CCS373 - VISUAL EFFECTS

UNIT-1 ANIMATION BASICS

What is Animation?

Animation is the process of creating a scene through the rapid display of pictures and motions. When we hear the word animation, we think about cartoon-like Doraemon, shin-chan etc. So in earlier times, animation was done by the continuous movement of the pictures of characters and scenes using hand-like puppets. Nowadays, with the help of many tools, it is possible to create the characters and scenes in 2D or 3D and make the animation.

There are a lot of tools created by the developers to make the animation, like Blenders3D, Maya, etc. Animation can be of various types like 2D animation, 3D animation, paper animation, traditional animation, puppet animation, etc.
There are some topics that the term "animation" covers in today's society, which is full of creativity and visualizations. Everyone immediately conjures up images of cartoons and various Disney World shows when they hear this word. Children love animated films like Disney World, Doraemon, etc. All cartoons and animated images are a sort of animation created by combining thousands of individual images and playing them out in a predetermined order.

When we think back a few decades, all animation was produced by hand or by painting, and certain puppet-like structures were made to display the animation. These types of animation, however, are real-world animations, while in that technological era, digital animation will advance.

There are numerous animation styles that we may observe on TV, as well as numerous productions and images that mostly diverge from actual productions and films.

What are the types of animation?

There are **five** main types of animation:

• **3D -** computer generated imagery (CGI) is used to create characters and the worlds they inhabit. This is the most common method in modern animation.

• **Traditional -** also known as cel animation, hand-drawn and 2D. This is the original method of animation, dating back to the 19th century.

• Stop motion **-** involves physically moving objects, often made with clay, one frame at a time.

• **Motion graphics -** animated graphic design that brings text and images to life.

• **Vector -** a more modern version of traditional, using 2D graphics.**VFX PRODUCTION**

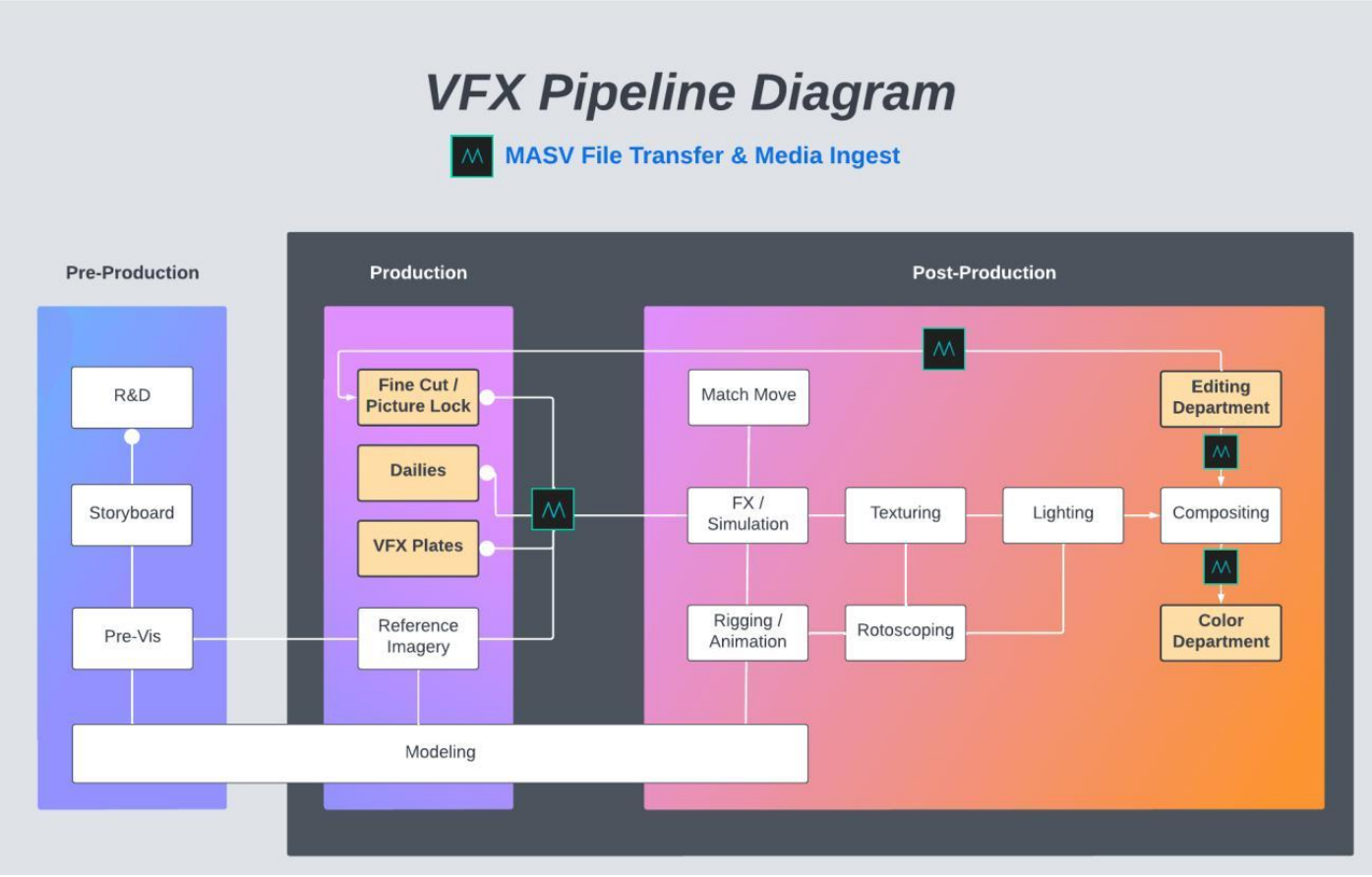
PIPELINE :

Visual effects (VFX) can transport audiences to new worlds and show off mind bending animations and CGI creations one can only dream of. But before audiences can experience a brave new world, a **VFX pipeline** needs to be in place to make it a reality. But just what is the VFX pipeline, and what does it entail? You can lean on this **handy VFX guide** when developing your own customized VFX plan.

What is the VFX Pipeline?

The **VFX pipeline breaks down the steps of a visual effects workflow for film, television, and digital media projects**. It keeps the entire VFX process organized; it allows everyone to know their role and how it fits into the production timeline. From storyboarding and reference imagery, all the way through modelling, rotoscoping, composition, and lighting (just to name a few).

In smaller productions, one VFX artist may handle the entire workflow, but most productions use teams of specialized artists. The pipeline brings a level of sanity to a process that is usually not completely linear. Members of the VFX process often get involved during the pre-production, production, and post-production stages. To do their best work (and to ensure they're not asked to redo various steps), artists should understand and appreciate each step of the VFX workflow pipeline.



VFX Pipeline DiagramThe VFX Workflow :

When asking the question “What is VFX mean in editing?”, it’s important to understand
that no two real-world VFX pipeline workflows are identical. We’ve divided these steps into the pre-production, production, and post-production phases in our VFX roadmap below, but **many steps below often occur in parallel throughout the project.**

PRE-PRODUCTION :

Much of the visual effect workflow in pre-production is planning-related, which helps keep crews informed while preparing for any technical requirements or potential execution issues. VFX artists in the planning stage can download VFX shot
list templates to save time when planning which shots and scenes need visual effects.

1. Research & Development (R&D)

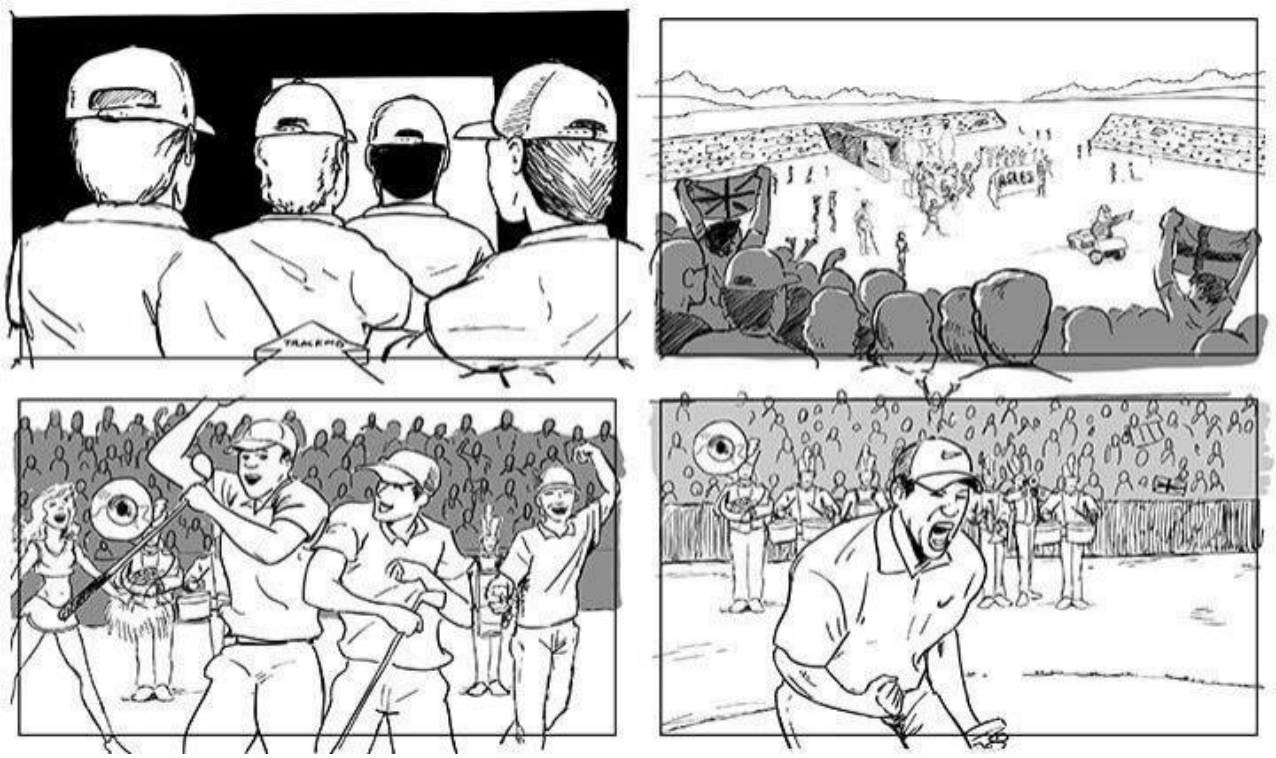
R&D on a video project primarily involves Technical Directors (TDs) who work with VFX supervisors to plan the technical approach and determine which shots and effects are technically feasible. Extremely VFX-heavy projects may also involve outside scientists, engineers, or mathematicians for further guidance.
TDs must ensure that all software and files used throughout the VFX pipeline are compatible and sometimes create custom software and plug-ins to improve VFX pipeline efficiency.
Most of the R&D stage is ongoing throughout a project’s lifetime as the material is tweaked and concepts evolve.

2. Storyboarding and Animatics

Storyboarding is where the VFX artist team creates visual representations of all the actions within the script. Character motions and story settings are analyzed and basic drawings are created to illustrate the desired framing on a shot-by-shot basis.
Like most planning elements, however, storyboarding isn’t final. It’s more about planting a stake in the ground and giving the VFX artists a solid idea of what the editorial team wants.

3. Pre-Visualization

Also known as previs, pre-visualization uses storyboards to create low-poly 3D models, wireframes, and scene representations to function as stand-ins for the visual effects to come. Previs typically takes place alongside other members of the creative team to determine camera angles, determine shoot locations, and plan complex scenes.Other VFX steps in the pre-production stage can include concept and art design, which further refine artistic concepts and produces full images to define characters, settings, and props. Layout (also known as production design), as the name implies, defines what final sets should look like and provides guidance to creators of physical or digital sets.t 20GB free to use with MASV’s fast, reliably large file .



PRODUCTION :

This is when the VFX workflow really gets cracking because it's when most of the shooting takes place, raw video files are created, and VFX dailies are submitted. But plenty of VFX tasks can be done in tandem with the production process.

4. 3D Modeling

3D modeling takes place throughout all three production phases, but in the production phase, artists transform storyboard art or low-poly 3D models into lifelike representations. Most 3D modeling is devoted to creating assets such as vehicles or buildings that either aren't practical or cost-effective to bring on set, but 3D models are also used to create characters (to illustrate non-humans or stand in as digital doubles) and other props.

While 3D models of impractical things like spaceships or the Batmobile are the most visually interesting, 3D modelers also replace or complement physical objects shot on set that need improvements in lighting, shadowing, or texture.

3D modeling is one of the most time-consuming and labor-intensive elements of the VFX pipeline and often depends on reference photos taken during production. The 3D models that move must be rigged and animated, but more on this later.

5. Matte Painting

Matte painting is one of the oldest VFX techniques in existence and involves creating visual backgrounds that don't exist. These days such backgrounds are often created digitally using LED panels and game engines, often as entire 3D sets for virtual production, or by chroma keying using a green or blue screen.

Years ago, matte painting was exclusively done using photographs and painted glass panels (matte paint was used because it doesn't reflect light).
But matte painting is still used in many productions — including the *Harry Potter* films, *Game of Thrones*, and *The Witcher* — partly because it can save money.
But it's pretty limited in what it can do: Matte paintings can't change their lighting, camera angles, or other elements.

6. Reference Photography

Throughout the entire production phase members of the VFX team hang out on set to take reference photos of actors, scenes, props, and anything else important. These photos are then used to rig, animate, and add texture to 3D models.

POST-PRODUCTION

Post-production brings all the elements of a video production together — VFX, footage, music, and sound — into the finished product. While, as we've seen, the VFX team is busy throughout the production cycle, the VFX post-production workflow is the busiest phase of the entire process for the VFX team.

7. Rigging and Animating

Imagine what happens when a puppeteer pulls the strings on a marionette, and you've already got a pretty good idea of what rigging and animating are all about — only at a digital level. Rigging and animation breathe life into 3D models by building a system of controls that animators can use to manipulate these objects.

Rigging teams often rely on reference photographs, but motion capture cameras or suits are also often used to capture movement data to aid the rigging and animation process.Rigging teams often get so granular that their jobs can include calculating skin weights and adding digital skeletons and muscles within 3D characters to replicate natural movement.

8. FX and Simulation

FX artists are responsible for creating concepts and scenes that move and react according to the laws of physics, such as a long shot of a raging battle at sea or in space — complete with fiery explosions, which in reality can't exist in space, but whatever — they look cool. FX artists often work with elements such as fire, smoke, liquids, and even particles.
FX artists work alongside animators to ensure these simulated elements don't stick out (in a bad way) while looking and feeling as natural as possible.

9. Motion Tracking/Match Moving

Motion tracking, also known as match moving, allows VFX artists (in this context, referred to as match move artists) to insert effects into moving scenes and live-action footage without the entire thing looking bad. After all, inserting VFX elements into a static shot is relatively easy, all things considered — but adding the same elements to a camera move involves many more variables. That's why motion tracking accounts for the positioning, orientation, scale, and how the object moves within the shot, including replicating physical camera moves using virtual cameras in their motion tracking software.

10. Texturing

The texturing process is pretty much as it sounds: It adds textures to the surfaces of 3D models. Texture can include anything from surface color to scaly skin on a reptile, to reflections in water, to a metallic shine or scratches on a car door. This ensures models look as realistic as possible.

11. Rotoscoping and Masking

Rotoscoping involves artists drawing around and cutting out objects or characters from frames in the original footage, to use the cutout images against a different background or context. Rotoscoping has typically been a relatively painful and manual process, especially in the days before computerized VFX.

"One legendary example of manual rotoscoping occurred during Alfred Hitchcock's

The Birds, when crews filmed birds in nature and rotoscoped them into each shot. It took three months to rotoscope hundreds of birds, one by one, into a single shot."
Nowadays VFX artists still perform manual rotoscoping, but new tools such as Runway, which use machine learning, have helped to accelerate the process dramatically.The entire rotoscoping and masking process can be avoided through chroma keying, which, as we mentioned, is the process of shooting foreground subjects against an easily removable background (like a green screen). But in many cases rotoscoping is also required to create a perfect cutout.

12. Lighting and Rendering

Lighting is typically dealt with once the texture artists have done their thing. It's the last element applied before the effect or computer-generated image (CGI) is complete.
Adding and adjusting virtual lighting and shadows to match either static or live-action computer-generated scenes or characters, like texturing, helps make them look more realistic while enhancing aspects of the original shot such as color and intensity.
Just like real-life lighting, however, virtual lights must be placed strategically within a scene.
Lighting artists use tools such as shader settings and lighting maps to achieve this by positioning spot, area, and directional lights to match the angles and shadows of the original footage. Once lighting has been applied, the entire scene is handed off to compositing.

13. Compositing

Compositing, sometimes called stitching, is the final step of the post-production VFX workflow. While it is the final step in the VFX roadmap, it is also the most important because it integrates all the various VFX elements with real-life footage to create a finalized shot or scene.

A bad compositing job can ruin all your otherwise great VFX work up to this point — so it's crucial to get it right. The process involves a compositor gathering all the content — including live-action footage, renders, VFX plates, and matte paintings — and layering them

together in preparation for the next step in the post-production pipeline (typically coloring). Some shots may require combining just a couple of elements, but others may need to layer dozens while finalizing lighting, reflections, shadowing, and atmospherics to create a seamless look and feel.

VFX Tools and Software

VFX is only growing in importance in the modern video production industry — indeed, the first season of Amazon's *The Rings of Power* used more than 1,500 VFX artists from 20 studios. But what kind of software and VFX systems do industry-leading VFX artists use to weave their magic?
Here are a few examples.

