

Make an Item Colorable (Color Mask Guide)

Wogrim's Epic Guide to Making an Item Work with the Color Pickers

What Is This Guide For?

This guide is for making items colorable with the game's color pickers. This is one of the most important parts of character customization, so I felt it deserves its own guide. The basics are mentioned in some other guides, but not in a way that is good for reference and not with as much depth.

This is for making mods (from scratch, ports, or changing existing items), but in some cases (not clothes) you can throw in a new Color Mask and MainTex in Material Editor if you just want a quick fix. But I will use some terms you may not know if you haven't done a little modding.

Summary of Semi-Requirements / Troubleshooting

There are exceptions or special cases, but this is the quick checklist to get something working:

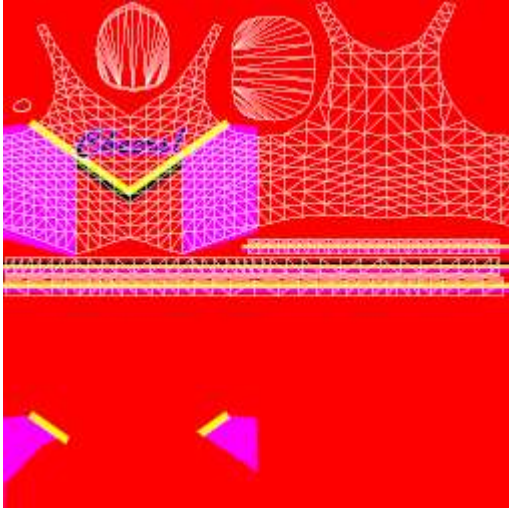
- White MainTex
- Color Mask with Red/Yellow/Magenta
- material uses appropriate game shader for item type
- material (or for clothes, list file) has MainTex and Color Mask
- the mesh(es) with colorable material referenced in MB (rendNormal or appropriate)
- color pickers enabled in MB (Clothes/Accessories) or list file (Studio Items)
- there isn't an overlay covering the item
- the mesh does not have multiple submeshes (uncommon; verify in SB3U, fix in modeling software)

If you're having troubles where your colors are coming out a little different than what you expect, it may not be the color mask's fault. Check:

- saturation filter / studio filter
- normals / lighting / layer problems

You can also get unexpected problems if there is something wrong with your list file or MB, so check them carefully.

Generally How it Works



(Color Mask with UVs for cheerleader top)

A texture called a Color Mask determines which of the color picker colors are applied to which parts of the item, based on the RGB channels (colors in an image are saved as a combination of red, green, and blue). Black on the Color Mask means no color picker colors get mixed in; it just uses the MainTex color. Do not use transparency on a Color Mask; it will read the color of the transparent pixels and probably mess you up. The color gets tinted with the MainTex color, so MainTex should generally be white wherever you want to have color picker colors (if the whole item is colorable, MainTex should be completely white). The squares I will be using for examples all use a pure white MainTex.

If you are reading this guide, there is a good chance you already have an item with a non-white MainTex. Keep it somewhere safe (and only edit a copy of it). You may want the original again, such as a reference for drawing your Color Mask, or to convert dark parts into texture shadows (detail mask).

Special Cases

You are generally limited to 3 color picker colors (for the red, green, and blue channels of Color Mask), with as much fixed color as you want on MainTex. Clothes and Studio items can get extra colors with patterns, but they get mixed into the same 3 areas as the regular colors. Clothes and Hair can get an “Accessory” color picker for special accessories; those accessories are only given that one color to their red Color Mask channel. Accessory Hair can use hair color pickers or accessory color pickers, but I don’t think there’s a way to use both.

Shaders' texture slots default to a color, so some items don't even need a MainTex because it defaults to white. I haven't tested which item types you can do this on, so attempt at your own peril; I know it doesn't work for clothes. Color Mask probably always defaults to black.

Many of the game shaders have the Color Mask on the item's material; the color picker colors also get sent to the material, and the shader mixes the colors. You don’t actually have to use the game shaders; you can use a custom shader that has been programmed to work the same way.

But if you look at some shaders (clothes) you will see there is no Color Mask slot. What happens in this case is the game has the Main Texture and Color Mask (specified in the item's list file) and mixes the color picker colors itself, and gives the already-mixed result to the shader in the MainTex slot (probably for performance). So for most other item types the shader has to do the color mixing itself (and you can't use just any shader), but for clothes to be colorable you can technically use any shader that takes a MainTex.

