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Introduction

Thank you for downloading U-RENDER. We provide download links through our https://u-render.com/downloads and the U-RENDER Forum where you can download the latest version.

If you need further assistance or have suggestions or features requests, please visit our user forums at https://talk.u-render.com or contact us at help@u-render.com.

Main Features

- Live Mode (real-time feedback for materials, lights and most scene changes)
- Linear Workflow
- Physically Based Material System (specular and metallic workflow)
- Non Physically Based Material System (Cartoon Styles)
- Line Rendering (globally and per material)
- Support for various light types and shadow modes
- Image Based Lighting (IBL)
- Screen-Space Reflections
- Rendering of Transparent Objects
- Geometry Displacement
- Post Processing (Tone Mapping, Ambient Occlusion, Bloom and Depth of Field)
- Support for UV-less workflows using texture projections
- Cinema 4D Integration like support for Cloners / Instances, shader baking etc.

Feedback

We are always happy to receive your feedback. We are particularly interested in these areas:

- Usability
- Stability
- Suitability for use in production
- Workflow issues
- Issues with parsing scene data
- Improvements and missing features. We have a long list of planned features for future versions. We will prioritize development depending on your feedback.
Real-Time Rendering

U-RENDER's approach to rendering is to use advanced methods of real-time rendering. From a technical point of view this is closely related to the methods that are used in modern video games. In contrast to CPU and GPU renderer, U-RENDER does not use methods like ray-tracing or path-tracing. This allows us to render images within milliseconds, opening new venues for rendering, supporting the creative workflow and drastically reducing turnaround times and costs.

U-RENDER fits naturally between video games and traditional renderers. We can use methods that allow higher image quality than in video games as there is no strict limit to render times (usually 16 to 33 milliseconds in games).

Real-time rendering brings its own set of limitations though. The possibilities are limited by hardware implementations. Using modern GPUs, these limitations are less and less strict and allow for increasingly elaborate algorithms to be implemented but there are still some boundaries that remain. For once, we cannot easily and quickly cross over to CPU memory and use algorithms for materials that run on the CPU. Transferring data between RAM and the GPU also slows down the process considerably.

There is a long list of desirable features that have the potential to make U-RENDER the go-to choice for any rendering task. We are actively researching solutions to how to implement those in the context of real-time rendering.
Installation of U-Render

Starting with an already installed version of U-Render:

⚠ If you have an older version of U-Render installed in your user directory, please locate and delete U-Render from your plugins folder. Due to changes in our installation process this step does not need to be taken every time you want to install a new version of U-Render.

To find the plugins folder:

1. Open Cinema 4D
2. Goto menu Edit - Preferences
3. Select “Open Preferences Folder...” at the bottom of the window:

4. Open folder “plugins”
5. Delete the “U-Render” folder

First time installation of U-Render:

1. Start the U-Render-Setup.exe file and follow the instructions:
2. The setup tries to find your existing Cinema 4D installations and makes suggestions for the correct installation path of U-Render. Of course, you can change it manually.

⚠ Note that you have to run this setup each time if you want to install U-Render for several versions of Cinema 4D.

You also can install U-Render Studio with the installer:

3. After the installation you can open Cinema 4D or view the U-Render Documentation.
 Licenses

Account Creation

1. When starting U-RENDER for the first time, the License Manager will open and ask you to create a U-Render account. Select “Create account”.

2. Your default browser will now open the U-Render account creation page. Create your profile by following the simple on screen instructions and select the “Sign up” button.
3. You will receive an email to validate your account, check your spam folder if you don’t see it. Select “Confirm your email”.

4. You have created and validated your U-Render account.
## Trial version license

1. After the account creation and after you have confirmed your email you can sign in with your account in the U-Render License Manager.

   The U-Render License Manager opens automatically when U-Render is started for the first time.

You also can open the license manager manually in the “Extensions - U-Render - Open U-Render License Manager” menu of Cinema4D.
2. To get a trial license, please read the information text and select "Activate Trial".

3. You immediately get a trial license that lets you test U-RENDER without any limitations for 14 days.
Subscription License

1. If you already have an activation code for your Subscription License you can paste it here and click on Activate.

2. After activation you can see your consumed licenses. Note that you can use one U-RENDER License parallel on two devices.

You can release your license any time by using the blue x button:

If you accidentally have released your license, just click on “Fetch License”. You immediately will get your license back.
Quick Start Guide - First Steps

This is a step by step quick start guide on how to set up a scene from scratch and should give a main idea of the workflow.

Step 1 - Download assets

Every resource file and steps as Cinema 4D files can be found in the Quick_Start_Guide folder. Download the content from https://u-render.com/downloads/examples-assets

There are two scene files available.

U-RENDER_Quick-Start-Guide_v001_Completed.c4d
This is the scene of the last step of this Quick Start Guide.

U-RENDER_Quick-Start-Guide_v001_Start.c4d
Scene that is used for the next step.

A couple of textures.

Step 2 - Load Quickstart scene

Load the quickstart scene:
\Quick_Start_Guide\ur_quickstart_step02_v001.c4d or create some props.

The quickstart scene contains a nice material probe that is very suitable for testing the appearance of materials.
Step 3 - Rendering in Picture Viewer and Viewport

Go to render settings, and check if U-Render is set as Render Engine. Leave default settings for now.
Render to Picture Viewer or render the current view. The rendering appears in the Picture viewer.
You also can use the U-Render Viewport menu and set “Start U-Render” to render in your viewport in real-time:

Step 4 - Creating and Assigning Materials

Create U-RENDER Materials for Sphere, Floor, Base/Symbol and assign them to the objects.
Leave the default Material Settings.

Step 5 - Creating and tweaking Spotlights and Light Tags

Create some Spotlights and align them as you like. In this example there are 2 Spotlights created. It is important that every light source has assigned a U-Render Light tag to get access to all U-Render features:
The most important settings that should be adjusted are:

- Attenuation: inverse Square
- Radius Decay (depends how far away is your spotlight)
- Outer Angle (cone size of the Spotlight)
- Shadow Mode: Soft Edges
- Shadow Map Size (can be set for each light separately)
- Sample Radius (defines the softness of the shadows)
- Absolute Bias, Slope Bias (shadow contact and artifact optimization)

Step 6 - Tweaking Materials

For the wood material:

- put 04_wood_scotch_pine_diffuse.jpg into the Color texture slot
- set Brightness between 5%-8%
- put 04_wood_scotch_pine_glossiness.jpg into the Glossiness texture slot
- put 04_wood_scotch_pine_normal.jpg into the Normal texture slot with strength about 15%

Assign the material to the ur_symbol and ur_base object.
Adjust the other created and assigned materials as you like. The scene contains bright single-colored Materials with Brightness ~5% and Glossiness ~70%.

**Step 7 - Setting up IBL and Environment in Real-time**

Using an HDR environment map is one of the most efficient ways to get very nice reflections and diffuse lighting with just a few clicks for the cost of very less performance.

Go to Render Settings - Environment:
There is already a default environment map set in the render settings. You can choose any kind of environment map you like. Image Based Lighting is activated by default too. This generates very nice ambient light by calculating spherical harmonics based on the used HDR image. Adjust the Exposure values as well as the Azimuthal Rotation as you like.

Note that an Ambient Occlusion Method is set on by default too (Render Settings - Lighting). Otherwise, the IBL would illuminate areas in your scene too much.

**Step 8 - Further Improvements**

You may have recognized that some areas of our scene are burned out because of the brightness of the lights and bright materials. In this case it is a good idea to tweak tone mapping in the Render Settings. In this scene Reinhard does a very good job with a White Point value ~2.

When using **Bloom** (Render Settings - Effects) in a subtle way it gives a nice color bleeding effect.

Additional Lighting effects can be done by using **Screen Space Global Illumination** (Render Settings - Lighting). Please check the SSGI section in the documentation for further details.

**Chromatic Aberration** and **Vignette** gives the rendering some kind of photo-like appearance. (Render Settings - Post Processing) You also can activate **Color Correction** curves if you want to set any kind of curve-based color correction.
**Step 9 - Final Steps**

Finally, it's time to get rid of the pixelated corners and aliasing effects. Go to Render Settings - Basic and activate FXAA. This is a very fast anti-aliasing algorithm that also can be turned on when working in LIVE mode in real-time. For final quality that may be not enough and Multi-Frame Sampling should be activated too. Note that the performance decreases but it does a very good job.

Render your Scene in the Picture Viewer with final settings and save your work.

*Congratulations! You have mastered your first project with U-RENDER!*
U-Render Viewport and U-Render Studio

There are two ways you can use U-Render. Rendering directly into the Cinema 4D viewport or using the external U-Render Studio window

**U-Render Viewport**

The U-Render viewport uses any Cinema 4D viewport to render the scene. To activate it goto the view panel menu “U-Render - Start U-Render”. This also automatically sets U-Render as your render device in the render settings.

1. **Start U-Render:** U-Render starts and renders the scene in the according viewport.

2. **Pause U-Render:** Pauses U-Render and keeps the Cinema 4D UI responsive when using heavy scenes. It doesn't remove data on the graphics card, so when unpause U-Render the scene is rendered again immediately.

3. **Stop U-Render:** The render process of U-Render is stopped and U-Render itself shuts down. This completely removes render data from the graphics card.

4. **Clear Scene:** Removes the scene from the Renderer. The next synchronization process needs to update the entire scene. Clear scene completely removes render data from the graphics card.

5. **Dashboard:** Opens the dashboard that gives control about what kind of updates should be synchronized in the U-Render viewport.

⚠ Note that the viewport is used that is set to “Use as Render View” in the C4D view panel menu: “View - Use as Render View”
U-Render Studio

U-Render Studio renders the scene into a separate window. It is also used for license management. Starting U-Render studio also sets U-Render as a render device in the render settings.

1. **Use Studio:** starts U-Render studio and automatically renders the scene into a separate window. When deactivating this button, the complete rendering information is removed from your VRAM. Also, the Studio Sync button is activated automatically. Note when Studio is active rendering to the viewport is deactivated and vice versa.

2. **Studio Sync:** synchronizes all adjustments and changes to the scene and updates U-Render Studio in real time. Uncheck this button for heavy scenes to keep your Cinema 4D UI responsive. Unchecking does not remove any data from the VRAM so when synched again, the scene starts rendering immediately.

3. **Clear Scene:** In certain cases, closing U-Render Studio does not remove all information on the VRAM. Clear scene completely removes render data from the graphics card.
U-Render Layout

The U-Render Layout (*Cinema 4D R24 and earlier is shown here*) has the focus to improve the workflow when working with U-Render. It also provides useful scripts and presets. It can be set by using the Layout drop down menu or the pull-down menu: Window - Customization - Layouts - U-Render (User)

1. Quick access for Recent Files / Open Project / Merge Project

2. Create Area / Omni / Spot / Infinite Light including U-Render Light Tag / Lighting Tool

3. Create Camera with U-Render Camera Tag / Create U-Render Volume Object
4. Start / Pause U-Render Viewport

5. Save Incremental / Save Project as / Save selected Object as / Export / Save Project with Assets

6. Object Manager and Render Settings

7. Shows Geometry only in Viewport / Hud display filter
   - Object highlighting display filter (when hovering the cursor over an object)
   - Display filter for the orange outline when an object is selected. ▲ Note that this also disables object highlighting filter
   - Display filter for the orange outline when a subdivision surface object is selected.
   - Display filter for the orange outline when a generator object is selected.
   - Handles display filter.

8. Quick creation of U-Render Advanced Material and simplified presets. The simplified materials have the intention to display only the most important settings and should increase the overview. They can be transferred anytime to an Advanced Material without
losing the set values by using the “Convert to Advanced” button.

9. Center Axis to and Axis Center

10. Area for Material Editor
Real Time Updates (Live Mode)

You can enable real time updates by activating “Start U-Render” Command from the viewpanel menu or by activating the “Sync Studio” button when using U-Render Studio. We suggest that you place the icon for the command somewhere in your UI layout where it will be easily accessible.