After Effects

After Effects is regarded as one of the best, if not the best, VFX software around. That's partly because it integrates seamlessly with Adobe's Premiere Pro video editing software and collaboration tools such as Frame.io, but also because it's damn good at what it does. After Effects also has plenty of third-party, customizable VFX templates you can download to help scale your project.

Fusion :

Blackmagic Design's Fusion is a great tool for creating immersive 360 or VR video; stereoscopic 3D effects; and the compositing of 3D models and real-life, live-action footage. It comes as part of video editing software DaVinci Resolve, and has been used to create VFX scenes in films such as Guardians of the Galaxy and the Hunger Games and even cinematics for video games such as Halo 5.

Nuke :

Foundry's Nuke is VFX and film editing software used by major industry players such as Walt Disney Animation Studios, Blizzard Entertainment, Sony Pictures Animation, and DreamWorks Animation, and has been used on productions from The Crown to Boardwalk Empire. It offers seamless review workflows and the ability to add VFX elements to dynamic editorial timelines.

Houdini :

Houdini by SideFX is used in the R&D process and at other junctures to come up with customized effects. It integrates animation design, effects rendering, and character modeling and provides a host of VFX simulation modules for fluids, crowds, grains, and other elements including destruction and pyro FX. Houdini also integrates with other software such as Maya.

Maya :

Autodesk's Maya provides 3D animation and modeling, simulations, and ultra-realistic rendering. Lighting artists often use it to create and place virtual lighting and by 3D modelers to create and rig animated characters or other objects. Although it has been described as difficult to use by reviewers, the software covers various VFX pipeline elements, including dynamic simulations, texturing, and animation.

HitFilm Pro:

HitFilm Pro (and its free consumer market version, HitFilm Express) is an all-in-one VFX and video editing tool that allows VFX artists to apply effects to the NLE timeline (instead of laying them). The app comes loaded with nearly 1,000 VFX templates and presets, with features such as masking, 2D and 3D motion tracking, green screen keying, and particle simulators.

Blender:

Blender by Blender Foundation is powerful open-source freeware perfect for those starting in VFX who want to learn the craft without shelling out thousands of dollars on other alternatives (many mentioned above). Its 3D animation tools include a camera and object tracker that offers manual or automated tracking, camera reconstruction, and real-time previews.
with other video production

Tips and Best Practices for High-Quality Visuals

• Engage in constant and ongoing communication between various creative teams; not just other VFX artists but also video editors, colorists, the on location production team, the director, etc.

• Know the various VFX systems (tools, processes, software, etc.) of the entire VFX workflow inside and out before embarking on a months-long project.

• In virtual production, VFX artists must be aware that what looks good on workstations may not on a gigantic LED wall. Unreal Engine recommends their In-Camera VFX Production Test to see recommended configurations for virtual stages.

• Replace physical objects (fires, potholes, tire tracks, etc.) with VFX renderings to save a ton of money over replicating the same thing in the physical world, or having to go back and re-shoot certain scenes to get things perfect.

• Netflix recommends VFX artists working from home use virtual desktop

solutions such as HP RGS or Teradici, a single monitor at 1920×1200 as a baseline resolution, and dedicated bandwidth and low-latency connections.

• Always follow proper file naming conventions.

PRINCIPLES OF ANIMATIONWho invented the 12 principles of animation?

Ollie Johnston and Frank Thomas were the men behind the principles. The duo were two of Disney's famous Nine Old Men (even Walt Disney himself would call them this).

This group were the studio's core group of animators. In 1981, Johnston and Thomas released a book called The Illusion of Life: Disney Animation. The Nine Old Men had been using the principles for decades, but this was the first time the outside world were made aware.

Why are the 12 principles of animation important?

These principles of animation are important because combining all 12 helps ground animation in the real world. The sky is the limit when it comes to using your imagination, but you also need to consider gravity and other laws of physics. Failure to do so will make animation much less believable and your audience won't care about what happens to your characters, whether hand-drawn or 3D.

The 12 Principles of Animation (With Examples)

In their 1981 book, The Illusion of Life, Disney animators Ollie Johnston and Frank Thomas introduced the twelve principles of animation. The pair were part of Disney's "Nine Old Men," the core group of animators at Disney who were instrumental in developing the art of traditional animation. The twelve principles have now become widely recognized as a theoretical bedrock for all animators, whether they are working on animated entertainment, commercials, or web-based explainers.

In order, they consist of:
• Squash and Stretch
• Anticipation
• Staging
• Straight Ahead Action and Pose-to-Pose
• Follow Through and Overlapping Action
• Ease In, Ease Out
• Arcs
• Secondary Action
• Timing
• Exaggeration
• Solid Drawing
• Appeal
Each principle is vital to the animation process, so let's dig deeper into each one.

1) Squash and Stretch:

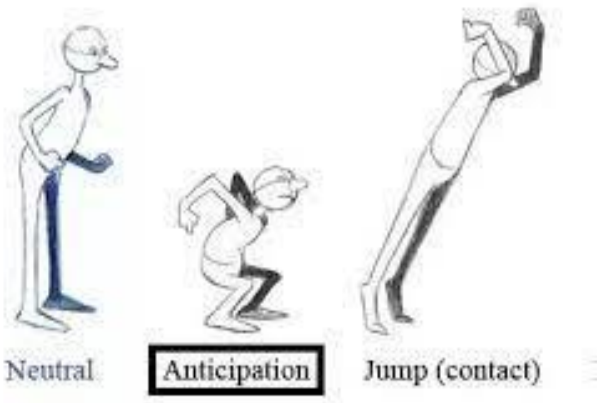
Squash and stretch is debatably the most fundamental principle. Look at what happens when a ball hits the ground. The force of the motion squashes the ball flat, but because an object needs to maintain its volume, it also widens on impact. This what's called squash and stretch.

This effect gives animation an elastic life-like quality because although it may not seem like it, squash and stretch is all around you. All shapes are distorted in some way or another when acted upon by an outside force; it's just harder to see in real-life. Squash and stretch imitates that and exaggerates it to create some fun.

When the letters spring from the ground, they elongate to show the impression of speed. Conversely, the letters squash horizontally when they come into contact with the ground. This conveys a sense of weight in each letter.

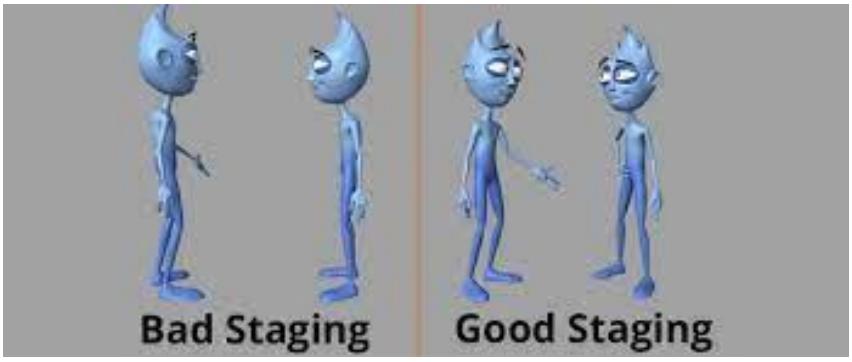
2) Anticipation:

Imagine you're about to kick a soccer ball. What's the first thing you do? Do you swing your foot back to wind up? Steady yourself with your arms? That's anticipation. Anticipation is the preparation for the main action. The player striking the soccer ball would be the main action, and the follow-through of the leg is well… the follow through. Notice how the progression of action operates in this scene. We first see the woman as she's standing on the box. She then bends her knees in *anticipation* of what's about to happen and springs into action by leaping from the ground up into the air.



2) Staging:

When filming a scene, where do you put the camera? Where do the actors go? What do you have them do? The combination of all these choices is what we call staging. Staging is one of the most overlooked principles. It directs the audience's attention toward the most important elements in a scene in a way that effectively advances the story. It builds from problem to realization to shared understanding, to the beginning of a solution, all in a visual telling.



4) Straight-Ahead Action and Pose-to-Pose

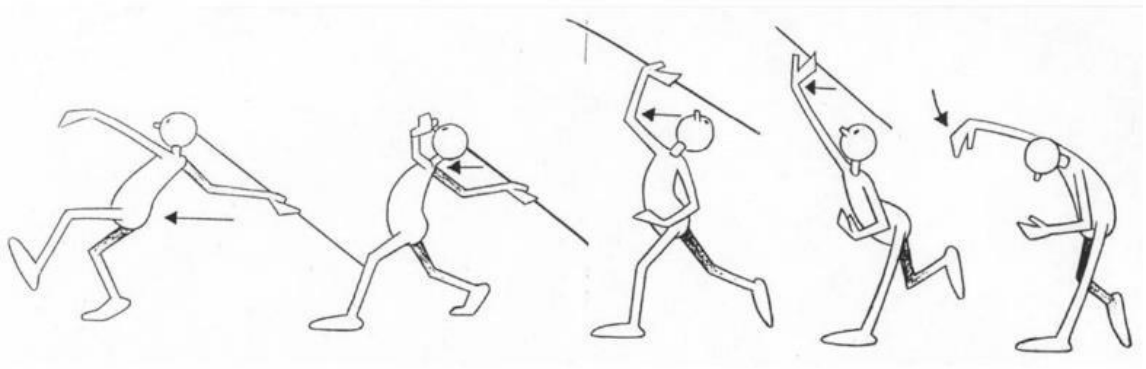
These are two ways of drawing animation. Straight-ahead action is where you draw each frame of an action one after another as you go along. With pose-to-pose, you draw the extremes – that is, the beginning and end drawings of action – then you go on to the middle frame, and start to fill in the frames in-between.

Pose-to-pose gives you more control over the action. You can see early on where your character is going to be at the beginning and end instead of hoping you're getting the timing right. By doing the main poses first, it allows you to catch any major mistakes early. The problem with it is that sometimes it comes off as too neat and perfect.Straight-ahead action is less planned, and therefore more fresh and surprising. The problem with it is that it's like running blindfolded… you can't figure out where you're supposed to be at any one time.

Mastering both techniques and combining them is the best approach to being a successful animator because then you can get both structure and spontaneity. And incidentally, this distinction is just as important in computer animation, where molding a pose at each keyframe is the equivalent of making a drawing.

5) Follow-Through and Overlapping Action

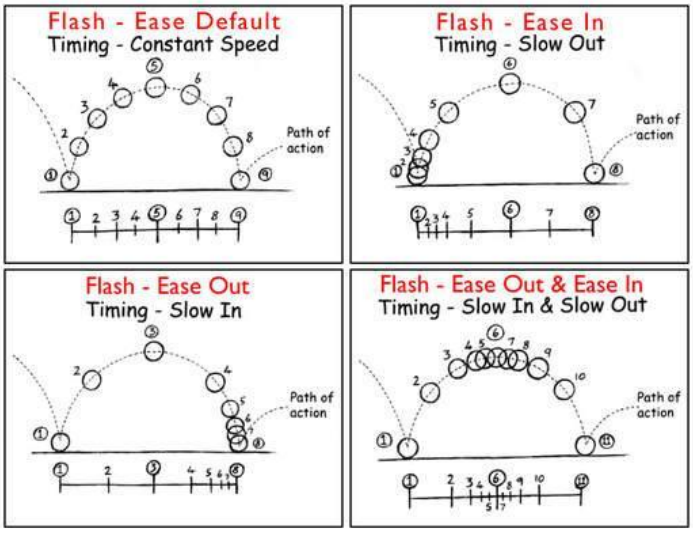
When a moving object such as a person comes to a stop, parts might continue to move in the same direction because of the force of forward momentum. These parts might be hair, clothing, jowls, or jiggling flesh of an overweight person. This is where you can see follow-through and overlapping action. The secondary elements (hair, clothing, fat) are following-through on the primary element, and overlapping its action.



Follow-through can also describe the movement of the primary element though. If you land in a crouch after a jump, before standing up straight, that's follow-through. Take a look at an example from a video we did for ViewBoost. Watch the sleeves of the "Cheese Jedi's" cloak when he swings his lightsaber. They move with the momentum of the action, but when it's over, the sleeves continue to go before settling to a stop.

6) Ease In, Ease Out

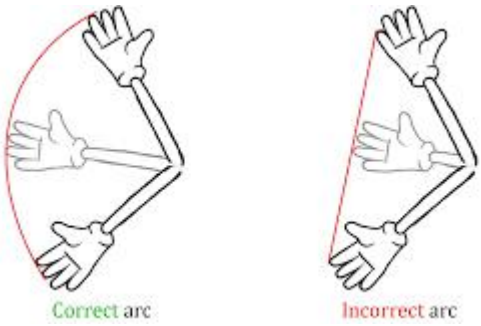
When you start your car, you don't get up to 60 mph right away. It takes a little while to accelerate and reach a steady speed. In animation speak, we would call this an *Ease Out*.



Likewise, if you brake, you're not going to come to a full stop right away. (Unless you crash into a tree or something.) You step on the pedal and decelerate over a few seconds until you are at a stand-still. Animators call this an *Ease In*.Carefully controlling the changing speeds of objects creates an animation that is more realistic and has more personality.

7) Arcs

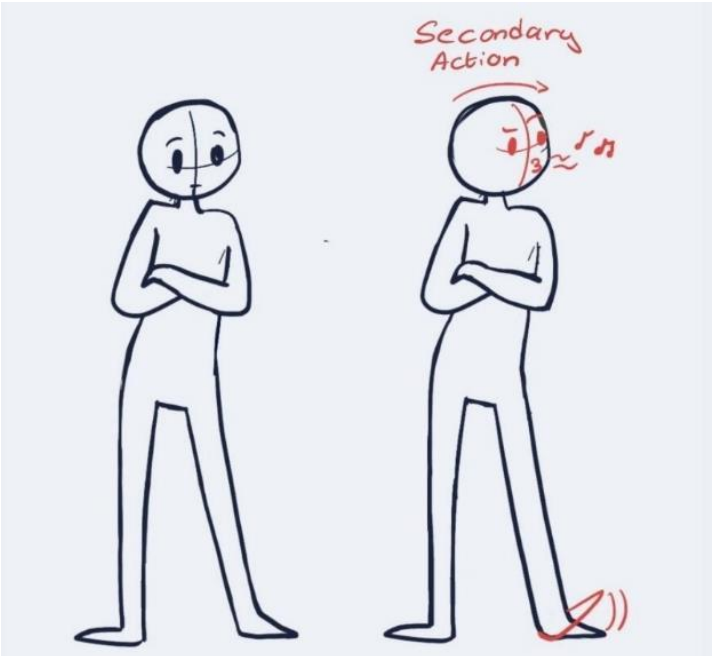
Life doesn't move in straight lines, and neither should animation. Most living beings – including humans – move in circular paths called arcs.



Arcs operate along a curved trajectory that adds the illusion of life to an animated object in action. Without arcs, your animation would be stiff and mechanical.
The speed and timing of an arc are crucial. Sometimes an arc is so fast that it blurs beyond recognition. This is called an animation smear – but that's a topic for another time.

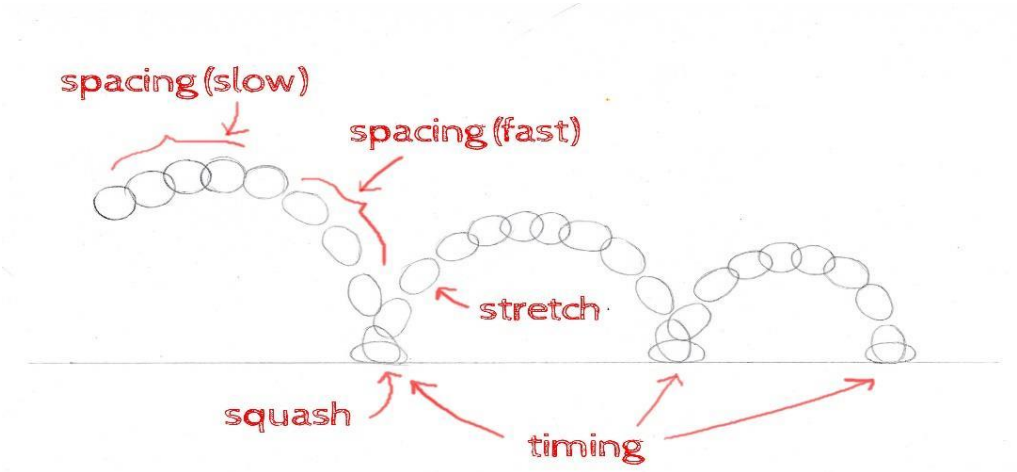
8) Secondary Action

Secondary actions are gestures that support the main action to add more dimension to character animation. They can give more personality and insight to what the character is doing or thinking.

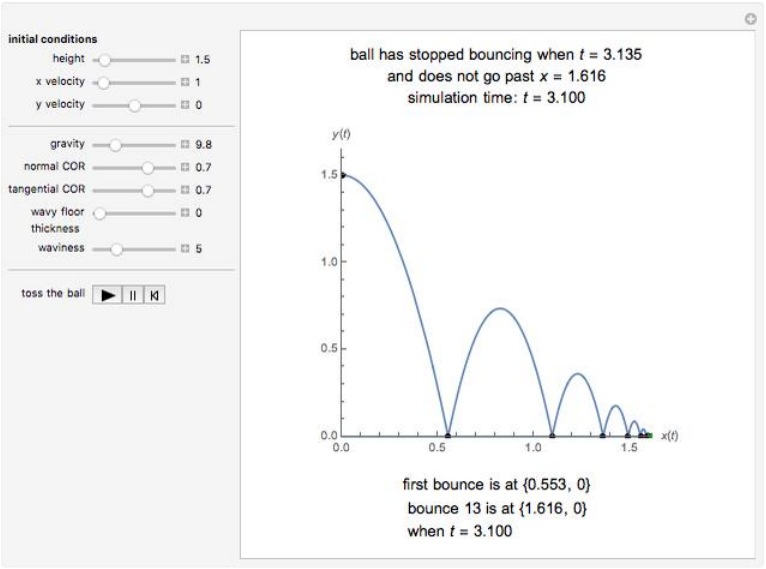


9) Timing

Timing is about where on a timeline you put each frame of action. To see what this means in action, let's look at the classic animator's exercise: the bouncing ball that we saw earlier when we were talking about squash and stretch. (The reason this is a popular assignment is that there is a lot of wisdom to be gained from it!)
Notice that at the top of each bounce, the balls are packed closer together. That is because the ball is slowing down as it reaches the peak of the bounce. As the ball falls from its peak it and accelerates, the spacing starts becoming wider.