Skin color (base skin color and skin reds color) is mixed by the game instead of the shader, similar to clothes, but works slightly different. (Only relevant if making a body or head mod). Seems to act as if red channel is always full.

The Item's MB

Color pickers do not show at all for Clothes and Accessories if they are not enabled in the MB (look for **useColor**). Color mixing does still happen even if the color pickers are not shown; you may run into this if you make colorable Clothes but forget to turn on color pickers in the MB. For Studio Items, useColor does not seem to do anything from my testing; color pickers are enabled in the list file for them.

The game finds the materials for updating the colors (and sometimes other things) via the item’s MB; for Studio Items and Accessories, generally any mesh you want colorable must be referenced in **rendNormal**. Clothes have **rendNormal01** and **rendNormal02**, which correspond to MainTex/ColorMaskTex and MainTex02/ColorMask02Tex in the list file (2 colorable textures but they get the same color picker colors). On the Hair MB you use **rendHair**. You will see rendAlpha and a couple others on some MBs; they basically aren’t used.

Related: the game only affects the material on the first submesh of a mesh; you can examine meshes in SB3U to make sure there is only one submesh per mesh. It is normally caused by a mesh having different materials applied to different faces; separate into different meshes (one material each) in modeling software [Blender].

If you want your item to have default colors, this can be done in the item's MB (look for **defColor**) on Accessories and Studio Items. Clothes can be given default colors, but when you change clothes the color remains the same; the user has to press the “Restore Defaults” button above the item for it to change to the default colors. As far as I know Hair can't be given default colors.

But What Colors Should the Color Mask Be?

The shader makes calculations of color on a scale that goes from 0 to 1. So Black has red, green, and blue channels all at 0; I will write this as (0,0,0). Red has red channel at 1, green and blue at 0; I will write this as (1,0,0). Here is a table for the main colors I will talk about, and what color you get when you put them on the Color Mask.

Color	RGB Values	Color Result
Black	(0,0,0)	MT (MainTex color)
Red	(1,0,0)	CP1 (Color Picker 1 color)
Green	(0,1,0)	CP2 (Color Picker 2 color)
Yellow	(1,1,0)	CP2
Blue	(0,0,1)	CP3 (Color Picker 3 color)
Magenta	(1,0,1)	CP3
Cyan	(0,1,1)	CP3
White	(1,1,1)	CP3

Does it matter if you use Green or Yellow, because they both give you CP2? Sometimes.

Smooth Color Transitions

Note: You may have no interest in smooth color transitions, but knowledge in these sections is relevant to sharp color transitions

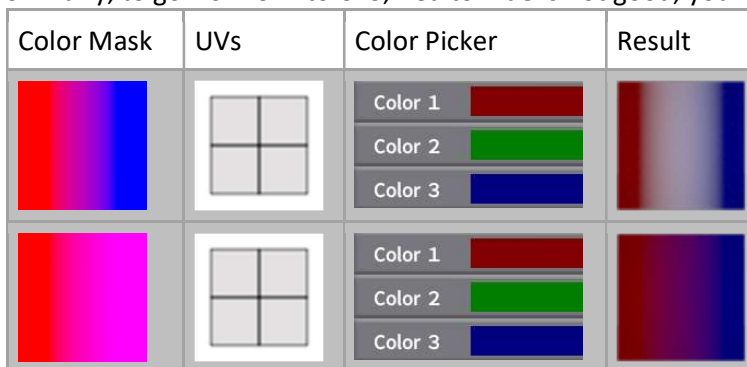
Let's say you have a square. On the left side you want CP1, and a smooth transition across the square to CP2 on the right side. So you may think that you could do a gradient from Red to Green on your Color Mask, but here is what happens:



If you look at a pixel in the middle, the color is (0.5,0.5,0). This causes MT to get mixed in, which is not what we wanted. So instead we want our gradient to go from Red to Yellow. This means there is full red channel across the whole Color Mask, so MT does not get mixed in; it is always overridden by CP1. Here is the result:









Similarly, to go from CP1 to CP3, Red to Blue is not good; you need Red to Magenta.







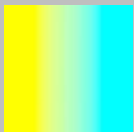







So We Just Use Red, Yellow, and Magenta?



