



3D GIS

Sharing 3D Data and Scenes

This module explores creating visuals, animated visualizations, and videos for sharing geospatial data and 3D models. We'll cover still image composition principles, animation fundamentals, physics simulations, and video flythrough techniques.



Module Topics



1. Generating still images
2. Photographic composition
3. Principals of animation
4. Animation considerations
5. Parenting
6. Point of rotation
7. Rigging
8. Keyframing
9. Motion interpolation methods
10. Rendering animations
11. Physics simulation
12. Video fly-throughs
13. Post-production

These are the topics covered in this module.

Still Images

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Still images are a fundamental building block of animation and video. Every frame in a video is essentially a still image, so understanding principles of good still image composition directly applies to creating better animations. Strong compositional choices make individual frames more visually interesting and engaging.



Key Considerations



- ❖ Viewing extent
- ❖ Camera position/composition
- ❖ Lighting
- ❖ Use of color/shadow
- ❖ Aspect ratio
- ❖ Depth of field simulation

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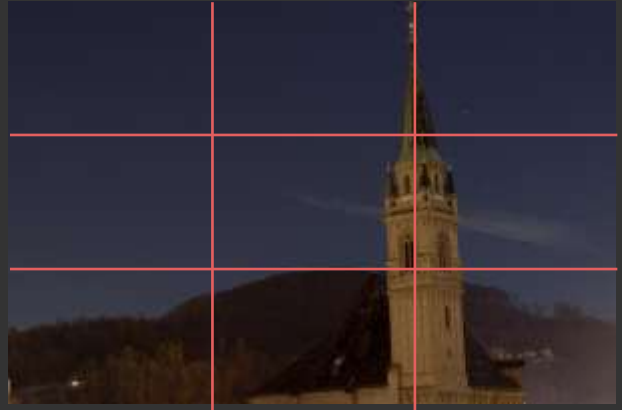
When creating still images, several key considerations impact the visual quality and effectiveness of your composition. The viewing extent determines what portion of the scene is visible. Camera position and composition affect how the viewer perceives the scene. Lighting is crucial for mood and visibility. The use of color and shadow guides viewer attention. Aspect ratio affects how the image is perceived. Depth of field simulation controls focus and emphasis.



Rule of Thirds



- ❖ Divide image into 9 equal parts by two equally spaced horizontal lines and two equally spaced vertical lines
- ❖ Important elements should be placed along these lines or their intersections.
- ❖ Creates more tension, energy, and interest in the composition than simply centering the subject.



The rule of thirds is a fundamental compositional technique. Divide the image into nine equal parts using two equally spaced horizontal lines and two equally spaced vertical lines. Important elements should be placed along these lines or at their intersections. This creates more tension, energy, and interest in composition than simply centering the subject.



Leading Lines



- ❖ Use natural or man-made lines in image to guide viewers attention
- ❖ Use line crossings
- ❖ Consider these lines in your composition



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Leading lines are natural or man-made lines in an image that guide the viewer's attention. Use natural lines like roads, rivers, or paths. Use man-made lines like fences, buildings, or power lines. Consider the intersections of these lines in your composition. Leading lines create visual flow and help direct viewer focus.



Framing



- ❖ Use windows, doorways, branches, or other structures
- ❖ Adds depth
- ❖ Isolates subject

Framing uses windows, doorways, branches, or other structures to create a frame within your image. Framing adds depth to compositions and isolates the subject from distracting background elements. This technique is particularly effective in landscape and architectural photography.



Symmetry and Patterns



- ❖ Create balance
- ❖ Rhythm and texture



Symmetry and patterns create balance and rhythm in your composition. Symmetrical compositions feel stable and formal. Repeating patterns create visual interest and rhythm. These techniques are particularly effective for organized landscapes or architectural elements.



Depth



- ❖ Create sense of depth
- ❖ Foreground anchors scene
- ❖ Midground carries the subject
- ❖ Background provides subject



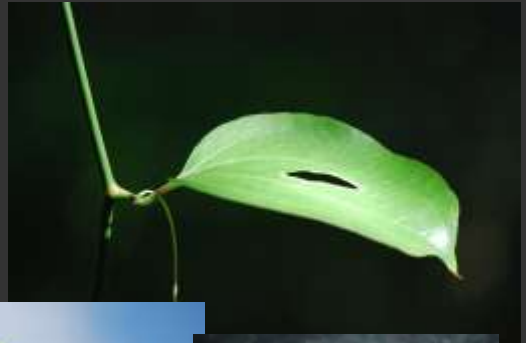
Creating a sense of depth makes images more visually interesting and three-dimensional. The foreground anchors the scene and provides context. The midground carries the main subject. The background provides additional context. Using all three zones creates layered, interesting compositions.



Negative Space



- ❖ Empty space around subject
- ❖ Clean and minimalist look



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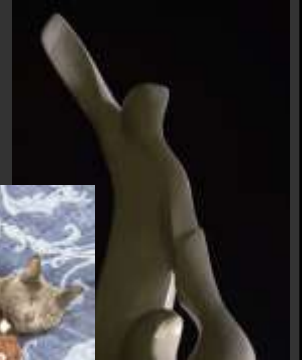
Negative space is the empty area around the subject. Using negative space creates a clean and minimalist look. Negative space gives the viewer's eye room to breathe and can emphasize the subject through contrast. Not every part of an image needs to be filled with content.



Fill Frame



- ❖ Remove distractions
- ❖ Highlight textures and detail
- ❖ Good for portraits



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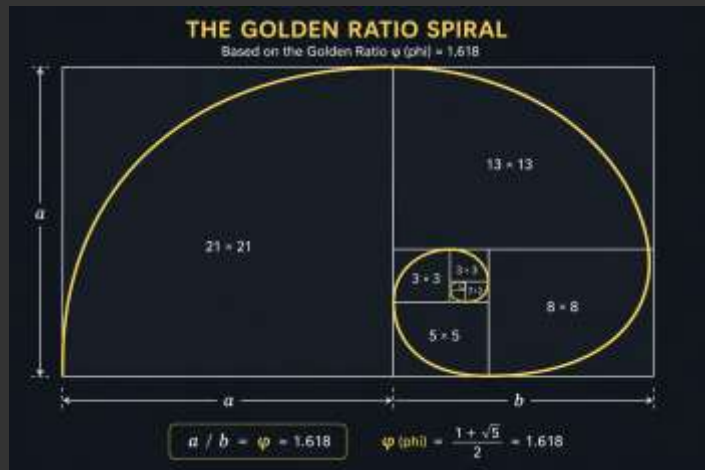
Fill frame means composing tightly so the subject takes up most of the image. This technique removes distractions, highlights textures and detail, and is particularly effective for portraits. Fill frame emphasizes the subject and eliminates competing visual elements.



