



modo[®] 401 improvements

Animation

Channel Linking

- You can now create a Channel Link (relationship) between two channels of an item; one providing a value for the input, the other being the channel that will be modified.
- This relationship can be keyed, so you can change the relationship between the driver and driven channels as many times as needed.
- Channel values can be adjusted via a new heads up display.
- The relationship curve can also be edited in the Graph Editor.
- Links between float and integer numeric type channels are supported.
- You can now add new, user defined channels to any item and individual channels can also be locked.
- Channel values can be limited to fall within a range of values set by the user. Both the minimum and maximum values can be enabled independently and the ranges can be animated to vary over time.

Constraints

A system of Constraints are introduced which control how one item relates to another. The 'constrained' item in modo is the item being affected or controlled by the constraint. modo's constraints are weighted, meaning that a weight value can determine the influence a constraint has over the item it's controlling.

There are several Constraints provided in modo 401 including:

- **Position constraint** - causes an item to follow the position of another item or a weighted average of the positions of multiple items. When an item is Position constrained to multiple items, the weights control how much influence a particular item has on the position of the item being constrained. Weights can be adjusted and animated so the relative position can be influenced to bias the location towards (or away from) a particular item. Setting a weight channel to 100% means that the constraining item will exert full influence on the constrained item, a value of 0% means the constraining item will have no influence on the position of the constrained item
- **Rotation constraint** - allows an item to match the orientation of another item or a weighted average of the orientations of multiple items. Each of the constraining items has an associated weight channel on the constraint channel modifier; these can be animated to blend between the orientations of multiple items
- **Scale constraint** - allows an item to match the world scale of another item or a weighted average of the scale values of multiple items. Each of the constraining items has an associated weight channel on the constraint channel modifier; these can be animated to blend between the scale values of multiple items
- **Direction constraint** - causes an item to face in a particular direction
- **Vertex position constraint** - constrains item's position match that of a selected vertex
- **Vertex normal constraint** - constrains item's rotation to match that of a selected vertex
- **Edge Position constraint** - constrains item's position along a selected edge
- **Edge normal constraint** - constrains item's rotation to match normal direction of a selected edge
- **Edge normal constraint** - constrains item's rotation to match normal direction of a selected edge
- **Poly position constraint** - constrains item's position to the center of a selected polygon
- **Poly normal constraint** - constrains item's rotation to match normal direction of a selected polygon
- **Parent constraint** - allows an item to act as if it's a child of a constraining item without actually being part of the normal parenting hierarchy.

- **Distance constraint** - provides a way to maintain distance to a point (and distance to a sphere) functionality
- **Path constraint** (and its 2 variants, position & normal) positions an item on a curve based on a percentage along the curve. It has options for which axis to use, roll, whether it should wrap or not (useful on closed curves). It supports up vectors either by the channels on the constraint item or by linking to another item.
- **Path Normal constraint** - The 'Path Normal' constraint will match an item's rotation to the normal direction of a particular position along the curve
- **Path Position constraint** - The 'Path Position' constraint will bind an item to a user generated curve or the weighted average of multiple curves affecting its position values only
- **Intersect Line** -Two Items - This creates a new locator at the closest point along an infinite line, defined as running through the world center positions of two selected items
- **Intersect Line** - Linear Curve - This creates a new locator at the closest position along a user generated linear curve, e.g. a curve defined by only two vertices
- **Intersect Plane** - This constraint creates a new locator at the closest point (by default) from the first selected item to an infinite plane derived from the world axes of the second selected item. The default axis plane can be changed by adjusting the 'Plane' setting
- **Intersect Surface** - This constraint can be used to project a closest point or ray intersection from an item to a mesh surface. Select the item that will be the source of the intersection followed by a mesh item. A new locator will be created at the closest point on the surface from the driver item.

Channel Modifiers

A system of Channel Modifiers is introduced to modify or generate new channel values in an animation. There are over 30 Channel modifiers supplied with modo 401:

- **Basic Math** - The math modifier combines two input channels into an output channel using one of a set of mathematical operations namely Add/Subtract/Multiply/Divide/Modulo/Average/Minimum/Maximum
- **Distance Constraint** - restricts an item's position relative to another item in the scene
- **Direction Constraint** - orients an item toward the position of another item
- **Revolve** - The primary output of the Revolve Channel Modifier is a world space distance traveled along a specified vector, as well as outputting a distance traveled the modifier also has channels to compute a rotation value from a given radius and a percentage traveled along a specified length
- **Measure Angle** - This Channel Modifier type can be used to measure the angle formed between any three 3D items in the scene
- **Channel Oscillator** - This is a motion generator that generates the standard sine wave and does not actually 'modify' any channel. The output waveform is controllable as to amplitude, frequency etc.
- **Channel Noise** - This motion generator creates a smoothly changing random value. Numerous parameters are provided to adjust the values generated
- **Gravity** - This channel modifier applies a gravity-like constant acceleration to a channel with a given initial value and speed. It computes a trajectory after bounces based on an imaginary 'ground' plane's position, and an elasticity factor describing the energy loss per bounce
- **Metric Vector** - Used to extract a normalized direction vector from a rotation matrix or the translation row from a translation matrix input
- **Channel Color HSV** - This modifier produces an RGB color (3 channels) from an input color defined by hue, saturation and value. This allows the artist to animate the hue, saturation or value of a color with correct interpolation, rather than making a multitude of keyframes in the red, green, and blue channels individually
- **Intersect Channel Modifier** - This performs closest point and ray intersections on lines (both on linear curves and between two items) and planes (defined by the world transform of another item). The 'length' channel can be used on both lines and planes to specify a fixed distance between the source location and the intersection point, pushing it along the line or plane as needed to maintain that length. A new locator item is created and placed at the intersection point
- **Channel Relationship** - Channel Relationships are useful to apply a non-linear relationship between two item channels

Forward/Inverse Kinematics

A simple 2D two joint Planar Inverse Kinematics capability is available in modo 401. This initial implementation includes support for preferred joint angle (requires the joints are bent in the required direction before IK is applied) and supports FK/IK blending.

Pivots and Centers

modo now provides two methods for setting the point around which an item rotates and scales, Centers and Pivots:

- **Center** - This is the local origin of the model and the default location around which item transforms originate. It's the location that sits at the world origin when all the item transforms are at their defaults, i.e. when the item has not been moved, rotated or scaled in Item mode. Adjusting the Center of an item allows you to set the location around which the item will rotate and scale
- **Pivot** - Pivots also provide the ability to specify the location around which an item will rotate and scale. They can also be used when one needs to animate this location (a rolling cube for example), (Centers cannot be animated). The Pivot is specified as an offset from the item's Center and once set, the rotation and scaling occurs around this offset instead

Groups

- Groups are a new way to organize items and channels into sets that can more easily animated. These groups exist independently of other item attributes and are mainly provided for segregating items that the author wants to treat similarly in an animation.
- Groups can be made up from any number of scene items, including mesh items, cameras, lights, and even locators. Groups can also contain any number of individual channels from any combination of items in the scene.
- You can drag items from the item view or the 3d view into a Group.
- Groups can be parented together, similar to 3D items, just drag a child group and drop onto a parent item, working the same way parenting is performed in the Item List.
- You can specify how you select or keyframe across multiple items using Groups. This makes it easy (for example) to animate both arms at the same time. Control is provided over how a Group is displayed, including solid and wireframe colors, visibility and text labels can be supplied.
- You can lock members of Group so that items or channels cannot be selected or edited. This allows you to create a "rig" that is all set up for animation and yet cannot be altered in any other way (such as modeling).
- Multiple items can act as base prototypes for replicators when set into a group, allowing for greater variety in replicated objects.

Other Animation Improvements

- Locator shapes can be modified via the 'Display' viewport.
- New Parenting tools (with and without compensation) are provided for modifying hierarchies, such as removing or inserting an item without destroying lower portions of the hierarchy.
- You can re-direct selection from a locator to a Group.
- A new Parent action center is introduced. The Parent action center positions the tool handles at the location of the current item's parent. If the item doesn't have a parent the handles are instead placed at the origin. Centre and axis options are provided (The axis option is useful for moving items in a hierarchy relative to their parent.).
- The Transform tool has a new attribute, "Child Compensate". When enabled, any changes made to the position, rotation or scale of an item in a hierarchy will not (visually) affect the item's children. The child item's transforms are modified to counteract the transforms being applied to their parent (but not animation curves).
- A new 'Compensate' button found in the top area of the animation layout, next to the mode buttons, changes the Parent/Unparent function to Parent in Place/Unparent in Place. What this does is ignores prior parental transforms, so items retain their initial positions in relation to their parent. Compensation is used when creating constraints or dynamic parents to allow the item affected to retain its world space placement. Compensation works when the constraints are created, or when adding and switching between Dynamic parent targets.

Modeling Improvements

Pen Tool

- Improved the quad mode of Pen tool to use existing boundary vertex for the 2nd point if the base position of the quad is on a boundary point.
- The new wall mode in Pen tool draws double lines and includes handles to adjust the 'offset' amount.
- The new Merge option in the Pen tool snaps and merges to an existing vertex.
- Element pre-highlighting is now supported in the Pen tool.
- A "Show Angles" option will show corner angles of face polygons. 5 Degree Angle Constraint can be invoked by the Ctrl key. A "Make UVs" option will create UVs for the new polygons. If "Backdrop Item" is set to "Project To" option, the pen positions are projected to the current selected Backdrop Item to create the UV values.
- Pen Extrude can make a tube with a selected profile or polygon along the selected edges with ability to cap the tube and invert profile.