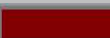



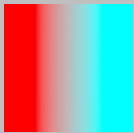

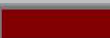


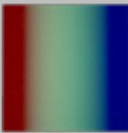
Red/Yellow/Magenta will often be fine, but let's say you want a transition from CP2 to CP3. If you use Yellow and Magenta, you get problems (CP1 brightened to show better).

Color Mask	UVs	Color Picker	Result
		<div>Color 1 </div> <div>Color 2 </div> <div>Color 3 </div>	

Going from Yellow to Magenta, a pixel in the middle is at (1,0.5,0.5), which means some CP1 gets mixed in the middle, just like how MT got mixed in when going from Red to Green. We can fix it by instead making it Yellow to White or Yellow to Cyan.

Color Mask	UVs	Color Picker	Result
		<div>Color 1 </div> <div>Color 2 </div> <div>Color 3 </div>	
		<div>Color 1 </div> <div>Color 2 </div> <div>Color 3 </div>	

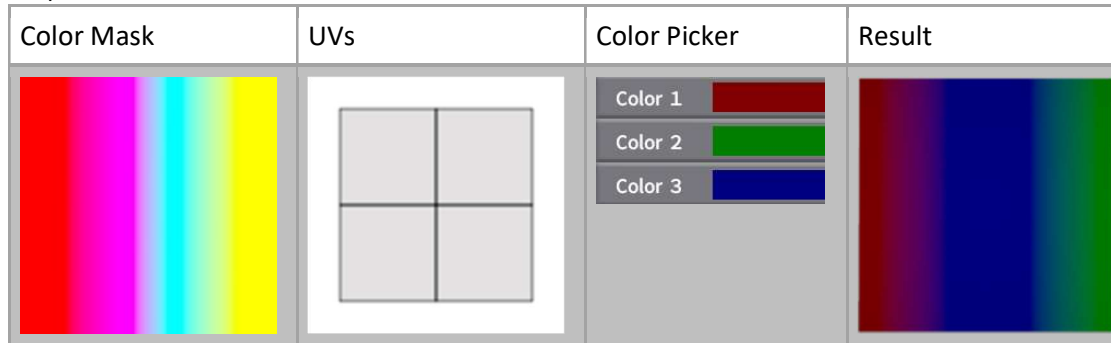
However, going from CP1 to CP3, a Red to White transition gets CP2 mixed in, and a Red to Cyan transition gets both MT and CP2 mixed in (CP2 brightened to show better).

Color Mask	UVs	Color Picker	Result
		<div>Color 1 </div> <div>Color 2 </div> <div>Color 3 </div>	
		<div>Color 1 </div> <div>Color 2 </div> <div>Color 3 </div>	

So there's no 3 Color Mask colors you can use for every situation. Here's a table of all the "safe" color transitions, which are the ones that will not give you another color mixed in during the transition. Note that smooth transitions with MT may look bad because of how MT tints.

Visual	Color Names	Transition		Visual	Color Names	Transition
	Red Yellow	CP1 CP2			Green Yellow	CP2 CP2
	Red Magenta	CP1 CP3			Blue Magenta	CP3 CP3
	Green Cyan	CP2 CP3			Blue Cyan	CP3 CP3
	Green White	CP2 CP3			Blue White	CP2 CP2
	Yellow Cyan	CP2 CP3			Magenta Cyan	CP3 CP3
	Yellow White	CP2 CP3			Magenta White	CP3 CP3
	Black Red	MT CP1			Cyan White	CP3 CP3
	Black Green	MT CP2				
	Black Blue	MT CP3				

So you may look at Magenta to Cyan and say "Why would I ever do that?". Well you may get into a spot where you are going from CP1 to CP3, and then from CP3 to CP2. You need CP3 as Magenta for CP1 to CP3, but there is no safe transition from CP3 to CP2 with Magenta. So you transition it to Cyan (could use sharp transition) so that you can use Cyan to Yellow for CP3 to CP2 (or Cyan to Green; Yellow can transition back to CP1, Green to MT).







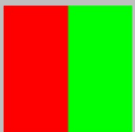







Of course, you could also change which areas of the item are which color picker colors; if this was your whole item, the color mask would be easier if you put CP1 in the middle.