Golden Ratio



- ❖ Guides eye through the image
- ❖ Seen often in classic art



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The golden ratio is a mathematical proportion found throughout nature and classical art. Composing with this pattern in mind can guide the eye through the image. Using the golden ratio in composition creates visually pleasing and balanced images. This principle is seen often in classic art and professional photography.



Focus and Depth of Field



- ❖ Sense of depth
- ❖ Isolate subject
- ❖ Remove distraction



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Focus and depth of field are powerful compositional tools. A shallow depth of field creates a sense of depth by keeping the subject sharp while blurring the background. This isolates the subject and removes distraction. Deep depth of field keeps more of the scene in focus, which is useful for landscape photography.



Breaking the Rules



You should learn to use the rules before you break them!

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You should learn and understand compositional rules before you break them. Once you understand why rules create effective compositions, you can deliberately break them to create specific effects or challenge viewer expectations. Rule-breaking is more effective when it's intentional.



Export



- ❖ Size and resolution
- ❖ Aspect ratio
- ❖ Color space
- ❖ Transparent background
- ❖ Compressed or uncompressed file format
- ❖ Rendering engine (if rendering from a 3D modeling software)



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When exporting images, several technical considerations affect the final result. Image size and resolution determine detail and display quality. Aspect ratio affects composition and display format. Color space affects color accuracy and compatibility. Transparent backgrounds are important for compositing and overlays. Compression affects file size and quality. The rendering engine choice can affect quality and appearance.



RAW Format



- ❖ Unprocessed sensor data
- ❖ Digital negative
- ❖ High bit depth
- ❖ Wide dynamic range
- ❖ Metadata
- ❖ Lot of control/flexibility when editing

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RAW format captures unprocessed sensor data, also called a digital negative. RAW files have high bit depth, capturing more tonal information than compressed formats. They contain wide dynamic range, preserving detail in both shadows and highlights. RAW files include metadata and provide significant control and flexibility when editing.



Photo Editing



- ❖ Resample
- ❖ Resize
- ❖ Blur or sharpen
- ❖ Crop
- ❖ Color adjustment
 - Hue
 - Saturation
 - Contrast
 - Darken/Brighten
- ❖ Effects
- ❖ Combine with other images



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Photo editing involves many techniques for improving and adjusting images. Resample and resize change image dimensions. Blur or sharpen adjust focus appearance. Crop removes unwanted portions. Color adjustments modify hue, saturation, and contrast. You can darken or brighten images. Effects add special visual elements. Compositing combines multiple images.



Photo Editing Software Examples



- ❖ Adobe Photoshop
- ❖ Adobe Lightroom
- ❖ GIMP
- ❖ Darktable
- ❖ Capture One
- ❖ Snapseed
- ❖ Canva

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Many photo editing software options are available. Adobe Photoshop is the industry standard. Adobe Lightroom is focused on photo organization and adjustment. GIMP is free and open-source. Darktable is open-source and RAW-focused. Capture One is professional-grade. Snapseed is mobile-focused. Canva is user-friendly for simple edits.



- ❖ GNU Manipulation Program
- ❖ Free and open-source
- ❖ GNU General Public License (GPL)
- ❖ Developed by Spencer Kimball and Peter Mattis as semester project at University of California, Berkley
- ❖ Released in 1998
- ❖ Written in C, C++, Python, and Scheme



<https://www.gimp.org/>



GIMP stands for GNU Image Manipulation Program. It's free and open-source under the GPL license. GIMP was developed by Spencer Kimball and Peter Mattis as a semester project at UC Berkeley. It was released in 1998 and is written in C, C++, Python, and Scheme. GIMP provides powerful image editing capabilities.

Animation

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Animation brings movement to 3D scenes and characters. Understanding animation principles helps you create motion that feels natural, intentional, and compelling. Animation can tell stories, convey information, and engage viewers through motion.

We begin this section with a discussion of general animation principles then discuss how animation is implemented in Blender. Not that this is pretty introductory; we do not cover more advanced animation techniques.



Principals of Animation



1. **Squash and stretch**: objects deform as they move, collide, and change speed
2. **Anticipation**: an action is usually preceded by a smaller preparatory action
3. **Staging**: important action should be clear to the viewer
4. **Straight ahead action and pose-to-pose**: Straight-ahead action means animating frame by frame from beginning to end. It can feel spontaneous and fluid, but it is harder to control. Pose-to-pose means planning major poses first, then filling in the in-between motion. It gives more control and is common in character animation.

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Fundamental principles of animation include squash and stretch, where objects deform as they move and collide. Anticipation means an action is usually preceded by a smaller preparatory action. Staging ensures important actions are clear to the viewer. Straight ahead action means animating frame-by-frame from beginning-to-end, creating spontaneous and fluid motion but requiring more control. Pose-to-pose means planning major poses first and filling in in-between motion.



Principals of Animation



5. **Follow-Through and Overlapping Action:** Parts of an object or character do not all stop at the same time.
6. **Slow in and slow out:** Most motion does not start or stop instantly.
7. **Arcs:** Natural motion often follows curved paths rather than straight lines.
8. **Secondary Action:** A smaller action supports the main action.

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Follow-through and overlapping action means parts of an object or character do not all stop at the same time. Slow in and slow out means most motion does not start or stop instantly. Arcs means natural motion often follows curved paths rather than straight lines. Secondary action means smaller actions support the main action.



Principals of Animation



9. **Timing**: how long an action takes
 10. **Exaggeration**: Animation often needs to push motion, poses, and expressions beyond realism
 11. **Solid drawing/solid posing**: In 2D, this originally meant understanding form, anatomy, volume, and perspective. In 3D, the equivalent is strong posing.
 12. **Appeal**: the design, pose, motion, or performance is visually engaging.
- Characters and objects should feel balanced, readable, and three-dimensional. A good pose should work clearly even as a silhouette.

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Additional animation principles include timing or controlling how long an action takes. Exaggeration pushes motion and expressions beyond realism. Solid posing means strong, balanced, readable poses that work even as silhouettes. Appeal means the design, pose, and motion are visually engaging.



