Quick Start Guide

This is a copy of the user manual on MudBun's official website.

Please visit the **online manual** for the latest manual.

Features & Terminologies

Pleas read the **info page** first to better understand the features & terminologies.

Importing The Package & Building Executables

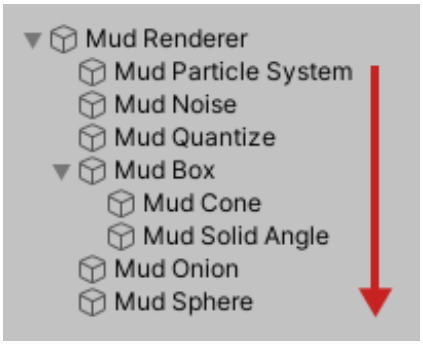
When upgrading from older versions of MudBun, **DELETE** the entire MudBun folder before re-importing from a newer package. File structures might have changed, and directly re-importing a new package on top of an existing one could cause unexpected issues.

There are folders specific to render pipelines: **Built-In RP**, **URP**, and **HDRP**. There are one of each under the folders **MudBun/Examples** and **MudBun/Resources/Render**. Only import the folders that are specific to the current render pipeline and leave out the rest. It wouldn't matter in play mode in editor, but it would cause errors when building executables.

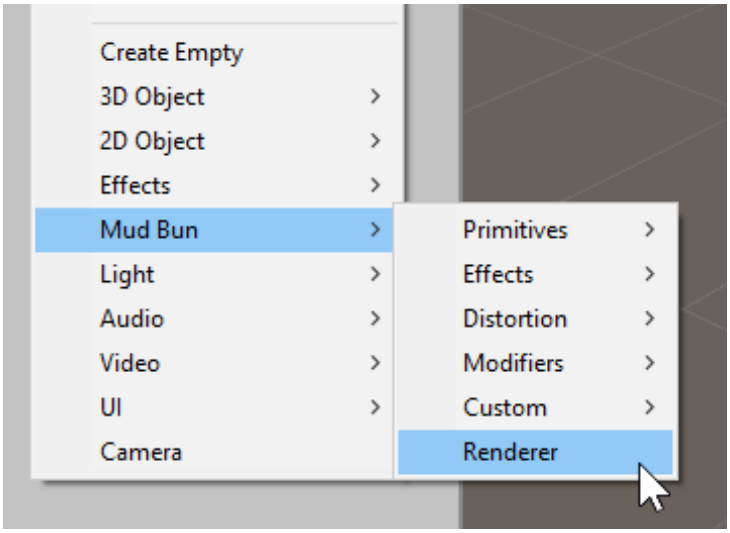
Note that there are different examples in each render pipeline's example folder. Be sure to check out all of them under different render pipelines.

Renderers & Brushes

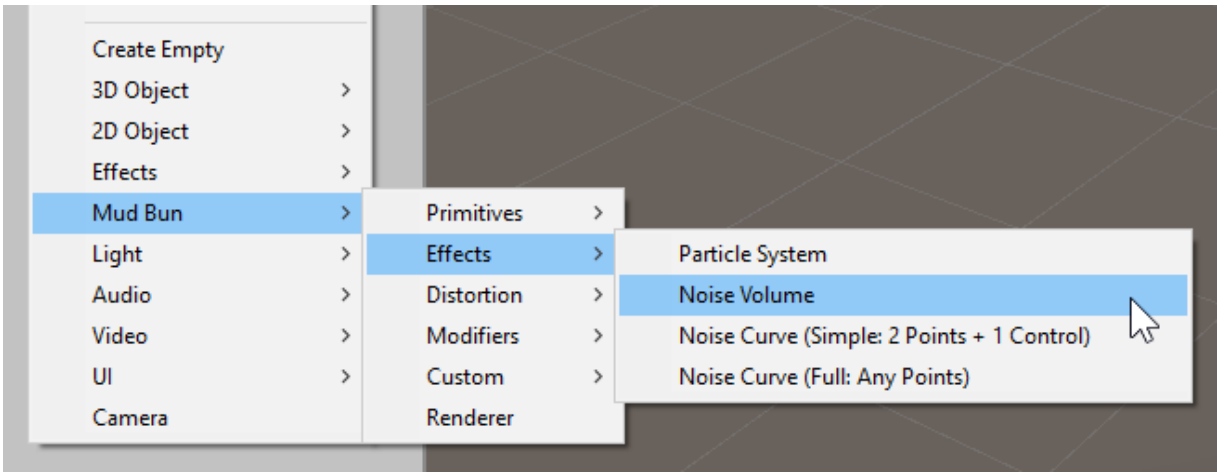
To generate volumetric VFX mesh, a renderer is needed. Brushes nested under the renderer will be processed in a top-to-bottom order as presented in Unity's Hierarchy panel.