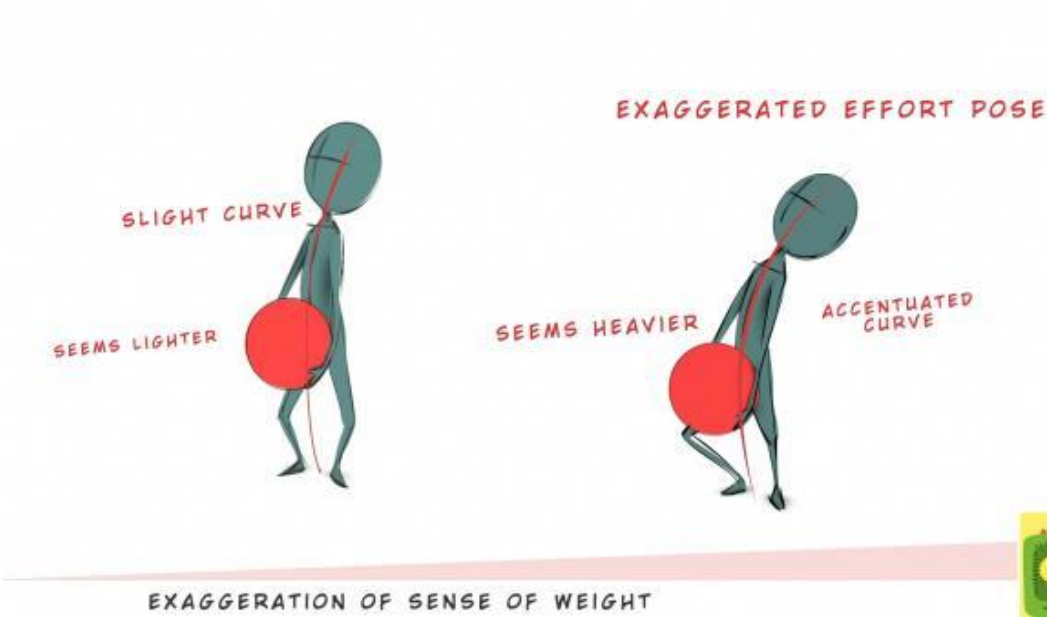


Notice also how many drawings there are in each bounce. As the momentum of the ball diminishes, the bounces become shorter and more frequent (i.e., the number of frames in each bounce decrease.)In practice, the success of your animation is going to depend on your sense of timing.



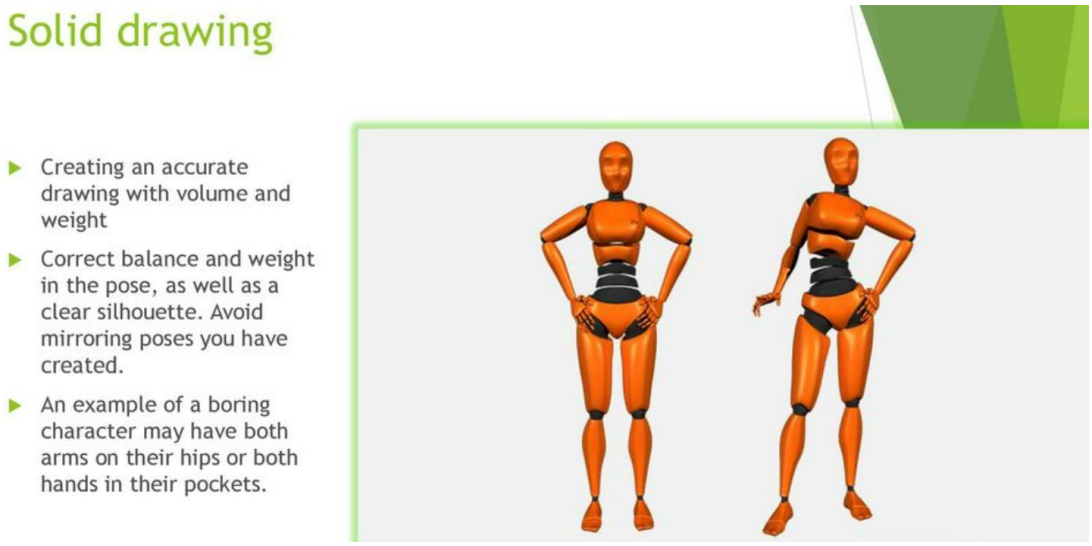
10) Exaggeration

Sometimes more is more. Exaggeration presents a character's features and actions in an extreme form for comedic or dramatic effect. This can include distortions in facial features, body types, and expressions, but also the character's movement.
Exaggeration is a great way for an animator to increase the appeal of a character and enhance the storytelling.



11) Solid Drawing

Solid drawing is all about making sure that animated forms feel like they're in three dimensional space.



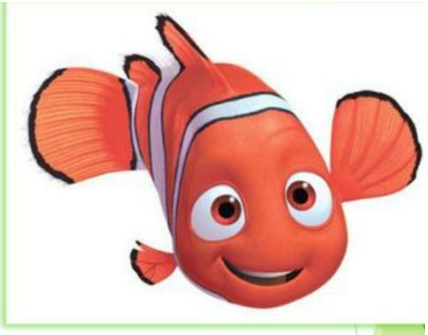
12) Appeal

People remember real, interesting, and engaging characters. Animated characters should be pleasing to look at and have a charismatic aspect to them; this even applies to the antagonists of the story. Appeal can be hard to quantify because everyone has a different standard. That said, you can give your character a better chance of being appealing by making them attractive to look at.Play around with different shapes and proportions of characters to keep things fresh.

Enlarging the most defining feature of a character can go a long way to giving the character personality. Strive for a good balance between detail and simplicity.

Appeal

- You want a character that the audience can connect to or relate to. A complicated or confusing character design can lack appeal.
- Push and exaggerate to create a more unique character design that will stick out in the audience's memory.
- For example, simply exaggerating the jaw of the character or larger eyes can help create more appeal.



What Are Keyframes In Animation?

Keyframes in animation are specific points that denote the start and end of a transition.

They define the precise moments when movements or transformations begin and finish, allowing animators to map out the animation's timing and motion path.

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What is a keyframe?

A keyframe in animation **is a specific reference point in an animation where a change or adjustment is made** to an object's state or property.

Usually, all keyframe-based animation tools use keyframes to change states for animators such as:

- **Position**
- **Scale**
- **Rotation**
- **Opacity**
- **And many others**

This list includes any other transition that takes place between the predefined starting and ending points. Keyframes are essential for precise control over animation effects and timing in creating motion graphics.

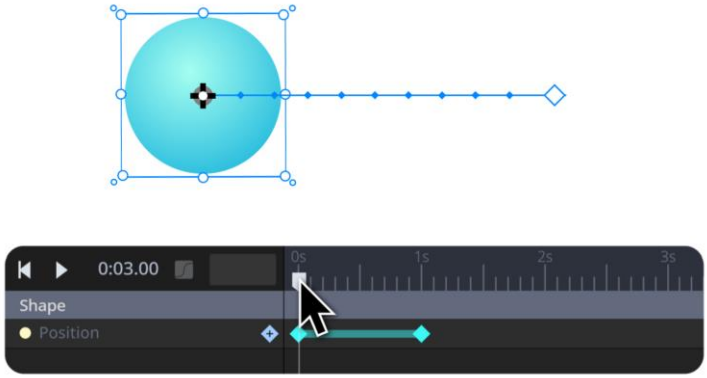
For example, if you would like to create an animated element that moves from the left to the right over the duration of 3 seconds, you should:

1. Set a keyframe at the starting **position (A)**
2. Set another keyframe at the ending **position (B)**

☑

The animation software will automatically create the in-between positions and create a smooth transition between **point (A)** and **point (B)**.

The speed of the transition is determined by the distance between the two keyframes in the timeline. A longer distance will mean a slower speed for the element to get from (A) to (B).



Keyframe Animation Example - Made by SVGator

Where does the word "keyframe" come from?

The word "keyframe" comes from the early days of keyframe animation, when each frame was drawn by hand, which was a very time-consuming and difficult task.

Disney pioneered keyframe animation in the 30s by setting up the main poses of movement to be drawn by artists and the inbetween frames were created by less experienced colleagues or machines.

The company was the first to set up the principles of animation and influenced other studios to adopt their techniques.
Computer animation arose in the 70s as a new technique for producing animations. It followed the keyframe animation principles and adapted them to the digital image generation using mathematical models and algorithms.

What is the difference between a frame and a keyframe?

The difference between a keyframe and a frame is that a frame is a single component from a sequence of frames, while a keyframe is a reference point that marks how the object or element transitions, or changes to that particular frame.

- **Frame**: one single component from a sequence of frames
- **Keyframe**: marks the changes/transitions assigned to a particular frame

What is a frame?

A frame is a single image within a sequence of images. It is the building block of any video, film, or animation. Each frame is flashed on the screen for a fraction of a second and human persistence of vision blends them together, producing the illusion of movement.

The number of frames displayed within a second are measured by FPS (frames per second). **The standard FPS for videos is 24**; higher frame rates produce even smoother motions.

How are keyframes used in keyframe animation software?

Every keyframe animation software follows the same logic and can be used by following the next steps:

1. **Mark the initial state** of an object with a keyframe.
2. **Choose whether to leave the initial state as it is or apply more changes to it**, which, of course, will represent the new initial state of the animation.
3. **Define how long the animation will be** by adding a second keyframe on the timeline at a certain second. This will mark the ending point of the animation.
4. **Change the state of the object** at the timing marked by the second keyframe, so that it is different from the state of the object at the first keyframe.
5. **Hit play and see a smooth transition** between the two states of the object

The state of the object that you are changing should be the same state as the assigned animator that you are adding keyframes to.

Take for example the Rotation animator. You will only change the degrees of the object (between 0 degrees and 359 degrees from the center).

Changing the object's position, scale level, or any other state except degrees of rotation, won't result in any animated effect.

In SVGator, the first keyframe will be added along the animator right where the playhead is positioned on the timeline. By dragging the playhead on a different second and making the adjustments to the element, another keyframe will be automatically added to mark the end

of the transition. The adjustments should match the chosen animator, so if you chose the Rotate animator, you can only adjust the element's rotation.

Pro Tip: You can also reuse keyframes on the timeline by simply copying and pasting them along the timeline in order to repeat a certain transition for the same element.

You can also copy them to a different element that you want to animate in the same way. Additionally, you can make more adjustments to the keyframes that will change the timing or the behavior of the animation.

Using keyframe animation software - Made by SVGator

What changes can you make with keyframes on an object?

There are a large number of changes you can make with keyframes on an object. For example, in SVGator, you have the following options:

Changes made with keyframes to an object	
Position	Changes the object's location
Origin	Changes the object's origin (center) point
Scale	Makes the object bigger or smaller

Rotate	Moves the object in a circle around a fixed point
Skew	Makes the object oblique, asymmetrical
Opacity	Changes the degree to which an object appears to be transparent
Fill Color	Changes the object’s color
Fill Opacity	Changes the object’s opacity
Stroke Color	Changes a stroke’s color
Stroke Opacity	Changes a stroke’s opacity
Stroke Width	Changes a stroke’s width
Stroke Offset	Changes the location of a dash along a path
Stroke Dashes	Changes the dash-gap pattern of a stroke
Filters	Adds filters to the object

Types of changes made with keyframes to an object

What changes can you make to keyframes?

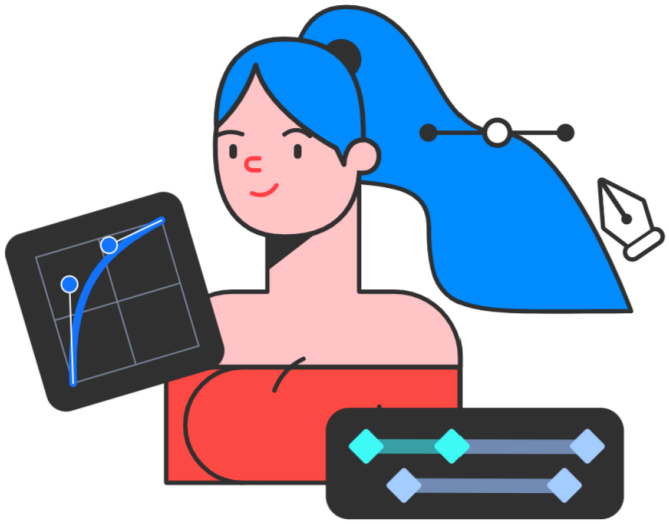
The changes you can make to keyframes are the following:

- **Timing between keyframes:** Timing between keyframes dictates the speed of the transition between the two keyframes. You can change the timing between two keyframes by increasing or decreasing the distance between them on the timeline.
- **Position of the keyframes**: By manipulating the position of the keyframes you can reverse an animation by selecting its keyframes, right-clicking, and choosing "Reverse keyframes." This action will simply interchange the position of two or more keyframes on the timeline.
- **Keyframe easing effects**: Keyframe easing effects imply selecting at least one keyframe, to which you can then apply an easing effect from the Easing panel. The

easing will apply on the transition from the selected keyframe toward the second/following one.

- **Skipping transitions between keyframes**: Skipping transitions between keyframes means that you can also eliminate the transition between two or more keyframes by choosing the Step End or Step Start easing functions. Also known as hold keyframes in other animation tools, these easing functions will simply remove the transition and make jumps between the steps of the element.

Note: Step keyframes support step numbers as well. You can set a certain number of steps between two-step keyframes. The state of a step keyframe will be easy to distinguish in the timeline as the keyframe shape will change to a square instead of a rhombus.



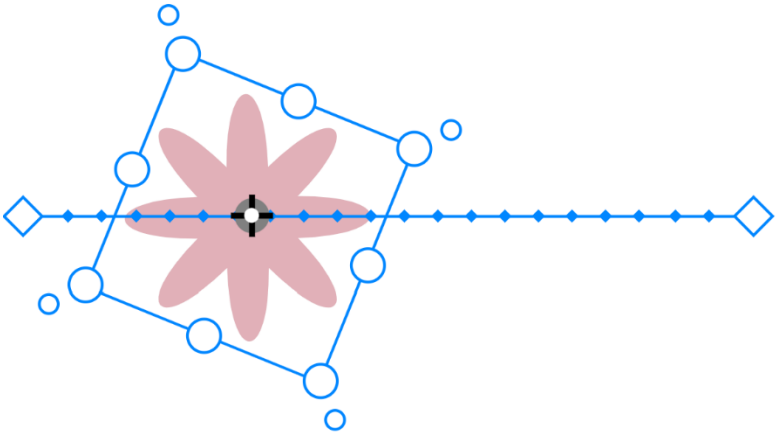
Example of changes made to keyframes - Made by SVGator

What are the main types of keyframes?

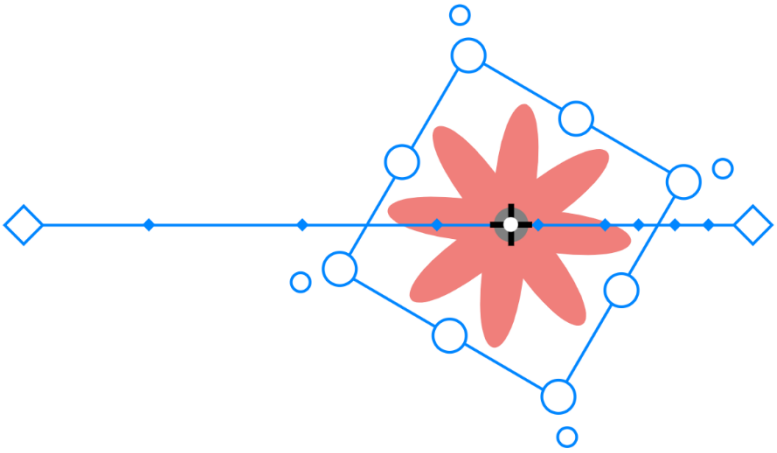
There are 3 main types of keyframes used in animation software:

Linear Interpolation Keyframe	Bézier Interpolation Keyframe	Hold Interpolation Keyframe
Linear interpolation creates a uniform and consistent change of values from the beginning to the end, at a constant speed.	This is a more complex interpolation that makes it possible to specify the object's velocity and motion path between two points.	This maintains the object in a particular pose. It is used to freeze or block a certain keyframe in a static phase. It is also known as a stop-motion keyframe.