Other Considerations



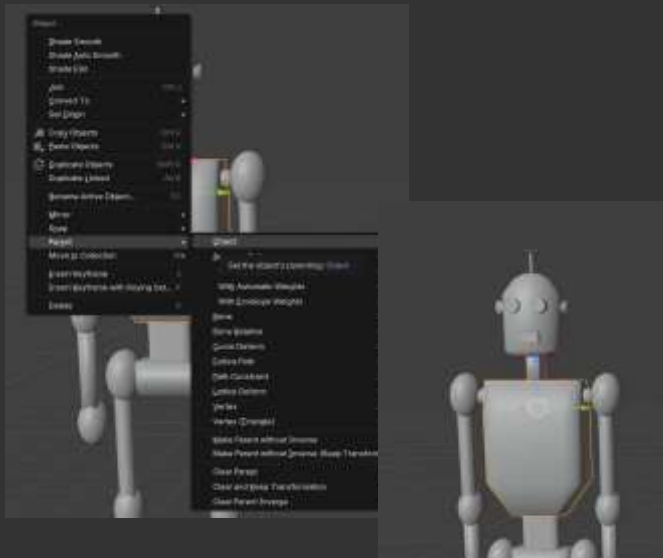
1. **Weight:** Motion should suggest mass and gravity
2. **Spacing:** The distance between positions affects perceived speed
3. **Silhouette:** The pose should be readable from its outline
4. **Contrast:** Mix fast/slow, still/moving, large/small actions
5. **Rhythm:** Motion should have a pleasing pattern or beat
6. **Clarity:** The audience should understand the action immediately
7. **Motivation:** Movement should feel caused by something
8. **Continuity:** Motion should flow logically between poses

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Other important considerations include weight, suggesting mass and gravity. Spacing relates to how distance between positions affects perceived speed. Silhouette indicates that poses are readable from their outline. Contrast relates to perceived differences between fast/slow, still/moving, and large/small actions. Rhythm creates a pleasing pattern or beat. Clarity means making actions immediately understandable. Motivation means making movement feel caused by something. Continuity implies letting motion flow logically.



Parenting



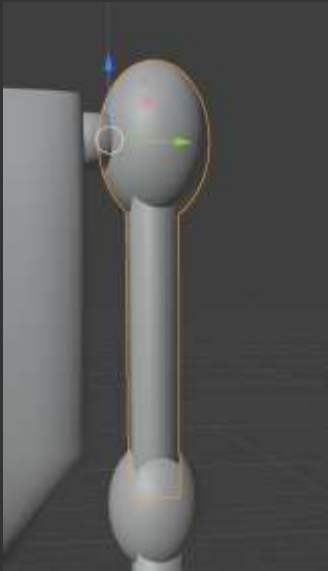
- ❖ Controls how objects move relative to other objects
- ❖ Object built out as a series of related components
- ❖ Last selected object is **parent**
- ❖ All prior selected objects are **children**
- ❖ Generally, start with **center of gravity** (hips)

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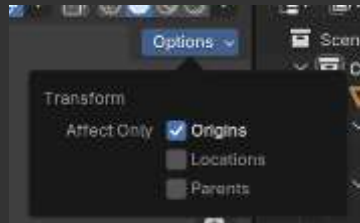
Parenting controls how objects move relative to other objects. Objects are built as a series of related components. The last selected object becomes the parent. All prior selected objects become children. Generally, start with the center of gravity, like hips in a character.



Point of Rotation



❖ Change **origin** to define the **point of rotation** of **child** relative to **parent**



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Change the origin to define the point of rotation of a child relative to its parent. This controls where rotation happens and is crucial for natural-looking character animation.



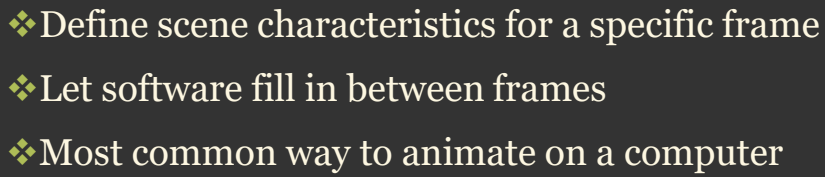
Rigging



❖ Object can be animated once **parent-child** relationships and **origins** are defined

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Objects can be animated once parent-child relationships and origins are defined. The rigging structure is now ready for animation.



Keyframing is the most common way to animate on a computer. This consists of defining scene characteristics for specific frames and letting the software fill in between frames. This provides control while reducing manual work.



What can be animated



Objects

- Location (x, y, z)
- Rotation (x, y, z)
- Scale (x, y, z)
- Material properties

Camera

- Location (x, y, z)
- Rotation (x, y, z)
- Focal Length

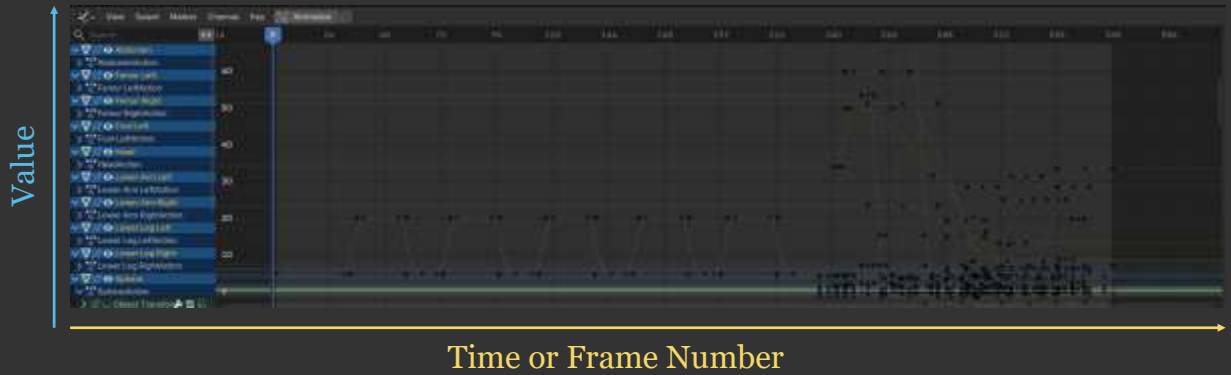
- Aperture
- Depth of Field

Lights

- Location (x, y, z)
- Rotation (x, y, z)
- Power
- Exposure



Many properties can be animated in Blender. For objects, you can animate location, rotation, and scale along the X, Y, Z axes, plus material properties. For cameras, you can animate location, rotation, focal length, aperture, and depth of field. For lights, you can animate location, rotation, power, and exposure.



The Graph Editor in Blender shows the relationship between time or frame number and property values. This allows fine control over how properties change over time and is crucial for professional animation.



Interpolation Methods



❖ Define how motion between the keyframes is implemented

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Interpolation methods define how motion between keyframes is implemented. Different interpolation methods create different motion qualities and feel.



