begins by creating and setting bones and joints that represent as an armature the model. Then, the skin meshes to the bones.
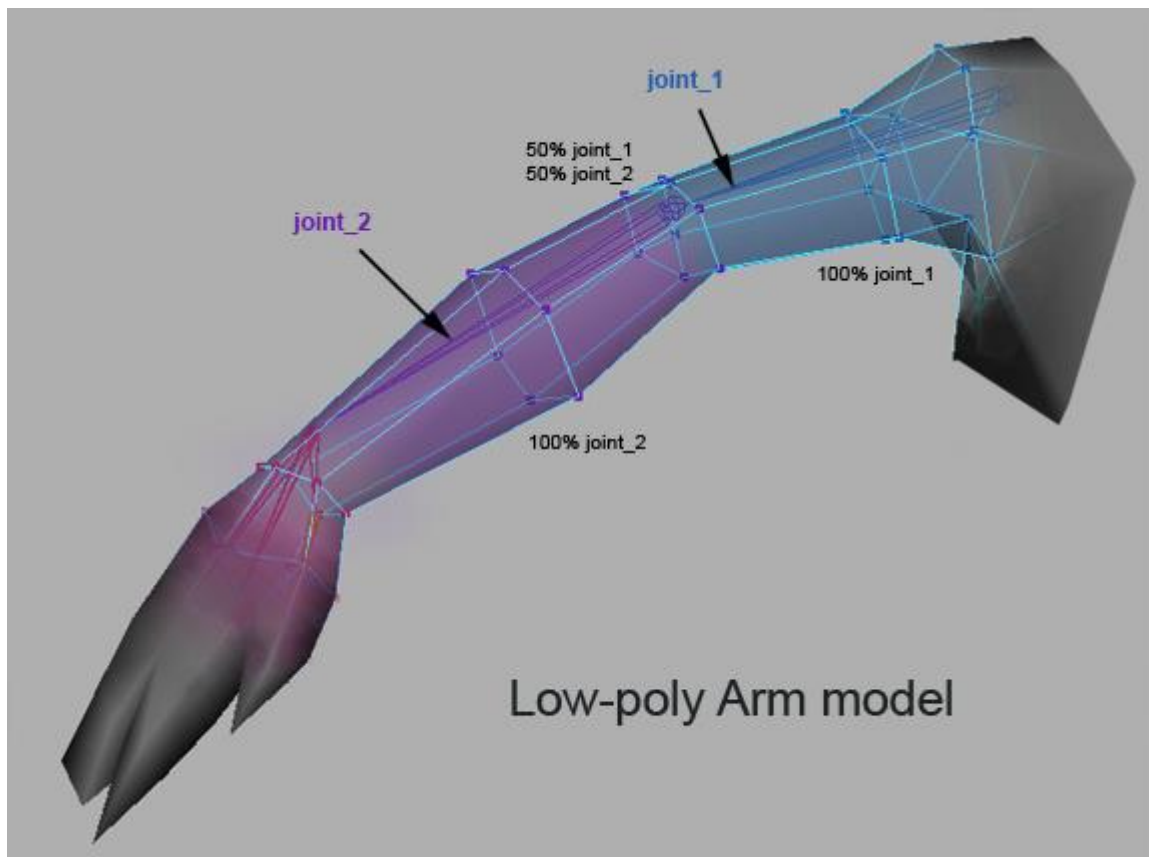

Gamasutra

2.The second is creating controllers. For controlling the effects of every part of the model's movement and helping animators understand the function of controllers, they represent different geometrical shapes. Some of these shapes defined:

- Diamond serves for rotation and translation of the model. We use it for the central part, hand, and feet of the models.

- The Cube serves to translate controls.

- Sphere serves for rotation. It is used most of the time for the neck, pelvis, and torso.

- Trapezoid serves for joints. It is used most of the time for the knee and elbow.