When real time updates are active the current state of the scene is synchronized in the background. Once all data has been transferred U-Render starts to give real time updates. Now you can make changes to your scene and see the updates of supported properties in real-time.

Features

The main purpose of Live Mode is to allow for real-time updates in the rendered image while you make adjustments to your materials and lights. Live Mode allows you to immediately see the effect of your changes. There is also limited support for updates of matrices, i.e. the position and orientation of objects. This allows you to intuitively work on scene layout with real-time feedback on shadows, shading and reflections.

What Live Mode essentially tries to achieve is to provide instant feedback using high quality real-time rendering.

Currently, these changes are synchronized:

- Render Settings
- Light Settings (for best results, use the U-RENDER Light Tag)
- Material Settings
- Object positions and orientations (transforms)
- Geometry changes

Dashboard

The Dashboard gives you better control over what kind of data is going to be updated when LIVE- Mode is active. Adjustments in these settings can be useful to increase the playback performance.

⚠ Deleting objects is synchronized always no matter if the update settings are turned on or off.

⚠ Creating objects is only synchronized when “Update Geometry” is turned on.
Live Updates

- **Transforms ON / OFF**
  Enables synchronization of position, rotation and scale of objects.

- **Camera ON / OFF**
  Enables Camera updates in LIVE-Mode. Useful when using a single view panel and the scene has to be tweaked for a specific camera view. If enabling this option, the current view is updated automatically.

- **Camera Children ON / OFF**
  Enables child objects that are parented under the Camera to update in LIVE-Mode.

- **Lights ON / OFF**
  Enables Light updates in LIVE-Mode. Especially a high amount of point lights with high resolution shadow maps can cause longer render times.

- **Materials ON / OFF**
  Enables Material updates in LIVE-Mode.

- **Geometry ON / OFF**
Enables Meshes updates in LIVE-Mode. Concerns mesh deformation based on point level animation or skinned meshes as well as modeling operations. Updating those types costs a lot of performance. It needs to be turned on when creating new objects should be synchronized.

⚠ Note that scaling a mesh in “Model mode” modifies vertex positions. Scaling a mesh in “Object mode” does change its transformation matrix and is a lot quicker to update.

➦ Instances ON / OFF

Enables Render-Instance updates in LIVE-Mode.

➦ Render Settings ON / OFF

Enables Render-Setting updates in LIVE-Mode.

Live View

 Vad

 ➢ Refresh Scene

Available when Live Mode is active. Deletes and resends the scene. Useful if the scene is not updated correctly.

➦ Live Resolution

1. Viewport: Viewport mode is set by default. The exact resolution of the active view panel itself is used for rendering the scene in the view panel or Studio window.
2. Output: Uses the render resolution that is set in the render settings for the U-RENDER view panel resolution or Studio window.
3. Custom: a custom resolution can be set for the U-RENDER view panel or Studio window.

➦ Scale

Influences all Live Resolution Modes: The scale lets you quickly adjust the size of the U-RENDER Live View resolution. When the view panel is used for rendering, the rendering gets scaled up if a scale is used lower than 100%. For example, scale 50% means that the displayed pixel size is doubled. When using Studio, the pixels are not scaled but the image adjusts its size.
Volumetrics

Temporal Blend-Factor

Blends a certain number of former frames with the actual frame's volumetrics. This softens and removes artifacts but high values cause smearing when transforming lights or if tweaking volumetric noises. This setting only affects the Live View and has no influence on images rendered to the picture viewer.

Limitations

There are a couple of limitations to Live Mode as U-RENDER needs to parse the Cinema 4D scene to update the rendering. Most of these limitations are due to performance constraints. Parsing the whole scene, including meshes for all objects, would take too long to still have real-time feedback. So, we limit updates to immediate changes that are quick to parse.

These are the most significant limitations:

- Mesh deformations and geometry changes are only updated when enabled in the Dashboard
- Scaling: In Model Mode scaling changes vertex positions. The changes are only updated when geometry updates are on (see the Dashboard).
  In Object Mode, scaling changes the object transformation (scaling) parameters. The scale is updated when transform updates are on (see the Dashboard).

We are looking into ways to add more features to Live Mode and to increase its performance.
Render Settings

Basic

Anti-Aliasing

- **Anti-Aliasing Mode FXAA**

  Simple mode that works very fast and gives a basic amount of antialiasing. Can be combined with Multi-Frame Sampling.

  (FXAA: off / on)

- **Enable Multi-Frame Sampling**

  Enables/disables Multi-Frame Sampling. This method gives a high quality result of aliasing but also costs render time with increasing passes. It’s good for final quality rendering.

- **Samples**

 ⚠ Sets the samples $n^2$. A value of 2 means 4 x samples.

  (Multi-Frame Samples: off / 2 / 4)

- **Filter Size**

  Adjusts the area that is sampled. A higher value gives a softer result but has a better chance to reduce aliasing artifacts.
Render-Resolution Overscan

Renders an additional area outside the visible frame but keeps the resolution that is set in the render settings output or live view resolution. This can help to prevent screen space effects like Ambient Occlusion or Screen Space Reflections from fading out too early at the frame borders.

Note that the use of Render-Resolution Overscan results in longer render times.

In the following example the output resolution is set to 1920x1080. Render-Resolution Overscan x and y is set to 25%. So U-RENDER renders the image in 2400x1350 but the output of the render result is 1920x1080. You can see both resolution values in the bottom bar of the U-RENDER Live View window:
Geometry

✦ Backface Culling

By default this setting is turned off and every face is rendered two sided.

✦ Displacement

Enables/disables the geometry displacement. Enable if displacement maps are set in U-RENDER materials.

✦ Limit Displacement Steps/Maximum Displacement Steps

Limits the maximum subdivision level of U-RENDER materials for the entire scene by setting maximum displacement steps. It limits the Subdivision Level of the displacement setting in the material.

Shaders

✦ Baking Resolutions

Sets the resolution for the low/medium/high settings that are used to bake Cinema 4D shaders. Also see chapter “Materials - Cinema 4D Shader support”

✦ Preview Resolutions

Sets the resolution of Cinema 4D shaders for Material Preview and Live-Mode. See also chapter “Materials - Cinema 4D Shader support”
**Autostart**

- **Autostart U-RENDER for Rendering/Material Previews**

  This option lets U-RENDER start automatically and render the Material Previews, Render View, Picture viewer and U-RENDER Live without starting the application manually. Note that you have to set the executable path of the application in the global preferences (Edit - Preferences - U-RENDER)

**Environment**

**Environment Map**

Image Based Lighting (IBL) is based on spherical harmonics and provides a very efficient and fast way of diffuse and specular ambient illumination of objects or entire scenes based on an equirectangular image. For best results use a high dynamic range image.

By default we added a Wood high dynamic range environment map. Use the Preset menu and set No Environment if you don't want to have an environment map on your scene, or choose one of the other environment preset maps:

Of course you can use your own maps by loading them in the Global Map channel:

1. Select an equirectangular environment map as global environment map (32-bit float *.hdr recommended). Specular IBL is activated automatically. (needs material with Reflectance Channel turned on)
2. Enable diffuse image based lighting by activating "Enable Diffuse IBL" (needs material with diffuse Color brighter than black)

**Global Map**
Select an equirectangular environment map for setting a global environment map. (32-bit float *.hdr recommended).

❖ Exposure

Adjusts the brightness of the image and the strength the HDR is affecting the specular reflection of materials. The amount of this value depends on the dynamic range and general exposure of the used environment map.

⚠️ The exposure doesn’t influence the behavior of the diffuse IBL.

❖ Horizontal Rotation

Due to the calculation of the IBL based on the environment map, you can use the Azimuthal Rotation to adjust the horizontal orientation. This also affects the Diffuse IBL as well.

❖ Enable Diffuse IBL

Turns the diffuse image based lighting on or off and depends on the global environment map. Diffuse IBL is based on spherical harmonics and provides a very efficient and fast way of diffuse ambient illumination.

❖ Exposure

Adjusts the strength the environment map is affecting the diffuse illumination of materials. The amount of this value depends on the dynamic range and exposure of the used environment map. It does not influence the strength of the specular IBL. Use the Azimuthal Rotation to adjust the orientation.

(IBL: off / 0.2 / 0.5 / 1.0 / 2.0 )

❖ Occlusion

IBL Occlusion is dependent on the Screen Space Ambient Occlusion (SSAO) (Render Settings - Effects - Ambient Occlusion). Set IBL Occlusion value to 0% if you don’t want extra calculation of ambient occlusion on IBL illuminated geometry/areas. 100% IBL Occlusion uses the SSAO settings to decrease ambient illumination on self shadowing areas of nearby geometry.

❖ Samples

Defines the number of samples used to calculate IBL. In most cases the default value of 10.000 should work fast with good quality.
Background

➤ Background Color

You can set a simple background color for your scene.

➤ Use Environment

When activated, the environment map is displayed as a background image in the U-RENDER view. Check the tone mapping render settings if you want to have tone mapping affecting the background or not.

➤ Environment Blur

Environment Blur gives some control about blurriness of the environment when used as background. That blurriness does not influence the blurriness of the specular or diffuse IBL calculation.

Fog

Fog sets the obscurance of objects that are far away. This effect is a post effect and doesn't interact with light sources and objects in the scene. It can be used for basic ground fog as well as distance haze.

➤ Fog Color

Sets the fog color that also can be used to darken the scene in distance when using a dark color.

(color white / light orange / black)

➤ Falloff Type/Density/Distance

This setting controls the density of the fog starting from the camera along the view direction.
Height Falloff/Height

The height falloff lets the fog fade also in +Y direction, starting from scene point 0,0,0.

Background Strength

This value controls the intensity the fog is influencing the background color or background environment map.

Volumetrics

Adds volumetric effects like fog, haze and participating media to your scene. Requires a Volume Object and a Light Source. Allows Godrays, Atmospheric and Fog effects. Volumetrics are calculated using voxels.

Resolution X,Y,Z

Defines the resolution of the voxel grid in X, Y and Z direction. Note that in most cases a higher number of Z values is needed to get a good result.

The global volume that is rendered is always aligned with your camera. So X and Y correspond to width and height in screen space, Z corresponds to the depth / distance from the camera.
⚠ The Z resolution of the voxel grid also depends on the clipping planes of the camera as the voxels are distributed between the near and far clipping plane.

Subdivisions

The subdivisions are multiplied with the resolution X, Y, Z. The slider allows you to quickly control the quality and performance of the scene.

Density Scale

A global density multiplier that affects every volumetric object in the scene. In addition the density can also be set for every single volume object. Volumetrics always have extinction: the light gets darker when passing through the medium. The higher the density of the medium, the stronger the absorption of the light.
Temporal Jitter-Radius

A temporal blend effect that can reduce artifacts if the resolution of the voxel grid is too low. In the Live View Mode this effect occurs a few seconds after there is no update like camera movement or changes in volumetric settings. Rendering to picture viewer will always use the jittered result if the Temporal Jitter-Radius is greater than 0.

Reflectance

This option allows adjusting global settings of the screen space reflections. Note, that they also have to be activated for each material in the material reflectance settings. In the current version the result may be slightly different between rendering in live mode and picture viewer.

Enable Screen Space Reflections

Check on to enable the SSR.

Ray Trace Iterations

Increase the iterations to include larger distances that should be reflected.
Jitter

Defines the density of the Screen Space Reflections and can be used if the Screen Space Ray Trace Iterations has to be very low.

Screen Fade Start/End, Distance Fade Start/End

This value adjusts the amount of fade in general and screen space.
Lighting

Global Settings

✦ Default Light

The U-RENDER default light is parented to the position of the active render camera. If set to Automatic and a light source is created (spot/area/omni/infinite light and Image Based Lighting), in the scene, the default light is deactivated automatically and doesn’t influence the render result. It doesn’t need to be turned off manually in the render settings if set to Automatic. The default light can constantly be turned on/off by setting the pull down menu:

✦ Ambient Light Color

Sets a global ambient light that influences the entire scene. It’s black by default and calculated additionally to the Diffuse IBL settings. Using the Ambient Light is the simplest way to give the impression of indirect illumination.