Profile Presets

- Profile Presets are one type of many Presets supported in modo 401. These will store a geometry pattern ("profile") which can be used to enhance the functionality of many modeling tools in modo.
- A new Profile Browser is provided to select profile presets from (numerous ones are supplied).
- You can also make and store your own Profile Presets.
- There are two types of Profiles:
 - 1D profile is a single path consisting of lines and curves and is used for a parametric function to modulate a scale parameter along a path in modeling tools such as Tube, Sketch Extrude and path step generator. The 1D profile would be also worked with lathe tool as a source profile curve. The following tools support the 1D profile: Tube tool, SketchExtrude, CurveExtrude, RadialSweep, PolygonBevel, LoopSlice, EdgeSlide, and Bridge tool.
 - 2D profile is a 2-dimensional pattern shape consisting of lines and cubic Bezier curves. This profile is especially useful when it is used with sweep tools and thus the 2D profiles work with CurveExtrude, BezierExtrude, PenSweep and RadialSweep. The supporting polygon types are curve, Bezier, face and text. 1D profiles must have only one open path. 2D profiles can have multiple open and closed paths without intersections.
- The Linear, Radial and Cylinder falloff tools support 1D profiles to modulate the weights along the profile path.
- Clone effectors also support Profile Presets.

Background Constraint Improvements

New capabilities at modo 401 include:

- Offset the constrained point along the normal vector.
- The Geometry Constraint (Vector) will constrain transformed positions to background meshes. The Transform tools and the Push tool both work with in this mode, further enhancing modo's ability to support re-topology operations.
- Geometry Constraint called Screen Axis will constrain the position in the direction of the screen axis. Transform tools work within this constraint mode.
- Smooth tool works with Background Constraint.
- Solid Sketch tool works with Background Constraint.
- A "Double Sided" option has been added to Background Constraint.

Sketching Improvements

New options for the Sketch tool at modo 401 include:

- Added "Precision" and "Uniform Spans" attributes to the Sketch tool.
- Added "Curve Interpolation" option to the Sketch tool.

- Added “Connect” option to Sketch tool which connects drawn quadrangles to existing boundary edges.
- Added “Slice” option to Sketch tool.
- Added “Quads” mode that lets you draw out quadrangle strips. It can be used in conjunction with the Background Constraint to easily place quads over background geometry.
- The Sketch tool now supports Ctrl key constraint on drawing to force a straight line result.

UV Editing Improvements

- The Relax tool now lets you save out your constraint points selected in the interactive mode to a vertex selection set. This allows you to not have to re-select those points if you drop the tool. You can also “add to” the selection set in the UV editor by using any of modo’s regular selection tools.
- UV Pack command now lays out UV islands with greater density.
- We have improved the speed of transform tools with tear off mode in modo 401.

Painting

- Painting has been updated to allow painting directly on projection textures (non-UVed).
- Painting now works with image sequences.
- The painting tools can now paint on Backdrop Items.
- There is a new UV seam projection method which reduces (in some cases completely eliminates) UV seam issues when painting and sculpting.
- Painting is now multi-threaded.
- Added ‘Auto Scale’ option to Image Ink, which maintains the image scale relative to the object. This means that the image becomes smaller as you zoom out and bigger as you zoom in. This is an effective way to make sure that your texture is always painted on the surface at a consistent scale.

Sculpting

- Added fast mode which uses interpolation to speed up image sculpting. This delivers speed at the expense of precision.
- Added support for fur and surface particle maps. This allows real-time sculpting of fur direction for example.

Instance Replicator

- The new Instance Replicator item accepts mesh or static mesh item(s) as prototypes and places replicas of them at the location given by a “source” that has modes for basic particles, aligned to surface, and polygons. Replicators are much lighter than instances because each instance has its own transform and various other data. Replicators simply derive their pos/rot/scale from the particles that feed them and are only generated at render time. This allows for renderings which contain >1 trillion polygons for example.
- The polygon mode places a particle at the center of each polygon using the normal and first edge for orientation.
- The particles for an Instance Replicator can come from a Surface Generator item. This is a texture layer that is applied to surfaces by masking in modo’s Shader tree. The surfaces that it affects will have random particles distributed over them based on the spacing channel of the Generator. To use it, set the source of the Instance Replicator to the Surface Generator item of your choice. A “seed” channel on the Surface Generator allows for different particle sets over the same surface.
- Orientation of the replicas can be controlled by a normal vertex map, or an XFRM vertex map. To use normals, make some geometry and create a normal map from the Vertex Maps menu. Replicas will be oriented so their Y axis in model space points along the normal.
- Texturing: the Surface Generator can be textured using the surface particle effects. The surface particle ‘normal’ effect is a vector effect which controls the orientation of particles on the surface.

- Replicators are recursive. Replicators can thus replicate other replicator items via the “Use Children” option.