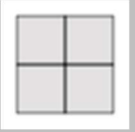




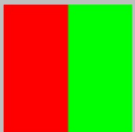
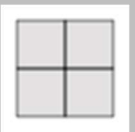




Sharp Color Transitions

Note: I greatly decreased Color Mask resolution for this section to better show what happens without having to make bigger images

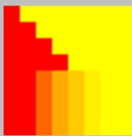

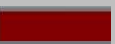
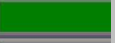
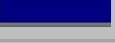
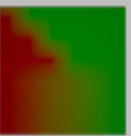
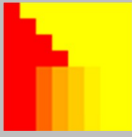



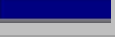

Often you don't want a smooth transition. So let's say your color mask is Red on the left half and Yellow on the right half, no gradient in-between. You may expect a sharp transition from CP1 to CP2, but you actually get a blurry line between them. In other words, it is a smooth transition on a smaller scale (so you should still use safe color transitions).

Color Mask	UVs	Color Picker	Result
		<div>Color 1 </div> <div>Color 2 </div> <div>Color 3 </div>	
		<div>Color 1 </div> <div>Color 2 </div> <div>Color 3 </div>	

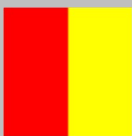





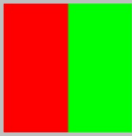



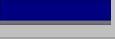

This is because when sampling the texture, the shader will interpolate between pixels to aim for a smooth transition, which is usually the behavior you want with textures, but in this case it gives us a small gradient we didn't want. So one way we can fix this is in Unity's texture settings you tell it you want the color of the nearest pixel instead of interpolating. If making your item in Unity, go to the texture's import settings and change Filter Mode to "Point". If building your item in SB3U, go to the color mask and change Filter to 0. And then we get our sharp transition. Since there is no gradient, this works with unsafe color transitions also.

Color Mask	UVs	Color Picker	Result
		<div>Color 1 </div> <div>Color 2 </div> <div>Color 3 </div>	
		<div>Color 1 </div> <div>Color 2 </div> <div>Color 3 </div>	

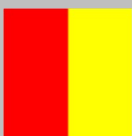







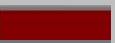
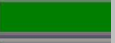


But for most items, this will not look good because where you want your sharp transitions does not line up with pixel edges, or you want smooth transitions on other parts of the item which now look blocky without the interpolation. Here's a before and after for this color mask.

Color Mask	UVs	Color Picker	Result
		<div>Color 1 </div> <div>Color 2 </div> <div>Color 3 </div>	
		<div>Color 1 </div> <div>Color 2 </div> <div>Color 3 </div>	

So what can we do instead? Well, on some items, we can UV them so that there are no color transitions on the parts of the mesh where the UVs are. This works great on simple items where you can make separate UV islands for parts that you want to be different colors. So in the case of my square, I marked a seam down the middle in Blender and did a new UV unwrap, and spread them apart a little. The mesh itself is still one piece. So now with no color transition on the UVs, we get a perfect sharp color transition. This also works with unsafe color transitions.

Color Mask	UVs	Color Picker	Result
		<div>Color 1 </div> <div>Color 2 </div> <div>Color 3 </div>	
		<div>Color 1 </div> <div>Color 2 </div> <div>Color 3 </div>	

