MicroSplat

TRAX

URP2021.3+ Compatibility:

Depth Priming Mode must be set to disabled for Trax to work in URP2021.3 or greater. This can be found on your URP's Renderer settings.

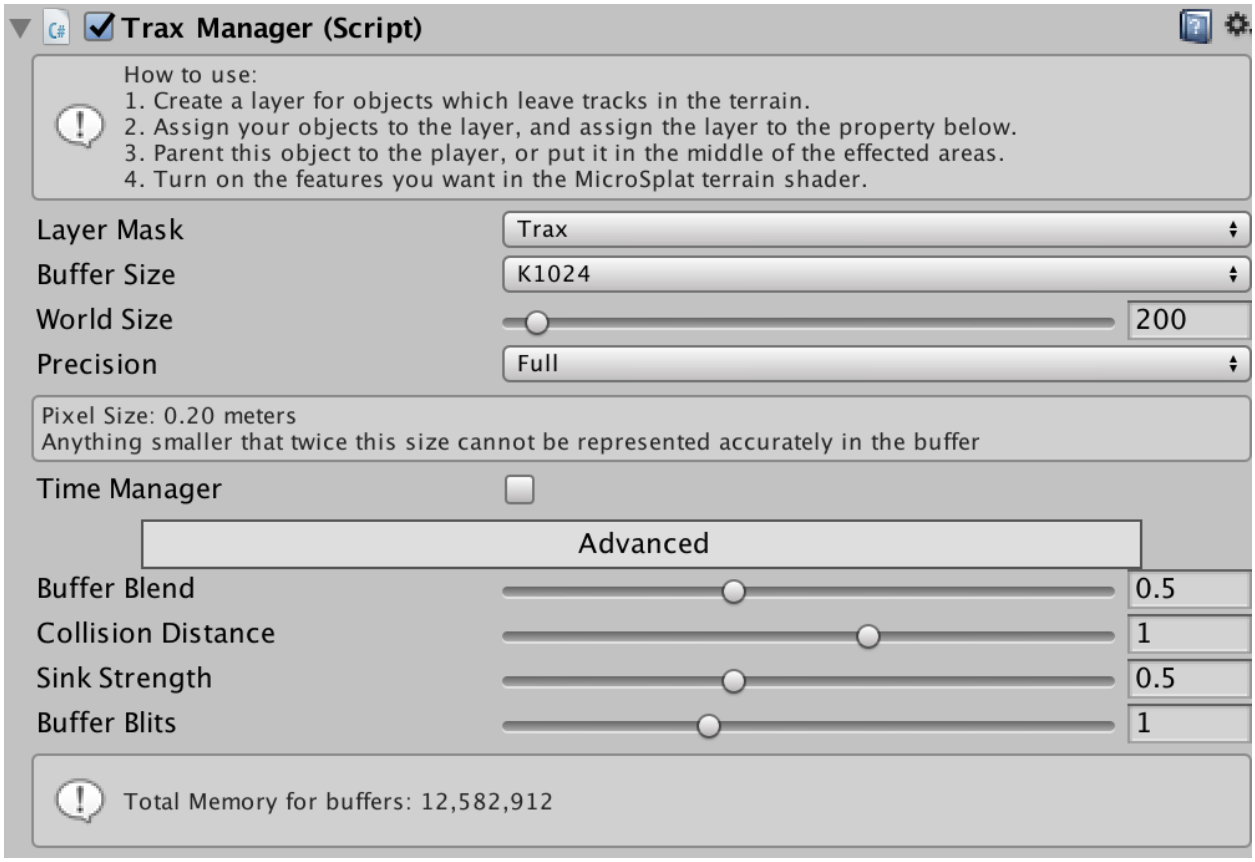
I believe this is due to a Unity bug which causes their materials to not render correctly into a separate depth camera render target when Depth Priming is enabled. If you need this feature, you can get around it by duplicating your meshes onto a layer only rendered by Trax and

assigning them a material from the Built in Render pipeline, then making sure your main camera does not render this layer (which will show as pink).

Overview

The Trax's module for MicroSplat adds several new features to the MicroSplat framework, allowing you to dynamically clear snow or change the textures on the ground based on objects positions in the world.