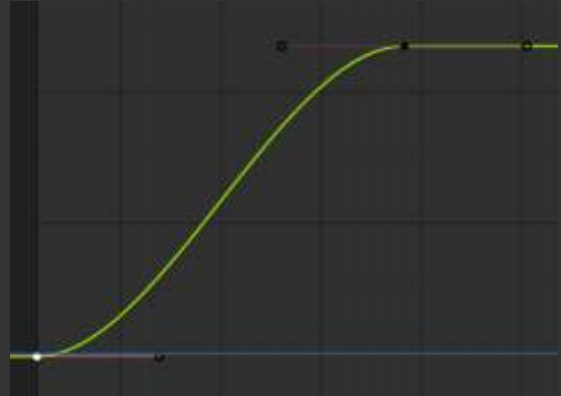
Interpolation Methods: Bézier



❖ Bézier

❖ **Handles** help shape the curve

- Automatic
- Automatic Clamp
- Free
- Aligned
- Vector



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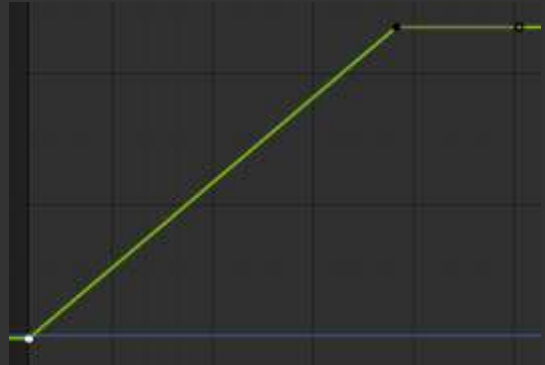
Bézier interpolation uses handles to shape the curve between keyframes. Different handle types control the curve shape. Automatic handles are calculated automatically. Free handles can move independently. Aligned handles maintain smooth curves. Vector handles create sharp transitions.



Interpolation Methods: Linear



❖ Linear



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Linear interpolation creates constant-speed motion in straight lines. Linear interpolation is useful for mechanical motion but can feel unnatural for organic motion.



Interpolation Methods: Constant



❖ Constant

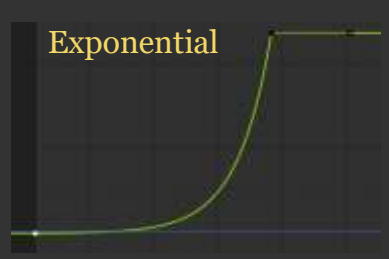
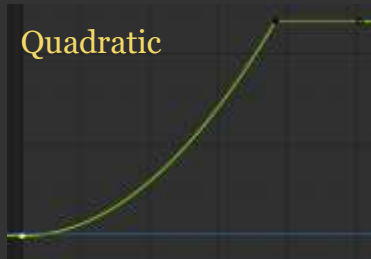
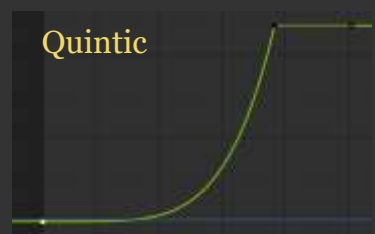
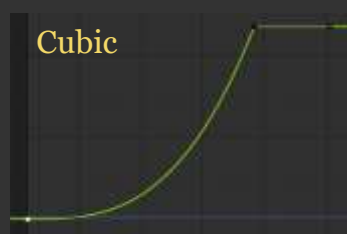


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Constant interpolation jumps instantly between keyframe values with no in-between motion. This is useful for toggling properties on-and-off rather than smooth transitions.



Other Methods

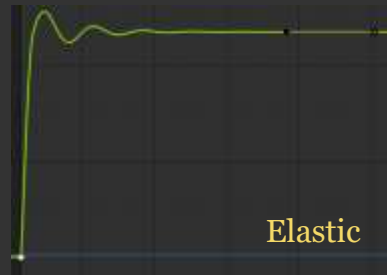
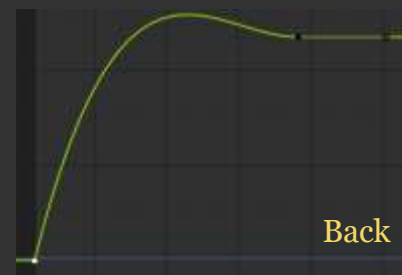
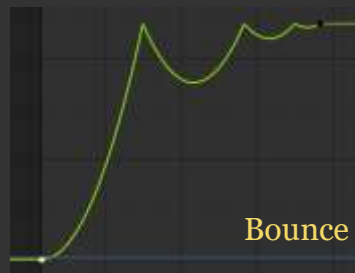


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Other interpolation methods include Quartic, Quadratic, and Cubic for polynomial curves. Sinusoidal creates wave-like motion. Quintic provides smooth acceleration. Exponential creates accelerating curves.



Other Methods



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Additional interpolation methods include Elastic for bouncy motion, Back for motion that goes backward before moving forward, Bounce for bouncing effects, and Circular for circular motion patterns.



Auto Keying



- ❖ Allow software to add **keyframes** when a property changes



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Auto keying in Blender automatically adds keyframes when properties change. This can speed up animation workflow by automatically recording changes without manually inserting keyframes.



Render Animation



- ❖ Render each frame to an image
- ❖ Merge images into a video using the Video Editing functions in blender
- ❖ Save to a video file

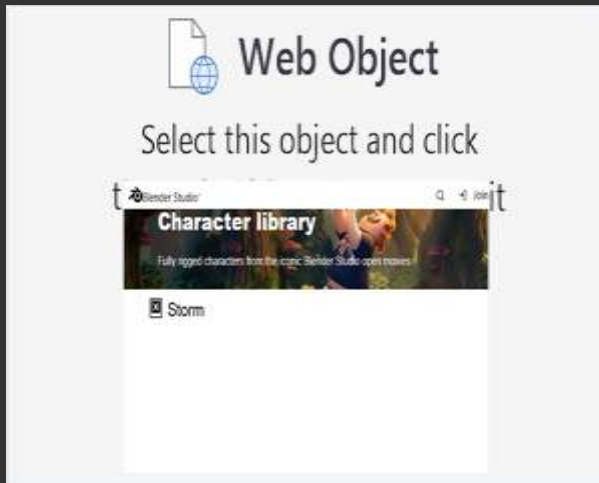


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To render animations in Blender, render each frame to an image then merge images into a video using video editing functions. Lastly, save to a video file.