Now, We've completed the process of designing the skeleton. After that, the character rigger should add movement patterns and facial gestures to the model. The relationship between the bones in every movement is hierarchical, like the parent-child relationship. If you want to move a 3D model character's shoulder, its hand and forearm bones also move. This connection simplifies rigging because the character rigger does not need to define actions for every little part of a model.
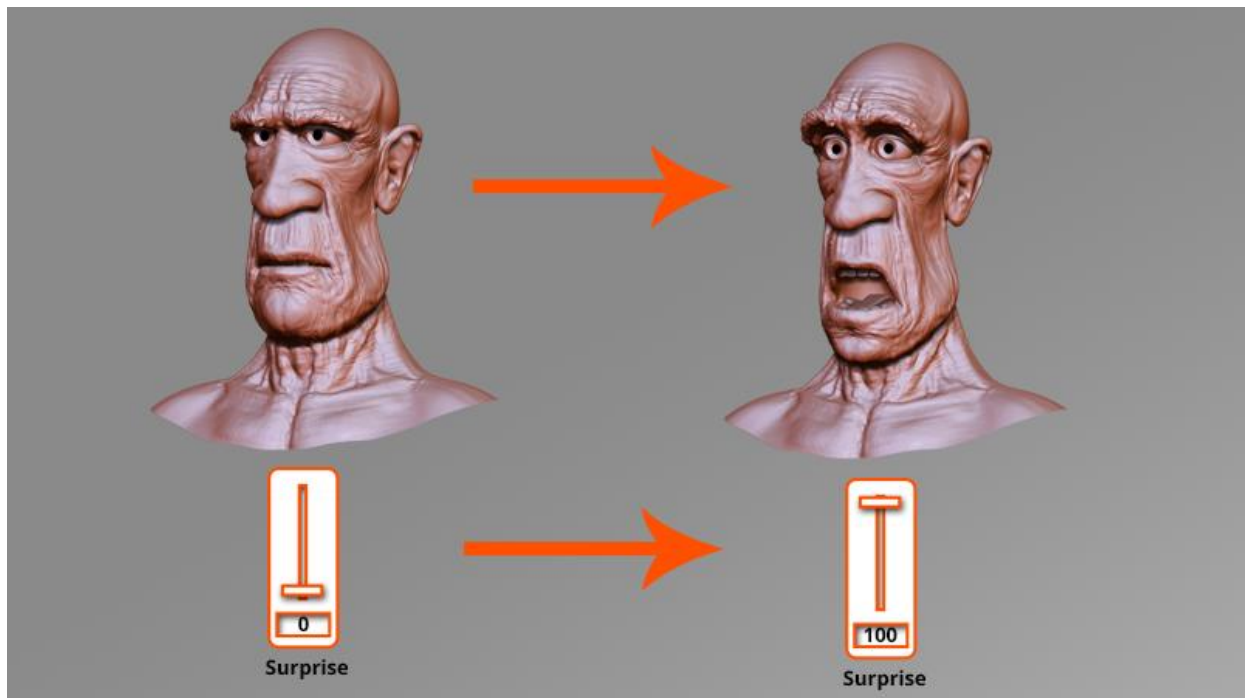

Pluralsight

3. The third is joints which are different from the joint that we mentioned in step one. Joints define the limitation of models in movement, and another point that is important in this step is weight painting. The interaction of every part of the 3D model depends on the weight scale. It means that how much a part's weight influences a bone in movement is essential in the model's realistic and natural physiologic rigging.

Most software programs have an auto-weight-painting mode like Blender. They are designed based on this theory that most characters follow the same limited pattern of the skeleton. Although, for perfect rigging, it is necessary to tune the weight of each bone.