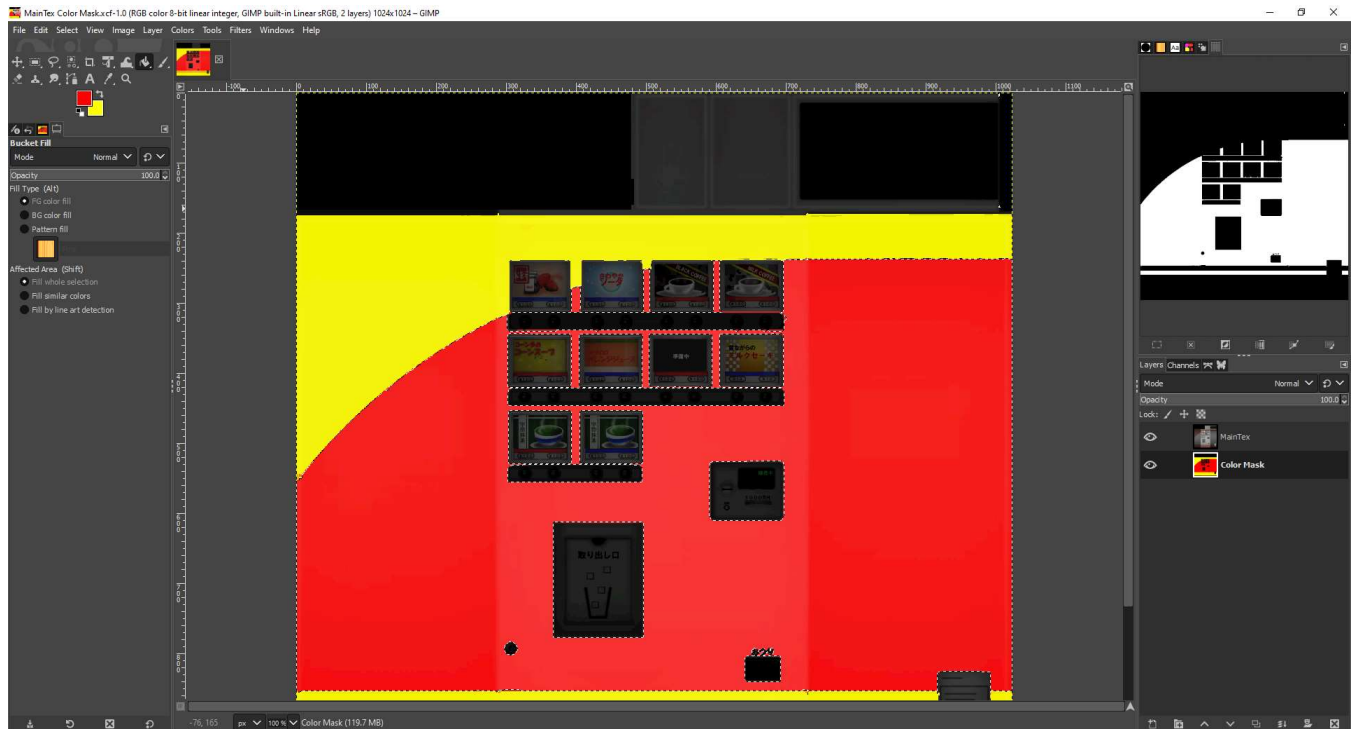
Unfortunately, this will not work for things with color schemes that do not follow the mesh edges (unless you can add the edges), nor for things that you can't or are unwilling to separate the UVs on (because of how it affects all other textures). In these cases, the best you can do for sharp color transitions is to increase the resolution of the color mask so that the pixel interpolation covers a smaller area; the blurry line is thinner but not gone. Before and after doubling resolution width and height.

Color Mask	UVs	Color Picker	Result
		<div>Color 1 </div> <div>Color 2 </div> <div>Color 3 </div>	
		<div>Color 1 </div> <div>Color 2 </div> <div>Color 3 </div>	