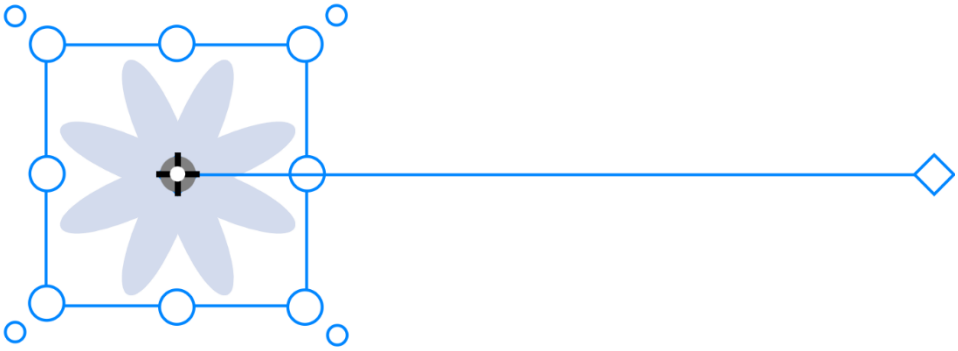
The 3 Main Types of Keyframes



Linear Interpolation Example



Bezier Interpolation Example



Hold Interpolation Example

What is interpolation in the context of keyframes?

Interpolation in the context of keyframes is the **process of filling data between two keyframes**. The changes made to property values can be calculated in different ways based on what type of keyframes are set.

Interpolation in animation is a mathematical method used to fill in the unknown values in between two or more specified points.

What are the advantages of keyframes?

The advantages of keyframes are:

- **They speed up the animation process**
- **They let animators create any kind of movement with ease**
- **They create smooth transitions**
- **They make later changes easy to make**
- **They can be reused for other elements because they are easy to copy and paste**

The biggest advantage of using keyframes in animation is that **they make the creation process far quicker without losing quality**.

The animator has to set up only a few important reference points instead of creating hundreds of individual frames.

Keyframe animation software offers a huge range of different animation movements on an advanced level and in a reasonably short time.

Another advantage of keyframes is that the final work will retain the artist's personal charm and specific hand-drawing style together with sleek movements and a professional finish. Later changes are also easier with keyframes because the editor has to modify only their main values or features instead of going through all of the frames.

What are the disadvantages of keyframes?

The disadvantages of keyframes are:

- **It can be time-consuming to manually set up and adjust each keyframe**
- **Complex movements are challenging to create**
- **It is difficult to keep track of them when you have a lot of keyframes set on the timeline**

Keyframes have some disadvantages when it comes to producing and handling realistic, complex, and natural movements. These are easier to achieve with motion capture, another technology to record movement.

Video animations are great for explaining complicated processes and entertaining viewers, but they are not so efficient when it comes to expressing feelings and pushing people to action.

What are the use cases for keyframes?

The main use cases for keyframes are video production and animation:

1. **Post-production**: Post-production is the last stage of video-making when color correction, special effects, sound design, and many other editing work takes place. In this stage, creators can add animated filters, graphics, and various animation effects, whether they are making a simple YouTube video or a Hollywood blockbuster.
2. **Creating animations**: Animations can be created from scratch using graphic software to draw and animate characters, showcase products, present a process, or just entertain the viewers. Besides traditional motion art production, there is an increasing number of businesses that choose to have animated elements on their websites for better engagement and higher conversions.

https://www.svgator.com/blog/what-are-keyframe-animations/

I. KINEMATICS

What is Kinematics?

Kinematics is the study of motion without regard to the forces that cause it. In visual effects (VFX), it is used to create realistic and believable motion for objects and characters. Kinematics deals with the following aspects of motion:

i. **Position:** The location of an object at a given time.

ii. **Velocity:** The rate of change of position over time.

iii. **Acceleration:** The rate of change of velocity over time.

Why is Kinematics Important in VFX?

Kinematics is essential for creating realistic and believable motion in VFX for several reasons:

i. It provides a foundation for animation:

By understanding the principles of kinematics, animators can create motion that is physically accurate and looks natural.

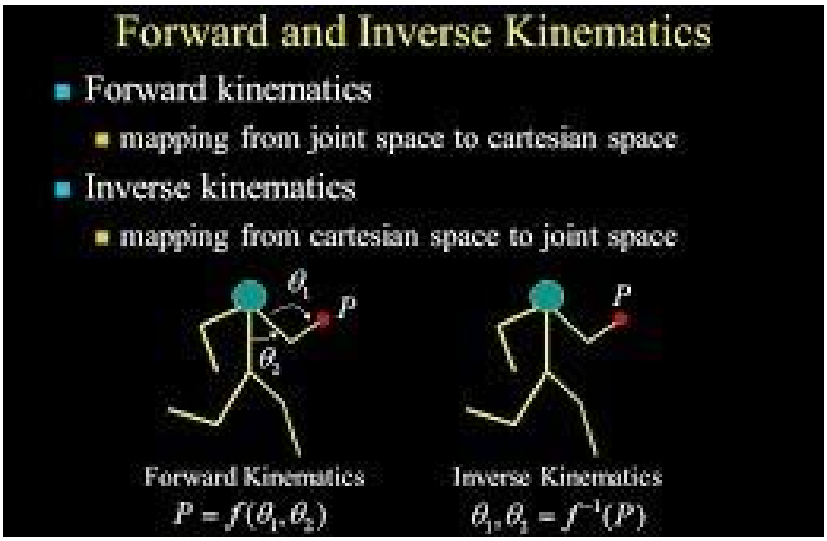
ii. It enables realistic physics simulations:

Kinematic principles can be used to create simulations of objects interacting with their environment, such as cloth, hair, and fluids.

iii. It allows for efficient animation:

Kinematic tools can automate some of the animation process, freeing up animators to focus on more creative aspects.

There are several subtopics of kinematics that are relevant to VFX:



Forward kinematics: This is the process of calculating the position of an object based on the positions and rotations of its joints. It is often used to animate characters and robots.
Image of Forward kinematics in VFXOpens in a new window.

Example: www.educba.com

Forward kinematics in VFX:

Inverse kinematics: This is the process of calculating the positions and rotations of an object's joints to achieve a desired position for the end effector (e.g., the hand of a character). It is often used to create animations where the end effector needs to follow a specific path.
Image of Inverse kinematics in VFXOpens in a new window.

Inverse kinematics in VFX:

Motion capture: This is the process of recording the motion of an actor or object using sensors and then using that data to animate a character or object in a computer. Motion capture data can be used to drive forward kinematics or inverse kinematics calculations.

Example: Image of Motion capture in VFXOpens in a new window

Motion capture in VFX:

Procedural animation: This is a type of animation where the motion of an object is defined by a set of rules or algorithms. Kinematic principles can be used to create procedural animations, such as the animation of cloth or hair.

Example: Image of Procedural animation in VFXOpens in a new window

Procedural animation in VFX:

Rigid body dynamics: This is a type of physics simulation that treats objects as if they are made up of rigid bodies that cannot deform. Kinematic principles can be used to constrain the motion of rigid bodies in a simulation.

Example: Image of Rigid body dynamics in VFXOpens in a new window

Rigid body dynamics in VFX:

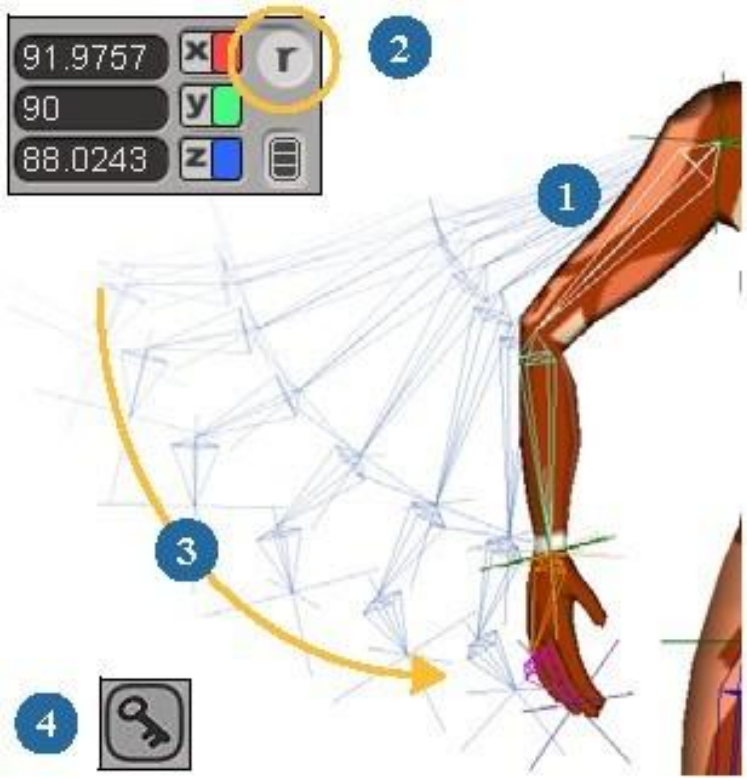
Kinematics in Action: Kinematics is used in a wide variety of VFX applications, including:

Character animation: Kinematics is used to create realistic and believable motion for characters, such as walking, running, and jumping.

Vehicle animation: Kinematics is used to animate the motion of vehicles, such as cars, airplanes, and spaceships.

Crowd simulation: Kinematics is used to simulate the motion of large crowds of people.

Destruction effects: Kinematics is used to create simulations of objects being destroyed, such as buildings collapsing or explosions.



Kinematics is a powerful tool that can be used to create realistic and believable motion in VFX. By understanding the principles of kinematics, VFX artists can create stunning and immersive visual effects.

II. FULL ANIMATION

Full Animation:

Full animation in visual effects (VFX) is the process of creating moving images entirely through digital means. It's used in a wide range of productions, from movies and TV shows to video games and commercials.

Here are some subtopics that explore the details of full animation in VFX:

Types of full animation:

3D animation: This is the most common type of full animation, where objects are created and animated in three-dimensional space. Popular software programs for 3D animation include Maya, Houdini, and Blender.

Image of 3D animation software HoudiniOpens in a new window

Example: 3D animation software Houdini

2D animation: This type of animation uses flat, two-dimensional images that are manipulated to create the illusion of movement. Traditional 2D animation is drawn by hand, while modern 2D animation is often created using digital software like Adobe Animate.
Image of 2D animation software Adobe AnimateOpens in a new window.

2D animation software Adobe Animate

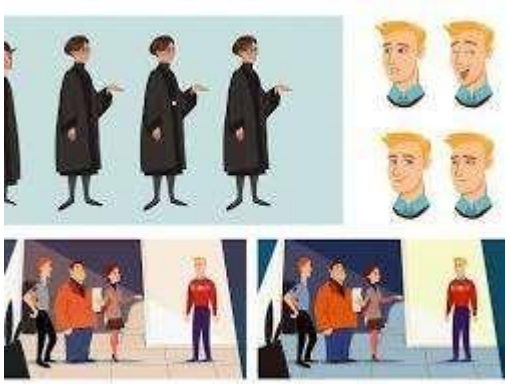
Stop-motion animation: This technique involves physically moving objects in small increments between frames, creating the illusion of movement when played back at normal speed. Popular stop-motion materials include clay, puppets, and paper cutouts.
Image of Stopmotion animationOpens in a new window

Example: Stopmotion animation

The animation pipeline:

The animation pipeline is the process of creating a full animation, from the initial concept to the final rendered image. Here are some of the key steps:

Pre-production: This involves developing the story, characters, and environment for the animation. It also includes creating storyboards, animatics, and concept art.
Image of Concept art for animationOpens in a new window.



Concept art for animation:

Modeling: This is the process of creating the 3D models of the characters, objects, and environment.

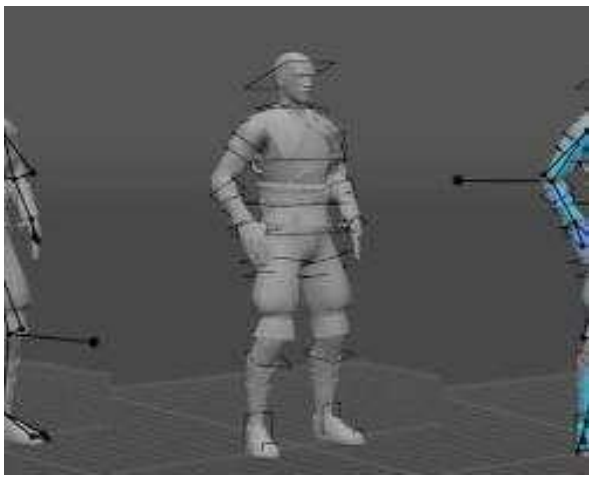
Image of 3D modeling for animationOpens in a new window

dreamfarmstudios.com

Example: 3D modeling for animation

Rigging: This involves adding a "skeleton" to the models that allows them to be animated.

Image of Rigging for animationOpens in a new window



Rigging for animation:

Animation: This is the process of bringing the models to life by moving them and creating facial expressions.

Image of Animation processOpens in a new window

studiopigeon.com

Animation process:

Lighting and rendering: This involves adding lighting and other effects to the animation to make it look realistic.

Image of Lighting and rendering for animationOpens in a new window

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Lighting and rendering for animation

Compositing: This is the final step, where all of the different elements of the animation are put together into a single image.

Image of Compositing for animationOpens in a new window

Compositing for animation;

Applications of full animation in VFX:

Full animation is used in a wide range of VFX applications, including:

Movies and TV shows: Full animation is used to create everything from cartoon characters to photorealistic creatures and environments.

Image of Full animation in movies and TV showsOpens in a new window

Example: Full animation in movies and TV shows

Video games: Full animation is used to create the characters, objects, and environments in video games.

Image of Full animation in video gamesOpens in a new window

www.ign.com

Example: Full animation in video games

Commercials: Full animation is used to create eye-catching and memorable commercials.

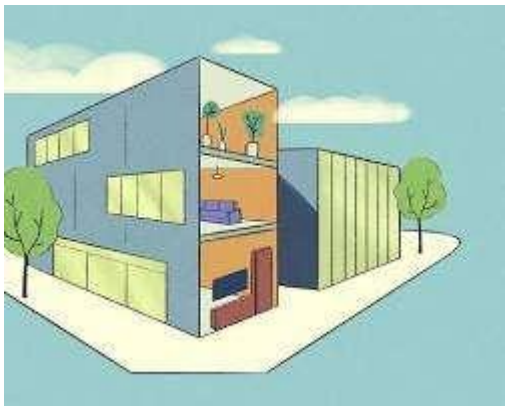
Image of Full animation in commercialsOpens in a new window

Example: Full animation in commercials

Architectural visualization: Full animation is used to create realistic visualizations of proposed buildings and landscapes.

Image of Full animation in architectural visualizationOpens in a new window

Example: Full animation in architectural visualization



The future of full animation:

Full animation is a rapidly evolving field, with new technologies and techniques emerging all the time. Some of the trends that are shaping the future of full animation include:

i. **The use of real-time rendering:** This allows animators to see their work in real-time, which can make the animation process more efficient and interactive.

ii. **The use of artificial intelligence (AI)**: AI is being used to automate some of the more tedious tasks in the animation process, such as lip-syncing and character rigging.

iii. **The use of virtual reality (VR) and augmented reality (AR):** VR and AR are being used to create new and immersive animation experiences.

III. LIMITED ANIMATION

While limited animation isn't typically used directly in visual effects (VFX), its principles and techniques can definitely find application and influence the approach. Here's a breakdown of how limited animation and VFX intersect:

Limited Animation Basics:

Definition: An animation technique that intentionally reduces the number of drawings and movements to save time and resources. It often employs:

Stylized drawings: Simplified designs focusing on key features.

Limited frame rates: Fewer frames per second (FPS) than traditionally animated works *(12-24 FPS vs. 30 FPS).*

Reused animation: Repeating cycles of movement for efficiency.

Limited backgrounds: Static or minimally animated backdrops.

Historical Use:

- ❖ Pioneered by studios like Hanna-Barbera and UPA in the mid-20th century.
- ❖ Often utilized in television cartoons due to budget and production constraints.
- ❖ Notable examples: "The Flintstones," "Scooby-Doo," "South Park."

- ❖ While it's true that limited animation directly doesn't apply to most VFX, its principles and techniques can influence the approach in subtle and profound ways. This deeper dive explores how limited animation's impact goes beyond mere stylization.

Benefits:

- Cost-effective and time-saving.
- Allows for stylistic expression and exaggeration.
- Can lend a unique charm and comedic timing.

Drawbacks:

- Can appear less fluid and detailed compared to fully animated works.
- Requires careful planning and execution to avoid looking choppy or unnatural.

Influence on VFX:

- ✓ **Stylization:** Limited animation inspires stylized VFX choices, focusing on specific details and effects rather than hyper-realism. Think of stylized creatures, exaggerated explosions, or cartoon-like elements within a live-action scene.

- ✓ **Efficiency:** The "less is more" approach of limited animation translates well to VFX workflows. Optimizing rendering times, using procedural techniques, and strategically placing VFX elements can save resources without sacrificing impact.

- ✓ **Storytelling:** Similar to limited animation's use of exaggeration and simplified visuals, VFX artists can use these techniques to emphasize emotions, actions, and key information within a scene.

Technical Considerations:

- **Frame Rates:** While limited animation typically uses lower frame rates *(12-24 FPS)*, VFX can leverage this concept through:

- **Selective frame drops:** Intentionally dropping frames in specific scenes for stylistic or dramatic effect *(e.g., action sequences)*.

- **Frame-by-frame animation:** Utilizing hand-drawn or meticulously crafted individual frames for specific elements *(e.g., character expressions)*.

- **Animation Cycles:** Reusing and subtly modifying animation cycles can be applied in VFX for:

- **Background elements:** Repeating cycles of clouds, smoke, or water movement for efficiency.

- **Crowd animation:** Creating variations on a base animation cycle to populate a scene with diverse-looking characters.