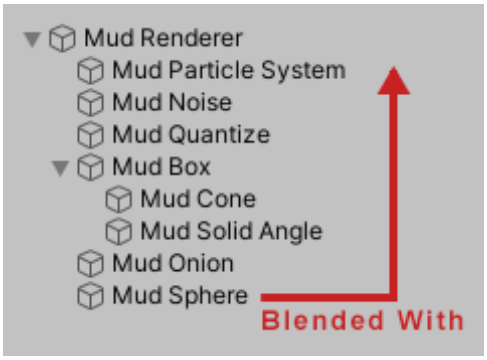
To add a new renderer, right click in the Hierarchy panel, and select **MudBun > Renderer**.



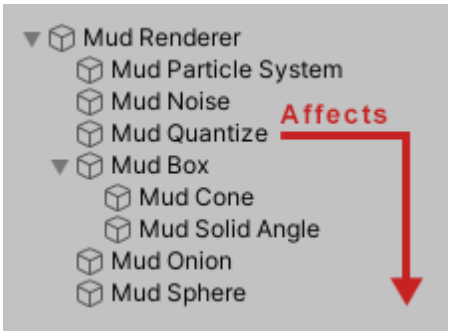
Alternatively, a renderer will be automatically created if a newly created brush is not under an existing renderer's hierarchy. For example, creating a new noise volume brush will also create a new renderer and the noise volume brush will be nested under the renderer.



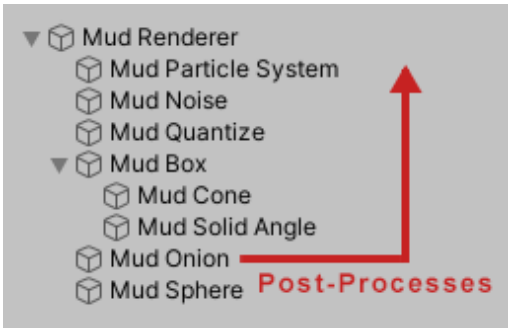
A **solid** brush (e.g. the Sphere brush) is blended with all the brushes **above** it in the Hierarchy panel.



A **distortion** brush (e.g. the Quantize brush) distorts the sample space and affects all the brushes **below** it in the Hierarchy panel.

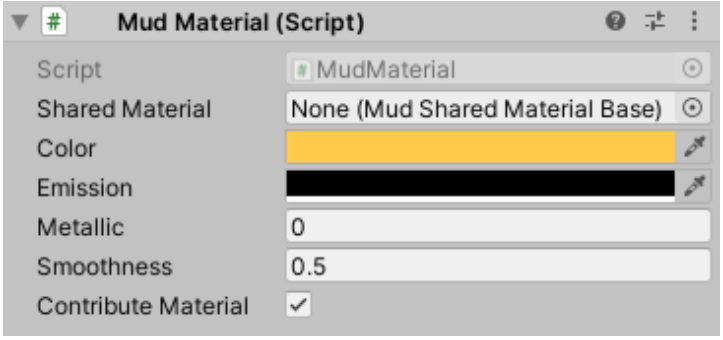


A **modifier** brush (e.g. the Onion brush) post-processes the accumulated SDF and thus affects the results from all the brushes **above** it in the Hierarchy panel.

