conoa cylinderwarp

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Overview

Conoa CylinderWarp is an Adobe After Effects-style plug-in that allows video to be mapped to a cylinder in a true three-dimensional space and animated through the video host interface. The cylinder has a 'wrap' capability, allowing it to flatten to a rectangle, and a 'flex' capability, allowing it to bend around the center point of the cylinder. The cylinder is rendered with a powerful raytracing engine. Raytracing is a method of computer graphics rendering that simulates a wide range of real world materials, such as metal or glass. Conoa CylinderWarp employs raytracing to produce images with refraction, specular highlights, texture mapping and reflection mapping.

Coordinate System

Conoa CylinderWarp employs a left-handed coordinate system. In a left-handed coordinate system, if the thumb is aligned with the X-axis and the fingers are aligned with the Y-axis, then the palm faces in the direction of the Z-axis, which in this case points into the screen or page.
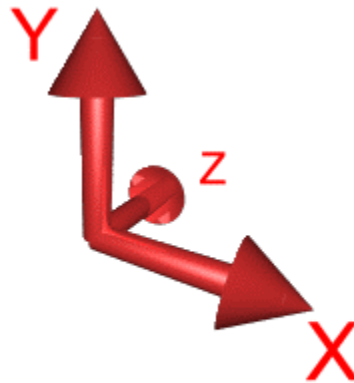

Figure 1 – Conoa CylinderWarp's coordinate system

The angles of rotation are similarly left-handed. By pointing the thumb in the direction of the axis of rotation, the fingers curl in the direction of the rotation. Figure 2 shows the angles of rotation with respect to the coordinate system.
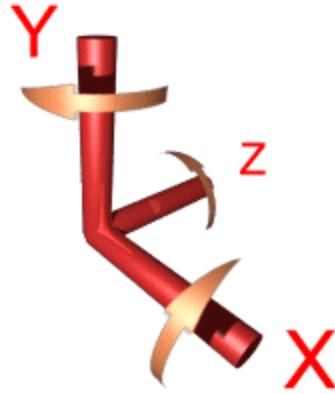
Figure 2 – Conoa CylinderWarp's angles of rotation

Note: Conoa CylinderWarp's coordinate system differs from the After Effects coordinate system in that Conoa CylinderWarp's origin is centered in the composition window and the positive Y-axis points up. After Effect's coordinate system has the origin in the upper left corner of the composition window and the positive Y-axis points down.

Cylinder Controls

Conoa CylinderWarp supports positioning and rotating within the coordinate system described above. The height, or length, and width of the cylinder may be set with the *Height* and *Width* controls. Layers can be applied to the surface with the *Texture* control.

The *Wrap* control specifies the curvature of the cylinder. A value of 1.0 signifies full curvature of the cylinder surface, resulting in a completely closed cylinder. A value of 0.0 results in a cylinder with no curvature, which is a flat rectangle. Negative values of wrap signify inverse curvature.

The *Flex* control specifies the amount that the cylinder bends about its middle. A flex of 0.0 signifies a straight cylinder. Increasing values of flex will bend the cylinder into a ring shape.

The *Pivot Point* control specifies the point about which the cylinder will flex and wrap. If *Cylinder Center* is set to on, the wrapping and flexing of the cylinder will be relative to the center of the center. If *Cylinder Center* is not set, wrapping and flexing will be relative to a point on the surface of the cylinder. The cylinder is moved in the +X direction the distance of its radius and the pivot point is the origin of the coordinate system, which will exactly touch a single point on the cylinder surface.

Camera

Conoa CylinderWarp supports two camera models: its own camera model and the camera model of After Effects 5.0. The control *Camera Source* chooses between the two models. By default, Conoa CylinderWarp's native camera model is used.

Conoa CylinderWarp's native camera model employs a spherical coordinate system. With spherical coordinates, two rotation angles and a distance from the center of the coordinate system define the camera's position. The camera's default position is along the negative Z-axis. *Azimuth* rotates the camera around the Y-axis and *Declination* rotates the camera around the X-axis. *Radius* moves the camera towards or away from the origin. The camera is always pointed at the origin.