Examples of Limited Animation in VFX:

i. **Stylized creatures:** Think of the fantastical creatures in "Harry Potter" or the Muppets in "Muppet Treasure Island." Their movements and designs might not be hyper-realistic, but they effectively convey their emotions and character.

ii. **Exaggerated effects:** The over-the-top fire and explosions in films like "Who Framed Roger Rabbit?" or "Pirates of the Caribbean" draw inspiration from limited animation's use of exaggeration for comedic or dramatic effect.

iii. **Minimalist aesthetics:** Some VFX-heavy films like "Sin City" or "300" utilize a limited color palette and simplified backgrounds, reminiscent of limited animation's focus on key elements.

iv. **Speed Ramping:** Intentionally altering playback speed to create a stylized effect, reminiscent of limited animation's use of timing for comedic or dramatic emphasis.

v. **Particle Systems:** Utilizing procedural techniques to create complex effects like fire, smoke, or explosions efficiently, echoing the focus on key elements in limited animation.

Key Features of Limited Animation :

- **Simplified Character Designs:** Characters in limited animation have simplified and streamlined designs to facilitate faster animation production.

- **Symbolic Movement:** Limited animation employs symbolic movement, where characters convey actions with minimal frame changes, implying movement rather than fully illustrating it.

- **Looped Sequences:** Animators use looped sequences, repeating short segments of animation to depict continuous movement efficiently.

- ✧ **Cost and Time Efficiency:** Limited animation’s reduced frame count and simplified designs contribute to quicker production times and cost savings.

Use Cases and Advantages :

Limited animation finds application in various scenarios:

Television Series: Limited animation is commonly used in TV series due to its efficiency and suitability for tight broadcasting schedules.

Commercials: It is favored for commercials that require quick turnaround times tomeet marketing campaigns.

Online Content: Limited animation is ideal for web-based animations, short videos,and online advertisements.

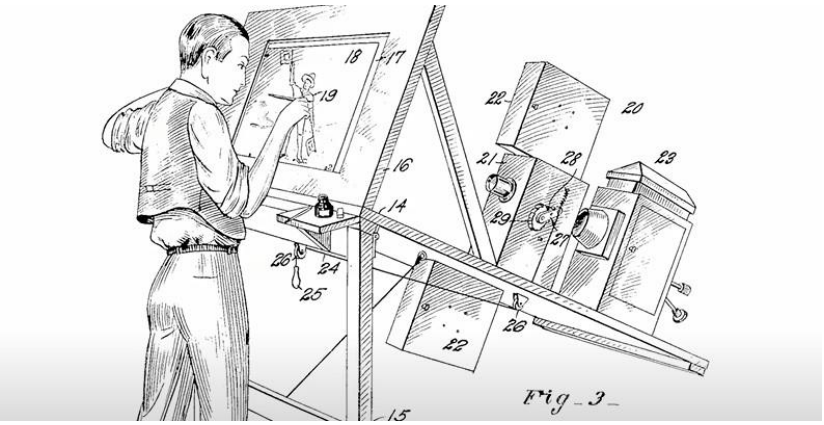
Limited animation's influence on VFX goes beyond surface-level stylization. It's a philosophy of efficiency, prioritization, and effective communication through simplified visuals. By understanding and applying its principles, VFX artists can create impactful and memorable visuals within budget and resource constraints.

ROTOSCOPING

What is Rotoscoping?

Rotoscoping is an animation technique that consists of drawing or tracing over a photo or live-action footage frame by frame to create more accurate and smoother animations. The result is having the live-action footage as a reference to produce realistic movements in the animation. Rotoscoping was used for intricate dance movements, walking, running, jumping, and other smooth motions, such as facial expressions that were difficult to replicate in the hand-drawing animation process.

Instead of drawing by hand, animators projected the reference live-action footage onto glass panels and traced over the image frame by frame. It was a tedious and time-consuming process, but it was faster than drawing frame by frame, resulting in more realistic animations, enhanced artistic style, and more emphasis on a dramatic scene.



Today, most rotoscoping is done digitally as a special effect on live-action footage to create an animated film version or as a visual effect to composite the footage on a different background. Before diving into digital rotoscoping, let's take a look at the history of rotoscoping.

The History of Rotoscoping

Rotoscoping originated in 1915 when animator Max Fleischer created the rotoscoping technique to produce his *Out of the Inkwell* series. Fleischer wanted to create a realistic animation where cartoons moved and looked more like real people; therefore, he decided to film his brother Dave dressed as a clown to breathe life into his cartoon character Koko the Clown, the first rotoscoped cartoon character.

From that moment, Fleischer and his rotoscoping technique revolutionized the film animation industry, bringing other iconic cartoon characters such as Betty Boop, Popeye, and Superman to the screen.

Back then, everyone wanted to try this new technique for their animations. When the Fleischer Process patent expired, other studios could use the rotoscope process. The first full-length animated feature films using rotoscoping were Disney's Snow White and the Seven Dwarfs (1937) and Gulliver's Travels (1939) by Fleischer Studios.

Rotoscoping became popular and mainly stayed the same until the mid-90s when a computer scientist veteran, Bob Sabiston, developed the interpolated rotoscoping process and created Rotoshop, an advanced computer software for hand-tracing frame-by-frame over layers of frames. Rotoshop allowed shifting the rotoscoping technique to a computer, though as of today, it's a technique only the company Flat Black Films can use.

Director Richard Linklater was the first filmmaker to use digital rotoscoping to make a live-action full-feature film. Linklater's full-length movies *Waking Life* (2001), *A Scanner Darkly* (2006), and more recently, *Apollo 10½: A Space Age Childhood* (2022) used rotoscoping to animate the live-action footage of the actors while keeping the animation extremely realistic.

Types of Rotoscoping

The film industry uses considerably rotoscoping techniques for multiple purposes. Here are some types of rotoscoping that you can do to add creativity to a dramatic scene, to add visual effects, or to make an animation from scratch using real-life footage.

- ### Traditional Rotoscoping

  Let's start with the most traditional technique. As mentioned before, rotoscoping starts with live-action footage. Let's say you want to create an animation about

basketball players for an animated feature film. You can draw them by hand, but it'll be difficult to replicate the movements of the player's body.

The best option is to first record players to capture their actions to make it more realistic as if you were creating motion picture footage. Then, using a movie projector, play the movie through glass or use a lightbox to trace over the footage.

- **Reference Film Rotoscoping**

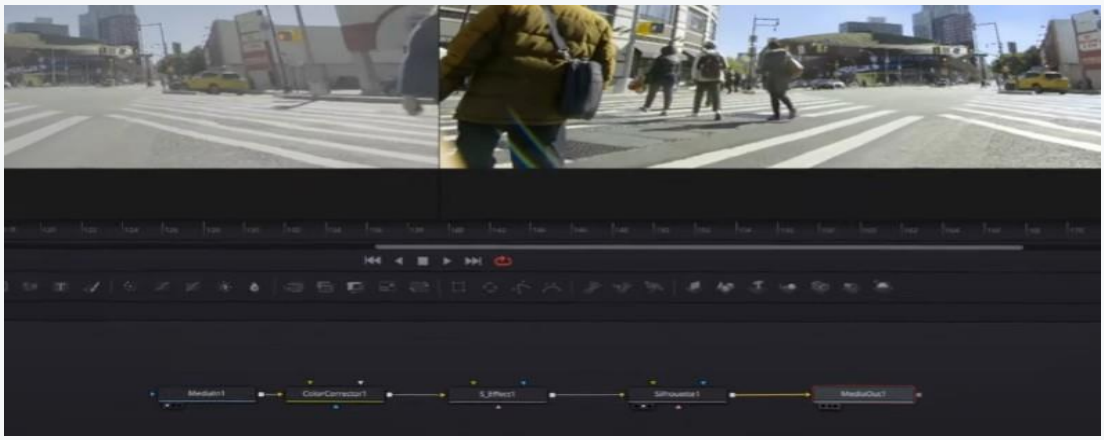
Filmmakers have used rotoscoping in various ways. Walt Disney used reference films to define a character's movement from a live movie reference and animate *Snow White and the Seven Dwarfs* accordingly. Having a reference film allowed Disney to reuse many of their motion scenes: you can find the same motion in many Disney films, like the dancing scene from *Snow White* and *Robin Hood*, and other rotoscoping movements across movies like *The Jungle Book, Winnie the Pooh, 101 Dalmatians, Pinocchio, The Sword in the Stone, Bambi,* and many more.

This type of rotoscoping allows you to use your animator skills to draw your characters on top of the reference film instead of tracing directly from the footage and to reuse the reference for future projects and different animated characters.

One recent use of reference rotoscoping was in James Gunn's *Guardians of the Galaxy* (2014). Gunn used rotoscoping with a real-life raccoon to keep the animal features and movements for Rocket, the raccoon.

- **Digital Rotoscoping**

In the digital realm, rotoscoping opens up other animation opportunities, such as motion-tracking and motion capture, to get live-action footage and then rotoscope on computer software. Animators trace directly in the rotoscoping software using tablets and other digital hardware.



Digital rotoscoping streamlines the traditional rotoscope process to create mattes to move subjects and objects into scenarios impossible to shoot in live-action films. However, it still involves tracing and is still a time-consuming process.

- **Rotoscoping for Visual Effects**

  Rotoscoping allows you to add effects such as glow, color grading, flickers, and more. One of the most popular uses of rotoscoping as a visual effect is in the original *Star Wars* trilogy. The Jedi lightsabers were recorded using sticks; then, the VFX team rotoscoped the sticks on every frame and added the characteristic glow of the lightsabers.

  Also, in Hitchcock's movie *The Birds* (1963), animator Ub Iwerks created the bird scenes using rotoscoping.

- **Photorealistic Rotoscoping**

  Rotoscoping has proven to be a fantastic creative tool outside of animated films too.

  Director Richard Linklater pioneered photorealistic rotoscoping with the movie *A Scanner Darkly*, where most features from the real actors were kept to create a unique visual experience. Linklater used the same proprietary rotoscoping process for his other movie, *Waking Life*. You can find another recent example of using the rotoscope technique to create facial expressions in Mark Ruffalo's Hulk.

Rotoscoping Animation Software

If you want to get into the rotoscoping animation world, you will need an animation software. While you can definitely do it in the traditional way, why not use the help of the technology available when it saves you time *and* money?

The ones below are the most popular software for rotoscoping.

- **Silhouette**

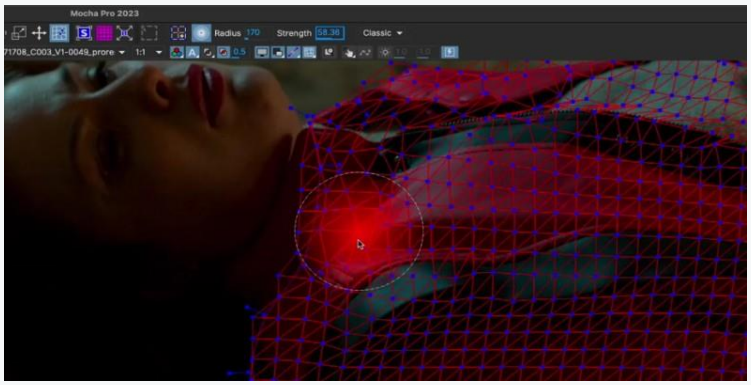
Silhouette is a refined rotoscoping tool by Boris FX. It allows you to create complex mattes and masks using B-Spline, X-Spline, and Magnetic Freehand shapes. Silhouette integrates point tracking, planar tracking, and Mocha Pro planar tracking.

It has been the tool for Academy Award-winning films such as *Black Panther: Wakanda Forever*, *Top Gun: Maverick, Dune*, and *The Mandalorian*.

Silhouette: Quick Start to Rotoscoping

- Mocha Pro

Mocha Pro is a plug-in for planar tracking and rotoscoping from Boris FX. You can use it on other video editing software like DaVinci Resolve, After Effects, Premiere Pro, and Vegas Pro. Mocha Pro allows you to rotoscope with fewer keyframes and speed up the rotoscope process with the X-Splines and Bezier Splines with magnetic edge-snapping assistance.



- Adobe After Effects

Adobe After Effects is a professional software for motion graphics and animation. It's popular among video editors and graphic designers to create eye-catching motion graphics and visual effects. Adobe After Effects is available as part of the Creative Cloud bundle subscription. Additionally, After Effects includes a limited version of Mocha with rotoscoping features from the Pro version of the Boris FX plug-in.

- Blackmagic's DaVinci Resolve Fusion

Fusion is built into DaVinci Resolve, and it's your tool for all visual effects and motion graphic-related work. It features advanced mask and rotoscope tools with B-Spline and Bezier shapes. Just switch to the Fusion page on your DaVinci Resolve project to start using rotoscoping to animate characters and objects.

Rotoscoping Examples

Here is a list of the most notable rotoscope movies produced with rotoscope techniques. It includes TV shows and music videos for you to explore and analyze the rotoscoping technique in depth.

- Movies
  - *Alice in Wonderland*
  - *Star Wars Trilogy*
  - *Fantasia*
  - *Gulliver's Travels*
  - *Lord of the Rings (1978)*
  - *Fire & Ice*
  - *Waking Life*
  - *A Scanner Darkly*
  - *Apollo 10½: A Space Age Childhood*
- Video Games
  - *Prince of Persia*
  - *Another world*
  - *Flashback*
- Music Videos
  - A-Ha - Take On Me
  - INXS - What You Need
  - A-Ha - Train Of Thought
  - Opposites Attract – Paula Abdul
  - Incubus - Drive
  - Linking Park - Breaking the Habit
  - Kanye West Heartless
- TV Shows and Series
  - *Jem and the Holograms*
  - *The Simpsons*
  - *Family Guy*

- *The Flowers of Evil*
- *Undone*

Final Words

Nowadays, rotoscoping is more commonly used as a visual effect rather than an animation technique, thanks to the rise of 2D and 3D computer graphics. Nonetheless, some filmmakers still appreciate rotoscoping for its unique aesthetic qualities in both animation and live-action films. As such, we can expect to see filmmakers continue to find new and innovative ways to incorporate the rotoscoping process into their movies, series, and other creative projects.

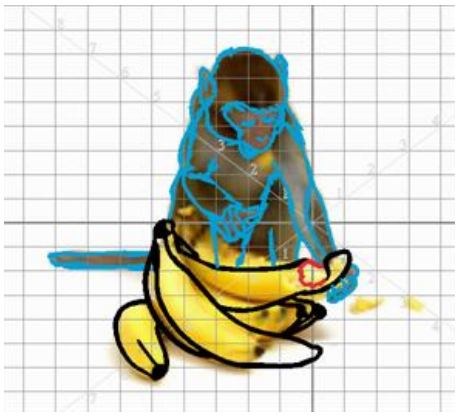
For more detail visit

https://medium.com/@uxgayatri/mastering-rotoscoping-techniques-for-achieving-seamless-results-1c902fa51233

ROTOSCOPING

Maybe you have heard about this process, but do not know how to use it. Perhaps you have an idea of how this technique works, but do not know where to begin. This section will help you get started.

What is Rotoscoping?



Rotoscoping is an animation technique where the animator traces over each frame of a live-action movie to reproduce a realistic movement. This technique was invented by Max Fleischer in 1915. The movie was projected frame by frame onto a piece of glass that the animator could trace over. The piece of equipment used in this process is called a rotoscope. Today, the rotoscope has been replaced by the computer.

Reasons for Rotoscoping

Some reasons you may chose to use this process:

- The motion is very realistic.
- The timing is accurate.
- The characters or other elements retain their proportions and volume.
- It helps you learn how to animate.
- It helps you understand how to break down a movement.
- It teaches you how to animate very subtle motions, like a slight head turn or a slow raise of the hand.

You can also superimpose your character design and only use the motion but not the actual object, person or animal from the video.

Because rotoscoping is so realistic, it leaves little room for exaggeration, movement, squash and stretch, or a very cartoony look. If you use this technique, make sure it suits your project.

Selecting a Video

Selecting a video to rotoscope is simple. You can:

- Film the actions you need to animate yourself. For example, you could film a dog playing with a ball or a pe
- Find a free movie clip on the web, or
- Purchase a royalty-free movie clip from a website.

Your movie format can be any of the following:

- AVI (*.avi)

- QuickTime (*.mov)
- MPEG (*.mpg)
- iPod (*.m4v)

If you find a movie clip that is not in any of these formats, you can easily convert it in an editing software.

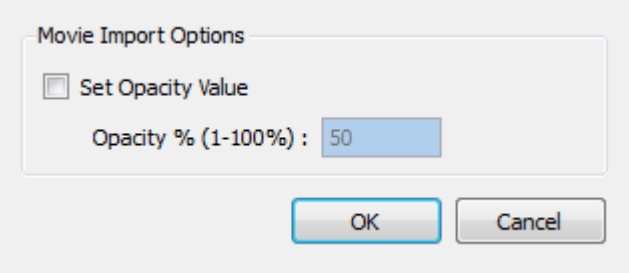
Your clip does not need to have a very high resolution, however the higher the resolution, the more detail you see. A minimum resolution of 300x200 is recommended.

Importing a Video

When you create your Toon Boom Studio project, you can avoid having too many drawings to trace over by creating the project with a rate of 12 frames per second instead of 24.

To import your video:

1. Select **File > Import File**.
2. In the Open dialog box, browse for your clip and click **Open**.
3. In the Import Options dialog box, do **NOT** set an opacity value.



4. Click OK.

Tracing the Character

Before you start tracing your movie, set up your brush with a low smoothness and a lively tracing colour. This is so your lines will be more faithful to the video still and you will be able to see your lines clearly.