(Ambient light: black / gray / bluish color)

✦ Subsurface Scattering

Enables you to globally turn on/off Subsurface Scattering for the entire scene.

Ambient Occlusion

Ambient Occlusion defines if a point is lit by ambient light. You can choose between Hemisphere AO and Ground-Truth AO.
⚠ Note, if there is no ambient light set, there are also no occluded areas. If lighting a scene with spot/omni/direct lights without ambient light you will not see any kind of ambient occlusion at all, because these light sources cause diffuse light and not ambient light. In order to see the ambient occlusion effect, set an ambient light in Render Settings - Background - Ambient Light Color or Render Settings - Environment - Environment Map and Enable Diffuse IBL.

⚠ Ambient Occlusion can cause artifacts in the render result. To fix them, adjust the near and far clipping values in the U-RENDER Camera Tag. You also can try to raise the Hemisphere Offset value when using the Hemisphere AO method.

**Hemisphere Ambient Occlusion**

This Ambient Occlusion method is very fast and the result is smoother than the Ground-Truth Ambient Occlusion.
❖ Radius

Defines the distance geometry is occluding nearby areas. Note that the units are [cm].

(Hemisphere-AO radius: 2 / 8 / 32)

❖ Power

Defines the strength of darkening of the occluded areas.

(Hemisphere-AO power: 1 / 4 / 8)

❖ Samples

Sets the samples that are used for calculation. High amounts cause more render time.

(Hemisphere-AO samples: 8 / 64 / 256)

❖ Hemisphere Offset
Small amounts give detailed results if objects are very close to each other. Otherwise, small amounts can cause unwanted occlusion on faces that are bent very slightly and nearly flat.

⚠ Note that the units of the Hemisphere Offset are [cm].

(Hemisphere-AO hemisphere offset: 0.1 / 0.5 / 1.0)

**Ground-Truth Ambient Occlusion**

This method is more advanced than Hemisphere AO. It is good when there are fine details needed. When increasing the values, it can cost more render time compared to Hemisphere AO.

⚠ Note, when using Spherical Camera use the Hemisphere AO. The Ground-Truth AO method can produce unwanted seams and wrong shading.

✎ **Radius**

Defines the distance geometry is occluding nearby areas. Note that the units are [cm].

(Ground-Truth-AO radius: 2 / 8 / 32)

✎ **Max. Range**

Limits the visible range of the Ground-Truth-AO of the set radius.
Sample-Steps

Increased Sample-Steps provides smoother results.

Power

Defines the strength of darkening of the occluded areas.

Use fast preview-filter in Live-Mode

Activating this option when working in Live-Mode can greatly increase the performance. Note, that there may occur flickering artifacts that are caused by the Ambient Occlusion, so deactivate this option when rendering the final image.
Enable Depth-Peeling

This option uses depth peels to “look” behind objects and prevents halos that can occur on foreground objects when there are other objects close behind them.

Include Backfaces (option for Depth-Peeling)

Only active if Depth-Peeling is enabled. Includes backfaces for calculating the Ground-Truth Ambient Occlusion.

Depth-Layers Count (option for Depth-Peeling)

Only active if Depth-Peeling is enabled. Increase the layer count if there are still halos visible when Depth-Peeling is enabled. High values cost render time.

Screen Space Global Illumination

SSGI emits diffuse light bounces to illuminate nearby objects in screen space.

⚠ Note that a direct light source or emissive material is needed to cast SSGI.

Since the effect is calculated in screen space, there are some limits when objects are not visible on the screen and need to be considered in the SSGI calculation. In some cases, the use of Render Resolution Overscan can increase the results.

Radius

Sets distance the diffuse bounce is casting illumination on nearby objects.

(Radius: 100 / 200 / 400, example scene room height: 250cm)
Max. Range
When larger radius values are needed it can be useful to limit the distance of the diffuse light bounce.
(Max. Range: 0.5 / 1 / 2)

Sample Steps
Defines the number of samples used. It has an impact on the performance and on the appearance as well. Higher values also mean a more precise result.
(Sample Steps: 1 / 8 / 32)

Strength
Defines the brightness of the light bounces.
(Strength: 0.1 / 1 / 5)
*Fast Preview Filter*

Sets the filter passes amount to the lowest value (one single pass) to save performance. This means that there are no multi bounces used and this also causes a darker result.

⚠ Note that this only affects the viewport. The render result in the picture viewer is not affected and will always use filter passes settings!

![Fast Preview Filter: on / off](image)

*Filter-Passes*

Sets the amount of used filter passes. Higher values need more performance but give a detailed result. The higher the filter pass value the brighter the result.

![Filter-Passes: 1 / 8 / 32](image)

*Multi-Bounce Amount*

If more filter passes are needed for precision and the result gets too bright, the Multi-Bounce Amount can be used to dim the result.
DEPTH PEELING / INCLUDING BACKFACES

The depth slices (number of slices can be set with Depth Layers Count value) are used to increase the accuracy of the calculation. Including back faces can further increase the result.

NON FACING SAMPLES

Non Facing Samples can be useful to prevent areas from getting too much GI from surrounding areas that are turned away from each other.

BLUR STRENGTH / THRESHOLD
Blurs the SSGI result and gives a smoother result. The threshold controls when the blur effect is assigned.

(Blur Strength: 0 / 2 / 15, image scale 600%)

**Shadows**

- **Default Shadow Map Size**
  
  Default Shadow Map Size that is used, if in the U-RENDER Light tag is no specific shadow map size defined. (See U-RENDER Light Tag - Shadows chapter for shadow examples)

- **Use Limit**
  
  Enables the Shadow Map Size Limit and overwrites the U-RENDER Light Tag Shadow Map settings.

- **Shadow Map Size Limit**
  
  No Lightsource can have a higher Shadow Map Size larger than the Limit Size. Check Use Limit to activate. It is a good way to increase the FPS in LIVE mode without adjusting every single Light source.

**Effects**

**Motion Blur**

Supported Motion Blur: Camera Motion Blur and Object Motion Blur. In the current Release of U-RENDER, object deformation is not supported by Motion Blur.

⚠ Note, that Motion Blur is deactivated in LIVE-Mode. Render a sequence in Picture Viewer to get the render result with Motion Blur.

⚠ When scaling objects be sure that you use Object Mode and not Model Mode.
Use the Shutter Speed or Shutter Angle of the camera to adjust the strength of the Motion Blur. Smaller Shutter Speed/Shutter Angle values provide less Motion Blur.

(Shutter Speed: 1/125s, 1/30s, 1/8s)

(Shutter Angle: 90°, 180°, 270°)

Reconstruction Dithering

This value gives control over the Motion Blurs Dithering. Higher values produce smoother Motion Blur.

(Reconstruction Dithering: 2, 32, 64)

⚠ If Motion Blur is needed for a single still frame, you have to render an image sequence of at least two frames to get a proper result.
**Depth of Field**

Depth of Field refers to the range of distance that appears acceptably sharp. It depends on the distance between camera and objects and the camera settings. Additional Depth of field settings are available in the U-RENDER Camera Tag.

Enable Depth of Field

Enables/Disables Depth of Field for the entire scene.

Sample Count

Adjusts the amount of samples that are used to calculate Depth of Field. Higher values result in better quality of the DoF blur. The sample count is used for the fast bokeh and no bokeh mode.

Limit Blur Size

A larger value will allow for a larger blur radius of the effect. Limit Blur Size has a big impact on the performance. We recommend setting it as small as is possible for a given scene.

Scale

Parameter applies a multiplier to the spread of each pixel allowing to reduce or increase the blur. At 100%, the physical parameters of the camera are used (*F-Stop*). Use the Scale value to adjust the size of the blur if you build your scene at an unusual scale.
Focus Range

Determines the space between Depth of Field planes. The higher the value the less of the image will be blurred as a larger range will be kept in focus.

(0cm | 100cm | 300cm)

Bokeh (Fast | High Quality)

When Bokeh simulation is turned on, the shape of the aperture of the camera can be specified either by specifying its parameters, or by specifying a texture.

When using the polygonal Bokeh shape, it is possible to specify the number of blades of the aperture, the roundness of the blades, their rotation, the anisotropy of the lens, and the radius of a catadioptric mirror in the center of the lens.

When using a texture, the texture should be a greyscale or colored shape of the aperture with a black background. Colored textures simulate the effect of putting a colored filter in front of the lens.

The Fast Bokeh simulation uses Monte Carlo integration, thereby causing noise in the image. The High Quality setting produces a pixel-perfect blur, but it is slower.

- **Gamma**
  
  The Gamma parameter allows changing how bright and dark parts of the image are blended together. Increasing the Gamma makes bright spots (e.g. highlights) more visible. Decreasing it reduces the effect of bright spots. At 1.0 a physically accurate blending is used.

- **Bokeh Shape**
  
  Will determine the shape of the bokeh in the background depending on the Blades parameter.

- **Blades**
  
  Number will determine how many sides the shape will have. As default value is set to 5, your Bokeh effect will look like a pentagon.
With Angle parameters you can rotate the shape/blades.

- **Anisotropy**
  Depending on the value will stretch or squeeze the shape/blades.

- **Roundness**
  Can make the Bokeh shape/blades rounder.

- **Inner Radius**
  Will make Bokeh shapes hollow from the inside of the shape, depending on the value.

⚠ **Limitations**

⚠ Each color frequency should have a slightly different focus plane, leading to chromatic aberration. This is not simulated.

⚠ Objects in front of the focus plane should have the Bokeh shape mirrored. This is not simulated.

⚠ This is a post-processing effect. Objects that are hidden behind blurred objects are not revealed.
Bloom

Bloom simulates the artifact effect of camera lenses that cause bright light to fade outside from bright areas.

 الشيخ Firefly Reduction

Firefly Reduction can help to reduce flickering of the Bloom effect when there are small but bright spots ("fireflies") in your image that change over time. Firefly Reduction limits the luminance of the image when calculating the bloom. This will result in a reduction of the bloom intensity but also helps to get rid of flickers.

 الشيخ Intensity

Adjusts the intensity of bloom. Higher values mean brighter bloom.

 Sheikh Inner Weight

Inner weight controls the intensity of the bloom on the “inside”, i.e. close to the bright area.

 Sheikh Outer Weight

Outer Weight controls the intensity of the bloom on the “outside”, i.e. further away from the bright area. Reduce the Outer Weight to decrease the radius of the bloom.
Line Settings

The Lines can be used with all kinds of scenes no matter if PBR and/or NPR materials are used. There are 4 types of Lines, Object Lines (creates lines per mesh object), Material Lines (creates lines per material), Feature Lines (creates detailed lines based on the angle of edges and depth), Color Lines (creates Lines based on color areas).

All line types can have a color and a blend type:

(gray Lines: add / subtract / multiply)

All line types can have different width:

(Object lines red width 10, feature lines blue width 4, color lines green width 2)

⚠ The line render settings affect the entire scene. But it is possible to use the “Overwrite Lines” material channel of the U-Render NPR material to overwrite the global line render settings.

❖ Lines only

Lines only mode disables all shading and only shows lines. In this case the background color or environment color set in the Environment render settings is used as background.
Brush Texture

A grayscale texture can be used to define the line drawing style.

Object Lines, Material Lines

Object and Material Lines are outlines and are generated on the outside of single mesh objects or by materials.
Feature Lines

Feature Lines are based on the angle of edges (normals) and the distance between objects (depth information). Therefore there are thresholds to define where the lines should appear. Feature Lines are used for details and Line inside of outlines.