Other Modeling Improvements

- The Backdrop item has been enhanced to have “Contrast”, “Brightness” and “Transparency” channels. This provides better workflow when modeling over a reference image.
- A new “Camera” projection is a special projection mode for the camera view to display the image for front projection.
- There is a new Weld Effector tool and “Drag Weld” tool preset that lets you interactively merge vertices by moving one to be near the other.
- Edge Beveling quality is improved on complex edge selections.
- Image-based sculpting has improved seam smoothing.
- The Bridge tool has two new options; “Keep Aspect” and “Reverse Inset”.
- We improved the polygon reduction tool to keep characteristic edges and to minimize error between original shape and the approximated shape.
- The Edge Slice tool now has Element pre-highlighting.
- The Tube tool now allows the user to adjust the radius by RMB.
- An option to the Mesh Paint tool called tablet orientation has been added.
- We have improved the speed to create symmetrical geometry elements.
- The Edge Remove command now supports removing a curve edge.
- Element Falloff Improvement: A New “Edge Loop” mode has been added to the “Connected Elements” option.
- Loop Slice now supports an even N-gon and also has a “Reverse” option to reverse the slice positions.
- Grow Quads command creates quadrangles along the selected border edges.
- Fill Quads command makes quadrangles from open edge loops.
- You can now transfer vertex map information between two objects, including morph maps

Rendering

Preview Renderer Improvements

- We have improved the speed of the companion Preview Renderer for faster navigation updates.
- The Preview Renderer now offers extended refinement passes (aka progressive rendering) so your image gets “better and better”.
- Camera navigation inside the Preview Renderer is much faster, uses all available threads and scales well even with large numbers of items in the scene.
- The Preview Renderer now supports Irradiance Cache style global illumination.
- Box zoom: ctrl alt RMB performs a box zoom on the geometry under the mouse in the Preview Renderer. This moves the camera and sets the target point and focus distance to the point under mouse.
- Added a camera popup in the Preview Renderer so you can select whatever camera you have in your scene to be the camera used in Preview. This allows you have multiple previews in your scene – either separate cameras or showing different render outputs (e.g. a reflection channel).
- Images can be dropped directly onto the Preview renderer. When they are dropped over a mesh they are applied as a texture layer; otherwise they are applied to the environment.
- You can now see a subset of the Shader Tree contributing to the material under your cursor when you click with the RMB over an item.

Camera Improvements

- Added a film back preset for the 2/3" CCD size used by many digital cameras
- Added a spherical projection type for camera items that results in a "lat/long" panoramic image based on the camera's position and rotation. The intended use is the creation of spherical environment maps, including export of modo-created panoramic HDRI's.
- You can now specify Field of View by angle

Stereoscopic Rendering

- Turning this on will cause each frame to be rendered twice, first for the left "eye" and then for the right. When a stereoscopic image sequence is saved, the filenames will include the letter "L" or "R" after the frame number. The Interocular Distance (eye separation) and Convergence Distance (the distance from the camera at which an object will appear in the same position in both left and right images) are user-adjustable properties of the camera item. This works on stills and animated sequences (stereoscopic rendering can make use of irradiance and photon mapping caches when rendering multi-frame animations).

Photon Mapping

- Implemented direct light caustics using photon mapping for direct light sources (modo 302 already supported this for indirect light sources)
- The number of photons used is saved in the data saved with recent renders (and also shown in the Render Frame viewport as a readout).
- Caustic parameters can be animated.

Fur Material

- A new "Fur" material lets you add fibers to a surface with a wide variety of appearances. Fur can be seen in the Preview Renderer and fur parameters are animatable.
- You can style Fur interactively, using the Sculpt tools on curves, which act as hair "guides"
- Features of Fur include:
 - Length, Density, Taper, Flex and Growth Jitter can all be set
 - Fur "clumping" is supported
 - Circular or squarish fibers (e.g. tinsel) can be created
 - Root Bend provides a way to set fur direction and also the curvature
 - Sculpting Collision detection: works at the Sculpt tool and the hair guide tool level to detect collisions between the surface and curves and changes the curve so that it doesn't intersect the surface.
 - Support for UV maps and weight maps
 - Fur layering allows the layering of fur materials and their textures - this can be used to show things like a tennis ball that have a dense soft fur layer and a few longer, thinner, hairs that stick out
 - Fur direction can (also) be controlled with direction texture maps that can be sculpted like vector displacement maps.
 - Adaptive fur makes hair density goes down as a function of the distance to the viewer.
 - Fur strips have implicit UVs which can be accessed in the texture locator as 'Fur UV'. Using this texture projection mode you can do interesting texturing effects like feathers or fronds
 - Fur can be rendered with transparency
- The supplied hair shader improves specular highlights (and flattens diffuse shading) for more realistic hair
- Fur Presets are supplied to make application of Fur easier.