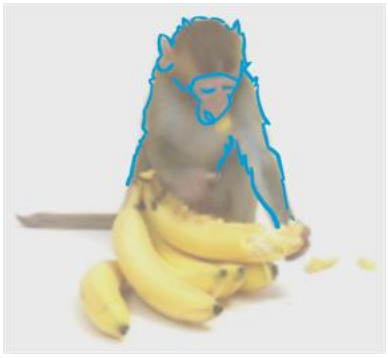
Tracing

When you trace over your imported movie, concentrate on one element at a time. For example, if there is a boy running with a balloon, trace the boy first and then the balloon. This helps when trying to create separate movements. The boy moves differently than a balloon, even if they are moving at the same speed and in the same direction.If the two objects or characters are interacting, it is best to draw them on the same layer.

Remember, when you trace over the character, try to close your zones for fast and efficient painting later on.

To trace your animation:

1. In the Timeline view, add a new layer to trace your animation.
2. If you work in the Drawing view, enable the **Light Table** to see the live-action frames.
3. In the Camera/Drawing view, zoom in on your image to see the details better.
4. Trace your first frame.



5. In the Timeline view, select the second cell and trace the second image.
6. If necessary enable **Onion Skin** to see your previous drawings.
7. Repeat the process until the animation is entirely traced.

Fine Tuning the Animation

Once your animation is traced, it is a good idea to deselect the live-action clip layer or turn off the Light Table, and then go over your animation to fix the little details, such as open zones and uncompleted lines.

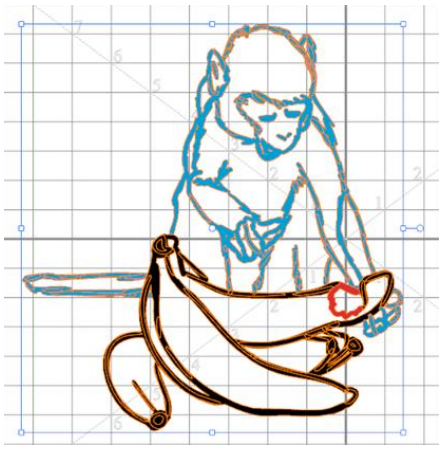
To learn more about closing gaps, see Adding Colours and to learn more about making invisible strokes, see Drawing and Design.

If you want your final project to be lighter once you are done tracing, select your lines and flatten them.

To flatten your drawings:

1. In the Drawing Tools toolbar, click the **Select** tool.
2. In the Timeline view, select the first frame of the tracing layer.

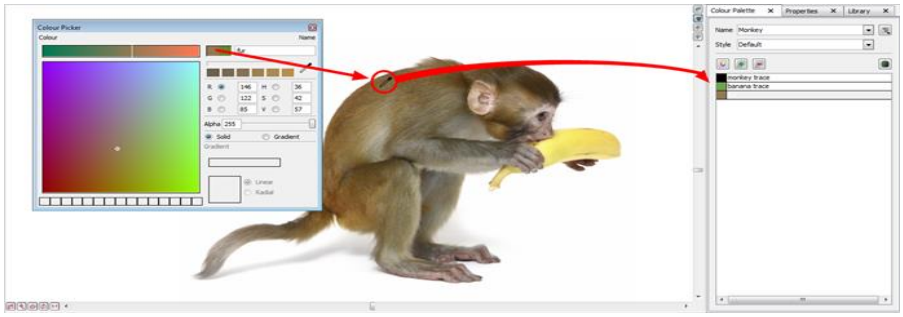
3. In the Camera/Drawing view, select your entire drawing.



4. Select **Tools > Flatten**.

5. Repeat this process for all your drawings.

Painting the Animation



To create your colour palette, use Toon Boom Studio's special dropper to pick colours from your live-action movie and paint your animation in the same colours as the clip.

To create your colour palette:

1. In the Colour view, create and rename your new palette.
2. In the Colour list section, add a new colour swatch by clicking the **Add Colour** button.
3. In the Camera view, display your live action movie.
4. Double-click on the new colour swatch to display the Colour Picker window.
5. In the Colour picker window, click the **Eye Dropper** button.
6. In the Camera view, pick a colour.
7. Repeat this process until the colour palette is entirely finished.

Your animation is now ready for painting.

STOP MOTION ANIMATION

What is Stop Motion Animation?

Stop motion animation (also called stop frame animation) is animation that is captured one frame at time, with physical objects that are moved between frames. When you play back the sequence of images rapidly, it creates the illusion of movement. If you understand how 2D drawn animation (early Disney) works, stop motion is similar, except using physical objects instead of drawings.

FRAME 1

FRAME 2

FRAME 3

FRAME 4

ANIMATED

You see stop motion animation all the time—in commercials, music videos, television shows and feature films—even if you don't realize it. While it is common for people to think of stop motion as just one specific style, such as clay animation, the reality is that stop motion techniques can be used to create a wide range of film styles:

Tools Required To Make Stop Motion Animation

If you want to try stop-motion animation at home, you can do it with simple tools. They include:

Camera

To capture the image, you can use a smartphone or a digital camera like a DSLR.

Tripod

A stand or holster to keep your camera steady.

Editing Software

To edit the frames together in an animation.

Materials/Objects

Inanimate objects become your subject of animation.

How To Process Stop Motion Animation?

1. Find Your Setting

The first step when you wish to stop motion animation is to establish where you can place your camera. Further, fill your frame with the location or backdrop and ensure not to capture the edges outside your frame to maintain consistency.

2. Set Your Camera Right

You need to limit your camera shakes to have a good setup for your stop-motion video. For this purpose, you can use a tripod or a stand to maintain your camera in a stable position.

3. Use A Remote Trigger Or Timer

You will get an elegant stop-motion animation when you avoid clicking your camera every time. You can trigger your camera using a remote or set a timer to take a picture every few seconds to make this possible.

4.Shoot With Manual Settings

When you shoot the picture with your camera in auto mode, the settings will adjust the camera itself to every image you take, resulting in a flickering effect. However, setting a uniform shutter speed, ISO, aperture, and white balance helps overcome this issue.

5.Control Your Lighting

Too much lighting can cause shadows and minor flickerings that may not suit your animation. Hence, always be mindful of windows and maintain only essential lighting to allow you to see your objects.

6.Frame Rate

As a beginner, it is enough for you to know that a second of video constitutes 12 frames. However, if you exceed this rate, your video can become jittery.

7.Move-In Small Increments

Move your objects in small, consistent increments to create a smooth animation. On the other hand, if you want your things to appear slower, you can move the objects quickly.

8. Audio

Once you are done shooting the silent stop-motion animation, you can add some audio to your video to make it enjoyable. For this purpose, opt for a dedicated stop motion software or app.

OBJECT ANIMATION :

Object animation is a fascinating form of **stop motion animation** that brings everyday items to life. Here are the key points about object animation:

1. **Definition and Technique**:

   - Object animation involves animating non-drawn objects such as **toys, blocks, dolls, and similar items**.
   - Unlike plasticine (clay) or wax, these objects are **not fully malleable** and are not designed to resemble recognizable human or animal characters.
   - Animators physically manipulate these objects, capturing each movement frame by frame. When played back, the sequence creates the illusion of motion.
2. **Distinct from Model and Puppet Animation**:

   - **Model Animation**: Uses recognizable characters (such as clay figures or puppets) as subjects.
   - **Puppet Animation**: Features characters with articulated joints.
   - **Object animation** works with **pre-existing objects** like static toy soldiers, LEGO bricks, or construction toys. These objects are not inherently designed as characters.
3. **Combining Techniques**:

   - Object animation is often combined with other forms of animation for more realism.
   - For example, a toy car might be animated using object animation, while a character (often in puppet or model animation style) is seen driving the car.

Pixilation Animation :

Before jumping into a definition of pixilation, we want to stress that we are not misspelling the word. "Pixelation" with an "e" is a different thing all together; that's when you zoom in on an image and you can make out the individual blocks (pixels) that it's made of. In other words, it has nothing to do with "pixilation" with an "i," which we will get into below.

Pixilation is a filmmaking technique where live actors and objects are shot frame-by-frame to simulate movement. This results in an animated-looking movie, where a human, and the things around them, move without being touched. The actual can often appear jerky or smooth, depending on gaps of motion between in each frame.

The name seems to come from the word "pixilated," which itself is a reference to someone being under the influence of pixies (yes, the small magical flying ones). Due to pixilation often representing human beings seemingly moving around on their own, it makes some amount of sense.

Stop-Motion Vs Pixilation

No doubt pixilation will remind you of stop-motion animation, and that's mainly because they're almost the same thing. The key difference is that stop-motion animation involves models, along with sets, that are 100% manipulated by a director/animator. Compare with pixilation, where a human being and their surroundings are manipulated, but that's all. In both cases, everything is shot frame-by-frame.

Characteristics of Pixilation include:

- Frame-by-frame filmmaking process
- Jerky and unnatural looking movement
- Surreal and fantastical subject matter
- Usually only reserved for specific moments and VFX shots in full-length movies

Pixilation is often used as a tool for creating a unique and comical movie, and has its origins dating as far back as the 1900s. In some movies, like *Hôtel électrique* (1908), objects are used around the character in such a way that they are affecting them without any other person's touch.

RIGGING

What Is RIGGING in 3DAnimation? Basics and How It Works

Three-dimensional (3D) computer animation can seem a lot like magic. How does a graphic artist's sketch of a character get transformed into a lifelike, 3D animation that's able to walk, crouch, jump, and use its limbs and hands as naturally as you or I can?

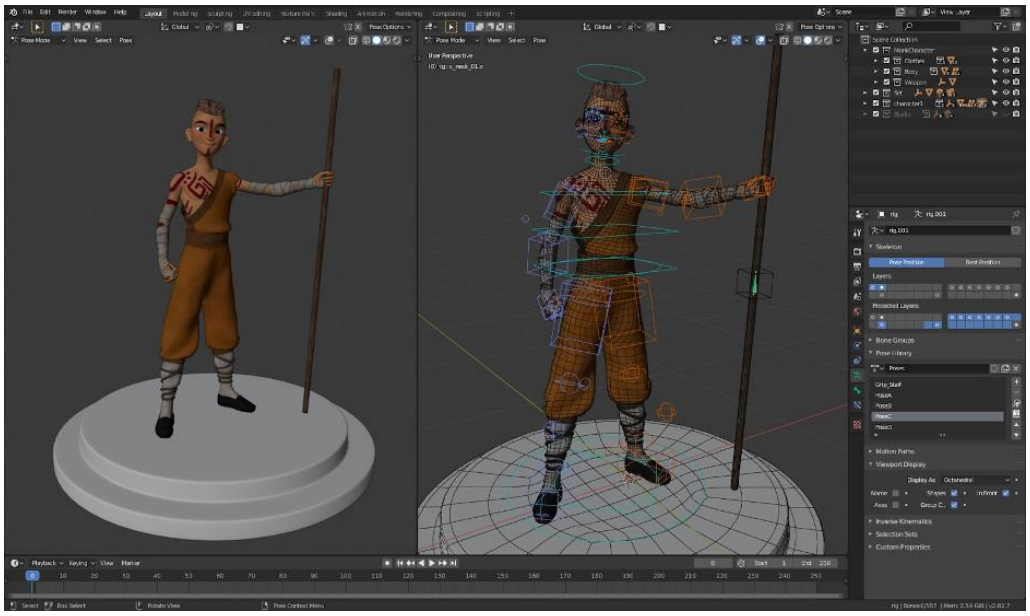


Image source: Kreonit

With 2D animation, motion is created frame by frame. Computers have since revolutionized animation, replacing hand-drawn frames with computer simulations that control how everything on screen moves: cloth, leaves on trees, and even hair.

But before a computer can take an artist's rendering of a character and bring it to life with motion, it has to go through an important phase: 3D rigging.

It's part art and part science. Here's a look at how it works.

What are 3D animation and rigging?

3D animation is simply the process of creating characters, objects, and even scenes or environments in a three-dimensional space. With 3D animation, designers can add more depth and realism to their creations than with 2D animation. It also makes it easier to achieve complex interactions like the

natural movement of water, fire, and wind—making final products more visually pleasing. In addition, 3D animations make it possible to abide by the natural laws of physics, texture, and lighting.

But before 3D animation is done, animators must first create rigs. Rigging involves creating bones or a digital skeleton that makes it possible to control the movement of characters and objects. For example, animators can control how characters run, how their hair, arms, legs, and other body parts move, and even their facial expressions.

Keep reading to understand the intricacies around rigging in 3D animation.

Key components of 3D rigging

Creating a 3D mesh, designing a skeleton, and finally incorporating the motion simulation and manipulation are the key components of 3D rigging.

The 3D mesh (skin)

In 3D animation, a mesh or skin is typically crafted using polygonal modeling, a technique where artists construct the character's form using interconnected polygons, usually triangles or quadrilaterals. This results in a wireframe structure, a kind of skeletal framework, that outlines the character's shape.

When this 3D mesh is placed over the rig or skeleton, it aligns perfectly with the underlying bone structure. This harmonious interaction between the mesh and the rig enables the character to move in a lifelike and cohesive manner, with each polygon adjusting to mimic realistic movements.

For example, when a character lifts a hand, the skin mesh should also follow along—generating an illusion of movement and flexibility. A rigging artist can also apply different colors, textures, and lighting effects to a 3D mesh to achieve different goals.

Designers can also deform and manipulate the skin mesh for characters to perform actions like laughing, smiling, and other expressions.

The skeleton: bones, joints, and muscles

Before you animate a character, it needs to be rigged. Using interconnected bones, muscles, and joints, you use the skeleton or rig to control how characters

or objects move. A skeleton can feature a few simple control points or it can also quickly grow and become complex, depending on the character.

In 3D animation, the skeleton can be represented by lines or shapes that are interconnected via joints. In this context, joints are places where skeleton bones meet—and they control how different body limbs move. For example, a knee is an example of a joint when creating a rig for a human character.

On the other hand, muscles are mainly mimicked when creating the skin mesh. They are connected to the underlying skeleton to allow them to move as realistically as possible while obeying the laws of physics.

Motion simulation and vertex manipulation

Character movements are simulated by a computer based on the properties of the internal skeleton.

In 3D animation, each bone in a skeleton is connected to specific vertices on a 3D skin mesh. This means that when the bone moves, the skin, clothing, or even facial expressions are also affected. Animators can assign skin weights to different body parts—which will determine how much deformation occurs.

Animators also control character movement through forward and inverse kinematics. In forward kinematics, each bone in a skeleton can be manipulated independently to achieve different actions and poses. Inverse kinematics makes it easier to move a character's limbs, like legs and arms, realistically to specific predetermined positions.

The rigging process: step by step

Rigging is a highly complex but necessary step in the animation process. It allows a character's body to be articulated in a structured way. Without rigging, trying to animate a character would result in a very distorted, deformed mesh.

From initial modeling to weight painting, here are key steps in a rigging process.

Initial modeling and skeleton creation

Before a 3D model can be animated, it has to get a rig. Let's talk about this by thinking of a 3D character as a hand-sculpted clay model.

Once a model has been created by an artist, it's inanimate, stuck in its original position until you manually bend an arm or turn its head. You can imagine that creating motion by hand for a feature-length film would be extremely tedious.

To automate the process, computer animation programs allow animators to assign motions. For that to happen, animators have to transform characters from clay models into marionettes that can be manipulated. That's where 3D rigging comes in.

3D rigging creates a skeleton for a 3D model—all the bones and joints inside a character that give animation software vertices it can recognize.

Assigning bones and creating the rig

Each bone in a character skeleton is assigned properties and constraints, just like bones in a human skeleton.

For example, the bones can rotate, bend in certain directions, and even control the motion of other bones. Bones can be weighted so that they have more influence over other bones. A "master bone" can be set to control the center point of how a character moves.

Weight painting and vertex assignment

With software platforms like Unity and Blender, experienced animators can use drivers, morphs, kinematics, and weight painting, among other tools, to control nearly anything on a character—say, raising the left eyebrow for a curious look or raising both for a surprised look.

Through weight painting, animators can assign different values or weights to vertices on a skin mesh. This will influence their level of deformation from nearby bone structures, allowing 3D objects to move naturally or in any desired way. For example, Blender has the Weight Paint mode you can use to assign weights and visualize different values.

AI and machine learning in 3D rigging

Artificial intelligence (AI) is transforming the animation industry, enabling stakeholders to be more creative and productive. We discuss how AI can fit into your 3D rigging workflow.

Automating the rigging process with AI

AI-powered tools can perform repetitive and time-consuming tasks, allowing you to focus more on creative tasks.

In 3D animation, AI tools can analyze models and identify appropriate places to include skeletons or bone structures. These platforms can also assist in weight painting—specifically, in setting and adjusting skin weights—to ensure different parts move as intended.

AI also enhances the motion capture process, making it easier to imitate the movement of real human actors and map it to 3D rigs, allowing animation characters to move or act in a natural or human-like way.

Today's AI tools have been trained on vast amounts of datasets, including rigging best practices. As a result, they identify errors or incorrect logic applications in your project and provide tips to enhance your rigging process.

Enhancing realism: AI in muscle and skin simulation

AI tools contribute to realism in animation by simulating realistic muscle and skin movements. From their massive training datasets, AI platforms can simulate how muscles stretch and contract or affect other body limbs and apply these fundamentals to rigs, adding a more realistic touch to animations.

Examples of 3D rigging

Rigging systems are used to create lifelike movements in animated creatures, such as the one below.