If the camera were to move freely, it's motion would be in the shape of a sphere centered at the origin. The following figure is a depiction of that motion.
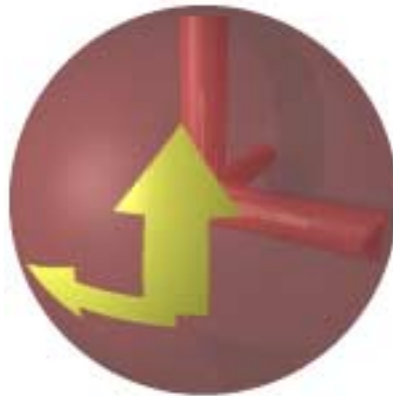

Figure 4 – A representation of the camera's spherical motion. The arrows point in the direction of positive rotation.

Choosing *Use Comp Camera* for *Camera Source* selects the After Effects 5.0 camera as the source for camera location and orientation. Only camera position and orientation are currently supported.

Note: It is recommended that Auto-Orientation in the layer's transform properties be set to 'Off', when choosing the After Effects camera model.
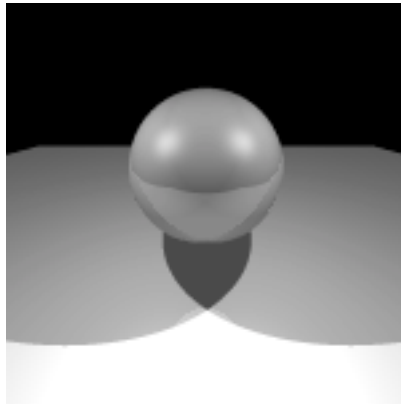

Lights

Conoa CylinderWarp supports two types of lighting controls: its own lights and those of After Effects 5.0. In both cases, only point lights are supported. Conoa CylinderWarp's own lights are automatically regarded as point light sources. When using After Effects 5.0's lights, "Point" should be selected as the light type.
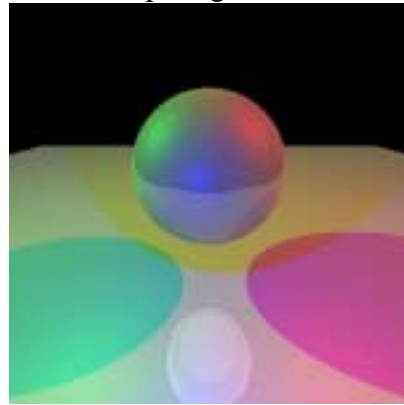
Conoa CylinderWarp supports one or two of its native lights. *Light 2 Toggle* will turn the second light on or off. Conoa CylinderWarp's lights are always white and always cast shadows.

Choosing *Use Comp Lighting* for *Light Source* selects After Effects 5.0 lights as the lighting source. Conoa CylinderWarp supports the position, color, intensity and 'casts shadows' properties of After Effects lights. Additionally, Conoa CylinderWarp supports up to 10 layer lights. Only the first 10 layer lights in a composition will be rendered; the rest will be ignored. A user should use the lights of After Effects 5.0 if color is desired, or shadows are not.

The following images were rendered with Conoa 3D, the full 3D raytracing plugin. They are presented here to demonstrate more fully the effect of multiple light sources.

Conoa CylinderWarp's native lights   After Effects 5.0 lights
Figure 5 – Conoa CylinderWarp's lights vs. After Effects 5.0 lights