The first step is to add the Trax Manager script to an object in your scene. This is the central control for the Trax system, and also controls where the center of the effect buffer is. For instance, you could parent this to the player in your game to make sure that the effects work in a radius around the player, or place it statically in the world to designate an area for the effects. There should only be one trax manager in the scene.



The Trax Manager has the following settings:

- Layer Mask
    - This controls which layers are rendered into the tracks buffers. If you have a layer for characters, you might want to add it here. You also might want to add a custom layer for trax objects. Only objects in these layers will be rendered into the buffer, and you should make sure that whatever layer your terrain is in is not listed here.
- Buffer Size

        - Internally Trax uses several buffers for the effect. This lets you set the size of those buffers, and the total memory used will be displayed at the bottom of this interface.
- World Size
    - This is how big of an area around the Trax Manager the buffer is mapped to. In the example above, with a 1024 texture and 512 meter world size, we have 2 pixels per meter. This means that the smallest object which can reliably interact with the buffer is about a meter in size. Using a higher res buffer or smaller world size would increase the resolution.
- Precision
    - You can use half precision to save memory, but if you use the Time Manager then full precision will be used because half precision is not enough. In most cases, half precision is good enough and halves the amount of memory used.
- Time Manager
    - This can be turned on to handle time based effects, like having a trail disappear after a while, or snow repairing the tracks left behind.
        - Repair Delay
            - This is how long to wait until the repair process starts happening, in seconds.
        - Total Repair Time
            - This is how long it will take to repair “1 meter” worth of change. Usually this works out to seconds, but sometimes could take longer.
        - Stop Repair After
            - If this is greater than 0, a stop time can be set for repairs, leaving some of the trail behind. This can be very useful so that older surfaces can be run over again and still produce an effect while still showing that they have already been run over.

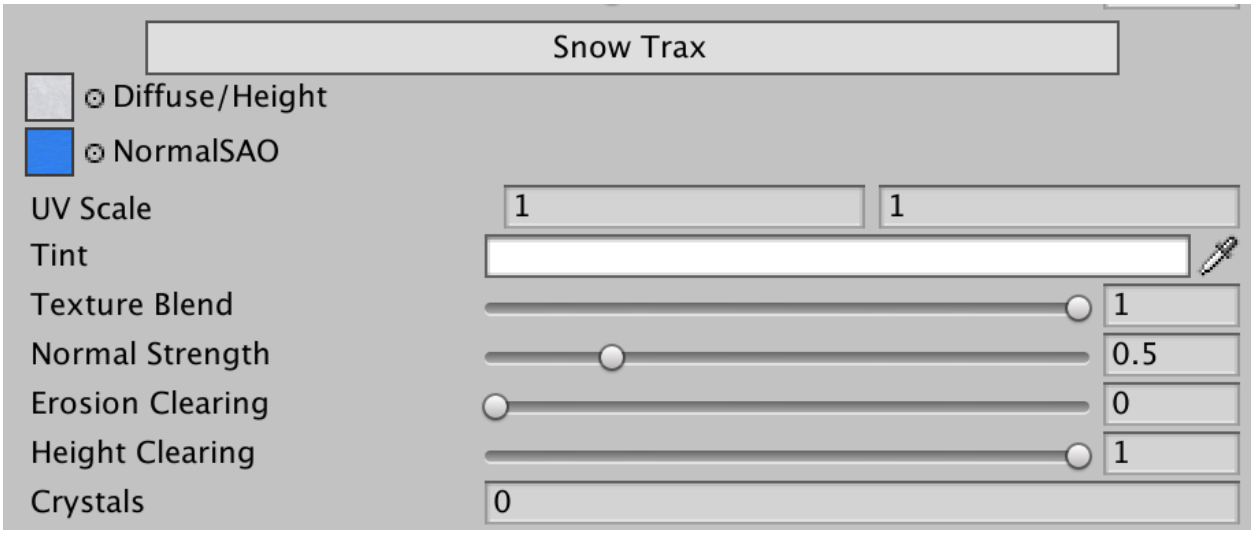
- As an example, you might set a 2 second delay, set the repair to take 20 seconds, but stop after 11 seconds, leaving the repair only 50% complete.
- Setting Repair Delay or Stop Repair After values greater than zero causes extra buffer space to be allocated, increasing memory use by 40%.