Rigged Characters: Blender



<https://studio.blender.org/characters/>

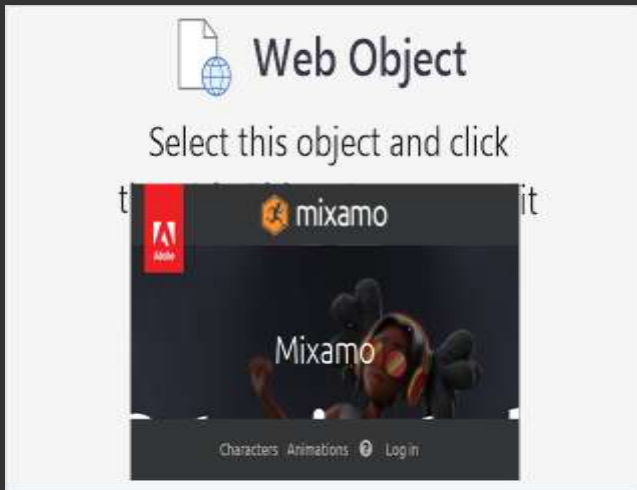
<https://studio.blender.org/characters/huginn/v2/>

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Blender provides rigged character models that are ready for animation. The Blender Studio website offers free rigged characters.



Rigged Characters: Mixamo



<https://www.mixamo.com/#/>

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Mixamo provides free and commercial rigged character models that can be used in animations. Mixamo characters come rigged and ready for animation.



Physics Simulation



- ❖ **Force Field**: invisible influences that push, pull, swirl, or otherwise affect simulated objects (wind, vortex, turbulence, magnetic, harmonic, drag)
- ❖ **Collision**: lets an object act as an obstacle for other simulations (character body for clothes, floor, wall, rock)
- ❖ **Cloth**: thin, flexible surfaces such as fabric, paper, flags, curtains, sails, blankets, or thin plastic sheets.
- ❖ **Dynamic Paint**: lets one object “paint” effects onto another through contact or proximity
- ❖ **Soft Body**: lets one object “paint” effects onto another through contact or proximity
- ❖ **Fluid**: liquids, smoke, fire, and gases
- ❖ **Rigid Body**: solid objects that move, fall, collide, bounce, roll, and slide without deforming
- ❖ **Rigid Body Constraint**: connect rigid bodies together, like joints (fixed, hinge, slider, piston, generic, motor, spring)

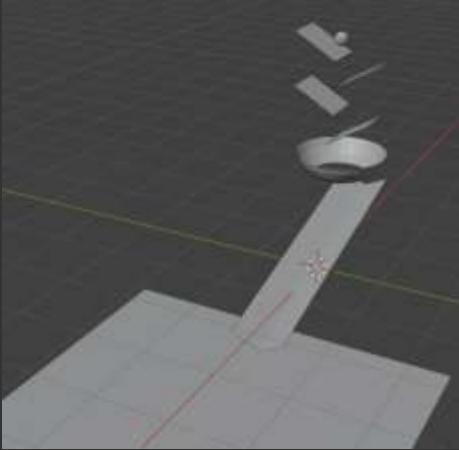
	Force Field		Soft Body
	Collision		Fluid
	Cloth		Rigid Body
	Dynamic Paint		Rigid Body Constraint

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Physics simulation capabilities include force fields that push, pull, swirl, or otherwise affect objects like wind and vortex. Collision lets objects act as obstacles. Cloth simulates fabric and flexible surfaces. Dynamic Paint lets objects paint effects onto others. Soft Body deforms and bounces. Fluid simulates liquids, smoke, fire, and gases. Rigid Body simulates solid objects. Rigid Body Constraints connect objects with joints.



Gravity



- ❖ Sphere = rigid body (active)
- ❖ All other features = rigid body (passive)

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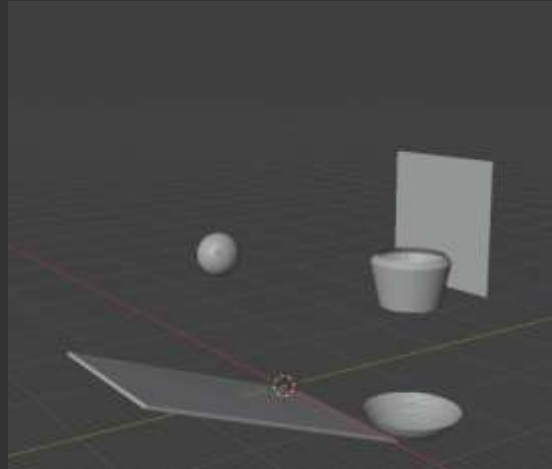
Gravity simulation pulls objects down realistically. Rigid body objects fall and collide with passive objects, demonstrating realistic gravity effects.



Gravity with Bounce



- ❖ Increase bounce
- ❖ Reduce friction



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Gravity with bounce adds bounciness to rigid body physics. Increase bounce for more lively motion. Reduce friction for more sliding.

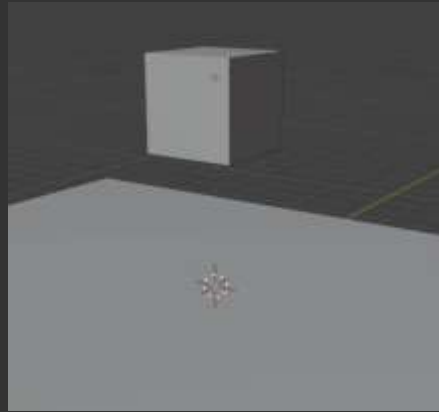


Soft Body Simulation



❖ Can control the amount of:

- Bounce
- Deformation



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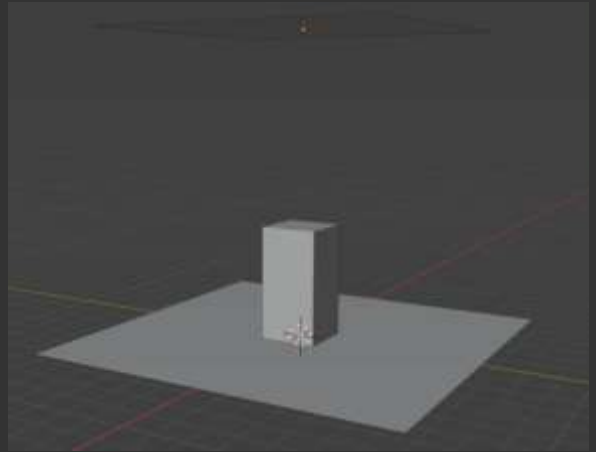
Soft body simulation controls deformation and bounce. You can control the amount of deformation to create objects that compress and deform realistically.