4.The fourth is Forward and Inverse Kinematics. As mentioned above, the relationship between the bones is hierarchical. It means that action in the upper parts of a model also affects the lower regions, known as forwarding kinematics. On the other side, if lower parts are animated independently from the upper parts, it is called inverse kinematics. The process of animation can be more straightforward by IK.
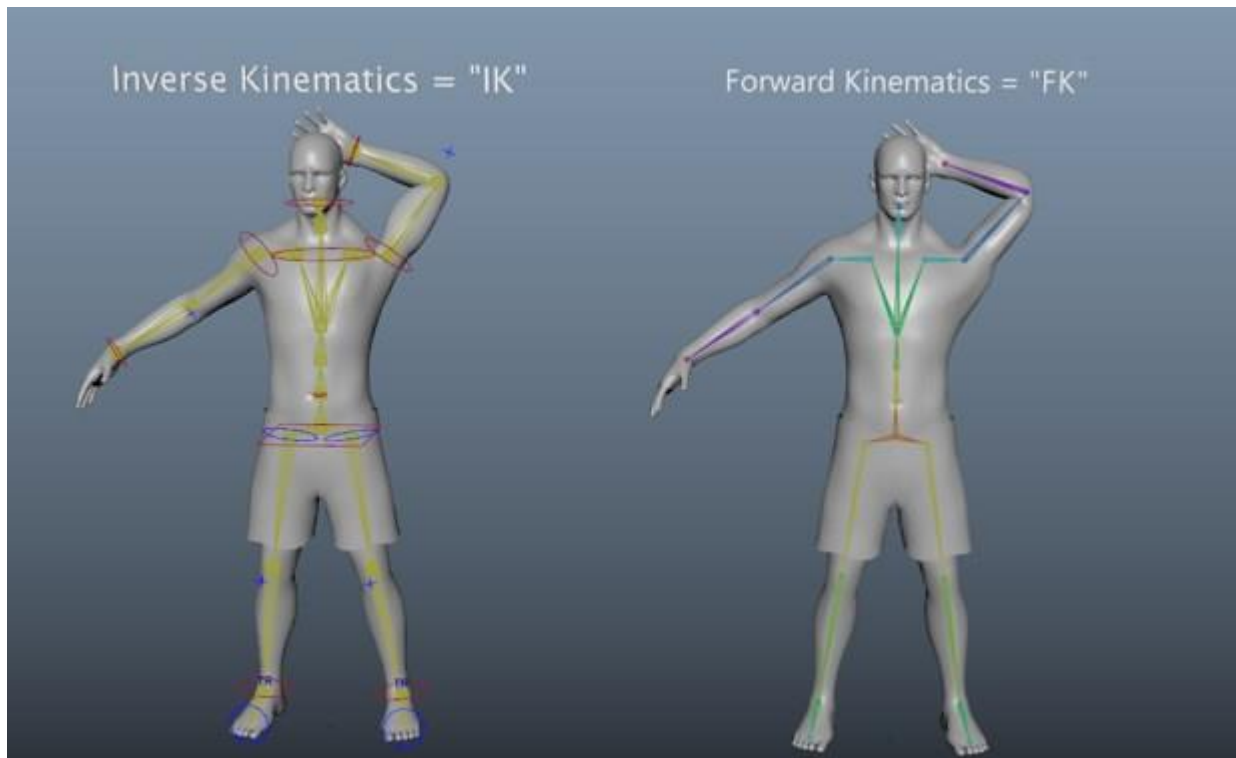
EduCBA

What does a character rigger do?

A character rigger designs the skeleton's framework of 3D computer-generated (CG) models, and they define their movement limitations for the next step of the animation pipeline, which is to animate.

If you want to know more about character design, check out these two perfect guides on **color theory on character design** and **shape language**.

Riggers work on the characters that modelers designed. After the design of the skeleton and network of movement, animators test rigs. Following the fixes of animators' improvement edits, the rigging section will complete.

How do you become a character rigger?

Every passionate character designer can end up working in a **3D animation studio**, but you can call yourself a professional character rigger by mastering the following skills:

- Anatomy and drawing
- Physics and movement
- Design, testing, and maintaining character setup
- Articulating characters within environments, layouts, and backgrounds

- Animation Pipeline

- Teamwork

- Programming languages, especially Python, to automate the rigging process in each step that is possible

- 3D animation software programs

- Problem-solving and being creative

MGCCC

How much is a character rigger salary?

The average salary for a character rigger is 78,396$ for a year in America. For a Senior artist in this field, the pay is 127,000$, and the lowest salary for a junior artist is 48,000$.

What are the best 3D Rigging Software Programs?