![Feature Lines Normals | Feature Lines Normals+Depth | Feature Lines N+D and Material Lines](image)

- **Line Mode**

  Line modes can be set to Soft and Hard with threshold values to adjust at what point lines should appear or disappear, depending on angle or depth information. The Soft mode lets the lines fade out:

![Line Mode: Soft | Hard](image)

- **Color Lines**

  Color Lines create outlines around every color area detected.
Dynamic Width

Dynamic width adjusts the width of the lines according to the perspective so they become thinner the further they are from the camera. When the value is set to 0, the line width stays constant.
Post Processing

Tone Mapping Settings

✦ Enable Tone Mapping

Enables/Disables tone mapping. Prevents the render result from clipping to white.

(tone mapping: off / Reinhard white point 1.5 / Reinhard white point 5.0)

✦ Affect Background

Use this option if you want to have your background tonemapped or not. It influences background color as well as environment map, if it’s set for use as background.

(affect background: off / on)
Tone Mapping Mode

Sets the tone mapping mode Linear, Exponential or Reinhard. In most cases Reinhard does a very good job.

Use HSV colorspace

When working with high reflective materials, there can be unwanted hue shifts in the specular highlights. In this case use HSV colorspace for compensation.

Exposure

Increasing the exposure increases the brightness of the render result but clipping in bright areas can occur.

Black Point

Increasing the Black Point makes the rendering darker without touching the highlights.

White Point

White Point adjusts the amount how strong the highlights are shifted into visible dynamic range. This will be the most important setting for tone mapping.

Colorspace conversion

You can set the colorspace that fits your workflow. Use Output Format uses the color Space that is set in the Save menu.

Chromatic Aberration

Simulates the different refraction indices of different wavelengths of lenses. As a result high contrast areas like edges are blurred with specific colors. This effect increases the closer the distance to the image border.

Enable Chromatic Aberration

Enables/Disables Chromatic Aberration.

Strength

High values cause more blur with increasing amounts to the borders of the image.
Vignette

Vignetting reduces the brightness of the image at the image border. It can be used to emphasize and draw attention to the image center.

- **Enable Vignette**

  Enables/Disables Vignette.

- **Radius**

  (radius 20 / 40 / 60)

- **Softness**

  (softness 10 / 40 / 80)
Strength

(Strenght 30 / 70 / 100)

Sharpening

The sharpening filter can bring back fine details and is useful if softer texture filters are used. Note that a too high amount of sharpening can produce noise in animations.

(Sharpening Amount: 0 / 50 / 100)

Filter

This section contains color correction tools. They are applied on the final render output and are also working when LIVE mode is active.

Saturation

In- or decrease the saturation of the rendering.
♦ Brightness

In- or decrease the brightness of the rendering.
⚠ Can cause color clipping when used too high or low values.

(Brightness: -50% / 0% / +50%)

♦ Contrast

In- or decrease the contrast of the rendering.
⚠ Can cause color clipping when used too high values.

(Contrast: -50% / 0% / +50%)

♦ Gamma
In- or decrease the gamma of the rendering. Does not affect the input or output gamma and only works as a color correction tool.

\[ \text{Gamma: 0.5 / 0 / 2.0} \]

- **Red, Green, Blue**

You can deactivate or activate single color channels.

\[ \text{(Red / Green / Blue)} \]

- **Invert**

Inverts the rendering.

\[ \text{(Invert on / invert off)} \]

- **Curve**

Curves are a more versatile way of color grading compared to saturation/brightness/contrast. It prevents highlight clipping or clipping to black much easier. You can adjust curves for each color channel separately.
⚠ If you need a larger window for adjusting the curves, press the right mouse button over the curves and select the “Show in separate Window” option.

⚠ If you messed up a curve you can reset it by pressing the right mouse button and select “reset”

**Gamma**

- **Output Color Profile**

  Choose the according output color profile to adjust the gamma value for your image.

  Available options are:

  - **Use Output Format**: Use this setting to make sure the gamma matches what Cinema 4D is expecting. The gamma is adjusted according to the Image Color Profile selected in the “Save” tab of the render settings. Right now, U-RENDER only understands sRGB and Linear color profiles. “Use Output Format” also makes sure to automatically change the color space to Linear for Multi-Pass rendering.
  - **sRGB**: The image will be gamma corrected for sRGB (a gamma of roughly 2.4)
  - **Linear**: The image will be kept in linear space (gamma 1.0). Use this if you want to continue to work in linear light for compositing.
  - **Custom Gamma**: Custom Gamma allows you to set any gamma value you need.

- **Gamma**

  Define your custom output gamma here. This field is only available when “Custom Gamma” is selected in the Output Color Profile.

**Multi Pass**

Multipass rendering allows you to have control over many aspects of the render result by rendering a single frame splitted into various files called multi passes.
Note that enabling the Multi Pass option takes longer render time. Also the file format and type of compression strongly influences the render time. In general, higher compression causes longer render time but smaller file size and vice versa.

Multi Pass render time/filesize examples:

<table>
<thead>
<tr>
<th>Fileformat</th>
<th>Compression</th>
<th>Render time [mm:ss]</th>
<th>File size [GB]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OpenEXR 32 bit float</td>
<td>none</td>
<td>01:59</td>
<td>7.7</td>
</tr>
<tr>
<td>OpenEXR 32 bit float</td>
<td>Zip in blocks of 16 scan lines</td>
<td>05:25</td>
<td>1.3</td>
</tr>
<tr>
<td>OpenEXR 32 bit half float</td>
<td>none</td>
<td>01:54</td>
<td>3.9</td>
</tr>
<tr>
<td>TIFF 32 bit</td>
<td>Compression pack bit</td>
<td>02:02</td>
<td>5.4</td>
</tr>
<tr>
<td>TIFF 32 bit</td>
<td>LZW compression</td>
<td>02:40</td>
<td>2.3</td>
</tr>
</tbody>
</table>

**Matte**

These special passes need additional Multi Passes that have to be created with the Multi-Pass option in the render settings:

- **Object Id**
  
  Create an “Object Buffer” in Multi Pass with corresponding Group ID that matches the Compositing Tag on your object. The result is a black/white pass that can be used for masking an object. Use Cinema 4D Documentation for more information about Object Buffer. Also activate the “Object Id” multipass.

- **Material Id**

  Create a “Post Effect” in the Multi Passes and check if your Materials have assigned a Material ID Color in the Material Editor. The result is a multicolored pass where every material has a specific color that can be used for masking/keying in your compositing software. Note that you have to apply “Post Effects” in the Cinema 4D Multi-Pass menu.

**Lighting**

Except for the RGBA Image pass, all the passes of this group are necessary to get the correct render result.

Available Passes:

- RGBA Image
- Ambient
- Diffuse
- Specular
- Reflection
- Refraction
● Ambient Occlusion

**Material**

All passes in this group are necessary to get the correct render result.

Available Passes:

- Material Diffuse
- Material Specular
- Material Emissive

**Advanced**

These are additional passes that can be very useful to make additional effects in your compositing application. Note, that for the Depth pass you need to activate near and far clipping settings in the U-RENDER Camera Tag.

Available Passes:

- Material Normal
- Material UVW
- Depth
- Instance Color

**Post Effects**

These passes consider Post Effects that are set in the render settings.

Available passes:

- Lines

**Compositing in After Effects**

We recommend OpenEXR 32-bit float/half float file format for the multipasses. In this case it is important to use 32-bit float compositions and make the following Project Settings:
In the Color Settings tab use “32-bits per channel (float)” as depth and use “sRGB IEC61966-2.1” as working space.

Also activate “Linearize Working Space”

Use following compositing approach to get the same result as the single pass render result:

Tip: If you don’t have a tone mapping plug-in installed in After Effects, the built in “HDR highlight compression” effect assigned on an adjustment layer on top does a good job to bring values higher than 1 into a visible range.
Note that following effects are currently not included in the multi passes and have to be done in your compositing software:

- Tone mapping
- Vignette
- Chromatic Aberration
- Depth of Field
- Bloom
- Anti-Aliasing
Materials (global settings)

The U-RENDER Materials focus on easy and fast adjusting and creating physically based materials. If you don’t see the material previews in the Material Editor or the Material Manager be sure that U-RENDER is set in the Render Settings and refresh the Material thumbnail by double clicking on it in the Material Editor.

Texture Projections (Procedural UVs)

One major benefit of U-RENDER is the ability to use texture projections in addition to uv texture coordinates. This can be a major time saver as there is no need to create uv-maps for each model.

These texture projections are supported:
● Spherical
● Cylindrical
● Flat
● Cubic
● Frontal
● Spatial
● UV
● Shrink Wrapping
● Camera Projection

In addition to the projection types, tiling, repetition and offsets are supported as well.

**Cinema 4D Shader support**

It is possible to use a wide range of Cinema 4D shaders for U-RENDER Materials. Not every Cinema 4D shader is supported at the moment. In general, all color correcting (filter, colorizer, posterizer) layering (layer, fusion) and shaders that produce textures (noises, surfaces) are supported well. Shaders that rely on render-time ray-tracing information will not work correctly.

⚠ We recommend to use C4D Shaders sparingly because texture baking can be time consuming.

⚠ If a C4D Shader is used as grayscale value for a material the gamma value for the texture has to be 2.2 that a grays value of RGB 128/128/128 corresponds to 50%. You can use the gamma slider for this adjustment.

Note that you set the number of CPU threads that should be used for texture baking in the global U-RENDER preferences (Menu: Edit / Preferences).

大爷 Cinema 4D Shader baking resolution

You can set three resolution settings for every Cinema Shader that needs to be baked separately. The specific resolution can be set in the "Render Settings - Basic - Shaders" tab. Because U-RENDER needs to bake the shaders, this process takes some time. To get a good performance we implemented separate resolution settings for U-RENDER live view and picture viewer renderings.

● If you want to adjust the entire scene/baking performance in LIVE mode, just set the resolution in the Render settings.
● The settings in the Material Editor gives you control over specific materials that need resolution adjustments.

大爷 Bake Animation

Set this option active if using animated textures, noises, image sequences or movie clips as texture.
Bake Resolution

There are three quality settings: low/medium/high. This setting affects the resolution the shaders are baked and rendered in LIVE mode as well as in the picture viewer. The default value is “medium”. When activating low or high, the resolution is set one step lower or higher. In this example lower would be 128x128 and higher 512x512.

The output resolution that is used for the picture viewer is set in the “Render Settings - Basic - Shaders - Render Resolutions” menu.

The Preview resolution for LIVE mode medium setting is set in the “Render Settings - Shaders - Preview Resolutions.”
General Texture Adjustments

All textures (normal map texture with restrictions) can be modified with several parameters to adjust brightness/contrast and other effects.

They also can be mixed with color or values by using blend modes (except normal map and emissive texture).

- **Mix Mode / Mix Strength**

  Possibility to blend the color/value with a texture (blend, add, multiply).

  For using a texture without mixing with color/value set blend mode to "blend" and the mix strength to 100%.

  *(mix mode blend, mix strength 25 / 50 / 75)*

- **Sampler**

  Textures can be filtered with several options: Point, Linear, Trilinear, Anisotropic

  △ Note that the Displacement channel only supports Point and Linear filtering method.

  *(Example with extremely noisy bump map: Sampler: Point / Linear / Trilinear / Anisotropic)*

- **Texture Adjustment**

  You can activate Brightness/Contrast/Gamma and Invert option to adjust your used texture and use the Texture Adjustment checker box for quickly turning it on/off

- **Brightness**
Adjusts the brightness of a texture from black (-100%) to white (+100%). Note that the brightness slider doesn't avoid clipping to black or white.

(brightness 85 / 50 / -50 / -85)

Contrast

Adjusts the contrast of a texture from gray (-100%) to black/white (+100%). Note that the contrast slider doesn't avoid clipping.

(contrast 50 / -50)

Gamma

Adjusts the gamma of a texture. Due to the nonlinear behavior of gamma, it avoids clipping to black or white.