Cloth Simulation



- ❖ Top plane = cloth
- ❖ Bottom plane and cube = collision

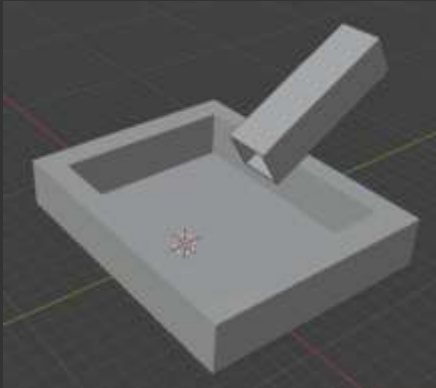


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Cloth simulation creates realistic fabric movement. A top plane acts as cloth while lower objects act as collision objects creating wrinkles and folds.



Fluid Simulation



- ❖ Domain = bounds over which to simulate fluid
- ❖ Source/flow = where flow originates
- ❖ Effector = objects that interact with the fluid

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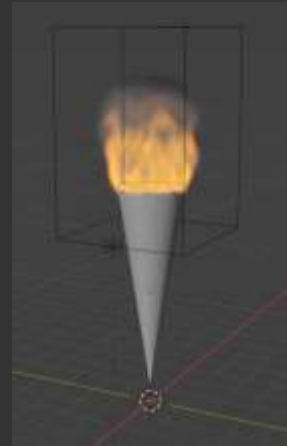
Fluid simulation includes a domain that bounds the simulation area. A source or flow defines where fluid originates. Effectors are objects that interact with the fluid.



Fire and Smoke Simulation



- ❖ Similar to other fluids
- ❖ Most define a domain
- ❖ Most define a source or inflow object
- ❖ Can simulate smoke, fire, or smoke+fire
- ❖ Can include obstacles as passive ridged bodies

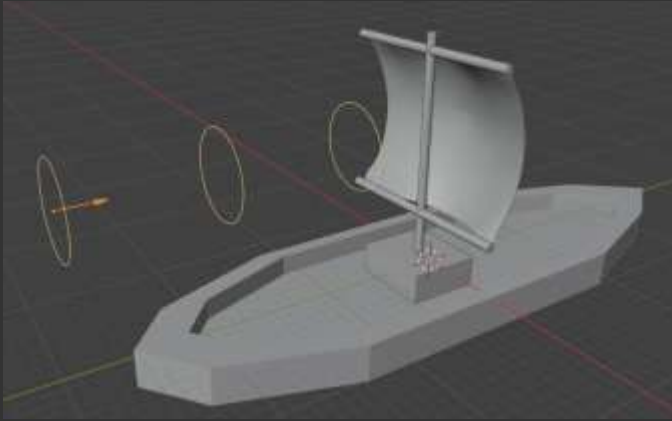


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Fire and smoke simulation is similar to other fluid simulations. You most define a domain and source or inflow. You can simulate smoke, fire, or smoke and fire together. You can include obstacles as passive rigid bodies.



Wind Simulation



- ❖ Sail = cloth
- ❖ Force Field = wind
- ❖ Other objects = rigid body (passive)
- ❖ Vertex group used to pin flag corners

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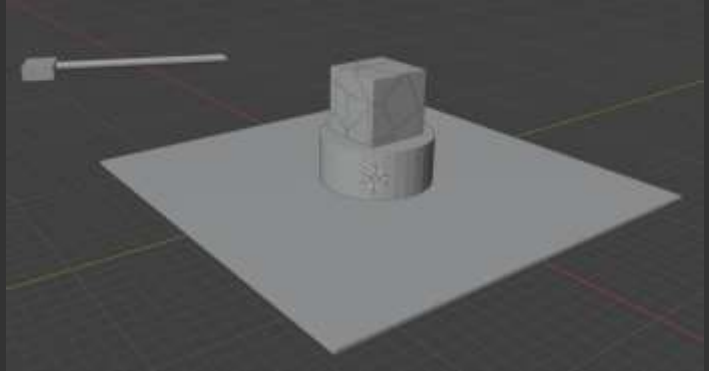
Wind simulation combines cloth with force fields. In the example, a sail cloth is affected by a wind force field while other objects act as passive rigid bodies. Vertex groups can be used to pin corners.



Shatter Simulation



❖ Use Cell Fracture Add-On

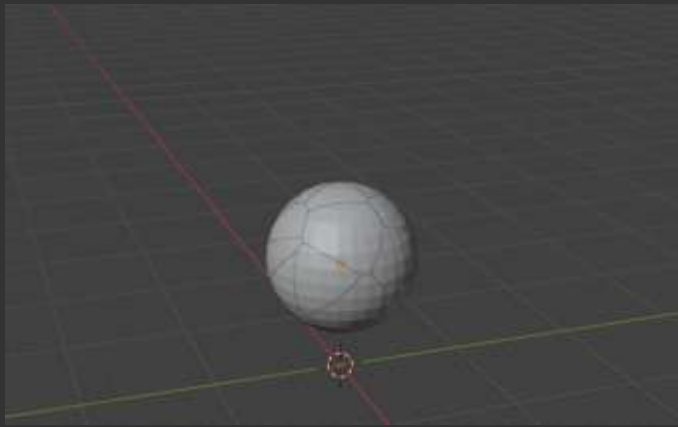


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Shatter simulation uses the Cell Fracture add-on to break objects into fragments.



Explosion Simulation



- ❖ Use Cell Fracture Add-On
- ❖ Use Force Field from inside the object

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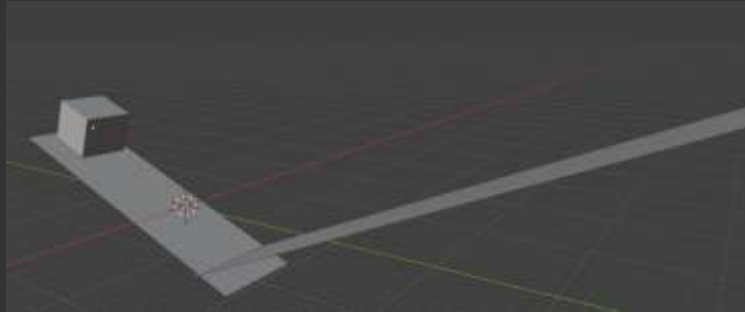
Explosion simulation uses the Cell Fracture add-on to break objects and a force field from inside the object to push fragments outward.



Magnet Simulation



- ❖ Use force field
- ❖ Negative strength = attraction
- ❖ Positive strength = repulsion



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Magnet simulation uses force fields with negative strength for attraction and positive strength for repulsion. This creates magnetic attraction and repulsion effects.