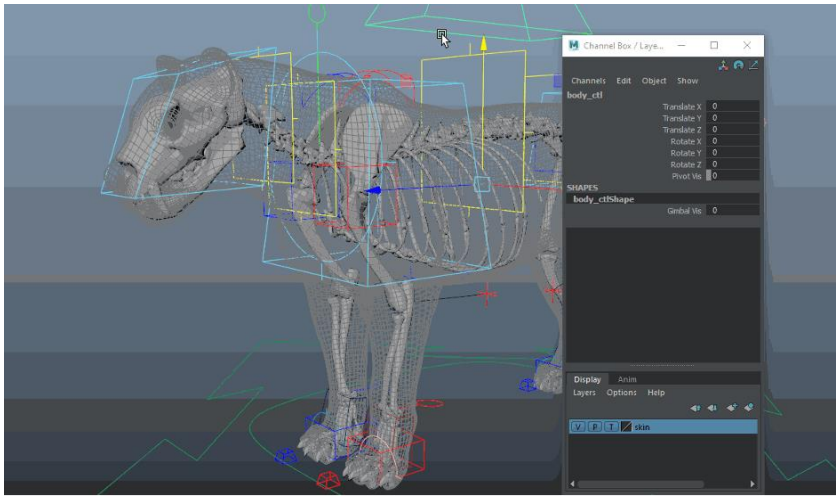


Image source: Paween Sarachan

Rigging is a widely used concept in different forums, including video games, films, marketing ads, and more. Below are some popular areas where 3D rigging has been exceptionally used.

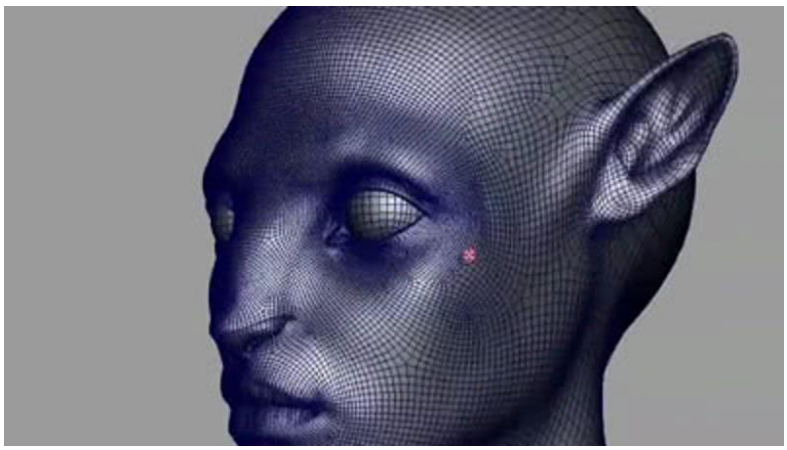


Image source: Media Division

- **Avatar.** This film used a performance capture technique to map a wide range of movements and actions of real actors to animated characters. As a result, the characters moved and behaved in a realistic and believable way.

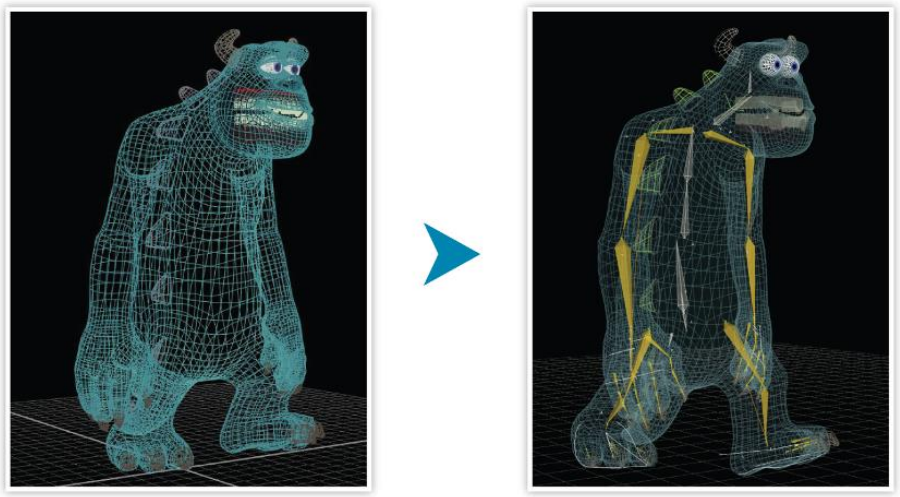


Image source: The Science Behind Pixar

- **Monsters Inc**. Pixar's movies, such as "Monsters Inc.," use advanced 3D rigging techniques to bring their characters to life. The rigging process in these films allows characters like Sully or Mike Wazowski to move in expressive and emotionally engaging ways.

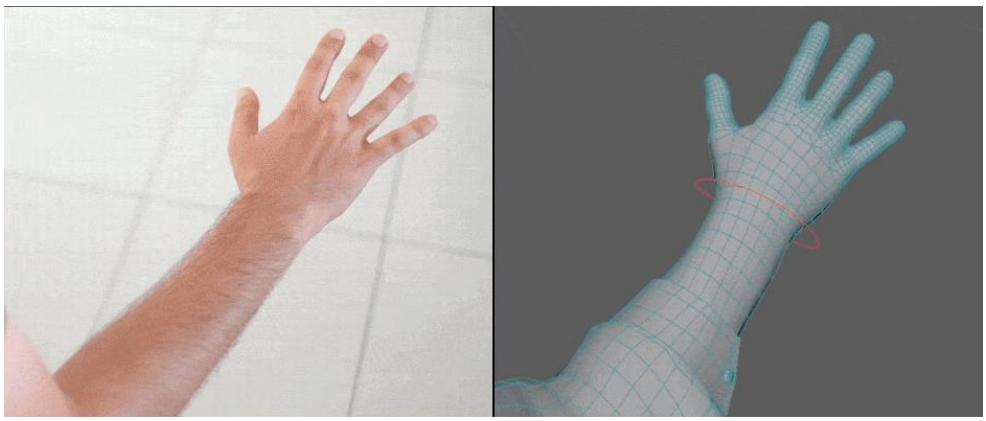


Image source: Vajont VR Devblog

- **Virtual reality** (VR) experiences. In VR environments, 3D rigging is crucial for creating immersive and interactive experiences. Characters or avatars in VR games and simulations are rigged to respond to player movements and actions, enhancing the sense of presence in the virtual world.

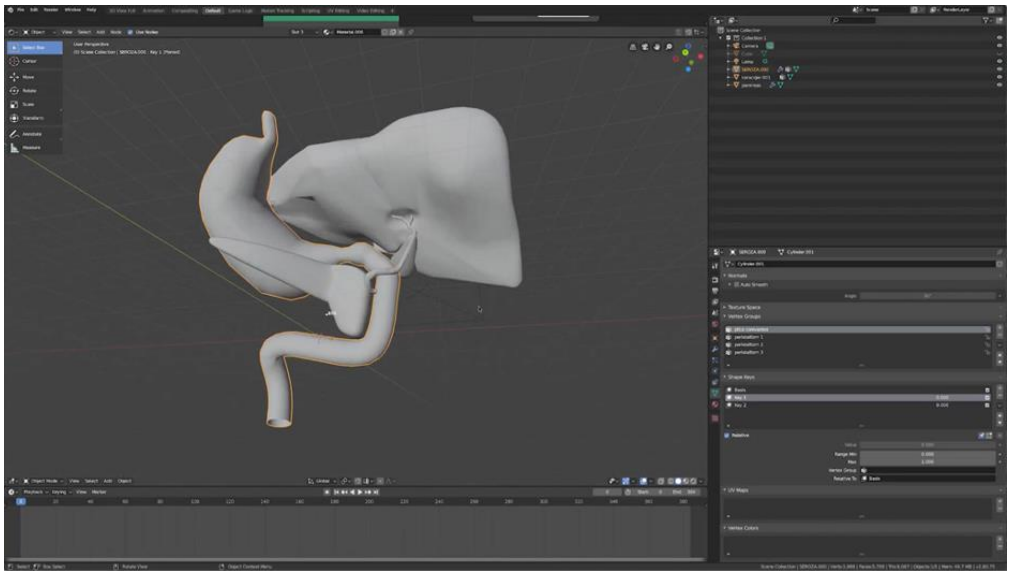


Image source: 3D Blendered

- **Educational software and simulations**. 3D rigging is used in educational software to create realistic models of the human body, animals, or machinery. These models help in understanding complex concepts through interactive visualizations.

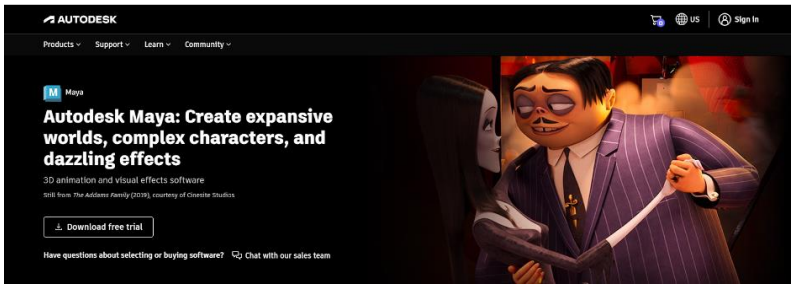
Image source: Thangs

- **Marketing and advertising mascots**. Many brands use animated mascots in their advertising campaigns. These mascots are often 3D models that have been rigged to perform various actions, like dancing or interacting with products, making them appealing and memorable to consumers.

Top rigging software tools

From Autodesk Maya to Cinema 4D, we discuss the top rigging software that you can integrate into your animation workflow.

Autodesk Maya



Autodesk Maya is a comprehensive platform used for complex rigging, rendering, facial animation, character modeling, skeletal animation, creating 3D effects, and simulations. It's used by special effects (also called FX) artists, riggers, animators, and 3D modelers in a wide variety of industries spanning from gaming to film.

Features:

- Ability to create complex skeleton structures for different characters
- Enhanced skinning tools
- Transfer rigs from one character to another with similar skeleton structure
- Polygonal modeling

Pricing:

You can purchase Maya via subscription or through flexible payments:

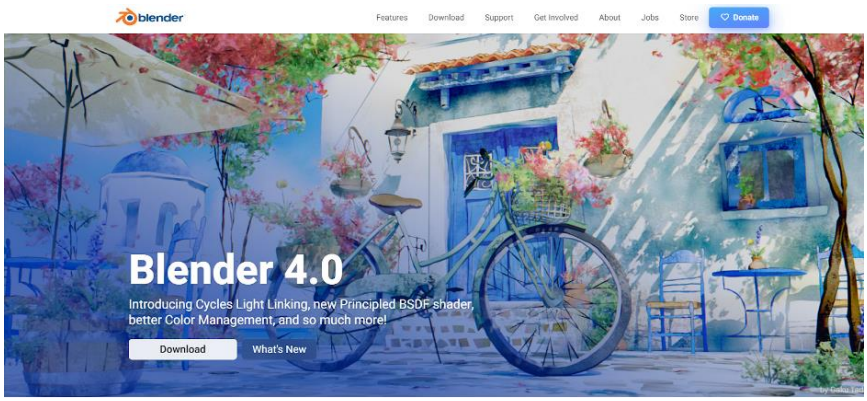
Subscription:

- $235 per month
- $1,875 per year
- $5,625 paid every three years

Flexible payments:

- 100 tokens for $300
- 500 tokens for $1,500

Blender



Blender is open-source software that helps artists and animators create complex characters, graphics, vectors, and visual effects. Apart from its intuitive interface, experienced creators can also write Python scripts and use them in 3D modeling, character rigging, and animation. Blender has a huge community support network, allowing you to access valuable learning resources and tutorials.

Features:

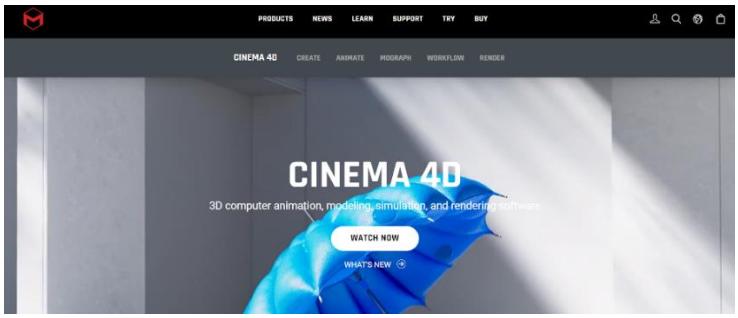
- A robust animation toolset

- A simple weight scale and painting tool for assigning different weights to digital bones
- Automatic skinning—which leads to realistic movements
- Bone layers and colored groups facilitating better organization
- Control objects easily by setting constraints
- Motion paths allow you to control character movement easily

Pricing:

- Available for free, donations accepted

Cinema 4D



Cinema 4D is a professional tool that performs numerous tasks in the 3D animation pipeline, including sculpting, character design, modeling, and rigging. Apart from built-in features, Cinema 4D also supports different integrations, including from popular apps like Adobe After Effects and Photoshop.

Features:

- Parametric, volume, and polygonal modeling
- Body paint 3D for adding textures to models
- Car rig templates
- Toon rig to animate cartoon characters quickly
- Provides a huge library of resources you can import and use in a project

Pricing:

- Maxon One for $99.91 per month or $1,199 billed annually
- C4D +Redshift for $81.91 per month or $983 billed annually

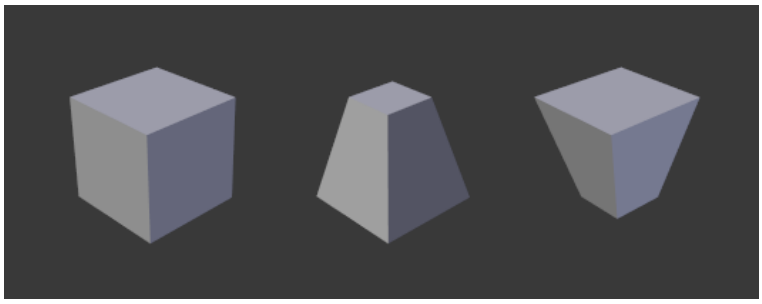
Shape Keys

Introduction

Shape keys are used to deform objects into new shapes for animation. In other terminology, shape keys may be called “morph targets” or “blend shapes”.

The most popular use cases for shape keys are in character facial animation and in tweaking and refining a skeletal rig. They are particularly useful for modeling organic soft parts and muscles where there is a need for more control over the resulting shape than what can be achieved with combination of rotation and scale.

Shape keys can be applied on object types with vertices like mesh, curve, surface and lattice.



Example of a mesh with different shape keys applied.

Workflow

Shape keys are authored in the Shape Keys panel which is accessed in the Object Data tab of the Properties (e.g. the Mesh tab for mesh objects).

A shape key is modified by first selecting a shape key in the panel, and then moving the object’s vertices to a new position in the 3D Viewport.

The panel has controls for affecting the current *Value* (influence, weight) of a shape. It is possible to see a shape in isolation or how it combines with others.

Adding and Removing Vertices

It is not possible to add or remove vertices in a shape key. The number of vertices and how they connect is specified by the mesh, curve, surface or lattice. A shape key merely records a position for each vertex and therefore shapes always contain all the object's vertices.

When adding a vertex, all shape keys will record it with the position in which it is created. Workflow-wise, adding and deleting vertices after creating shape keys is possible, but it is best to leave the creation of shape keys for when the mesh is finished or its topology is stable.

Adding Shape Keys

When adding a new shape key with the + button next to the list, the new shape will be a copy of the Basis shape, independently of the current result visible in the 3D Viewport.

When adding a new shape key from **Specials ▸ New Shape from Mix**, the shape will start of with the vertex configuration that is visible at that moment.
When doing facial animation with relative shape keys, it can be useful to first create a shape key with a complex extreme pose (e.g. anger or surprise), and then break this complex shape into components by applying a temporary vertex group to the complex shape and creating a copy with *New Shape from Mix*. This technique helps reducing conflicts between different shape keys that would otherwise produce a double effect.

Relative or Absolute Shape Keys

A mesh (curve, surface or lattice) has a stack of shape keys. The stack may be of *Relative* or *Absolute* type.

Relative

Mainly used for muscles, limb joints, and facial animation.

Each shape is defined relative to the Basis or to another specified shape key.

The resulting effect visible in the 3D Viewport, also called *Mix*, is the cumulative effect of each shape with its current value. Starting with the Basis shape, the result is obtained by **adding** each shape's weighted **relative** offset to its reference key.

Value

Represents the weight of the blend between a shape key and its reference key.

A value of 0.0 denotes 100% influence of the reference key and 1.0 of the shape key. Blender can extrapolate the blend between the two shapes above 1.0 and below 0.0.

Basis

Basis is the name given to the first (top-most) key in the stack.

The Basis shape represents the state of the object's vertices in their original position. It has no weight value and it is not keyable. This is the default *Reference Key* when creating other shapes.

Absolute

Mainly used to deform the objects into different shapes over time.

Each shape defines how the object's shape will be at *Evaluation Time* specified in its *Value*.

The resulting shape, or *Mix*, is the interpolation of the previous and next shape given the current *Evaluation Time*.

Value

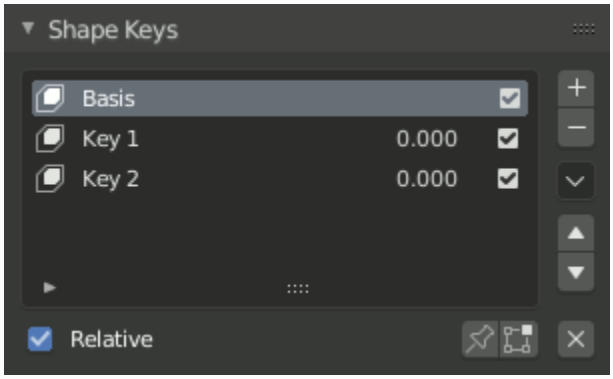
Represents the *Evaluation Time* at which that shape key will be active.