Tone Mapping

Implemented "photographic" tone mapping operator proposed by Reinhard et. al. so that images can have a warmer tone and extremely bright areas do not burn out.

Multiple Environment Support

The Shader Tree can now contain more than one Environment item. These should have different visibility settings to distinguish which one is used for the background seen by the camera, which is used indirect illumination, for reflection, and for refraction.

Shadow Catcher

A new “Shadow Catcher” feature is nice for making environments (such as HDR panoramas) appear to be receiving shadows cast by geometry. It is applied as a new alpha type in the shader item, and accounts for both direct lights and indirect illumination (cached or otherwise). It results in a surface that is completely transparent to the camera except where direct and indirect shadows appear. Useful for compositing meshes over existing image environments.

Procedural Texture Improvements

- The Cellular procedural texture now has options to randomly vary the ‘fill’ value of the interstitial areas between cells.
- The new Weave procedural texture generates a woven effect. A Roundness channel in the Weave texture at a value of 0% results in ribbon with a rectangular cross section and a value of 100% generates circular yarn effects.
- A new procedural Ripples texture is available; based on waves radiating from sources randomly arranged on a sphere whose size is that of the texture locator. The wavelength is a percentage of this size, and the phase can be keyframed to animate the ripples. Increasing the phase channel moves the waves away from their sources

Dispersion

This new setting is used to “tint” refraction rays, like you would see on a rendering of a cut gemstone. It controls how much the refractive index of a transparent material varies with wavelength.

Clearcoat

The new Clearcoat channel creates an additional unblurred, untinted reflection layer (with physically based Fresnel). This frees up the regular specular, reflection, and roughness controls to represent the underlying layer, and removes the need for adding an extra shader item. The most common application for this is metallic automotive paints.

Global Illumination

Shader Items now have an option for Global Illumination type, enabling the user to control which surfaces use Monte Carlo versus Irradiance Cache. Monte Carlo is better used on very detailed surfaces such as fur or carpet which can cause the Irradiance Cache to grow to unmanageable size.

Volumetric Lighting

- Lights can now have volumetric effects. A volumetric light is a volume that reacts to light as it travels through, showing effects like smoke and projected shadow rays.
- Volumetric lighting comes from the interaction of light with a medium, and this is controlled by the volumetric options in the light material. The two main effects are scattering and absorption, which is somewhat analogous to diffuse and transparency for surfaces. Control is also provided over volume density. If you imagine spot lights in a smoky bar, the volumetric effect is more visible when the air is thick with smoke (when the smoke density is high). Lowering the density makes the effects less visible.
- Volumetric shadows are supported, which projects shadow rays into the volume. In modo, this happens automatically if the light has shadow options.

Deep Shadow Maps

Deep shadow maps are shadow maps that can deal with transparent surfaces and volumetrics. These maps cache the shadow information as a way to speed up shadow rendering. They are mostly interesting to use on heavy

scenes that combine lots of geometry and volumetrics.

Light Linking

The effect of lights can now be excluded or included at the Shader Item level, allowing you to link a light to specific meshes in the scene so that only those parts of the scene are illuminated. This way you can highlight your main subject without adding extra light to your background. You can include or exclude by groups, you can have multiple lights in a group and lights can be in multiple groups and you can use any type of masking to control the light linking.

Blurry Refraction

Implemented blurry refraction, in which multiple refraction rays are jittered based on the material's roughness. This is useful for things like frosted glass.

Anisotropy Direction Mapping

Added a texture effect to allow texturing of the blurry reflection anisotropy direction for materials. You can use an image map to modify the anisotropy direction on a surface, which means controlling the orientation of the micro-scratches on the surface that spread out specular highlights and blurry reflections. Some common applications are carbon fiber and engine-turned metal parts.

Other Rendering and Baking Improvements

- Curves now be rendered as tubes with volume.
- Two new antialiasing levels with 128 or 256 samples per pixel have been added. This will enable improved motion blur quality, among other things.
- We are employing a new motion blur method for animated transforms that provides a superior result compared to the previous per-vertex motion vector method. This allows instances to be motion blurred differently from their source mesh, for example. This provides improvements in radial motion blurs, like a rotating wheel, for example.
- In modo 401 you can bake to a sequence of images. This allows baking of animated texture layers.
- Sampling of iris positions (for depth of field) and time (for motion blur) have been improved for higher quality.
- A new channel was added to control the roughness used for blurry refraction, so it no longer needs to be the same as the reflection roughness.
- Edit fields have been added to the render window for interactively adjusting white level, tone mapping, and gamma level after a render.
- There are new readouts about the light cache in the Render Frame window.
- The sampling of distributed light sources has been improved for higher speed and quality.
- Added an Exit Color channel to the advanced material item to specify what color to use for refraction & reflection when the maximum ray depth has been reached. This means you can pick any color instead of black when cutting off an infinite (or at least longer than the max depth) series of reflections or refractions. It will be modulated by reflection color, absorption, etc. in the usual way. It means you can lower the refraction depth and not get too much black.
- Shadow map resolution control has been added to spot lights.
- Added a Dissolve amount channel to the advanced material item which fades the regular shading of a surface toward the color returned by an unbent, untinted refraction ray. Shadows cast by dissolved surfaces are also appropriately faded.
- Added an option to make indirect illumination account for subsurface scattering (enabling objects with bright SSS to illuminate nearby surfaces, like glowing wax for example).
- Added keyboard controls for adjusting the exposure in the render window.
- Updated turntable rendering to support both X up and Z up coordinate systems.
- Image sequences can now be discontinuous, when a frame is not there the last texture in the sequence before that one is used.