Videos Fly-throughs

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Video flythroughs are animated sequences through a map or 3D scene. Flythroughs create compelling visualizations by moving the viewer through space.

Here, we focus on creating video flythroughs using ArcGIS Pro.



Video Fly-Through



- ❖ Similar to animation
- ❖ Primarily **keyframing** the camera

<https://pro.arcgis.com/en/pro-app/latest/help/mapping/animation/overview-of-animation.htm>

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Video flythroughs in geospatial visualization are similar to animation in general but primarily involve keyframing the camera rather than objects. This creates smooth navigation through data.



Types of Camera Animations



- ❖ **Fly-through** = Navigate through a map or scene smoothly as if you are following a route or path.
- ❖ **Tour** = Fixate on points of interest. Each destination typically has a Hold keyframe Hold Keyframe inserted to pause and observe it. Each transition typically uses the Hope type to emphasize zooming in to a location and zooming out to the next one.
- ❖ **Fly-around** = Rotate around a key position in the scene to visualize it from all directions. This mode is well-suited to showcase a single location or feature in great detail.
- ❖ **Fly-along** = Step along the vertices of a single linear feature as you follow the path. For best results, it is recommended that the linear feature be simplified and flow in one direction.

<https://pro.arcgis.com/en/pro-app/latest/help/mapping/animation/animate-the-camera.htm>

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Several types of camera animations exist. Fly-through navigates smoothly as if following a route. Tour fixates on points of interest with hold keyframes to pause. Fly-around rotates around a key position to visualize from all directions. Fly-along steps along linear features following a path.



Creating Video Fly-Through in ArcGIS Pro



1. Create a **Local** or **Global Scene**
2. Go to **View Tab**
3. Select **Add** from the **Animation** section
4. New **Animation Tab** will load



55

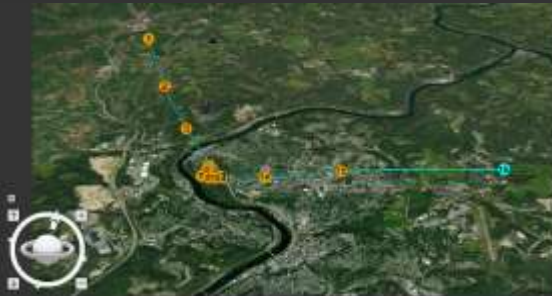
To create video flythroughs in ArcGIS Pro, create a local or global scene. Go to the View Tab and select Add from the Animation section. A new Animation Tab will load where you can set up your animation.



Flight Path



- ❖ Add **keyframes** to control motion
- ❖ **Keyframes** can be added, deleted, updated, and edited



56

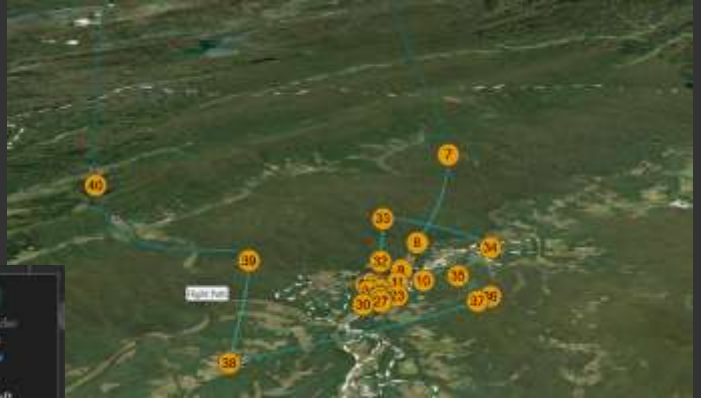
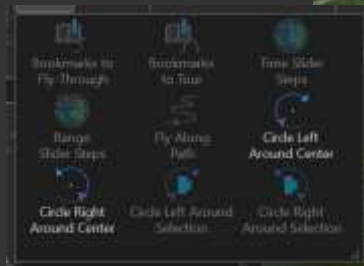
Add keyframes to control motion. Keyframes can be added, deleted, updated, and edited. The flight path shows the path between keyframes.



Import Key Frames



- ❖ From Bookmarks
- ❖ From Time Slider Steps
- ❖ Circle around objects/selections



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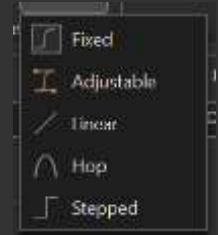
Import keyframes from bookmarks, time slider steps, or by circling around objects or selections. This provides quick ways to set up keyframes.



Interpolation between Keyframes



Fixed	Create a path with smooth, tightly controlled turns between keyframes. This is the default type for camera navigation.
Adjustable	Create a configurable curved path between two keyframes. This method uses a Bezier curve with adjustable control points.
Linear	Create a straight path between keyframes. This is the default type for layer transparency, time, and range properties.
Hop	Create a path with configurable bounces between keyframes.
Stepped	Create a path that cuts between keyframes. This is the default type for time or range properties that are



<https://pro.arcgis.com/en/pro-app/latest/help/mapping/animation/essential-terminology-list-for-animation.htm>

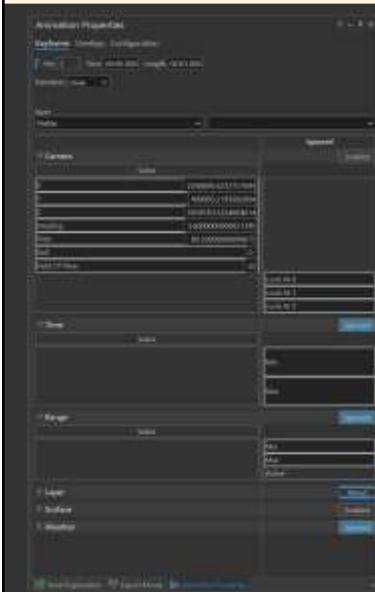
<https://pro.arcgis.com/en/pro-app/latest/help/mapping/animation/animation-transitions.htm>

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Interpolation between keyframes affects the path and motion. Fixed creates smooth, tightly controlled turns. Adjustable creates configurable curved paths using Bézier curves. Linear creates straight paths. Hop creates bouncing paths. Stepped cuts between keyframes.



Properties at each Keyframe



❖ Can augment **camera** properties

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You can augment camera properties at each keyframe, controlling not just position but also camera settings like focal length and depth of field.



Overlays



- ❖ Text
- ❖ Images
- ❖ Logos

60

Overlays add text, images, and logos to your video. Overlays provide context and branding.