(gamma 0.3 / 8)

Invert

Inverts the entire texture.
PBR Material

The PBR material is a physical based material and should be used if scenes should have a realistic appearance.

Color

- **Color**
  
  Defines the diffuse color of the material. Use dark colors for metals.

- **Texture**
  
  Loads a texture as a diffuse color. Use any common file-format 8/16/32 bit. All textures in the U-RENDER Material (except normal map) have basic color correction sliders for Adjustment.

  - **Texture Adjustments**
    
    See: General Texture Adjustments

Emissive

Set SSGI in the render settings if you want to illuminate nearby objects by emissive materials.

- **Color**
  
  Defines the color of the emission.

- **Brightness**
  
  Brightness is used to modify the tone value of the Color. It does not affect the emissive texture.

- **Strength**
  
  The Strength value allows you to tune the emission amount without the need to change the color. It acts as a multiplier for the emissive color as well as textures.
(solid emissive color color, emissive strength: 0 / 250 / 500)

➢ Texture

You can use a texture for the emissive color.

(emissive texture)

➢ Texture Adjustments

See: “General Texture Adjustments”

➢ Attenuation

Attenuation decreases the emissive amount over the distance.

(Attenuation: none / linear / inverse square)

➢ Attenuation Start
Defines from which distance from the camera the strength of the emission begins to decrease.

(Attenuation Start: 0 / 100 / 400)

Attenuation Distance
Defines the distance in which the emission loses its strength.

(Inverse Square, Attenuation Distance: 0 / 100 / 400)

When using linear attenuation, the emissive strength is zero at the chosen attenuation distance without a visible falloff.

(Linear, Attenuation Distance: 0 / 100 / 200)
Subsurface

Subsurface Scattering lets light pass the object’s surface and scatters the light within the material itself. It is an important part for materials like skin, wax, marble, milk etc.

⚠ Note that light sources have to be set up with any kind of shadow enabled.
⚠ Subsurface Scattering can be globally activated/deactivated in Render Settings Basic tab
⚠ To see the effect of SSS the diffuse color has to be brighter than black.
⚠ Also the light source color influences the Subsurface Scattering color.

(different settings of subsurface scattering)

➤ Color

The subsurface color defines the appearance of the light that is scattered in the material:

(diffuse color grey, subsurface color orange/green/blue)

➤ Surface Scattering
Surface scattering defines how much light from the front is scattered within the material. It visually smooths the surface of the geometry as you increase the strength.

**Strength** defines the scattering distance:

(strength: 0.01/0.5/2)

Depth Falloff decreases ghosting effects that can occur around the borders of the geometry:

(depth falloff: 0.01/0.5/5)

Sample Distribution adjusts the spread of the samples. Higher values preserves detail, but there still can occur ghosting effects around geometry borders:

(sample distribution: 1/2/5)

Sample Count defines how many samples are used. More samples gives smoother and softer results:
Translucency

Translucency defines how much light from the back reaches the front. Strength sets the distance how deep the light can scatter. If value is high enough, light shines through the object.

Wrap Lighting controls light wrapping around the geometry:
Shadow Bias can be used to prevent shadow artifacts and for adjustment:

(shadow bias: 0.5/2/6)
**Transparency**

The Transparency channel enables the possibility to create transparent materials like glass, water etc. Note that you can set the specular reflection separately by using the reflectance channel.

Rendering of transparent objects is a challenge for real-time rendering. Either it is really slow or it compromises on quality. Right now U-RENDER uses “order independent transparencies”. This approach does not require to sort all polygons before rendering - which is good for the rendering speed. It has a couple of limitations though. First, the algorithm does not know which object is in front of the other. This can lead to “wrong” looking results with objects that are more opaque. As all transparent objects are drawn in one pass they also cannot refract and blur each other.

(opens images of materials with transparency)

- **Opacity**

Opacity affects diffuse and emissive properties of the material. Following example shows the effect of different opacity values and the material color set to white.

(opens images: opacity 5%/50%/99%)

- **Refraction**

The IOR value for most materials is between 1,0 and 3,0. Refractions are a screen space effect. That means, other than with ray-tracing, only what is visible on the screen already can be seen (refracted) through transparent objects.
Transmission

To create a colored transparent object, use a transmission color other than white. The transmission color defines what color (wavelengths) are passing through the object. It is effectively the inverse of the absorption color. For example, a green transmission color makes the object appear green as it will absorb red and blue colors that are passing through the object.

Blurriness

This value simulates the diffusion of transmitted light and can be used for frosted glass effects. Blurriness does not affect other transparent objects. Note, that the glossiness of reflectance is not affected by the transparency blurriness. You have full control of reflection glossiness in the reflectance channel of the material.
Clear Coat

Clear Coat is an additional layer with Reflectance and Glossiness/Roughness that can be used for car paint materials for example. In the current release of U-RENDER it is possible to use textures to define the Glossiness/Roughness.

✦ **Strength**

Defines the amount how strong the Clear Coat will appear. Note that the Material is still energy conserving when using Clear Coat, so it also influences Reflectance Channel as well as Diffuse Channel.

(Strength 0% / 50% / 100%)

✦ **Glossiness/Roughness**

The Glossiness/Roughness defines the scattering of the specularity if the Clear Coat looks rough or glossy.

(Glossiness 50% / 80% / 100%)

✦ **Normal**

The Clear Coat can have its own normal map and also be blended with the global Normal/Bump Channel.
1. Left: No Clearcoat Normal at all: Blend with Base Layer 0% and Strength 0%
2. Middle: Blend with Base Layer 100% and Strength 0%
3. Right: Blend with Base Layer 50% and Strength 40%⚠️ Note: If you set the Blend with Base Layer value to 100% the global Normal/Bump Channel is completely overwritten.
Sheen

Sheen can be used to simulate the effect of fine microstructures like fine filaments or hairs. It is helpful for materials like cloth, velvet, microfibers but also getting a better result for materials like skin and some fruits like peach.

⚠ At least one direct light source like Omni, Spot, Infinite or Area light has to be active in the scene.

⚠ Sheen is implemented with energy conservation and will darken the information of the diffuse channel.

› Falloff

There are two falloff modes that influence the appearance of the Sheen gradient, Sinus and Gaussian. Gaussian produces a harder transition in the gradient itself but gives a softer result on areas with flat angle to the camera:

(Red = Sinus, Blue = Gaussian / falloff mode: sinus / gaussian)

› Color
The Color defines the color of the Sheen gradient:

(sheen: white color / cold color / warm color)

⚠ The color of the direct light source also influences the Sheen color.

✍ Weight

Weight defines the intensity of the Sheen effect. Also a texture can be used.

⚠ The weight texture does not influence the sheen color.

(weight: 0% / 50% / 100%)

✍ Glossiness

Glossiness adjusts the smoothness of the Sheen gradient. Higher values give a more silk like appearance:

(glossiness: 10% / 60% / 90%)
Reflectance

(examples of specular and glossiness textures)

Environment

Apply Global Environment Map

When active the global environment map from the Render Settings is used. Using an environment map greatly improves the appearance of the material. When you disable the environment, the reflectance only considers light sources for specular reflections.

Exposure

Works as an exposure multiplier for the global environment map. It affects the specular environment reflections but not the diffuse image based lighting (IBL). Use the exposure to increase or decrease the environment reflectance of specific materials to fine-tune their appearance. Typically, you do not need to adjust it though.

Fresnel Reflectance

Workflow: Metallic

The reflectance of the metallic workflow depends on the base color of the color channel. Because of that, there is a metalness value instead of a color to define the appearance of the material. The higher the metalness value the more of the base color is used for the color of the specular reflection.

(result / base color / metalness / roughness)
⚠ Note that non-metal materials like plastic, stone, wood etc. have a very low metalness value (4%-8%) and metal materials like chrome, copper, gold etc. have very bright metalness value (80%-100%).

If a colored texture is used for “Metalness”, you can select which RGBA channel should be used for calculation. Default value is “Luminance” and is calculated from the combined RGB values.

✈ Dielectric F0

This value lets you tweak the fresnel factor independently from the metalness value. Note that these adjustments are more noticeable when working with nonmetal materials.

(dielectric F0: 0% / 50% / 100%)

✈ Workflow: Specular

The reflectance of the specular workflow uses a specular RGB texture to define the appearance of the material.

(result / diffuse color / specular color / glossiness)

⚠ Note that nonmetal materials like plastic, stone, wood etc. have a very dark brightness value (4%-8%) and metal materials like chrome, copper, gold etc. have a bright brightness value (80%-100%). Also the color of the reflectance depends on specular color and texture.

✈ Workflow: Hybrid

The hybrid workflow lets you combine the metallic and the specular workflow to get even more control of the appearance of the material. It uses metalness texture as well as Specular texture.
**Glossiness/Roughness**

The glossiness/roughness defines the scattering of the specularity if the material looks rough or glossy.

It’s a good way to set the overall glossiness/roughness with the slider and then blend it with a texture to get very versatile appealing results. Note that you can use glossiness or roughness workflow for metallic, specular and hybrid materials. You also can use a glossiness texture as roughness texture if the invert option is active and vice versa.

⚠ Note that Glossiness/Roughness are very important material settings that influences the appearance very much. To get very soft, rough materials just decrease the Glossiness value or increase Roughness value.

› **Workflow Glossiness/Roughness**

Defines how glossy or rough a material appears. 100% glossiness means that it is not rough at all and behaves like a mirror vise versa. The glossiness/roughness slider conforms to a grayscale value: 0% = black and 100% = white.

(glossiness 20 / 40 / 60 / 80 / 100)

› **Texture**

Use a grayscale image to define the glossiness/roughness of the material. When a colored texture is put into the Glossiness/Roughness channel the luminance values are used for calculation.

› **Brightness/Contrast/Gamma/Invert**

See: General Texture Adjustments

**Screen Space Reflections**

Screen space reflections allow objects to reflect each other in the scene. Check the Render Settings for global SSR settings.

› **Enable**

Turn screen space reflections on/off for the material. The appearance of the reflections depends on the Specular Brightness and Glossiness/Roughness of the material.

› **Exposure**
With the Exposure value you can make the Screens Space Reflections brighter or darker.

(SSR: off / on / increased exposure value)
**Bump**

Bump mapping is an efficient way to get additional structures on surfaces based on a grayscale map (height map). Bright areas of the map define bulges and dark areas define notches. Due to the mesh geometry is not deformed by bump maps they are generally used to fake microstructures and smaller details on surfaces.

You can use bump and normal maps together, they are added.

» **Strength**

Strength adjusts the amount of bumpiness according to a grayscale texture (heightmap). Set a negative value to switch bulges with notches.

» **Texture**

Use a grayscale image (heightmap) that defines the bump appearance. If a colored texture is used, the color information is ignored and only the values are used for calculation.

![Example of bump mapping](image)

(bump: off / strength 40 / strength 80)

» **Brightness/Contrast/Gamma/Invert**

See: General Texture Adjustments
Normal

Normal mapping is an efficient way to get additional structures on surfaces based on a colored map where defined colors define XYZ alignment and how the normals of the surfaces are modified. Due to the mesh geometry is not deformed by normal maps they are generally used to fake microstructures and smaller details on surfaces.

⚠ Note that there are two kind of normal maps with an important difference: OpenGL normal maps uses green color for surfaces that are facing upside (+Y) and DirectX normal maps uses green color for surfaces that are facing downside (-Y).

You can use bump and normal maps together, they are added.

✦ Flip X (Red)

Activate this option if the red color in your normal map defines surfaces that are facing negative X direction. When using standard OpenGL or DirectX maps this should be deactivated.

✦ Flip Y (Green)

Activate this option if you are using a DirectX normal map. (green color defines surface facing down)

✦ Strength

Sets the amount the normal map texture influences the surface. Set a negative value to switch bulges with notches.

✦ Texture

Use an OpenGL(+Y) or DirectX(-Y) normal map. The usage of grayscale images may produce weird artifacts.