With the Conoa CylinderWarp lighting model, Conoa CylinderWarp supports area light sources. Area light sources produce soft shadows. The *Size* control sets the radius of light source. The larger the radius of the light source, the softer the shadow that is produced. A size of 0 produces a point light, which creates a sharp shadow. The *Light Supersampling Factor* controls how many shadow rays are used to calculate the shadow. The higher the sampling factor, the smoother the shadow gradient will be.
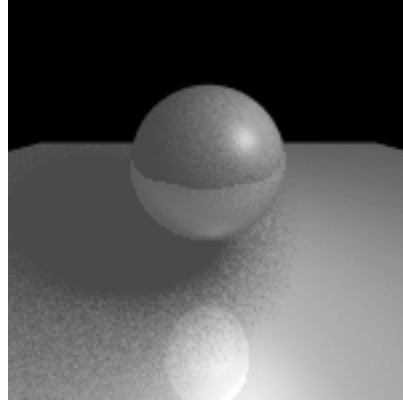
Note: Increasing the *Light Supersampling Factor* can drastically increase render times.
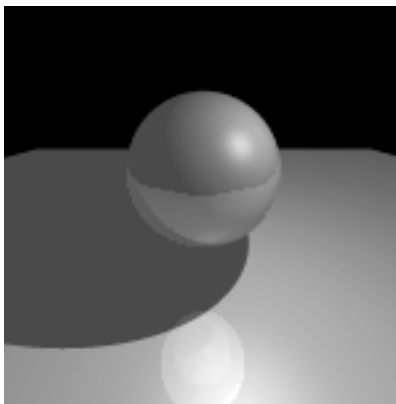
Size = 0, Light Supersampling Factor = 1

<div style="text-align:center">
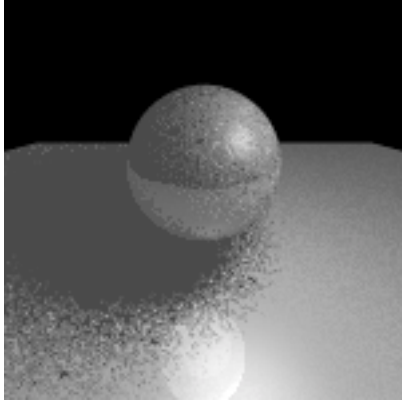
Size = 1.3, Light Supersampling Factor = 1 *Size = 1.3, Light Supersampling Factor = 25*

Figure 6 – Effects of *Size* and *Light Supersampling Factor*

</div>

Material Properties

Conoa CylinderWarp's material parameters define the visual characteristics of the surfaces of the objects. *Ambient Light* defines the amount of ambient light reflected off the surface. Ambient light is the background light of the scene, and is not dependent on either the position of the light source or the viewer. *Diffuse Light* defines the amount of diffuse light reflected off the surface. Diffuse light is light from the light source that is reflected off the surface. It is not dependent on the position of the camera. *Specular Light* defines the amount of specular light reflected off the surface. Specular light is usually seen as highlights on a surface and is dependent on the position of both the light and the camera. It is usually described as the 'shininess' of the surface. *Opacity* defines the opacity of the surface. The following figures show examples of different material parameters.
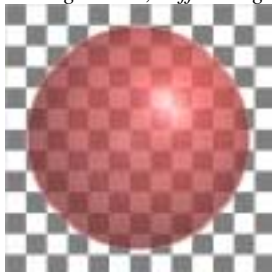

<div style="text-align:center">
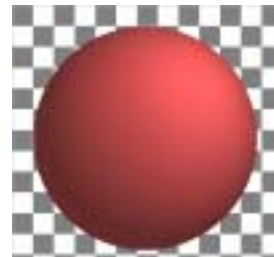
Ambient Light = 50 *Ambient Light = 50, Diffuse Light = 80*
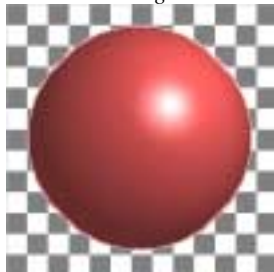
Ambient Light = 50, Diffuse Light = 80, Specular Light = 65 *Ambient Light = 50, Diffuse Light = 80, Specular Light = 65, Opacity = 50*

Figure 7 – Effects of the various material parameters

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Image Rendering and Quality

Conoa CylinderWarp supports draft and high quality rendering. Draft quality rendering produces images faster, but edges often have a jagged look. High quality rendering eliminates this problem. The layer's quality control can be used to select the rendering style, and thus the image quality.