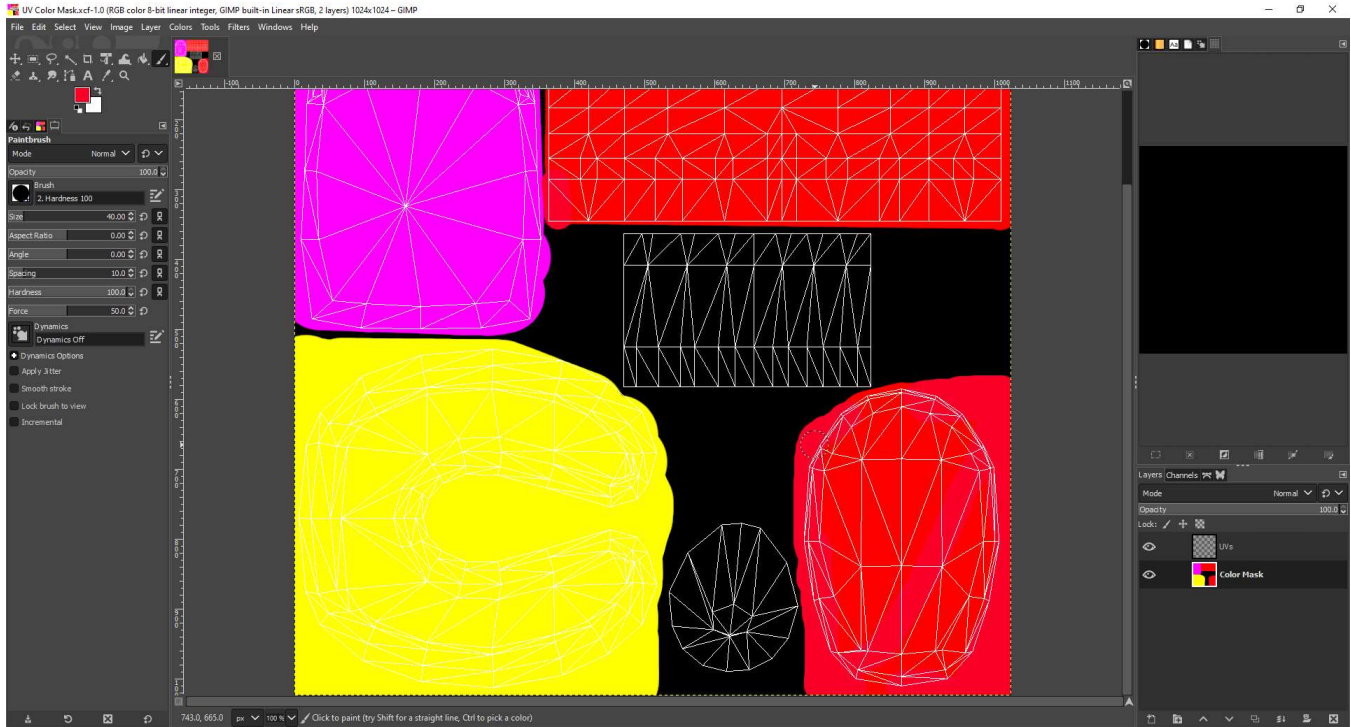
Ways to Create the Color Mask

Note: Information in these last couple sections is not exclusive to color masks, and can be applied to other textures on an item

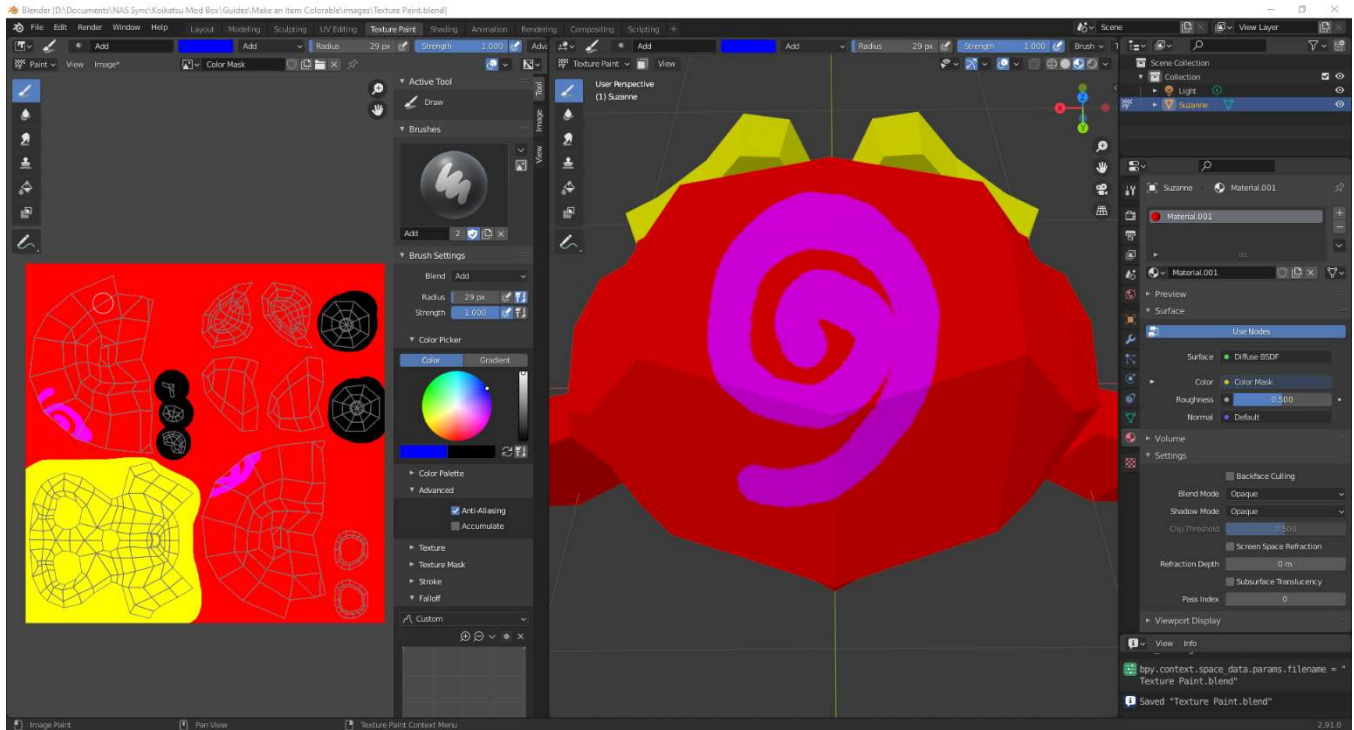
The basic method of creating a Color Mask assumes you have an item which already has a colored MainTex (which you probably have if the item is a port). You create a new image in GIMP (or similar image-editing software) filled with Black, and drag in your MainTex as a layer above that. Turn the opacity for the MainTex layer down alot so when you paint on the Color Mask layer you can see it. Or you can make selections on the MainTex layer (wand select pretty good) and then bucket fill on the Color Mask layer, but expect to have to fix some edges. Try to stick with safe color transitions, and don't forget to fill White in appropriate parts of the MainTex when done.