Shader Features

Tracks has several different modes of use, which can be adjusted in your terrain's materials.

Snow Tracks

To setup snow tracks, you will need the MicroSplat Global Snow module as well. Enable Rich snow and setup a snowy scene, the turn on the Snow Tracks feature. Your shader will show some new settings:



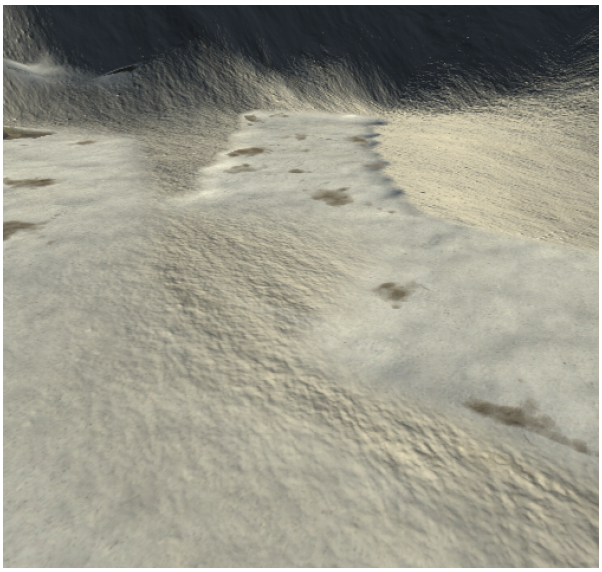
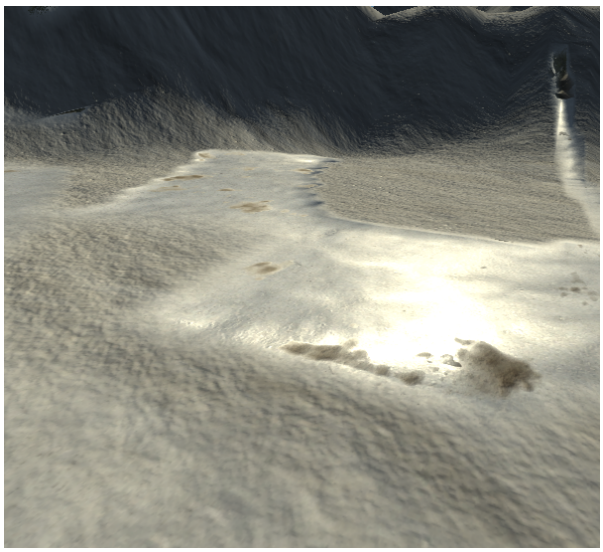
A second set of textures is used for the snow tracks. These must be packed into custom formats for optimal efficiency if you wish to use custom ones. The Diffuse has the height map packed into the alpha channel, while the NormalSAO map uses the following packing:

- (R) Smoothness
- (G) Normal G channel
- (B) AO
- (A) Normal R channel

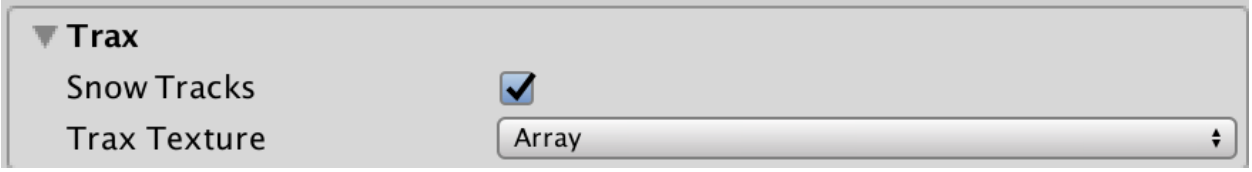
The UV scale is multiplied by the snow UV scale, so a value of 1, 1 will keep the texture the same size as the original snow. A tint for the texture is also available.

Texture Blend controls the opacity of the effect textures, allowing some of the original texture to be blended in as well. As the snow is deformed, a normal map is generated for the effect, and the Normal Strength controls how much of this map is used.

The snow can have different settings for erosion clearing, height clearing, and Crystals. This is very powerful, as it can allow the snow to look more compact or fluffy.