<div align="center">
<i>Draft</i>   <i>High Quality</i>
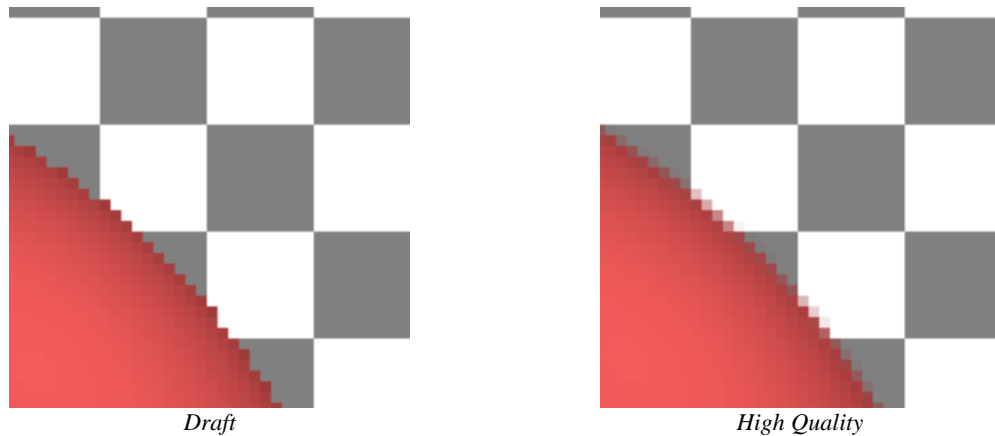
Figure 8 – <i>Draft and High Quality rendering</i>
</div>

Conoa CylinderWarp supports four levels of high quality rendering. These are *Coarse*, *Medium*, *Fine* and *Super Fine*, and are set with the pull-down control *Anti-aliasing quality*. These choices affect the level of anti-aliasing that Conoa CylinderWarp performs. Anti-aliasing is the algorithmic method by which Conoa CylinderWarp removes jagged edges from the images. The levels represent the level to which each pixel is examined by the algorithm. *Super Fine* is the highest level of quality, but the slowest to render. *Medium* is adequate for most situations and is the default.

The images below show the difference between the *Coarse* and *Super Fine* levels of anti-aliasing quality. The difference is subtle, but can be best observed along the edge of the cylinder.
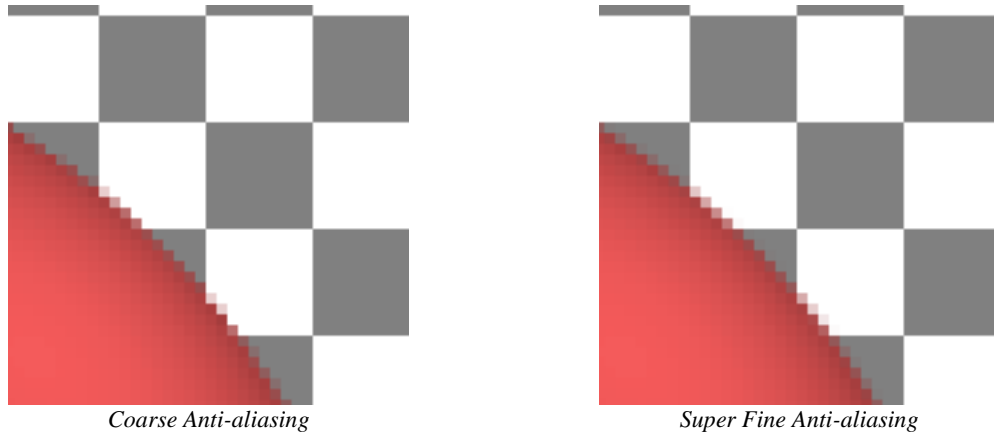
Coarse Anti-aliasing *Super Fine Anti-aliasing*

Figure 9 – *Anti-aliasing quality*

The *Compositing* toggle controls whether the objects will be rendered onto the layer to which Conoa CylinderWarp is applied. If the toggle is set, signifying *Composite On Original* is on, then the plug-in will render its objects "above" the layer to which it's applied. Any pixel not covered by an object will show the corresponding pixel from the layer to which the plug-in is applied. If the *Compositing* toggle is not set, signifying *Composite On Original* is off, then Conoa CylinderWarp takes over the entire layer to which it's applied. Any pixel not covered by an object will be set to transparent black.