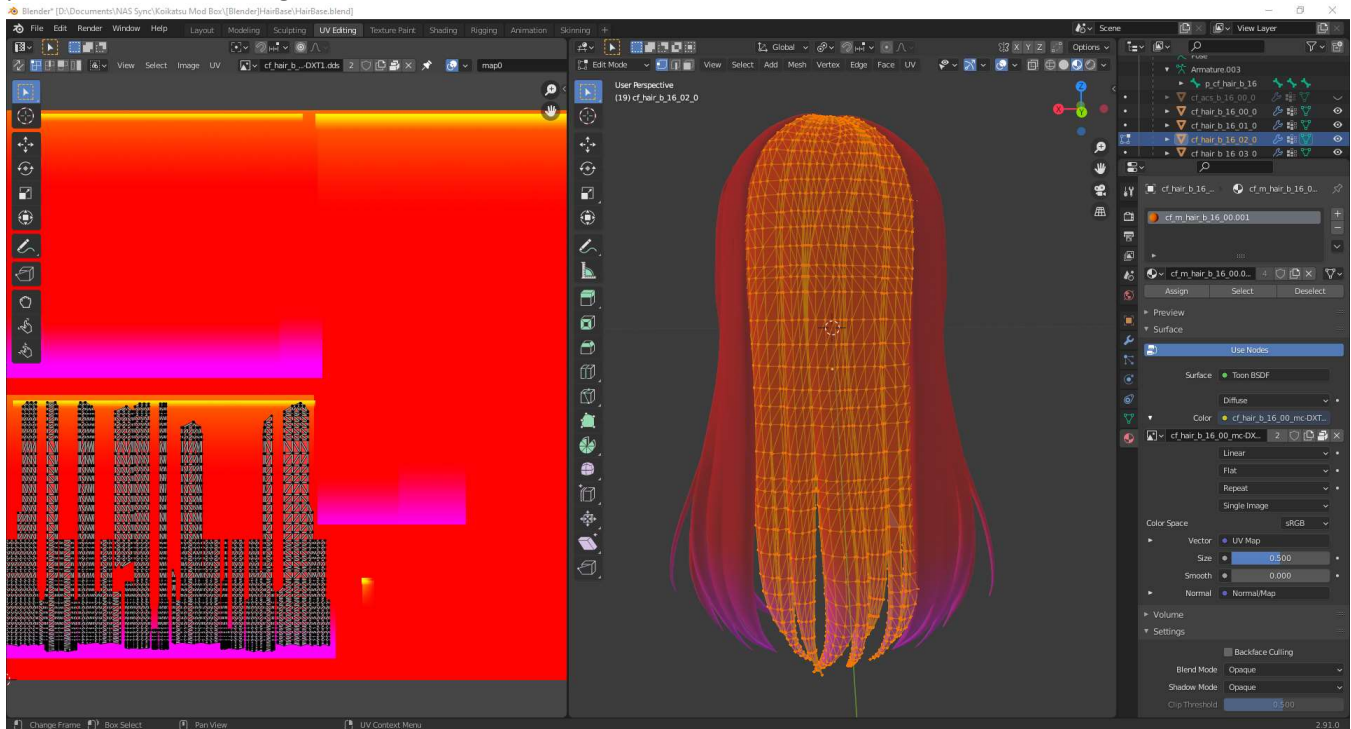
A slightly different approach is you still create your ColorMask in GIMP, but instead of making it based on the MainTex you base it off the UV mapping, which you can export from Blender, Material Editor, or SB3UGS. You may need to change the color of the UVs image so you can see them better. You need to know which UVs are which part of the item; on some items it is difficult to tell. This is a convenient way to paint the Color Mask in those situations where parts that you want different colors are separate UV islands, which is also super easy because you can (and should) color outside the lines without worry.