	
Regular Snow Settings: Crystals : 1 Height Erosion : 0 Trax Crystals : 0 Trax Height Erosion : 1 This makes the snow in the tracks fluffy and show some of the underlying texture show through.	Regular Snow Settings: Crystals : 0.3 Height Erosion : 0 Trax Crystals : 1 Trax Height Erosion : 1 Here the crystal settings are reversed, and you get fresher snow which has hard, icy, compacted snow after collisions.

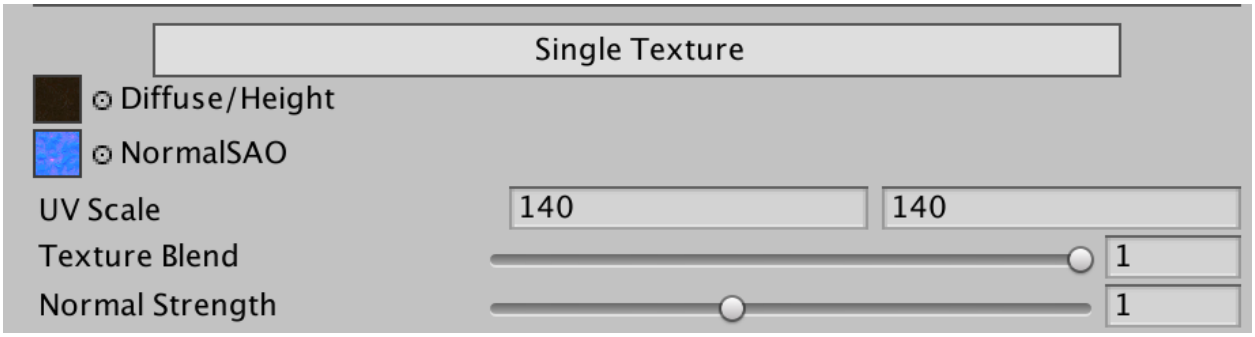
Note that in this example I am also using the Trax Texture feature described below- so the texture which shows through is the mud texture I have assigned for this feature, not the original terrain texture! This allows me to get a multi-surface blend, where snow fades away to a custom mud texture. But in areas without snow the terrain texturing can turn into mud as well (or not by disabling that in the per-texture properties).



Trax Texture is a method for performing similar operations to the regular textures on the terrain. There are two modes, Single, and Array.

Single Mode

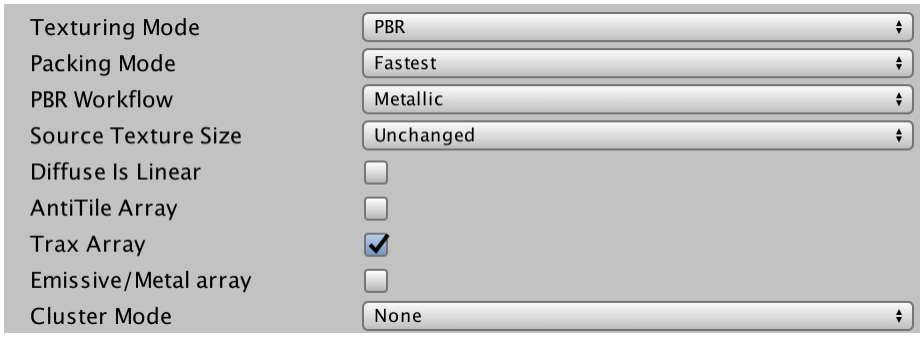
In Single mode, a single texture is used across all textures on the terrain. In Array Mode, the Texture Array Config may be used to pack a custom array, such that each texture can have it's own texture applied when objects perturb it.