In the following images, Conoa CylinderWarp has been applied to a single layer that is a bitmap of a checkerboard pattern.
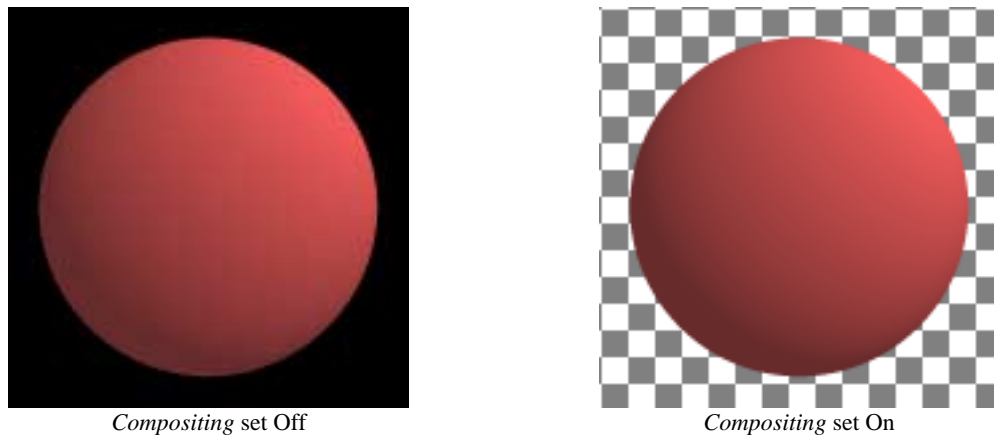

Compositing set Off *Compositing* set On

Figure 10 – *Compositing* toggle switch

Conoa CylinderWarp also has a *Render Mode* control, which is useful for working with the plug-in interactively. The *Render Mode* control specifies which level of material effects will be rendered. Since wireframe views are often sufficient for object placement and diffuse lighting is usually sufficient for light placement, a user can work in these modes for keyframing, leaving the full set of effects for the final rendering. The *Render Mode* control has four choices: *Wireframe*, *Ambient*, *Diffuse*, and *Full*. *Wireframe* will generate a wireframe rendering of the objects. *Ambient* will only use ambient light to light the objects. *Diffuse* displays both ambient and diffuse lighting. *Full* renders the complete set of material parameters, including specular lighting and opacity.

It is important to remember that *Render Mode* does not set material parameters. It simply selectively renders using previously set material parameters.

Note: The *Render Mode* control is only active during draft rendering. It has no effect in high quality rendering.
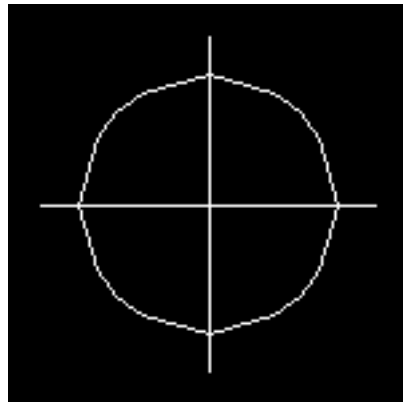
Render Mode set to *Wireframe*

Render Mode set to *Ambient*

Render Mode set to *Diffuse*

Render Mode set to *Full*

Figure 11 – *Render Mode* settings

Controls

Below is a complete list of the Conoa CylinderWarp controls.

Cylinder group:

X Translate - Move the object along the world X-axis.
Y Translate - Move the object along the world Y-axis.
Z Translate - Move the object along the world Z-axis.
X Rotate - Rotate the object about the local X-axis.
Y Rotate - Rotate the object about the local Y-axis.
Z Rotate - Rotate the object about the local Z-axis.
Height – The height, or length, of the cylinder.