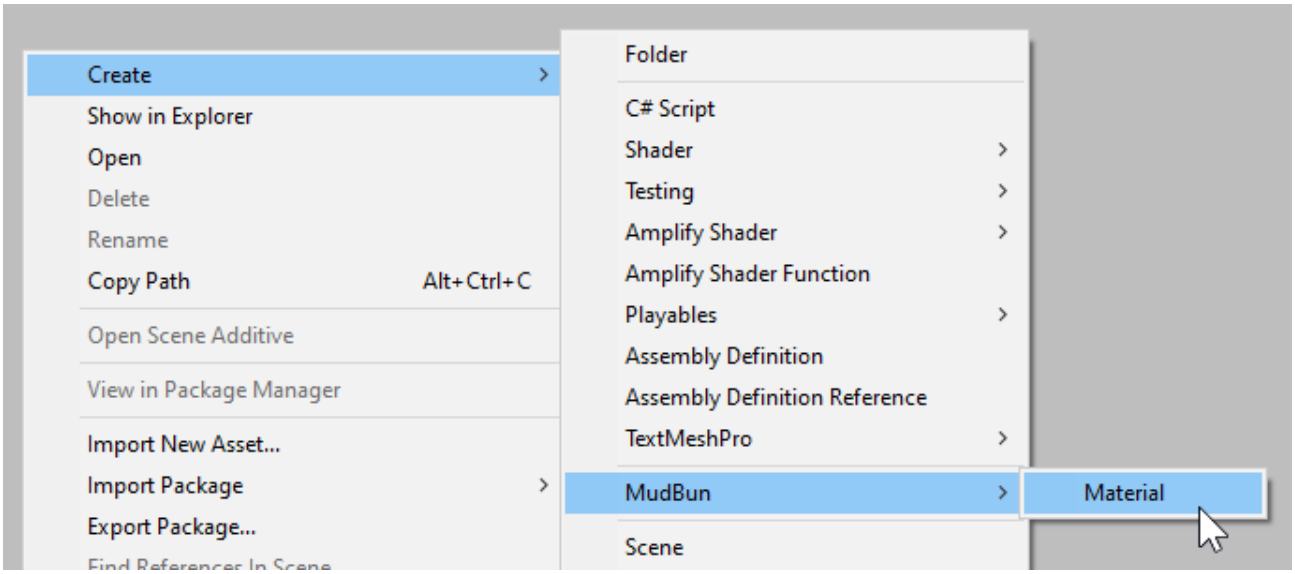


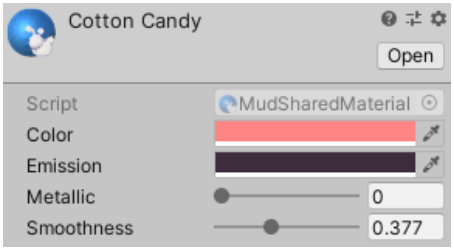
Materials

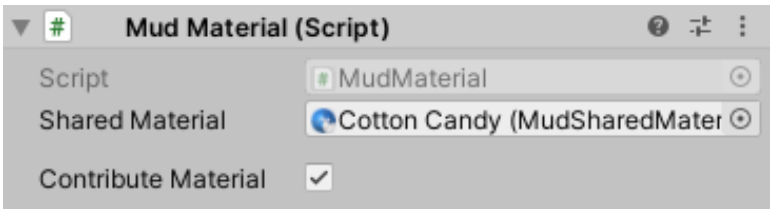
Each brush has its own material, as shown in its Mud Material component. A brush's material properties, such as color and smoothness, may be adjusted in-place right within the Inspector panel.



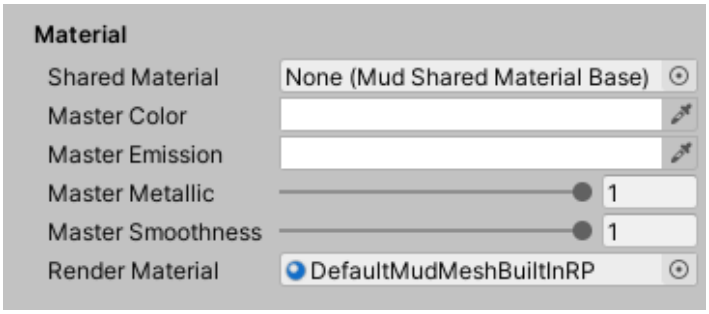
Alternatively, a shared material can be created in the Project panel by right-clicking and selecting **Create > MudBun > Material**. This is stored as an asset that can be shared across multiple renderers and brushes.





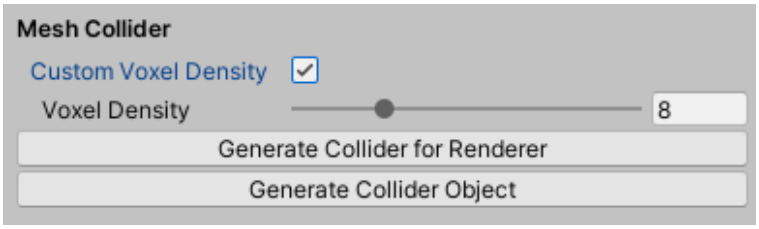


A renderer has some master material properties. These properties are multiplied with the final results of voxel materials. For example, setting the master color to a blue color will give the color of the generated mesh a blue tint. Same as a brush's material, a renderer's master material can be bound to a shared material asset.