There are many software programs for 3D rigging, and each of them has some unique options and features. 3D rigging artists prefer to work with multiple programs, and the most popular combination of them in **Photoshop, ZBrush**, and **Maya creates** fantastic results. All the following software programs have Skeleton animation functionality such as **Maya, Blender, 3Ds Max, Modo, ZBrush, Cinema 4D, and Houdini**.

Most game developers and animation studios are the first choices of Maya and 3D Studio Max because they are the industry standard for 3D modeling.

Blender Rigging

The option that makes Blender popular is that it is free. Blender has all the necessary rigging processes but not as professional as Maya or 3D Studio Max.

Other rigging software for rigging you should know

Some of the rigging software, such as **Moka Studio**, has a technology of real-time motion capturing that can lead to faster development and much more realistic output.

Mixamo is an excellent choice for entering the world of 3D modeling and rigging. It has an automated rigging and weight painting process. **Toon Boom** can also be a good choice for beginners and also for experienced animators. It offers features and tools not only for rigging but also for animation and drawing.

If you are not a character rigger or cannot employ a rigger expert for your project, you can use **MakeHuman** to create humanoid characters. It has a wide range of figures that you can customize, and after finalizing the model, it can rig the model for you.

A wide range of different software programs exists for rigging and modeling; it depends on your needs to choose which one or multiple of them for your projects. Specialists in rigging are familiar with most software programs of their field because the combination of software features can make a fantastic professional output.

CHARACTER RIGGING : HOW,WHY AND WHERE YOU CAN USE IT

Since the 1980s, rigging has been the gold standard in character animation. Unsurprisingly, this is also when 3D animation started to take off, and production companies started making a real effort to give their digital characters realistic features and movement. Today, rigging is an essential part of animation design and an absolutely mandatory addition for producing character realism.

Though character rigging is just one stage of a much larger animation process, there is a lot to consider, and the process can be much more complex and time-consuming than you think. Strap in, because we are about to take a deep dive into the world of character rigging, and specifically **3D rigging services**, answering your questions along the way.

WHAT IS CHARACTER RIGGING IN ANIMATION?
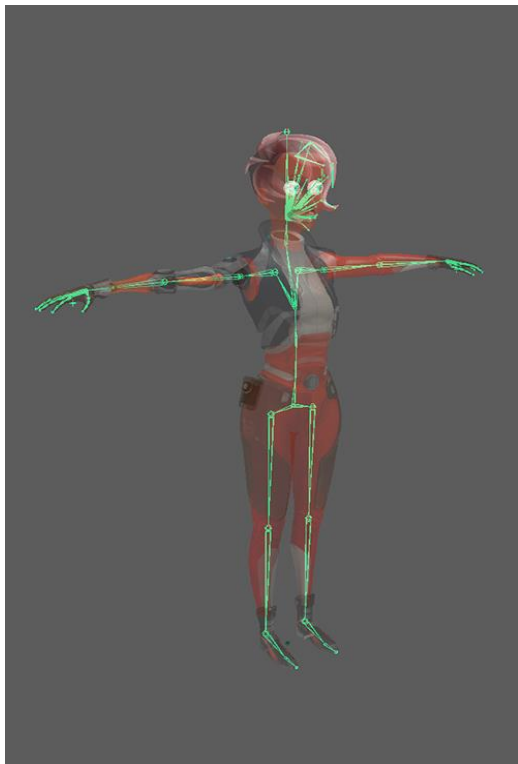
Character rigging is the process of creating the conditions for skeletal character movement in animation. It is one variety of the general rigging process, often referred to as **skeletal animation**.

During character rigging, an artist takes a character model and creates a digital "skeleton" for it. This is a structure outlining the various bones, limbs, joints, and movable elements of a character. With this rig in place, it is possible to create realistic movement animation for selected parts of the body. For example, a non-rigged character that is set to walk will look like they are frozen and gliding across the map, while you will see the legs and feet of a rigged person move with every step.

The greatest advantage provided by rigging is saved time. Imagine that you are creating 20 dance animations (think Fortnite): it will be a huge hassle to animate the hundreds of body positions frame-by-frame, but rigging lets you create an algorithm for how the body holds itself and moves, so the time spent on animation is cut exponentially.