(normal: off / strength 50 / strength 200)
Displacement

Displacement uses a height map to deform the geometry. The higher the subdivision levels are set in the material as well as in the render settings the more detailed information can be used for tessellation and displacement.

⚠ Note that displacement mapping has to be activated in the Render Settings - Basic - Displacement - Enable Displacement to have an effect.

شع Strength

Strength adjusts the amount of displacement according to a grayscale texture (heightmap) and height value. Set a negative value to switch bulges with notches.

شع Height

This value is used to set the maximum displacement height/depth. Fine adjustment can be done with a strength slider.

شع Subdivision Level

Sets how often the polygons on the mesh are divided by the GPU. Note that there can be set a limit in the render settings Render Settings - Basic - Displacement - Limit Displacement Steps. If you set a limit for displacement steps, the subdivision level in the material is limited by this value. Also note, that the maximum subdivision level is limited by the used GPU.

 Shay Smoothing

This value adjusts the smoothness of the displacement shading / normals interpolation. It doesn't change the displaced geometry itself. In many cases, lower values suit better for hard surface displacement and higher ones for organic shapes. It also can be useful for tweaking noisy height maps or to reduce compression artifacts if using low quality jpegs for displacement.
Type

Choose one of the following displacement types:

- **Intensity** needs a grayscale heightmap and displaces the geometry outside the existing geometry.
- **Intensity (centered)** needs a grayscale heightmap and displaces the geometry outside as well as inside the existing geometry.
- **RGB (XYZ Tangent/Object/World)** needs a colored vector displacement map.

Texture

Load the displacement map and set the according type to work properly.

Brightness/Contrast/Gamma/Invert

See: General Texture Adjustments

Assignment

If this material is assigned to objects, they are all listed here. If entries are deleted manually, only the material tag disappears on the objects.
Mask

As a quick alternative to transparencies, materials support a mask (stencil) texture. You can select the threshold when the object should be masked (i.e. be invisible). This can be used to render leaves, fences, grids etc. without the need for slower transparencies. Masked parts of the object are clipped / invisible.

➤ Threshold

Choose a threshold at which the object should be clipped. The default value of 0.5 usually works well. As soon as the mask value is smaller than this threshold, the object will be invisible.

➤ Channel

Choose the channel which should be evaluated for the threshold.

Options are:

- Red - the red texture channel will be evaluated
- Green - the green texture channel will be evaluated
- Blue - the blue texture channel will be evaluated
- Alpha - the alpha channel of the texture will be evaluated. Make sure the texture used actually has an alpha channel. You can for example use the same texture as for the diffuse color.
- Lumiance - the overall texture luminance (RGB) will be evaluated

➤ Texture

The texture that will be used to evaluate for visibility. You can use for example the diffuse texture if it has an alpha channel. You can also use shaders like Noise in the texture slot.

Material ID Color

The Material ID Color is useful if rendering multi-pass frames to achieve a multi-colored render pass that can be used to masking/keying out materials.
Non-photo-real (NPR) Material

The Non-photo-real (NPR) material should be used when more stylized scenes like cartoon shading is used. There are no limits due to energy conservation and other physically based properties. The basis of the NPR material is the use of gradients. It is recommended to deactivate image based lighting in the render settings when starting a NPR scene. The gradients are assigned due to the result of the diffuse and specular lighting. The Line Settings in the render settings are a good addition when using NPR materials.

Color

 mężczy Color, Map SSGI

Defines the diffuse color of the material. Use dark colors for metals. It is possible using the result of SSGI to be mapped for the gradient.

(Specular Gradient: single color / step / soft)
Glossiness

Glossiness defines the spread of the specular highlights.

(Environment Gradient: black-white / step / soft)

Emissive

The Emissive channel works similar to the NPR material. It is possible to use gradients.

Rim Light

The Rim Light channel can be used to add additional light information depending on the normal angle between geometry and camera.

Exponent

The Exponent defines the falloff of the gradient.
Gradient

Gradients can be used soft or step for different styles, as well as blend modes with colors.

Bump / Normal

Bump and normal textures add details to the object without tessellating the geometry. The gradients of the diffuse/specular/emissive channel are calculated after the bump/normal map. It is possible to have bump and normal maps active at the same time.

Bump mapping is based on a grayscale map (height map). Bright areas of the map define bulges and dark areas define notches.

Normal mapping is based on a colored map where defined colors define XYZ alignment and how the normals of the surfaces are modified.

⚠ Note that there are two kinds of normal maps with an important difference: OpenGL normal maps uses green color for surfaces that are facing upside (+Y) and DirectX normal maps uses green color for surfaces that are facing downside (-Y).
Displacement

Displacement uses a height map to deform the geometry. The higher the subdivision levels are set in the material as well as in the render settings the more detailed information can be used for tessellation and displacement.

⚠ Note that displacement mapping has to be activated in the Render Settings - Basic - Displacement - Enable Displacement to have an effect.

❖ Strength

Strength adjusts the amount of displacement according to a grayscale texture (heightmap) and height value. Set a negative value to switch bulges with notches.

❖ Height

This value is used to set the maximum displacement height/depth. Fine adjustment can be done with a strength slider.

❖ Subdivision Level

Sets how often the polygons on the mesh are divided by the GPU. Note that there can be set a limit in the render settings Render Settings - Basic - Displacement - Limit Displacement Steps. If you set a limit for displacement steps, the subdivision level in the material is limited by this value. Also note, that the maximum subdivision level is limited by the used GPU.
Smoothing

This value adjusts the smoothness of the displacement shading / normals interpolation. It doesn't change the displaced geometry itself. The calculation of the gradients is made after the calculation of the displacement.

Type

Choose one of the following displacement types:

- **Intensity** needs a grayscale heightmap and displaces the geometry outside the existing geometry.
- **Intensity (centered)** needs a grayscale heightmap and displaces the geometry outside as well as inside the existing geometry
- **RGB (XYZ Tangent/Object/World)** needs a colored vector displacement map.

Mask

A texture can be used as stencil. You can select the threshold when the object should be masked (i.e. be invisible). This can be used to render leaves, fences, grids etc. without the need for slower transparencies. Masked parts of the object are clipped / invisible.
Choose a threshold at which the object should be clipped. The default value of 0.5 usually works well. As soon as the mask value is smaller than this threshold, the object will be invisible.

➢ Channel

Choose the channel which should be evaluated for the threshold.

Options are:

- Red - the red texture channel will be evaluated
- Green - the green texture channel will be evaluated
- Blue - the blue texture channel will be evaluated
- Alpha - the alpha channel of the texture will be evaluated. Make sure the texture used actually has an alpha channel. You can for example use the same texture as for the diffuse color.
- Lumiance - the overall texture luminance (RGB) will be evaluated

➢ Texture

The texture that will be used to evaluate for visibility. You can use for example the diffuse texture if it has an alpha channel. You can also use shaders like Noise in the texture slot.

Overwrite Lines

To get line rendering enable the Line Settings in the Render setting. This will enable lines that affect the entire scene. To have more flexibility, it is possible to overwrite the render settings with the "Overwrite Lines" material channel to have more control about the line rendering. The Overwrite Line settings are equal to the Line Settings in the render settings. Please see chapter “Settings - Line Settings” in this documentation.

(thin black lines in the render settings, blue thicker line in the cats overwrite lines material)
Multi-Material

The Multi-Material can contain any kind of U-Render materials, NPR or PBR or both. They can be controlled by Color Brightness or Index Ratio of Cloners, Effector Fields etc. It is possible to drag existing materials into the Multi-Material channel or use the “Create Material” button:

For adding and removing material slots, use the “Add Material” and “Remove Material” buttons:

Example:

- For this example create a simple cloner setup with a random deformer and a linear field. Assign a Multi-Material to the cloner object:
● Set the Multi-Material mode to “Color Brightness” and create as many materials with different shading as you want. Use the Weight value to let specific materials more or less often appear.

● In the Randomize Effector set Fields Color as Color Mode in the Parameter tab

● Make sure to set the Color of the Field to Black in the Color Remap Tab
Lights

U-RENDER supports a range of light types to calculate diffuse and specular light contributions:

- point/omni lights
- spot light
- infinite lights
- area lights (disc, rectangle and sphere shapes)

Real-time shadows rely on the calculation of shadow maps. We are still investigating other methods of shadows that could exceed the current limitations of shadow maps.

Supported shadow types are:

- None
- Hard Shadow Maps
- Soft Shadow Maps

U-RENDER tries to match the behavior of Cinema 4D’s light sources as closely as possible. So lights without light tags work to a certain extent. Note, that not all parameters that Cinema 4D light objects offer are supported by U-RENDER though.

We recommend applying a U-RENDER Light Tag on your light sources to get quick access to all supported light features.

Default Light

U-RENDER uses a default light when there is no light source in your scene. As soon as there is a light in your scene, the default light is disabled.

You can disable this default light in the Render Settings.

U-RENDER Light Tag Settings

General

- Color
  
  Defines the light of the color. You can adjust the color in the U-RENDER Light Tag as well as in the light object Basic tab, the values are parented.

- Intensity
  
  Sets the brightness of the light and works as a multiplier for the light color.

- Type: Omni / Spot / Infinite / Area
  
  Sets the light type and makes light specific parameters available or unavailable.
Attenuation

Sets the attenuation of the light source. Use Inverse Square (photometric light intensity) falloff to have a physically correct falloff. Other falloff types are supported as well and may give you a result that matches your idea more closely. If you want to fake sunlight use an infinite light type and set the attenuation to “none”.

Options are:

- None - useful for very distant light sources which attenuation does not change over the range of the scene (e.g. sunlight)
- Linear
- Inverse Square
- Inverse Square Limited
- Step

Radius/Decay

Defines the distance where the falloff of the light starts.

Near Clip

Sets near clipping values with an from/to fall-off. All objects that are out of the clipping setting are unlit.

Far Clip

Sets far clipping values with an from/to fall-off. All objects that are out of the clipping setting are unlit.

Inner Angle

Only available for spot lights. Defines the inner spotlight angle until which the light retains maximum intensity.

Outer Angle

Only available for spot lights. This outer angle defines where the intensity drops to zero.
Area Shape (Area Lights Only)
Select the shape of the area light. Available options are:
- Rectangle
- Disc
- Sphere

Size X, Y, Z (Area Lights Only)
Define the size of the area light.

Show in Render (Area Lights only)
Enable this option to make the area light visible in the rendering.

Single Sided
Light is only emitted on one side, in direction of the positive z-direction. This matches Cinema 4D light’s “Z Direction Only” setting.

Diffuse
If active, the light creates diffuse lighting. Default value is active.

Specular
If active, the light creates specular lighting. Default value is active.

Shadows
Shadow Mode
U-RENDER provides several shadow modes: None, Hard, Soft Edges. Every mode has specific abilities.

(shadow modes none / hard / soft edges)
Color

Sets the shadow color. In reality shadows only exist in the absence of light and have no color. The effect of a colored shadow can occur when light is hitting transparent materials. We see green glass if all wavelengths are absorbed by the object except parts of the green ones that are transmitted. There are also parts of green light passing through the glass and the cast shadow seems green. Also, atmospheric effects can cause the impression of bluish colored shadows the more the distance increases, as well as other participating media effects.

(Shadow color black / blue / brown)

Shadow Map Size

It is possible to define the shadow map size for every single light source in the scene. Smaller map sizes render faster and influence the precision and appearance of the shadows. Note that it is possible to set the default shadow map size in the Render Settings, as well as set up the maximum shadow map size a light source can have. In that case, the Light Tag Shadow Map Size is overwritten.

(Shadow map size hard shadows 256 / 1024 / 4096)

(Shadow map size soft shadows 256 / 1024 / 4096)
Absolute Bias

Available for all shadow modes. This value tweaks the contact shadow behavior. Small amounts produce accurate shadows without offset between tangent objects and reduce the impression of floating. Otherwise, small amounts can produce artifacts on larger scene scales. In order to have the best result, this value has to be tweaked for all light sources.