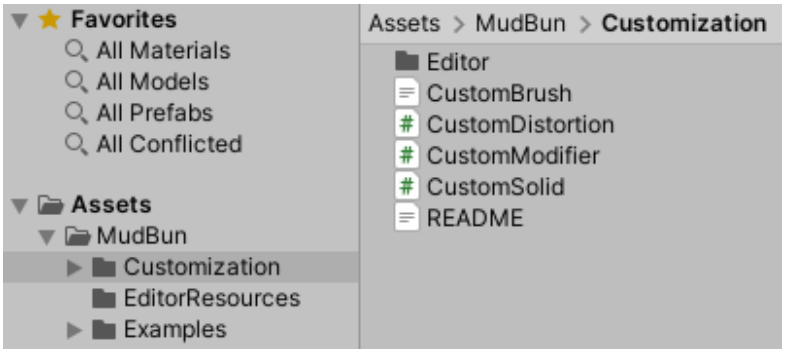
Mesh Colliders

Mesh colliders can be generated from a renderer's current mesh, which can be either added to the renderer itself or added to a new separate game object. A custom voxel density different from the one used by the renderer can also be specified for generating mesh colliders.



Custom Brushes

Templates and examples for creating custom brushes are located in the **MudBun/Customization** folder.



New custom brushes are created in 3 parts: create a brush class in C#, define the brush's signed distance field in compute shader, and add the brush class to the creation menu.

To create a brush class, extend either one of the `CustomSolid`, `CustomDistortion`, or `CustomModifier` class. Two things that must be overridden are the `Bound` property and `FillComputeData` method.

The `Bounds` property returns the bounding axis-aligned bounding box (AABB) of the brush, which is essential for the renderer to determine where to evaluate voxels. It is acceptable if the AABB is slightly larger than the actual shape of the brush, which will result in slightly more unnecessary voxel evaluation. But if the AABB is smaller than the brush, then some voxels will be skipped and holes will appear in the generated mesh.

The `FillComputeData` method fills up the brush data to be used by the compute shader and returns the number of actual SDF brushes to be evaluated by the compute shader, which is typically 1 but there are exceptions, like curves and particles. The `SdfBrush.Type` field must be a integer value that doesn't conflict with existing brush types; see `SdfBrush.TypeEnum` in **SdfBrush.cs** or the defines in **BrushDefs.cginc** for exiting brush type values.

Next, the signed distance field (SDF) of the brush needs to be defined in the compute shader. They are defined by adding new cases on the brush type in the `sdf_custom_brush` function in **CustomBrush.cginc**. Note that re-compiling compute shaders after changing anything in **CustomBrush.cginc** might take a very long time, due to the extensive use of SDFs in meshing compute shaders. There are some commented-out

defines at the top of **CustomBrush.cginc** that can be uncommented to skip the compilation of some meshing compute shaders to greatly speed up compilation for faster iteration. For example, to iterate custom signed distance fields under the flat mesh render mode and marching cubes meshing mode, uncomment all defines except `MUDBUN_DISABLE_MARCHING_CUBES_FLAT_MESH`. Once the iteration is complete, comment all the defines again; otherwise, the disabled render modes and meshing modes will not work.

When creating custom distortion or modifier brushes, it's also necessary to override the `MaxDistortion` property in the C# class to return the correct maximum possible distortion distance of SDFs, as well as add an extra case in the `sdf_custom_distortion_modifier_bounds_query` function in **CustomBrush.cginc** to return the SDF of the bounds of the effects of the brushes. If the former is not done correctly, some voxels might be skipped and holes will appear in the generated mesh. The latter is not necessary but can greatly help with shader-level optimization. In the `sdf_custom_brush` function, distortion brushes are meant to modify the `p` variable to distort the sample point, and modifier brushes are supposed to base the return value on the `res` input variable, which is the accumulated SDF results of preceeding brushes.

Finally, add a menu entry in **CustomCreationMenu.cs** for the custom brush so it shows up in the asset creation context menu. This step is not necessary if the custom brush is only meant to be instantiated in code and not meant for in-editor creation.