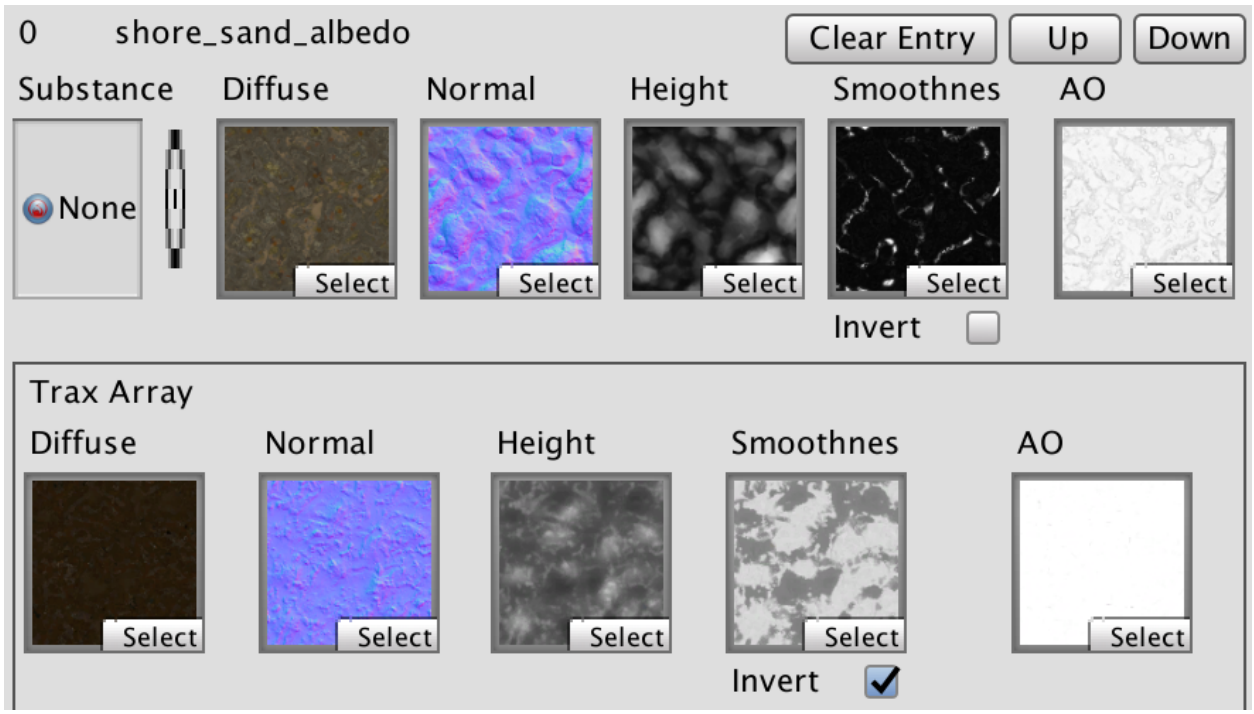
The textures used in single texture mode must be manually packed (Normal in G/A, smoothness in R, AO in B). Note that the UV scale is not based on the regular textures UV scales, but rather its own value. This is because unlike the rest of the terrain, effects like triplanar and stochastic are not currently applied to the deformation textures. Texture Blend and Normal Strength are as described in the Snow Trax Section.

Array Mode

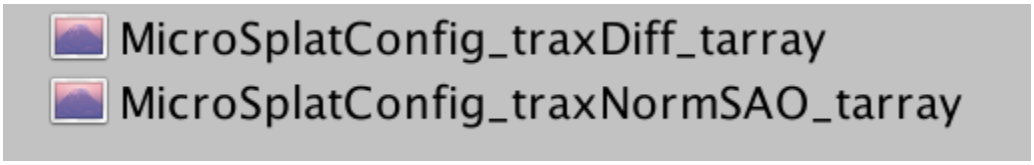
If you are going to use Array mode, you will need to pack textures so that each texture set on the terrain has a corresponding texture set in a trax texture array.



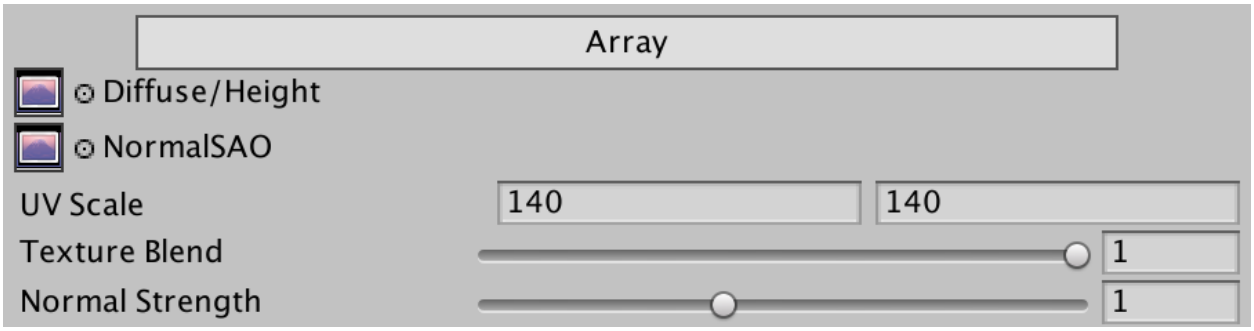
After Trax Array is turned on in your Texture Array Config (found in the MicroSplatData directory for your terrain), each texture entry will have new slots to pack the texture array for the trax feature:



Once your textures are assigned and you press Update, a new set of arrays will be exported with these textures in them.

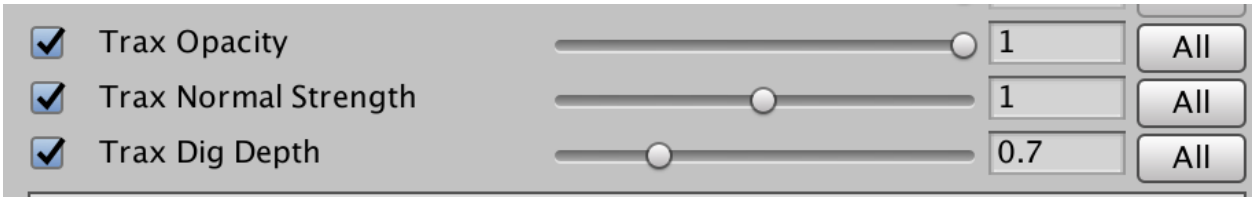


Once are created, they can be assigned to the corresponding texture slots in the Material.



The rest of the properties are the same as those described above.

Per Texture Properties



You can control the opacity and normal map strength on each texture individually, in Single or Array mode, by using the Per Texture properties.

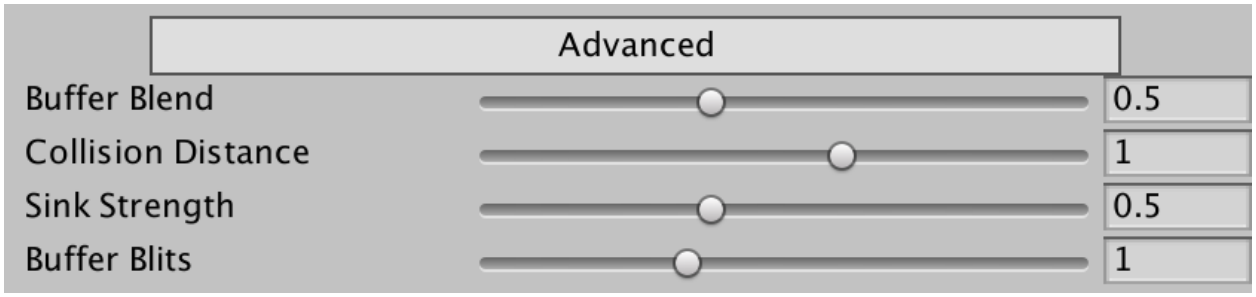
If Tessellation (sold separately in the Tessellation & Parallax module) is on, then a per-texture property is available to control how far down the depressions will go on each texture.

Wetness, Puddles, Streams, Lava

When the Wetness, Puddles, Streams and Lava module is installed and any of these features are active, an extra control appears in the trax properties, with weights for how much of these effects should show up in the Trax areas. A value of 1 in the X component will make the trax areas completely wet.

This can be a powerful combination with the Time manager. For instance, you could put a small amount of puddles into the trax, then set the time manager to repair the buffer quickly but stop before the repair is completed. Then every footstep would leave a small puddle behind which soaks back into the mud after a few seconds.