Basis

Basis is the name given to the first (topmost) key in the stack.

The Basis shape represents the state of the object's vertices in their original position.

Shape Keys Panel



Shape Keys panel.

The Shape Keys panel is used for authoring shape keys.

Active Shape Key Index

A List View.

Value/Frame (number)

In Relative mode: Value is the current influence of the shape key used for blending between the shape (value=1.0) and its reference key (value=0.0). The reference key is usually the Basis shape. The weight of the blend can be extrapolated above 1.0 and below 0.0.

In Absolute mode: Value is the *Evaluation Time* at which the shape will have maximum influence.

Mute (check mark)

If unchecked, the shape key will not be taken into consideration when mixing the shape key stack into the result visible in the 3D Viewport.

Shape Key Specials

New Shape from Mix

Add a new shape key with the current deformed shape of the object. This differs from the + button of the list, as that one always copies the Basis shape independently of the current mix.

Mirror Shape Key

If your mesh is symmetrical, in *Object Mode*, you can mirror the shape keys on the X axis. This will not work unless the mesh vertices are perfectly symmetrical. Use the **Mesh ▸ Symmetrize** tool in *Edit Mode*.

Mirror Shape Key (Topology)

Same as *Mirror Shape Key* though it detects the mirrored vertices based on the topology of the mesh. The mesh vertices do not have to be perfectly symmetrical for this action to work.

Join as Shapes (Transfer Mix)

Transfer the current resulting shape from a different object.

Select the object to copy, then the object to copy into. Use this action and a new shape key will be added to the active object with the current mix of the first object.

Transfer Shape Key

Transfer the active shape key from a different object regardless of its current influence.

Select the object to copy, then the object to copy into. Use this action and a new shape key will be added to the active object with the active shape of the first object.

Delete All Shape Keys

Removes all Shape Keys and any effect that they had on the mesh.

Apply All Shape Keys

Saves the current visible shape to the mesh data and deletes all Shape Keys.

Relative

Set the shape keys to *Relative* or *Absolute*. See Relative or Absolute Shape Keys.

Shape Key Lock (pin icon)

Show the active shape in the 3D Viewport without blending. *Shape Key Lock* gets automatically enabled while the object is in *Edit Mode*.

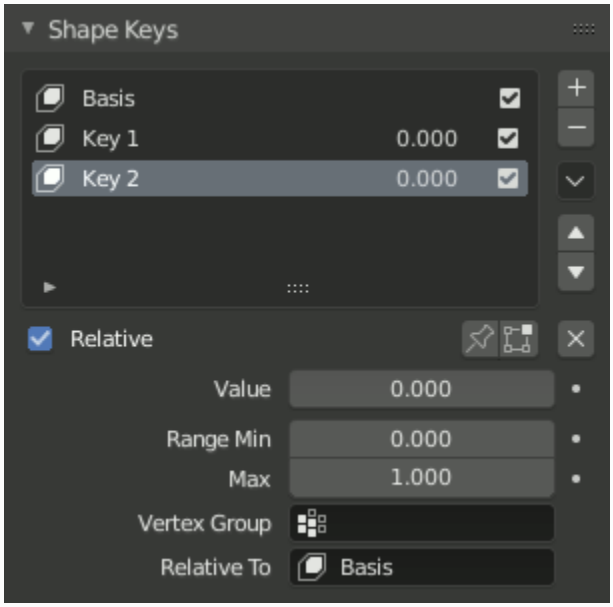
Shape Key Edit Mode (edit mode icon)

If enabled, when entering *Edit Mode* the active shape key will **not** take maximum influence as is default. Instead, the current blend of shape keys will be visible and can be edited from that state.

Add Rest Position

Creates an Attribute in the vertex domain called `rest_position` which is a copy of the `position` attribute before shape keys and modifiers are evaluated. Only mesh objects support this option.

Relative Shape Keys



Relative Shape Keys options.

With relative shape keys, the value shown for each shape in the list represents the current weight or influence of that shape in the current *Mix*.

Clear Shape Keys x

Set all influence values, or weights, to zero. Useful to quickly guarantee that the result shown in the 3D Viewport is not affected by shapes.

Value

The weight of the blend between the shape key and its reference key (usually the Basis shape).

A value of 0.0 denotes 100% influence of the reference key and 1.0 of the shape key.

Range

Minimum and maximum range for the influence value of the active shape key. Blender can extrapolate results when the *Value* goes lower than 0.0 or above 1.0.

Vertex Group

Limit the active shape key deformation to a vertex group. Useful to break down a complex shape into components by assigning temporary vertex groups to the complex shape and copying the result into new simpler shapes.

Relative To

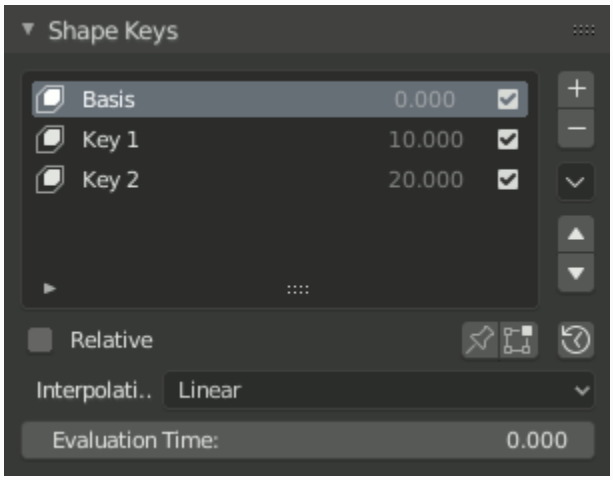
Select the shape key to deform from. This is called the *Reference Key* for that shape.

Note

Rather than storing offsets directly, internally relative keys are stored as snapshots of the mesh shape. The relative deformation offsets are computed by subtracting *Reference Key* from that snapshot.

Therefore, replacing the *Reference Key* has the effect of subtracting the difference between the new and old reference from the relative deformation of the current key.

Absolute Shape Keys



Absolute Shape Keys options.

With absolute shape keys, the value shown for each shape in the list represents the *Evaluation Time* at which that shape key will be active.

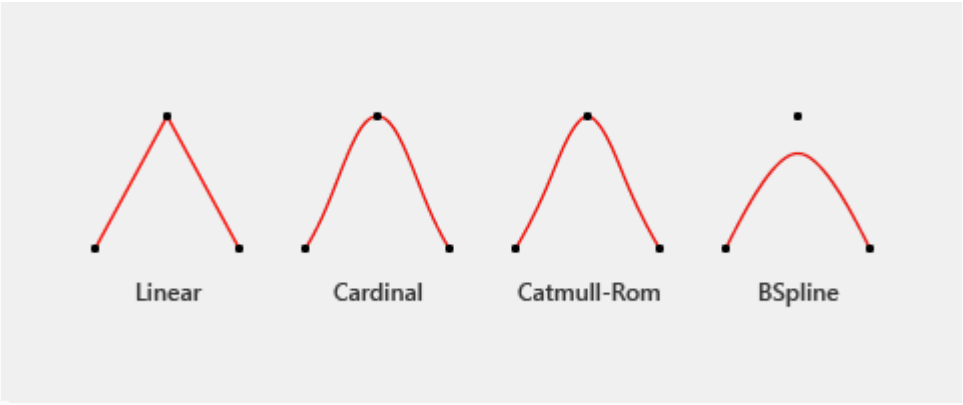
Re-Time Shape Keys (clock icon)

Absolute shape keys are timed, by order in the list, at a constant interval. This button resets the timing for the keys. Useful if keys were removed or re-ordered.

Interpolation

Controls the interpolation between shape keys.

Linear, Cardinal, Catmull-Rom, B-Spline



Different types of interpolation.

The red line represents interpolated values between keys (black dots).

Evaluation Time

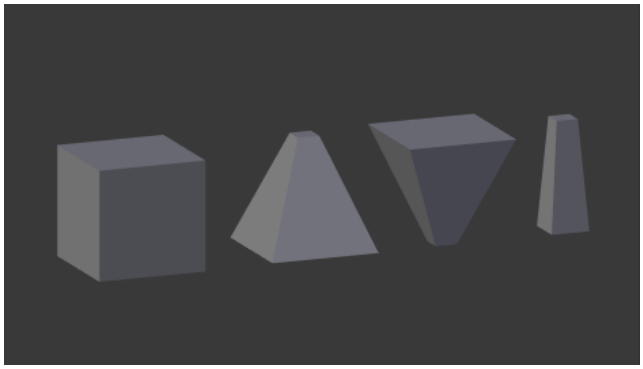
Controls the shape key influence. Scrub to see the effect of the current configuration. Typically, this property is keyed for animation or rigged with a driver.

Workflow

Relative Shape Keys

1. In *Object Mode*, add a new shape key via the *Shape Key* panel with the `+` button.
2. "Basis" is the rest shape. "Key 1", "Key 2", etc. will be the new shapes.
3. Switch to *Edit Mode*, select "Key 1" in the *Shape Key* panel.
4. Deform mesh as you want (do not remove or add vertices).
5. Select "Key 2", the mesh will be changed to the rest shape.
6. Transform "Key 2" and keep going for other shape keys.
7. Switch back to *Object Mode*.
8. Set the *Value* for "Key 1", "Key 2", etc. to see the transformation between the shape keys.

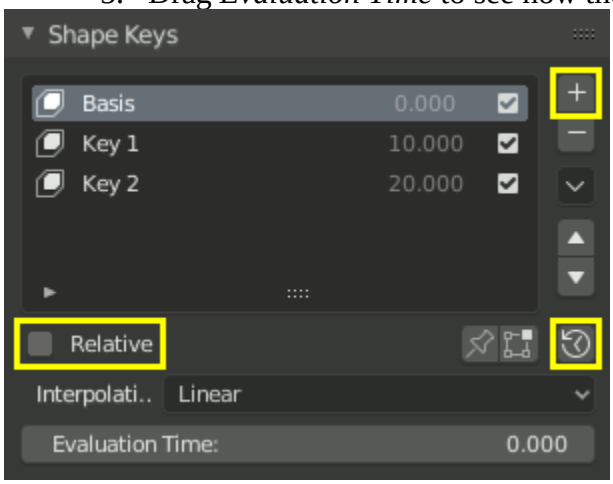
In the figure below, from left to right shows: "Basis", "Key 1", "Key 2" and mix ("Key 1" `1.0` and "Key 2" `0.8`) shape keys in Object Mode.



Relative shape keys example.

Absolute Shape Keys

1. Add sequence of shape keys as described above for relative shape keys.
2. Uncheck the *Relative* checkbox.
3. Click the *Reset Timing* button.
4. Switch to *Object Mode*.
5. Drag *Evaluation Time* to see how the shapes succeed one to the next.



Absolute shape keys workflow.

By adding a driver or setting keyframes to *Evaluation Time* you can create an animation.

MOTION PATHS

Motion Paths in Visual Effects: A Deep Dive

Motion paths are a fundamental tool in visual effects (VFX) for animating objects along predefined paths. They offer precise control over movement, enabling realistic and visually appealing animations. Let's explore the details, subtopics, and principles:

What are Motion Paths?

Defined as a sequence of interconnected points that guide an object's movement in animation software.These points can create straight lines, curves, or complex shapes, offering flexibility inmovement design.
Objects "follow" the path, animating their position frame-by-frame according to set timings.

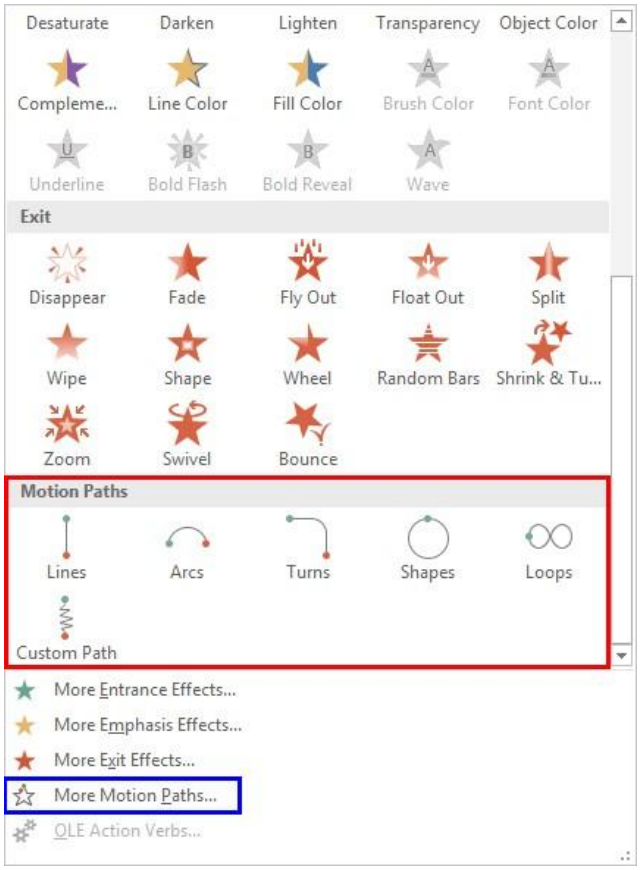
Types of Motion Paths:

i. Predefined: Software provides sets of built-in paths, like circles, spirals, or loops.

ii. Custom: Users draw their own paths using Bézier curves for complete control.

iii. Spline-based: Uses smooth, interconnected curves for organic movements.

iv.Motion capture: Records real-world movement and translates it into a path.



Keyframe Animation:

Motion paths work alongside keyframe animation, defining the object's location at specific frames. Interpolation fills the gaps between keyframes, animating the movement along the path.

Timing & Speed:

Control the animation speed by adjusting the time it takes for the object to travel the path.Use acceleration, deceleration, or ease-in/ease-out effects for natural-looking motion.

Rotation & Orientation:

i. Objects can rotate and adjust their orientation while following the path.

ii. This creates realistic 3D movement, like a car turning while traveling on a road.

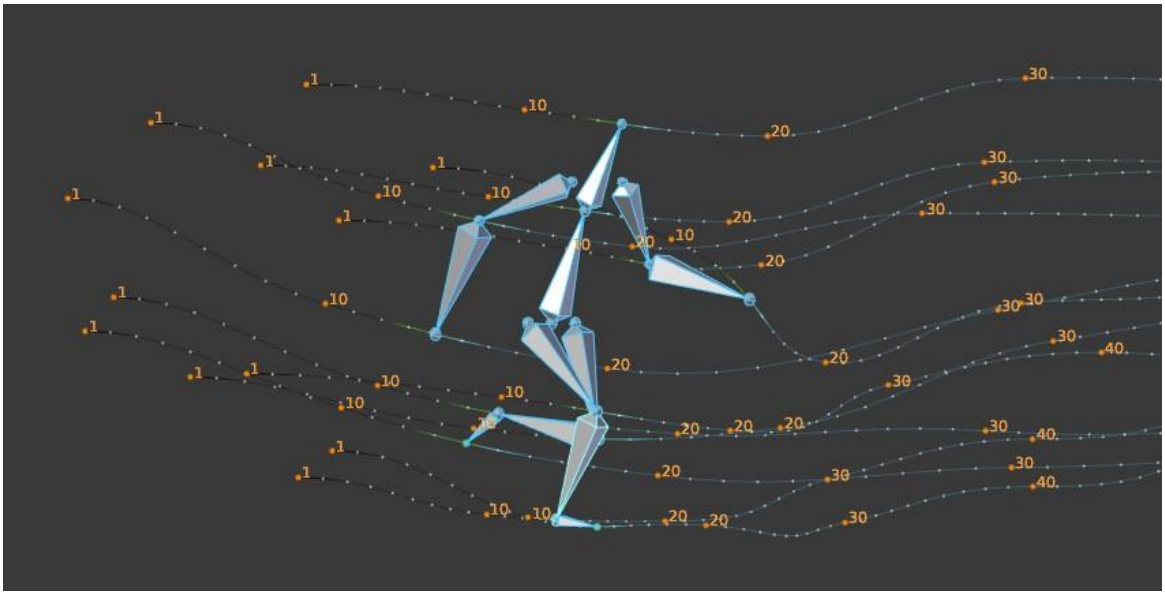
Additional Effects:

i. Combine motion paths with other animation techniques like scaling, opacity changes, or particle effects.
ii. This adds depth and complexity to your animations.

Software-Specific Features:

i. Different VFX software offers various tools and options for motion paths.

ii. Explore features like path editing, mirroring, looping, and path deformation.



Applications:

i. Motion paths are used in diverse VFX scenarios, including:

ii. Character animation (walking, running, jumping)

iii. Vehicle movement (cars, spaceships, planes)

iv.Projectile trajectories (weapons fire, magic effects)

v. Camera movements (tracking shots, pans, zooms)

vi.Abstract animations (geometric shapes, particle systems)

Principles for Effective Motion Paths:

Clarity & Purpose: Define the path's objective
(e.g., natural movement, stylized effect).

Anticipation & Follow-through: Use subtle movements before and after the path for realism.

Variation & Asymmetry: Avoid perfect symmetry for more natural dynamics.

Timing & Rhythm: Adjust speed and timing to match the object's mass, physics, and scene context.

Ease & Flow: Create smooth transitions between path segments for visually pleasing motion.

Online communities and forums offer valuable insights and discussions on motion paths.Experimentation and practice are key to mastering the art of creating effective motion paths!