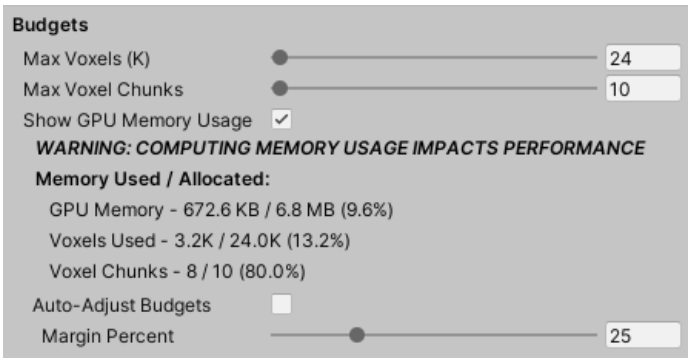
Although unlikely, users might find the need to customize the bone weighting logic for auto-rigging. It can be done by adding a case in the `apply_custom_brush_bone_weights` function in **CustomBone.cginc**. The user will be responsible for properly updating the `boneRes`, `boneIndex`, and `boneWeight` variables, which are `float4`, `int4`, and `float4`, respectively. They hold data for a maximum of 4 bones for each vertex that are sorted from the most-weighted bone to the least-weighted bone; for example, the `x` component of each variable holds the brush's SDF result, corresponding bone index, and bone weight, respectively. The bone transforms and indices are optionally recorded and assigned in the overridden `FillComputeData` function (see **MudCurveSimple.cs** as an example). The 4 components of the `boneWeight` variable must add up to 1. See the default `blend_bone_weights` function in **BoneFuncs.cginc** for a better idea on how to properly update these varialbes.

GPU Memory Budgets

It's important to keep track of how much GPU memory is allocated is used. It's good practice not to allocate too much more than what is actually needed. The renderer's **Budgets** section in the Inspector panel provides an interface to adjust budgets, monitor the usage, and automatically adjust based on actual usage.

The **Auto-Adjust Budgets** option keeps track of high-water marks of voxel & voxel chunk usage and automatically adjusts the budgets, with the **Margin Percent** option for reserving an extra safe percentage of memory margin.

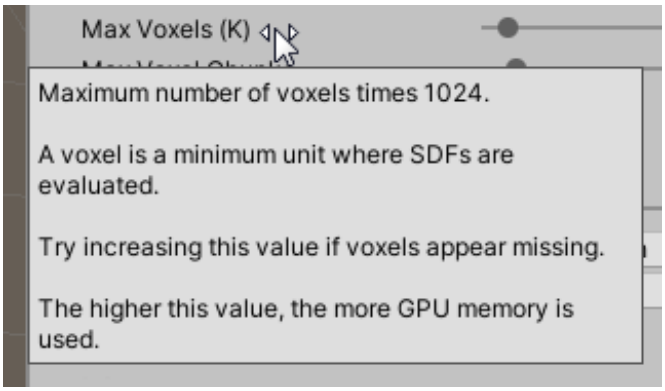
Allocating much more GPU memory than actually needed is not the end of the world, but this could mean that other code that also needs GPU memory might exhaust it when allocating, potentially leading to a crash.



If there appears to be holes in the mesh, i.e. some voxels are missing, chances are that the budgets for max voxels and/or max voxel chunks are set too low. Check the GPU memory usage and increase the memory budgets accordingly.

Tooltips

Don't forget that some parameters provide tooltips if you mouse-over them.



Amplify Shader Editor Nodes

Nodes for Amplify Shader Editor are located in the **MudBun/Amplify Shader Editor** folder. The **Mud Mesh** node is for flat & smooth mesh render modes. The **Mud Splat** node is for circle & quad splat render modes. The **Mud Generated Standard Mesh** node is for mesh renderers on locked meshes.

The default shaders for URP and HDRP can be used as references on how to hook up these nodes. They are located in the **URP** and **HDRP** folders under **MudBun/Resources/Render**. Make sure to open them in projects under the correct render pipeline with Amplify Shader Editor imported.

Performance

In general, having too much of anything in a game will induce unnecessary performance hit. Here are a few things to look out for to get the most out of MudBun while maintaining reasonable performance.

- Keep voxel density as low as possible while still looking good. This will help with performance as well as keeping GPU memory usage low.
- Remember that the flat mesh and splats render modes are computationally cheaper than the smooth mesh render mode.
- Keep the sizes of distortion and modifier brushes as small as possible, as they can quickly eat up a lot of voxels as they grow larger.
- Consider trying the splats render mode with low voxel density. It creates a stylized look, and low voxel density means good performance.
- Watch the number of particles. Each particle is treated as one solid brush. Try using higher self-blend values and less particles to achieve the same effect, or consider using noise volumes to arrive at similar effects.