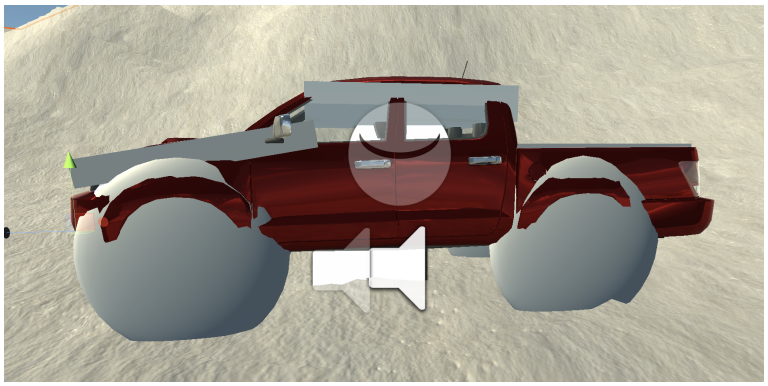
Advanced Controls



Under the Trax Manager you will find a set of Advanced Controls which you can open by clicking on the label.

Collision Distance

The way trax works is by rendering the objects you want to have interact with the terrain into a custom depth buffer, then in the terrain shader that data is used to render tracks. Often, these objects do not really intersect the terrain, because Physics works hard to prevent that. As such, these values are offset by a Collision Distance amount- set at 1, when an object is one meter from the terrain it will start interacting with the buffer. If this value is set too low, then objects may not intersect with the buffer at all, or only produce a very light trail because they don't intersect with the buffer enough.



An alternate approach to rendering a car directly into the buffer is to model a proxy for its basic form. In the above picture, several primitives are used to represent the car, and are only rendered by the Trax Manager (via layer settings). This speed up rendering slightly, but more importantly it gives you much more control over the imprints.

Note that the wheels are oversized. This allows me to turn down the displacement distance so a rabbit hopping along can make small/shallow imprints while the car makes big/deep ones. This also helps if the car is moving at rapid velocity - if it moves more than one tire length per rendered frame, then gaps in the tracks may appear. Finally, the body of the car's model is low enough to the ground that the entire car drags in the snow, and I want a more

defined “wheel” track, but still want the car to interact with the snow if it rolls or flips, so I have modeled it to only represent the top of the car.

Note that when using models for rendering and Trax, the Trax camera renders form 1000 units under the terrain, so if you are using LODGroups to stop drawing objects at some distance, they could be removed by the LOD system and not render into the Trax buffer. To fix this, one option is to duplicate one of the LOD meshes and have it only render into the trax buffer with no LOD group so it is unaffected by distance.

Buffer Blend

If a block were to fall onto snow or a tear up a surface, it wouldn’t leave a perfectly vertical intersection. Rather, the materials on the edges would cave in and produce a less vertical intersection. Trax accomplishes this by a special filter on the buffer which effectively transports the material over several frames. This setting controls how wide this filter is applied. Note that this is applied in pixel space, not world space, so extremely low values may produce artifacts where the transport creeps several pixels over, which on a cliff edge could go right up a cliff.

Sink Strength

Sink Strength controls how fast objects will affect the terrain. It represents a percent per frame that the new depth value will be used, creating a nonlinear animation that catches up to the depth of the object over several frames. If the value is set too high, then the effect can look “digital” on the front edge of a fast moving object, as the terrain is pushed instantly instantly and doesn’t give any time for the buffer transport to happen. If set too low, things will only create imprints if they are in an area for a while.

Buffer Blits

Snow can take a few frames to settle into its final position. Buffer Blits will perform this process more than once per frame, making this happen much faster at the cost of extra

performance. A value of 1 will do one extra blit of the buffer sim, and is usually enough to resolve any artifacts.

Tech Notes

Requirements:

Trax requires RFloat or RGFloat texture formats to work correctly. The RFloat and RGFloat formats are supposed to allow you to store a full floating point value per pixel, however some mobile devices do not handle these formats correctly, often giving you back a format that doesn't handle unsigned values or values outside of the 0-1 range. Some devices will fall back to a RHalf format, which will generally work for doing tracks, but lacks the precision needed for time based effects.

Also note that the trax system works by rendering your objects into a depth buffer from far below the ground. If you have LODs on your objects which cause it to not be visible after a certain distance, it's possible that they will be LOD'd in the trax camera. A workaround in these cases is to duplicate an appropriate LOD to use for the trax rendering, and not have the real character on the trax layer at all.

Trax for non-terrain objects

Trax can be used on any MicroSplat shader, not just terrains. Further, Better Shaders ships with a Trax Stackable, allowing you to add Trax support to any shader written in Better Shaders easily, and also makes it easy to write your own effects which use the Trax system.