UI and Workflow

Presets

- New varieties and workflows for using “Presets” are introduced in modo 401. Presets are various forms of content that can accelerate the content creation process. For example, Presets make it much faster and easier to assemble a scene or decorate an object in modo. A Mesh Preset might be a dining room table which you could assign a wood pattern to with a Material Present and then light the scene with an Environment Preset.
- Many Presets are supplied with modo 401, and any modo user can create Presets themselves. To facilitate the creation and distribution of Presets, Luxology is expanding its website to host a Content Sharing System, where modo users can upload and download Presets.
- Presets are available in these types: Material Presets – These Presets specify the “look” of an item in modo. Think “brushed aluminum” or “soft brown suede”.
- Note: This variety of Preset pre-dates modo 401
- Environment Presets - Indoor and outdoor scenes to place your models in for rendering. An Environment Preset might consist of a conference room or an abstract studio for example.
- Meshes – Geometry that is ready to be placed into a scene, like a table or a chair.
- Item Presets – Lights and Cameras mainly
- Assemblies – Make it easy to add animation to your scene
- Profiles – These are 1D or 2D lines that are used in modeling operations. You can use one to make crown molding for a living room ceiling for example.
- Image Presets – image files to enhance your creations for texturing, painting or backgrounds.
- A new Preset Browser in modo 401 presents visual representations of the available Presets so you can review and select them as you construct your scene.
- You can assign your own thumbnail image to saved Item Presets.
- You can assign the Preset Browser to look at whatever location on your network you want to locate the Presets on your hard disk.

Drag and Drop

- Items can be dragged from the 3D views directly onto groups (where they become members of the group) or into the Schematic viewport. Channels can be dragged from the Channel List onto groups or into the Schematic. This uses the standard tree LMB drag mapping.
- Some kinds of Presets (like Mesh and Material Presets) can be dragged and dropped into your scene.

Section Improvements

- A new Select Colinear option is introduced to select vertices that are in a line.
- New “Mouse Regions Trigger Selection” option provided in the OpenGL part of the Preferences. This defaults to true, and causes any region assignments in the 3D and UV Views to first try to select the item under the mouse before triggering the region. This is also how earlier versions of modo work. This is useful for users who want the selection to stay in Edge mode if they put it in Edge mode, and for the context menu to open for the current selection wherever they right-click, rather than changing the selection out from under them.
- Select Between command allows a selection to come from the rectangular region specified by two selected polygons.
- “Double-Sided Selection” is now available as a preference. When this option is true, paint selection and lasso selection will select double-sided polygons.
- “Pick walking” provides item selection navigation through hierarchies and user defined links. By default, pick walking up will select the item’s parent, and down will select its first child, and left and right will navigate through siblings. You can also define your own behavior by assigning pick walking links via the right click context menus or from popups in the ‘Display’ tab.
- “Selection redirection” allows a different item to be selected when an item is clicked on. This only works in the 3D views.

- The Scene item is now selectable from the Item list.
- There is a new 'Surface View' option in the Shader Tree. This option displays all the mesh bins in the scene grouped by mesh item. Inside each mesh bin (= surface) you can see the list of Shaders.
- There is a new bounding box display tool (Dimensions Tool) which shows the dimensions of your current selection.

Snapping Improvements

- You can now perform Item Snapping, and this is invoked via the 'X' key. This works with selected items, pivots and centers.
- Changed "2D Snap" geometry snapping to work in the perspective view.
- Added "Snap 2D" option to Element Snap tool. This makes it easy to snap on one plane without concern for elevation (for example).

OpenGL Improvements

- The OpenGL viewports have a new option for the Environment. Now you can reflect on a per material basis in OpenGL and it reflects whatever is in the Environment including Physical Sky etc. This respects the material reflection settings including Fresnel (so if your material uses Fresnel you see that in the OpenGL viewport)
- The modo Exploration Cardview now opens only after license checking, thus keeping its OpenGL window from opening when on an unlicensed system that is meant to run in slave mode. This is useful for running modo in a headless form on systems that are not equipped with OpenGL accelerated hardware.
- Item Bounding Box Selection Drawing is now available in modo. This is an Option to draw selected items with bounding box corners rather than the orange wireframe. This is for all items, not just meshes.
- Added 'Dissolve' channel to all locator items. It makes it very easy to dissolve out an entire mesh with one control instead of having to adjust Transparency for every material.