If you examine a 3D rigged character, it will normally look like a confusing bunch of lines, shapes, and dots connected together. However, there is definitely order to the chaos, since everything is organized in a hierarchy of movement. For example, the rigger can use **driven keys** to apply one action to multiple bones/joints/limbs, just as they can morph a solid shape into another (e.g. change a facial expression). The movements of bones is also subject to limits and rules, including **kinematics**, control curves, and constraints.

What is the difference between 2D and 3D rigging?

Rigging is used much more often for 3D models than it is for 2D models. One of the reasons for this is flexibility: cartoons that feature 2D characters often put them in wacky and unrealistic situations where the characters' bodies move in strange ways, with no clear pattern or algorithm. This is just one of the peculiarities of **2D vs 3D animation**.

However, the technique is much more common in 2D games, where designers and riggers have found that rigging sprites is both effective and time-effective. The process for 2D game characters tends to move at a fast clip, since the characters are normally less detailed, have fewer dimensions, and have fewer states/poses within the game.

Where is character rigging used?

Rigging is used extensively in games, movies, cartoons, video clips, and other media. In fact, you probably see characters animated with this technique several times a month, such as rigged cartoon characters in Disney movies and shows, 3D protagonists in video games, and even NPCs in VR software, among countless other examples.

For all forms of media, the overall process is the same, but the differences are in the complexities of each individual project: the more complex the character's actions and interactions with their environment, the more difficult and time-consuming the rigging process will be. Creating rigs for games is perhaps the most challenging, as you face the most technical limitations and restrictions in the formats you need to use.

WHAT ARE THE CHALLENGES OF CHARACTER RIGGING?

At first glance, it might seem that the hardest part of character rigging is marking and connecting the countless bones of a model. This indeed takes time and deliberation, but there are many other aspects of the process that make the job difficult. Let's look at some examples.

- **Creating realistic facial expressions**

It has long been **<u>proven</u>** that humans have an uncanny ability to recognize faces, and this superpower of our biology also applies to recognizing faces that look wrong. Due to this fact, and the large number of muscles that go into forming facial expressions, designers have always struggled with making these expressions look genuine and realistic. Our team experienced this firsthand when we created a female character rig with various facial expressions for one of our projects.

- **Evaluating interactions with the environment**

  It already takes a lot of work to define some default character movements through rigging, but it gets harder when the character starts interacting with external elements. These elements impact their behavior and movements, so rigging settings like movement speeds, angles of limb movement, and model reach may be tweaked. For example, if a character goes from walking on an even surface to a steep slope, they will be walking slower and lifting their legs up higher in lunge-like movements.

- **Defining weight distribution**

  When a designer wants to add an extra level of realism to a character, they may implement weight painting. This is a rigging technique that involves assigning a particular weight to bones and establishing the impact that they have on joints. For example, a model wearing a full suit of armor will likely have shoulders drooping from the weight and limited range motion in their legs. It takes a lot of thought and time to create this accurate weight system.

- **Creating bone constraints**

  Bone constraints are all about angles. As you start configuring how bones move individually/connectedly, you will also have to set realistic constraints on these movements. Just as you cannot rotate your head 360 degrees, you probably cannot bend your arm past 180 degrees. For humanoid characters with body structure familiar to us, setting these constraints helps viewers relate to and accept them better.

- **Fluid simulation**

  Liquids are always difficult to design, especially when they are in motion. Thus, if the rigged character is meant to interact with liquids (drinking them, wading through water, being splashed, etc.), it will traditionally take a lot of time to make the droplets or movement of water look realistic, unless it just stays in a static state and does not affect the character in any way. It may also not be a priority if you are working with a rigged low poly character.

WHAT IS THE BEST CHARACTER RIGGING SOFTWARE?

Nowadays, rigging (both 2D and 3D) is done purely through specialized software, and users have dozens of programs to choose from. We will review some of the most popular 3D character rigging software and its peculiarities.