Slope Bias

This value tweaks shadow artifacts that can occur when the angle between light, surface and camera is very flat. Also good for optimizing in cases where the Absolute Bias has to be very low. Most artifacts occur when using point lights and hard shadows.

![Example images of Absolute Bias and Slope Bias effects](image)

(Absolute bias: 0.001 slope bias: 0.001 / absolute: 0.01 slope: 0.001 / absolute: 0.01 slope: 0.1)

Shadow Sample Radius

Available for Soft Edges shadow mode. Adjusts the softness of the shadows. Note that higher values produce softer shadows but longer render times.

![Example images of Shadow Sample Radius effects](image)

(Sample radius 1 / 5 / 10)

Mesh Shadow Range

Can be adjusted if the cast Shadows are cut off. Normally the distance is calculated automatically and depends on the bounding box of the scene. The bounding box considers all meshes in the scene, except the volumetrics. If a mesh object needs to cast its Shadows into a Volume Object that is “outside” of the border of all mesh objects in the scene, the
Mesh Shadow can be cut off. To prevent that, adjust the Mesh Shadow Range. In the case of Volumetrics, you also have to enable “Enable Mesh Shadows” in the Volumetrics group.

(Mesh Shadow Range: Automatic / Automatic without ground plane / manually set without ground plane)

**Volumetrics**

- **Enable Mesh Shadows**

  Needs to be activated if meshes should cast shadows into Volumetrics. Example images show a plane with alpha texture casting mesh shadows:

  (hard shadows, low volumetric subdivisions / soft shadows, sample radius 3, low volumetric subdivisions / soft shadow, sample radius 0.5, high volumetric subdivisions)

- **Apply Shadow Color**

  If a shadow color is selected, then the cast volumetric shadow is colorized by this color too:
Enable Volumetric Shadows

Volumetrics can cast Shadows on itself and on geometry:

Resolution X,Y,Z / Subdivisions

Set the resolution of the Volumetric Shadows independently from the global Volumetric Render Settings:

(Apply Shadow Color: off/on)
➧ Volumetric Shadow Range

Depending on the scene size it can be necessary to adjust the Volumetric Shadow Range:

(Sub volumetric Shadow Range: 620 / 650 / 1000)

Subsurface

➧ Subsurface Light Scale

Adjustment for the amount of subsurface scattering. Needs a material with subsurface settings active and activated shadow in the light source.

(Subsurface Light Scale: 50%/100%/200%)
Volumetric Rendering

Volume Objects can be Layers or Cubes. Volumetrics need to be enabled in the Render Settings. The Volumetrics are voxel based and suitable for global volumetric effects like fog, haze, participating media, atmospheric effects, god rays and so on.

To enable volumetrics, you need to:

1.) Activate Volumetrics in the Render Settings:

2.) Create a Volume Object (U-Render menu - U-Render Volume):

3.) Create a Light Source.

⚠ Note that in the current release using Spot Lights is recommended. Point- and Infinite lights are supported as well, but they need more performance.
Object Mode

Layered Volume Mode

The Layered Volume object creates an infinite volume with a gradient that can be adjusted very easily.

» Orientation

Sets the Orientation of the volume in X, Y, Z

(Orientation: +X / +Y / +Z)

» Media A-B Blend Range

Defines the distance of the falloff between media A and media B. By default media A is set to density 0, so media B is blending into the empty environment.

(Blend-Range: 0 / 50 / 100)

» Clip Range

In addition to the blend range between both media you can clip the layer volume if needed so that it does not go to infinity. This has no influence on the global voxel grid.

Cube Volume Mode

The Cube Volume Object generates a volume inside of the boundaries of a cube.

» Size
Defines the size of the volume cube in X,Y,Z.

**Volume Properties**

**Density**

Defines how strong the light is scattered. A medium with more density scatters more light and causes more visible volumetric shadows as well.

(Density: 0.5 / 2 / 5)

**Phase**

Adjusts if the light is scattered more backward towards the light or if the light is passing forward through the media.

Zero is a neutral behavior that has both forward and backward scattering. Negative numbers result in more backward scattering (light is reflected back towards the light source). Positive numbers result in more forward scattering (light is passing forward through the medium).

(Phase: -0.5 / 0 / 0.5)

**Volumetric Noise**

Adds a noise for the density of the volume object. The noise can be adjusted and animated with several settings.

✦ Noise Space: World
If set to world mode, the volume object can be positioned/rotated/scaled without affecting the noise itself.

❖ **Noise Space: Object**

The noise inherits the position, rotation and scale of the volume object.

❖ **Noise Space: Custom**

Let’s you define a transformation object like a null or any other kind of object. Position, Rotation and Scale of the noise is now linked to the transformation object. If the transformation object is parented under the volume object, it behaves like noise space object mode.

❖ **Use Density Gradient**

Defines a gradient curve for the density of the volume. Can be used in addition to the adjustments (low clip, high clip, brightness, contrast)

(Density Gradient Spline Preset: linear / square / sin)

❖ **Octaves**

The number of octaves controls the amount of detail of the noise. So adding more octaves increases the detail of noise.

(Octaves: 1 / 3 / 10)

❖ **Lacunarity**
Works as a multiplier how quickly the frequency of the noise increases for each octave. By increasing the Lacunarity there is still the main shape that the octaves define visible but the details increase.

(Lacunarity: 1 / 2 / 4)

» Persistence

Works as a multiplier how quickly the frequency of the noise increases for each octave.

(Persistance: 0 / 1 / 4)

» Scale

Sets the global scale of the noise.

(Scale: 20 / 100 / 400)

» Animation Speed

Animates the noise itself without any kind of specific direction.
Movement Animation Orientation: Object
Moves the noise depending on the volume object position.

Movement Animation Orientation: World
Moves the noise in world position

Movement Animation Orientation: Custom
Moves the noise depending on a custom orientation object like null or any other object.

Movement
Defines the movement direction and speed in X, Y, Z

Speed
Used as multiplier for the Movement values

Adjustments Low Clip, High Clip, Brightness, Contrast
Adjustments to control the density distribution of the noise. Can be used in addition to the density gradient.

(Custom adjustments: default / variation example A / variation example B)

Cameras

U-RENDER Camera Tag Settings

Clipping

Near Clipping
Sets the near plane distance of the camera. There is no rendering of objects between camera and near plane distance. Also important when rendering Depth multipass to adjust the beginning of the grayscale depth gradient.
Far Clipping

Sets the far plane distance of the camera. There is no rendering of objects behind the far plane distance. Also important when rendering Depth multipass to adjust the ending of the grayscale depth gradient.

Depth of Field

To enable Depth of field has to be turned on in the Render Settings - Effects.

Focus Distance

Defines the distance that is rendered sharp. Depending on the F-Stop and scene scale, foreground and background gets more and more blurry.

F-Stop

Set the F-Stop of the camera. The smaller the f-stop number, the blurrier the foreground and background is rendered.

Motion Blur

Lets you set Shutter Speed or Shutter Angle to influence the strength of Motion Blur.

Volumetrics

Volumetric Far Clipping

This value behaves like the common Far Clipping of the camera, but it concerns only the Volumetrics and not the scene geometry. The resolution of the volumetrics depends on the Z distance that can be adjusted with the Far Clipping value. In large scenes there can be the problem that the Far Clipping value of the Camera needs to be high and the resolution for the Volumetrics gets too low. In this case the Volumetric Far Clipping value can be used to prevent objects in distance from being cut off due to the Far Clipping.
Spherical Rendering

To enable Spherical Rendering, goto the Spherical Tab and select “Enable”. U-RENDER supports all features Cinema 4D provides.

For the Mapping Types choose the following Aspect Ratios:

- Lat-Long: 2:1, e.g. 4096x2048
- Cube Map (Cross): 4:3, e.g. 4096x3072
- Cube Map (3x2): 3:2, e.g. 3072x2048
- Cube Map (String): 6:1, e.g. 3072*512

⚠ Post Effects like Vignette and Chromatic Aberration can cause unwanted artifacts. When using spherical rendering it’s better to turn them off.

⚠ Use the Hemisphere Ambient Occlusion method instead of the Ground-Truth AO. The Ground-Truth-AO may cause unwanted seams.

⚠ Slightly increasing the Render-Resolution Overscan (Render Settings - Basic) can prevent visible seams.
Object Tag

Settings

- Backface Culling

This option activates backface culling on/off. If active, the backside of faces is not visible/rendered.
U-RENDER Commands

After installing U-RENDER you can find additional commands in the Plugins - U-RENDER menu. We recommend pining the menu bar into your UI to have fast access to the U-RENDER features.

Use Studio

Starts U-Render studio and automatically renders the scene into a separate window. When deactivating this button, the complete rendering information is removed from your VRAM. Also the Studio Sync button is activated automatically. Note when Studio is active rendering to the viewport is deactivated and vice versa.

Studio Sync

Synchronizes all adjustments and changes to the scene and updates U-Render Studio in real time. Uncheck this button for heavy scenes to keep your Cinema 4D UI responsive. Unchecking does not remove any data from the VRAM so when synched again, the scene starts rendering immediately.

Clear Scene

When rendering a scene for the first time, it’s entirely sent to the GPU of the computer. This sending process may take more or less depending on the complexity of the scene. After changing minor things in the scene, like moving an object or adjusting a light source, U-RENDER checks what data has to be sent for the next render process because of changes. All other data that is still on the GPU and unchanged will not be sent again to the GPU. That can save enormous render time. In some cases there may occur wrong synchronization behavior. That can cause objects to be missing in the render result or placed at the wrong position etc. In that case use the clear scene option. That forces U-RENDER to send the whole scene again.

Dashboard

Opens the Dashboard. The Dashboard gives you better control over what kind of data is going to be updated when LIVE- Mode is active. Adjustments in these settings can be useful to increase the playback performance.

Scene Debug Info

This option prints scene debug information into the console window. (menu Script - Console)
**System Information**

Opens a window with basic information about your system that can be copied to clipboard or saved as *.txt file.

**Create U-RENDER Material**

This command creates a new U-RENDER material. We have added this command as an option that allows you to bind a keyboard shortcut to it or place it as an icon in your layout. No more Create → Shader menu wrangling.

**Material Converter**

The material converter converts existing U-RENDER materials into Cinema materials and vice versa. Note that there are not all features supplied, but it is a good starting point that saves a lot of time compared to replacing and assigning materials and textures completely by hand. The converter doesn’t delete the materials after replacing them, they are still available in the material manager.

**Convert all Materials to U-RENDER**

All Cinema materials in the scene are converted into corresponding U-RENDER materials. The material tags on each object are replaced automatically.

**Convert selected Materials to U-RENDER**

All selected Cinema materials are converted into corresponding U-RENDER materials. The material tags on each object are replaced automatically.

**Convert all U-RENDER Materials to Cinema 4D**

All U-RENDER materials in the scene are converted into corresponding Cinema 4D materials. The material tags on each object are replaced automatically.

**Convert selected U-RENDER Materials to Cinema 4D**

All selected U-RENDER materials are converted into corresponding Cinema 4D materials. The material tags on each object are replaced automatically.

**Convert all U-RENDER Materials to NPR**

All U-Render materials in the scene are converted into U-Render non-photo-real materials. The material tags on each object are replaced automatically.
Convert selected U-RENDER Materials to NPR

All selected U-Render materials are converted into corresponding U-Render non-photo-real materials. The material tags on each object are replaced automatically.

License Manager

Opens the License Manager. Here you can see the status of your license or release/upgrade it.

Volume Object

Creates a Volume Object. Can be a Layer or a Cube. Volumetrics have to be enabled in the Render Settings. The Volumetrics are voxel based and suitable for global volumetric effects like fog, atmosphere, godrays and so on.