Workplane

- Aligning the workplane to selected items is now possible. For single item selections the workplane is set to the item's world transform. When there are at least three items selected, the workplane will be set to the plane derived from the world positions of all of the items.
- New Workplane Properties Popover form (Shift + End key combination) allows for interactive editing of the workplane position and orientation in a 3D view.

Other User Interface Improvements

- New 401 default layout provided (301 layout still available as well)
- We added Quick Launch forms to all tabs. When clicked they bring up a floating palette of tools.
- Added new Animate pull down
- Background in non-orthogonal views is now a gradient, as opposed to being uniform in color.
- New 'quality' setting works as a general quality adjustment that works for GI, reflections and refractions
- On the Animate tab, we moved the status feedback viewport down to the bottom next to the animation toolbar
- Updated all tabs to be friendlier to laptop users or those with smaller screens.
- Added two pie menus for palettes, the first is mainly the viewport palettes and is mapped to Alt-tilde. The second is toolbars & properties palettes and is mapped to Shift-tilde. Ctrl-tilde is the standard "slash and remove" pie.
- Modified image saving from the render window to set the default image format for the remainder of the session. MMB click on an Item now opens the Item Properties popover.
- Axis Rotate mapping is accessible via Alt-Shift-e
- modo 401 has a gamma corrected color picker
- We updated the render window's vertex and polygon count readouts to use "T" to indicate trillions.
- Implemented the Total Remaining time readout which estimates how long the remaining portion of a multi-frame scene or turntable render will take. The render window status line now indicates the current frame pass

(unless there is only one). Added Preview preferences which let you set 'draft mode' quality settings in order to maintain fast performance.

- Added commands to adjust contrast, brightness and transparency of the Background image in the UV view.
- Added the option in the Preferences panel to not to include the backdrop item when modo performs viewport fitting.
- A choice has been added to the Render menu to reopen the render window without starting a render. This is called Open Last Stored Render.
- Added "Item name" to all item properties.
- There is a new Surface Generator, which is a random placement particle generator.
- There is a new 'Force Fixed' mode to Coordinate Rounding in your preferences which when activated will always deliver a fixed value for the grid.
- Changed file dialogs to default to "Content" on load and "Project" on save.
- Changed Text tool to support 'flip' attribute. This makes it easy to flip surface normals on text.
- Mouse wheel now works over the entire edit field, not just over the minisliders.
- Added fine/coarse support for the mouse wheel over edit field minisliders
- Added a "Duplicate..." entry to each of the item context menus and the system menu for setting duplication options.
- Added a "Save Assembly..." entry to the file menu.
- Added a "Draw Axes" entry to the Workplane menu.
- Added 'Hair Tools' tab to Sculpt/Paint form.
- Mapped 'l' to create locator in item mode.
- Clicking on the Scene name in the item list now selects the Scene item, allowing a properties form to be displayed for it
- Implemented a new "Box" texture projection which is similar to Cubic but matches the SolidWorks software convention. With Box mapping if you were to map text it will be "correct" from all sides. With modo's standard Cubic map, the letters would be flipped on one side.
- Added Color Unit System preference in Input>Accuracy and Units section. Options are Floating point, Percentage, Integer and Hexadecimal.

Command System, Scripting, Input Remapping and Form Editing Improvements

- We refactored the Form View layout engine, which allows for better handling of the available screen space and numerous bug fixes.
- Horizontal toolbars now support justification. Toolbars can be aligned to the left, right, center, or justified (stretched). Multiple toolbars can be chained together. Justifications can be mixed (say, four toolbars set to left-center-center-right, respectively, but the justifications must be in left-to-right order (left-right-center will be interpreted as left-right-right). Justified forms are used to fill the entire horizontal space, or just the space between two other justifications (ie: left-justified-center, justified-center-right, etc).
- Form "Categories" are introduced. Most useful for scripters, this inverts the normal parent/child relationship of forms and sub-forms. Instead of the parent form containing a list of all of its children, the child form instead declares itself as belonging to the parent's head or tail category, and does not otherwise the parent form in any way. This allows scripters and plug-in developers to provide new forms as configs with their product, and have their controls automatically appear in the correct place by simply placing the config in the User Scripts or User Configs directories. The existing parent/child relationship still works.
- Form Editor groups provide a way to organize forms. Each form may belong to one group by simply dragging and dropping it into the group. These groups are for organizational purposes in the Form Editor only.
- Windows and OS X now use the same Python version, 2.6.2, and the same Perl version, 5.8.9. Both included all standard packages.
- The Scripting documentation is updated
- User Values now support a defraction (that's "defer action") attribute, allowing the associated action to be deferred until the mouse button is released from the minisliders. Useful for complex operations that would otherwise be too slow for interactive use.