The third option for making a Color Mask is called texture painting, which is painting directly on the 3D model in Blender or other software. You can set the Color Mask to show directly on the item as you paint it. You can also still paint on the image with the UVs, which is usually easier for the broad strokes. This is a good way to make a Color Mask if the item doesn't already have a colored MainTex that you're trying to convert and you need to get in some details, especially because you can draw across UV seams easily.



There's one more technique for the Color Mask which has limited use, which is to make it in GIMP first (specifically the gradients), then do UV unwraps that line up with those gradients. You see this on game hairs where they have preplaced gradients for hair root and tip colors, because it is easier to do it that way than to place a bunch of small gradients later.



Other Tips and Tricks

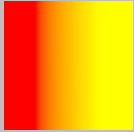





If you're getting compression artifacts (random slightly-off-color pixels) on your color mask, you want to save it with better compression. If you are creating the color mask in GIMP (free image editor similar to Photoshop), export as a PNG with Compression level 0. When you import the image to Unity, there is a Compression drop-down in the image's Import Settings. Setting this to High Quality will give BC7 compression, which is the best you can reasonably get. If using SB3UGS and you give it a PNG, you can't select compression, but what you can do is instead export from GIMP as a DDS. You need some kind of GIMP plugin or something to get BC7 compression, so if you don't have that, use None for best results (but biggest file size).

Mip Maps are smaller versions of an image built into the image which gives a better look from far away. Unity Import Settings let you Generate Mip Maps; SB3UGS automatically generates Mip Maps if you give it a PNG, or GIMP DDS export settings let you Generate Mip Maps. Generally check game textures to see if they use mip maps (usually yes).

Linear vs Gamma, the short version: Gamma correction lightens the pixels before compression which gives better quality to darker parts of the image, which the human eye can more easily see differences in. This is generally default on images (and software that display images re-darken the image first). But for Color Masks, Normal Maps, Detail Masks, and any other types of data-in-image-format, this is generally undesirable, so pretty much every game texture except MainTex you will see in Linear format. So create your Color Mask in GIMP as Linear (related: for smooth transitions set your Gradient tool to Linear, not Perceptual). You can also make it Linear if you're Texture Painting in Blender (don't know about other software). But you need to tell Unity your Color Mask is Linear, so in Import Settings, uncheck "sRGB (Color Texture)". In SB3UGS, Linear is 0 for the "ColorSpace" field. Also, a lot of software doesn't display linear images properly, so be careful.

Currently, Material Editor imports all images as if they are Gamma, so it will give you different results; it darkens the color mask to undo the assumed Gamma correction. You can get the Renderer Editor plugin which will let you load in Linear images (which is how I swapped out Color Masks to get screenshots for this guide) but as far as I know it is Studio-only. So here's a couple tests I did to compare ME results. It's much lower importance if you are only doing sharp color transitions.

Linear Color Mask loaded with Renderer Editor.

Color Mask	UVs	Color Picker	Result
		<div>Color 1 </div> <div>Color 2 </div> <div>Color 3 </div>	

Linear Color Mask loaded with ME.

Color Mask	UVs	Color Picker	Result
		<div>Color 1 </div> <div>Color 2 </div> <div>Color 3 </div>	

Gamma Color Mask (same linear gradient) loaded with ME.

Color Mask	UVs	Color Picker	Result
		<div>Color 1 </div> <div>Color 2 </div> <div>Color 3 </div>	