Check for Updates

The update window appears and shows the latest version available as well as the current installed version.
U-RENDER Preferences

The global U-RENDER preferences can be found under Edit - Preferences - U-RENDER.

Communication

❖ Port

The network port which the Cinema 4D plug-in uses to communicate with the standalone application if in use. Typically leave this at the default value of 65056. In case another program already uses that port, you need to change the network port to an available number. Try ports in the range of 65000 to 65500. Make sure you configure the U-RENDER Standalone to use the matching port.

To find out the network port that the standalone application uses, start the application and have a look at the status bar at the bottom. The used port shows to the right.

❖ Live Update Interval [ms]

The Live Update Interval limits the number of updates that are sent to the standalone application.

If you have the LIVE mode enabled and - for example - move the camera, these changes are sent to U-RENDER. If too many updates are sent there is the chance that the previous update is still being processed. This might lead to a situation where the updates are happening more frequently than U-RENDER can process them. To avoid this, you can limit the rate of updates with this setting.

Values for the Live Update Interval range from 16 ms to 100 ms:

- 16 ms - sending a maximum of 60 updates per second
- 100 ms - sending a maximum of 10 updates per second

❖ Render Executable Path

Set the path to your U-Render Application directory and U-Render.exe. For example: C:\Program Files\U-RENDER\U-Render.exe

❖ Autostart Renderer by Default

Enable if the U-Render Application starts automatically if rendering to Picture Viewer or Live-Mode. Set the correct directory of the Application in “Render Executable Path”.

❖ Autostart Renderer by Default
Sets if the U-Render Application should be closed automatically when Cinema 4D is closed.

**Updates**

 طويل Check for Updates

Turn on if U-RENDER should check updates automatically.

 طويل Time Interval

Sets the time interval if U-RENDER should check for updates on Cinema startup, daily, weekly or monthly.

 طويل Type of Update

Lets you set if only stable, beta/unstable or alpha/nightly versions should be checked for update.

**Material System**

 طويل Material Preview Size

Sets the size of the material previews are rendered in the U-RENDER view, if LIVE mode is not activated.

 طويل Shader Render-Thread Count

You can assign how many render threads are used for Cinema 4D shader baking that is used if you use Cinema Filters, Surfaces, Shaders etc. for your Materials. Initially there are not all available threads assigned to ensure that shader baking doesn’t interrupt your working process.

**Debug Options**

 طويل Clear Scene Before Rendering

The Scene is deleted from the GPU before U-RENDER starts rendering the image.

 طويل Use Shader Debug URLs

Option only for developers.

 طويل Enable Dashboard Debug-Mode

Enables additional information “Live-Stats” and “Debugging” in the Dashboard. You need to re-open the dashboard to update.
U-RENDER Standalone

The U-RENDER standalone program is the heart of the renderer and handles all rendering tasks - from material previews and live mode to offline rendering.

The standalone needs to run and to be able to communicate with the host application plug-in for rendering to work.

Menu Options

➢ Edit - Preferences

Fast access to change the Communication Port. Also update checking for new U-RENDER versions and the time interval can be set here. This can also be set in the C4D Preferences.

➢ View - Scene Information

Lists basic scene information containing objects like Lights, Meshes, Instances and Materials. Also used vertices and the number of triangles are listed.

➢ View - V-Sync

Activated V-Sync caps the U-RENDER frame rate to your Monitors refresh rate (typically 60 FPS). Deactivating V-Sync can cause issues when navigating in the scene at very high frame rates.
 появлением и уничтожением объектов в сцене.

✦ View - Always-On-Top

If you right click on the U-RENDER view title bar or left click directly on the U-RENDER icon you can check/uncheck Always-On-Top. That prevents other program windows overlapping the U-RENDER view.

✦ Help - Check for Update

Check if U-RENDER is up to date. We strongly recommend always having the latest version installed.

✦ Help - License Management

You can activate and deactivate your license and also see the current status of expiration.

✦ Help - Troubleshooting

Redirects to the U-RENDER community support forum. Feedback, issues, present your projects or just talking about any 3d topic is welcome. Please also see the Troubleshooting section in this documentation.

✦ Give us Feedback!

Redirects to a short survey that helps us to understand our customers better and make U-RENDER better even more!
Standalone and Plug-in Communication

The Cinema 4D plug-in communicates with U-RENDER using a local TCP/IP connection. Data is transferred using a HTTP based REST API.

For communication to work, the U-RENDER standalone application needs permission to listen on a network port. The default port is 65056 but can be configured. U-RENDER acts as a server.

The host plug-in acts as a client. It establishes the connection to the U-RENDER server.

The REST API is still in development and will change over time.

Configuring the TCP/IP Port of the U-RENDER Standalone

The U-RENDER Standalone is listening on a TCP/IP port (default port 65056). You might need to configure your Windows firewall to allow this.

U-RENDER runs on your local machine (localhost) and does not make connections to other servers on the internet or your local network. The Cinema 4D plug-in is making a connection to the U-RENDER standalone through a TCP/IP connection. As this connection is established only on your own machine (localhost) it does not make use of a proxy.

When the default port 65056 is already used by a different application, you can change the port by specifying it on the command line of the U-RENDER standalone (e.g. -port 65066) or by changing the settings.json file in your installation folder by adding or changing the "NetworkListeningPort" setting.

For example, add this entry to the settings.json:

"NetworkListeningPort": 65055

Now restart the U-RENDER standalone. It should be listening on port 65055 now.

You also need to change the settings for the communication port in the Cinema 4D Preferences for U-RENDER.

We are looking into making this more user-friendly in the future!
Troubleshooting

U-RENDER seems to be offline

Check if the U-RENDER standalone is running and can connect on the configured port. You can see the port configuration of the U-RENDER standalone in the window title. It shows the TCP/IP port it uses to listen for commands.

When the U-RENDER standalone could not use the configured port, it shows an error in the window title as well. There are several reasons why the connection on the configured port could fail:

- The Windows firewall or other security software is preventing U-RENDER to connect to the port
- The configured port is already used by another software

Make sure you have allowed U-RENDER to make the TCP/IP connection by checking your firewall and security settings.

Change the configured port if another software is already using the TCP/IP port. See the chapter “Standalone and Plug-in Communication” for details.

Debug Log

Both the Cinema 4D plug-in and the standalone application write debug level logs. These logs are written to the “U-Render” folder within the system temporary folder. There you can find URenderStandalone.g3log.###.log and URenderC4DBridge.g3log.###.log (with ### being the date and time when the log has been started).

A quick method to open the temporary folder is to open the Windows File Explorer and enter %TEMP% in the location field (shortcut: F4 or Ctrl-L).

The Cinema 4D plug-in also writes debug information to the Cinema 4D Console (menu: Script - Console, shortcut: Shift-F10).

Scene Debug Info

The Scene Debug Info menu command logs the current state of the scene into the Cinema 4D Console and into the log file. This technical scene info can be helpful in finding issues with parsing and synchronization.
Application Analytics

Why We Analyze Usage Data

We are constantly striving to improve U-Render. To be able to do that, we need to know more about how U-Render is used and what features are used often.

For example:

- How often is a feature like volumetric rendering used?
- What material features - like for example normal maps - are used frequently?
- Which anti-alias settings are used?
- How much VRAM do GPUs have on average?

Knowing more about how U-Render is used allows us to prioritize improvements to frequently used features. We might see the need for more training materials for those features.

This information is collected and sent to us via the internet if you enable anonymous usage data analytics.

What Usage Data is Collected

With application analytics we collect data about how U-Render is used. This includes settings for materials or which features of the renderer are used. What image resolution is used to render images or what features are used frequently.

We also collect some information about the hardware that runs U-Render. For example, how much RAM and VRAM is available to U-Render or how many CPU cores can be used.

We do not collect data that can be used to identify a computer or the user. We do not collect license keys or similar data. We also make sure that the collected data cannot be used to identify the user or computer.

Your Privacy

It is very important to us to protect your privacy!

Application analytics does not collect or store any data that allows us to identify the user. We do not store any personal data or any data that would allow us to make a connection with you. We make sure that data like your IP address is obfuscated so that it cannot be used to identify the computer or location which the information was sent from.

We use Microsoft Playfab to store and analyze the data. The data is not stored indefinitely but deleted after a certain time as well.
Limitations and Known Issues

Known Issues

- Negative object scaling produces shading errors due to inverted normals
- Camera Projection Types: When setting parallel projection, avoid putting this camera in a parent object with rotation values. This can cause jittering in movement.
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U-Render uses several Open Source libraries. We would like to thank all the developers that publish their work under permissive licenses so that others can build upon their work!

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C++ REST SDK (Casablanca)

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Dear ImGui

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OpenGL Mathematics (GLM)

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Real-Time Polygonal-Light Shading with Linearly Transformed Cosines

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A Phenomenological Scattering Model for Order-Independent Transparency

Portions of transparency rendering are based on “A Phenomenological Scatter Model for Order-Independent Transparency” by Morgan MacGuire and Michael Mara.


http://graphics.cs.williams.edu/papers/TransparencyI3D16/

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Efficient GPU Screen-Space Ray Tracing

Portions of screen space ray-traced reflections are based on “Efficient GPU Screen-Space Ray Tracing” by Morgan McGuire and Michael Mara. Their example implementation was provided under a BSD 2-clause license.

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From McGuire and Mara, Efficient GPU Screen-Space Ray Tracing,

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THE POSSIBILITY OF SUCH DAMAGE.
Documentation Changes

2018.12.01

- Added information about Early Access
- How to use license activation
- Added documentation of motion blur settings

2018.10.07

- Added description of Materials Clear Coat parameters

2019.01.15

- Added Ground Truth Ambient Occlusion

2019.03.01

- Added Dashboard

2019.06.02

- Added Render-Resolution Overscan
- Updated Screenshot Quick Start Guide
- Added Dashboard Live View
- Added U-RENDER Standalone menu options: Scene Information, Preferences
- Added Clearcoat Normal Map
- Added Spherical Rendering

2019.11.01

- Updated System Requirements with info on Cinema 4D R21 support
- Render Settings Volumetrics
- Added Dashboard Volume Object
- Added Volumetric Information Light Tag
- Added Volumetric Information Camera Tag
- Added Volumetric Objects Settings

2019.12.03

- Update Preferences Settings
- Added General Texture Adjustments: Sampler Types
- Update General Texture Adjustments: Emissive

2020.04.03

- Added Emissive Attenuation (Material Setting)
- Added Filter (Post Processing Render Setting)
- Updated Volumetric Light Types
- Updated U-RENDER Standalone menu
2020.6.4

- Added Application Analytics documentation
- Added Subsurface (Material Setting)
- Added Subsurface (Light Tag)
- Added Subsurface (Render Settings)

2020.9.2

- Added U-Render Studio and U-Render Viewport Rendering
- Updated Quick Start Guide
- Added Post Processing Curves Filter
- Added Apply Shadow Color Option
- Updated Dashboard
- Updated Live View Settings
- Updated Clear Coat
- Updated supported Cinema 4D versions

2021.1.3

- Updated Render Settings (Geometry: Backface Culling, Lighting: Default Light, Environment Map: Presets, Fog, Colorspace Conversion, Multipass: Instance Color)
- Added U-Render Layout
- Updated Quick Start Guide
- Updated Multi Pass Advanced
- Removed installation chapter (see the separate Installation & Licensing Manual)

2021.6

- Added documentation for the improved Depth of Field settings.

2021.9

- Added documentation for Sheen material settings.

2022.4

- Added NPR Material
- Added Screen Space Global Illumination (SSGI)
- Added Multi-Material
- Added Line Render Settings
- Added Sharpening Post Effect
- Updated Render Settings: Basic, Environment, Lighting, Post Processing, Multi Pass
- Updated Installation and Licensing Process
- Updated Material Converter
- Updated U-Render Viewport Menu
- Updated General Texture Adjustments
2022.8

- Added U-Render Studio install information
- Added U-Render License Manager information