Export



- ❖ Often slow to render
- ❖ Best settings generally depend on use case
- ❖ Things to consider:
 - File type
 - Frame rate
 - Range of frames to render
 - Resolution
 - Quality

61

Animations often render slowly, and best settings depend on the use case. It is important to consider file type, frame rate, range of frames, resolution, and quality settings.

Post-Production

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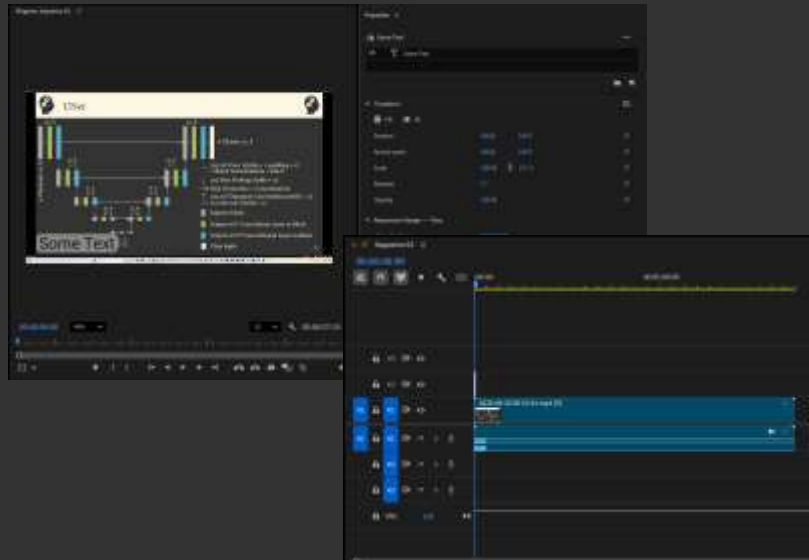
Post-production involves editing and enhancement after initial creation. This is where polish and professional quality are added to your animations or flythroughs.



Overlays



- ❖ Text
- ❖ Credits
- ❖ Logos
- ❖ Things to consider:
 - Position
 - Font
 - Size
 - Color
 - Background
 - Shadow
 - How long to display



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Overlays in post-production add text for credits and titles, logos for branding, and other graphics. It is important to consider position, font, size, color, background, shadow, and how long to display elements.



Video Editing Software



- ❖ Adobe Premier Pro
- ❖ Final Cut Pro
- ❖ Davinci Resolve
- ❖ Vegas Pro
- ❖ Filmora
- ❖ Capcut
- ❖ iMovie
- ❖ Kdenlive (open-source)
- ❖ Shotcut (open-source)
- ❖ OpenShot (open-source)
- ❖ Blender (open-source)

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Many video editing software options are available. Adobe Premiere Pro and Final Cut Pro are professional standards. DaVinci Resolve is powerful and offers a free version. Vegas Pro, Filmora, and CapCut are capable options. iMovie is simple but limited. Kdenlive, Shotcut, OpenShot, and Blender are open-source options.



- ❖ Not open-source but does offer a free version that is highly functional



DaVinci Resolve 21
Professional Editing, Color, Effects and Audio Post!

DaVinci Resolve is the world's only solution that combines editing, color correction, visual effects, motion graphics, audio post production and now photo editing all in one software tool! Its elegant, modern interface is fast to learn and easy for new users, yet powerful for professionals. DaVinci Resolve lets you work faster, at a higher quality, because you don't have to learn multiple apps or switch software for different tasks. You can work with camera original quality images throughout the entire process. It's like having your own post production studio in a single app! Best of all, by learning DaVinci Resolve, you're learning how to use the same tools used by Hollywood professionals!

DaVinci Resolve
Free Download Now

DaVinci Resolve Studio
Buy Online Now \$295

<https://www.blackmagicdesign.com/products/davinciresolve>

DaVinci Resolve is not open-source but offers a free version that is highly functional for video editing and color grading. It provides professional capabilities without cost.



Color Grading



- ❖ Manipulate image to obtain the desired look and tune
 - Color balance
 - Contrast and exposure
 - Saturation levels
 - Highlight and shadow detail
- ❖ Works best with RAW sensor data



66

Color grading manipulates images to obtain the desired look and tone. Color balance adjusts hue. Contrast and exposure control brightness range. Saturation levels control color intensity. Highlight and shadow detail preserves information. Color grading works best with RAW sensor data.



Rendering



- ❖ File format
- ❖ Resolution (e.g., 720p, 1080p, 4k)
- ❖ Aspect ratio (e.g., 4:3, 16:9, 1.85:1, 2.35:1)
- ❖ Frame rate (e.g., 24, 25, 30, 60)

67

Rendering considerations include file format, which affects compatibility and quality. Resolution like 720p, 1080p, or 4K affects detail. Aspect ratio affects display format. Frame rate like 24, 25, 30, or 60 fps affects smoothness.



Audio



- ❖ Sound effects
- ❖ Voice over/narration
- ❖ Music



Audiences are generally more forgiving of video issues than audio issues.

68

Audio is a critical component of video. Sound effects provide context and realism. Voice over and narration convey information. Music sets mood and paces the video. Audiences are generally more forgiving of video issues than audio issues.



Thanks to watch out for



- ❖ Unwanted background noise
- ❖ Levels (generally want peaks around -12dB)
- ❖ Clipping
- ❖ Relative levels between track (mix)
- ❖ Plosives
- ❖ Usage rights



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Audio pitfalls to watch out for include unwanted background noise. Maintain proper levels, generally with peaks around -12dB. Avoid clipping where audio becomes distorted. Balance relative levels between tracks. Manage plosives or harsh consonants. Verify usage rights for audio.



Audio Editing Software



- ❖ Most video editing software can also edit audio
- ❖ Pro Tools
- ❖ Audacity
- ❖ Adobe Audition

70

Many video editing software programs can edit audio. Pro Tools is professional audio software. Audacity is free and open-source. Adobe Audition is part of the Adobe suite.



- ❖ Free and open-source
- ❖ GPL license
- ❖ Written in C and C++
- ❖ Initially released in 2000
- ❖ Developed by Dominic Mazzoni and Roger Dannenberg at Carnegie Mellon University
- ❖ Now maintained by Muse Group

<https://www.audacityteam.org/>



Audacity is free and open-source under the GPL license. It's written in C and C++. Audacity was initially released in 2000 by Dominic Mazzoni and Roger Dannenberg at Carnegie Mellon University. It's now maintained by Muse Group. Audacity provides powerful audio editing capabilities without cost.



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Thanks! Hope you found this useful.