Width – The width, or radius, of the cylinder.

Wrap – The amount of cylinder wrap. 1.0 signifies full wrap, i.e. closed cylinder. 0.0 signifies full unwrap, i.e. the cylinder has been become a flat polygon. –1.0 signifies full inverse wrap, which is a full inverted cylinder.

Flex – The amount of the cylinder flex. 0.0 signifies a straight cylinder; 1.0 signifies a cylinder flexed into a ring.

Pivot Point – Determines whether the center of the cylinder remains fixed during wrapping and flexing.

Texture – The texture map to apply to this object.

Camera group:

Camera Source - Toggles between Conoa CylinderWarp's camera model and that of After Effects 5.0.

Azimuth - Rotate camera about the world Y-axis, i.e. rotate the camera left/right.

Declination - Rotate camera about the world X-axis, i.e. rotate the camera up/down.

Radius - Move the camera towards or away from the world origin.

Field Of View Angle - The field-of-view of the camera. This control allows the camera to zoom in or out without moving the camera position. As the field-of-view is increased, the camera zooms out and perspective distortion is increased.

Light group:

Light Source - Toggles between Conoa CylinderWarp's light sources and those of After Effects 5.0.

Shadows – Toggles the ability of the Conoa Sphere light sources to cast shadows or not. If After Effects' lights are used, their shadow property overrides this toggle.

Light Supersampling Factor – The number of rays to shoot toward each light source. Higher numbers of samples of the light sources enable soft shadows. Also, higher numbers of samples produce smoother shadow areas. This parameter affects the number of samples projected to all light sources. Lights that have a size of 0 are not sampled more than once.

Position – Position of the light in the world X-Y plane.

Depth – Position of the light along the world Z-axis.

Size – Radius of the light. A radius of 0 signifies a point light source, which will produce sharp shadows. Lights with larger radii will produce softer shadows.

Light 2 Toggle – Turns the second light on or off.

Light 2 Position – Position of the second light in the world X-Y plane.

Light 2 Depth – Position of the second light along the world Z-axis.

Light 2 Size – Radius of the second light.

Material group:

Color - The color of both surfaces.

Refractive Index - The index of refraction of both surfaces. This parameter is only taken into account if the opacity of the chosen material is less than 1.0. Otherwise, the material is completely opaque and refraction is not relevant.
Ambient Light - Proportion of ambient light reflected off objects' surfaces.
Diffuse Light - Proportion of diffuse light reflected off objects' surfaces.
Specular Light - Proportion of specular light reflected off objects' surfaces.
Specular Lighting – Toggles between specularity creating full reflections, or simply creating highlights.
Opacity - Amount of opacity that each object has, specified as a percent. A surface with 25% opacity is 75% transparent.
Reflection Map – Layer that is used to create an environment that reflects off the cylinder.
Reflectivity – Relative contribution of the reflection map to the surface.

Anti-aliasing quality - The level of anti-aliasing performed by the plug-in. The choices are: *Coarse*, *Medium*, *Fine* and *Super Fine*. The default choice is *Medium*.

Compositing - Determines whether the Conoa CylinderWarp will be composited onto the layer to which it is applied. The default choice is *Off*, so Conoa CylinderWarp replaces the layer to which it is applied.

Render Mode - Sets the style with which Conoa CylinderWarp will render the image. The choices are: *Wireframe, Ambient, Diffuse* and *Full*. When *Wireframe* is chosen, Conoa CylinderWarp will render the geometry with a "stick" representation, allowing for interactive placement of the objects. With *Ambient*, Conoa CylinderWarp renders the objects with all material properties set to full ambient light and all other material properties turned off. With *Diffuse*, Conoa CylinderWarp will render only ambient and diffuse light, allowing for quicker placement of lights. *Full* will render all material properties, including reflection and refraction. The default choice is *Full*.

Known Issues

- When switching from draft to high quality, materials with partial opacity can show a change in brightness.