- Added a new “Maya (Navigation Only)” choice, which uses Maya navigation combined with modo selection mappings.
- log.toConsole is now available, allowing event log output to be redirected to the console in headless mode.
- The Statistics viewport now allows users to directly change the name for vertex maps, material, part and selection set via inline edit fields.

Card View Improvements

Added support for regions defined by an image, with the image’s rectangle defining the region’s bounds by default. Also supports rollovers by switching to an alternate image. Rollovers may also cross-dissolve from the base to rollover image and/or zoom from a base size to a rolled over size. Card View has rollover images with high-light (scale up or down to new image over a timed period with a dissolve amount). Image quality has been improved (non power of 2 textures supported).

File I/O

- COLLADA Loader and Saver are introduced. These not only transfer geometry, they support animation.
- We have updated Autodesk FBX support support the older 2006 and the newer 2010 libraries.
- modo now has Path Aliases viewport to preferences, with support for user-defined content aliases.
- Added DDE support to the installer, double clicking an LXO file will no longer start a new instance of modo, just load it into the current one.
- Added Windows Media Format WMV movie saver plug-in and added an Image I/O preference to allow the user to choose from a list of WMV system profiles, default profile is high quality 2 Mbps broadband NTSC. This plug-in only runs on Windows. (Mac OS X uses QuickTime).
- Added support for 8k textures in texture.new command.
- There is a new Unpremultiply checkbox in the Final Color Output.
- Added File I/O section to preferences, which contains LightWave I/O, Scene I/O and Image I/O.
- The TIF, BMP, RGB and OBJ loaders have been replaced. Changed OBJ saver to consistently write out all of the vertex indices for a given mesh with or without texcoords and/or normals, such that partial vertex map indices are not written out at all. You can now load .OBJ files as static meshes if you set this as a preference in Scene I/O preferences. .OBJ saving will now save out mesh instances
- We reduced the default EPS line thickness.
- Changed the spot size during baking to depend on resolution, dPdu, and dPdv instead of the camera-based spot size used in normal rendering.
- Fixed a bug in which UV deltas were not being properly computed during object-to-object baking, causing texture antialiasing artifacts.
- Disabling a MDD deformer correctly updates the mesh now. MDD file reloading now also updates the end time which needs to be increased if the MDD now has more frames.
- We disabled adaptive subdivision during baking, so the subdivision level no longer depends on the camera. Each item’s fixed subdivision level is now used instead. Gave the JPEG 2000 saver 3 options: “JPEG 2000” (8-bit), “JPEG 2000 16-Bit”, and “JPEG 2000 16-Bit Lossless
- New PNG Saver has two options: (8-bit and 16-bit) for both the single (Save Image) and layered (Save Layered Image) cases
- A new Tri Surf entity allows support for large datasets via the API.
- A new Static Mesh Item type has been added. This allows using very large meshes in modo which are not editable, but can be used in rendering or as templates to model over. They were added mainly to facilitate the rendering of high-poly CAD data. They are particularly useful when they are utilized in a file written especially for modo by a CAD software. Changing an item type from a mesh (or mesh instance) to a Static Mesh within modo will implicitly freeze and triangulate the mesh. Converting from a Static Mesh (or Static Mesh instance) to a mesh inside of modo will make an editable mesh, although if it originally came from a SUBD mesh it will now be only faces. Static Meshes always have a vertex map storing per-vertex normals.
- Fur can be rendered on Static Meshes. A Static Mesh can be used to Constrain to Background.
- Added a Save Layered Image button to the render window, replacing the dialog that asked the user whether to save in a layered format. Also added a Layered Images option to the Save As menu in the Render Animation dialog.

Other

- Reorganized and updated modo documentation and also added a “Search” function. An Index has been added to the PDF form of the documentation.
- Help videos now stream from the Luxology website so we can more easily update them.
- The license agreement was updated.
- The minimum system requirements are updated as follows:

Minimum system requirements - Windows >>

- Win XP / Vista (32 and 64 bit) 2 GB available hard disk space (for full content installation)
- 2 GB of ram
- OpenGL accelerated graphics card capable of at least 1024 by 768 resolution
- Mouse or pointing device (pressure sensitive tablets supported)
- Pentium 4 processor or better
- Resolution Internet connection required for product activation and to access streaming help videos

Minimum system requirements - Macintosh >>

- Mac® OS X 10.4 or later
- Macintosh® G5 or Intel processor
- 2 GB available hard disk space (for full content installation)
- 2 GB of ram
- OpenGL accelerated graphics card capable of at least 1024 by 768 resolution
- Mouse or pointing device (pressure sensitive tablets supported)
- Internet connection required for product activation and to access streaming help videos