Application	Rigging peculiarities
Blender	Blender is a free-to-use application with an expansive set of rigging tools. Beyond the basic functionality, Blender character rigging includes advanced features like automatic skinning (binding the 3D mesh to rigged settings) and adding multiple layers to bones.
Maya	Maya makes rigging easy for beginners and pros alike. It offers a convenient feature called Quick Rig, which automatically scans a model and defines some bones and joints. Users are also free to add to these settings and apply each setting manually. In addition to that, the application provides great facial design tools for Maya character rigs like the UV and Proximity Pins.
After Effects	Adobe After Effects offers the same default features found in most rigging programs, with one major advantage. It allows users to utilize a wide variety of additional plugins, which customize the experience for different types of rigged targets. The most popular plugins for character rigging in After Effects include Duik, Puppet Pin, and RubberHose 2.
3DS Max	As a boon to users, various helpful tutorials are available for 3DS Max character rigging. Using this program, you can create joints and bone rigging with impressive precision, down to the smallest parts like clavicles, spinal disks, and knuckles.
Cinema 4D	Cinema 4D has a very user-friendly interface that makes even the most complex operations (like weight painting) easy and clear to understand. The whole system is modular and offers helpful auto-rig features, but C4D character rigging lacks functionality for building meshes meant for certain forms of media and certain control sliders.
Adobe Animate	Animate is another application geared mostly towards beginners. It supports both automatic and manual mapping of the skeleton, along with multiple pre-created rigs and movement patterns like walking or jumping that can be applied to static 3D models.
Moho	Besides a focus on 2D animation, perhaps the most distinctive feature of Moho is "Smart Bones". These bones define interactions between both internal elements (body bones) and exterior, like environments, sounds, etc. This feature comes especially in handy for swing rigging, which is vital for secondary animation of small elements like clothes, hair, and accessories.

How do I turn a rigged model into animation?

Polished and **complete character animation** can be achieved after your skinning process is complete and the mesh is integrated into animation software. As with rigging, there are many programs to choose from, but we highly recommend choosing a game engine like Unity or Unreal Engine for this purpose. Not only do these engines offer tools

for creating rigs, but they also have strong infrastructure in place for importing and working with rigged models.

Rigging for Unity

Unity character rigging models can be imported in just a few clicks, and you also select the desired animation type (Generic, Humanoid, or Legacy) as one of the first steps. You also have the option of importing materials for rigged characters for Unity or creating them in-engine. Supported 3D file formats for importing currently include .fbx, .dae, .3ds, .dxf, .obj, .max, .blend, and .skp.

Rigging for Unreal Engine

Unreal Engine claims to support the import of skeletal meshes from any 3D modeling applications, but works best with those originating from Blender, Maya, or 3DS Max. The import process is a bit more elaborate than with Unity, and users can choose to enable/disable close to a dozen options related to their mesh before they add it. Afterward, the imported UE4 character rigging model can be instantly viewed in the Persona feature.

Looking for an experienced partner to create rigging and animation for game engines?

Contact us

HOW TO FIND CHARACTER RIGGING SERVICES

So, you don't have the time to learn rigging or the resources to hire a dedicated rigging artis? No problem! There are plenty of rigging services offered by specialists and studios worldwide. You can choose the option most convenient for you – buy ready-made meshes compatible with your animation software or hire specialists to handle the rigging for you.

If you choose the custom-made approach, the specialist or provider may also offer **character 3D modeling** and **animation outsourcing** as part of the package. This is certainly the case with 3D-Ace! Our studio has a large team of 2D and 3D specialists that expertly handle each stage of content production from concept art to complete animation/software deployment.

Over 20+ years of design, we have successfully created rigs and animation for hundreds of characters, games, and media, so you can count on us to do it right. And if you need any additional services (art design, modeling, animation, VFX, etc.), we will be happy to demonstrate our flexibility and get your project moving forward.

All it takes to get started is to **contact us**. We are looking forward to your message!

Reference

1. https://sciencebehindpixar.org/pipeline/rigging

2. https://dreamfarmstudios.com/blog/what-is-3d-rigging/

3. https://3d-ace.com/blog/character-rigging-how-why-and-where-you-can-use-it/