Displacement Maps

Displacement Maps

In this lesson, you're going to learn how you can bend a flat image to make it look like it has more dimension. The feature used to create this type of effect is called a displacement map. A displacement map is a black and white image that is usually the same size as the image you're attempting to bend. In this image, areas that are bright are thought of as being close to the camera. Areas that are dark are thought of as being far from the camera and areas that are 50% gray will not cause any change in the image.

Manually Paint a Wavy Displacement Map (Timestamp 1:34)

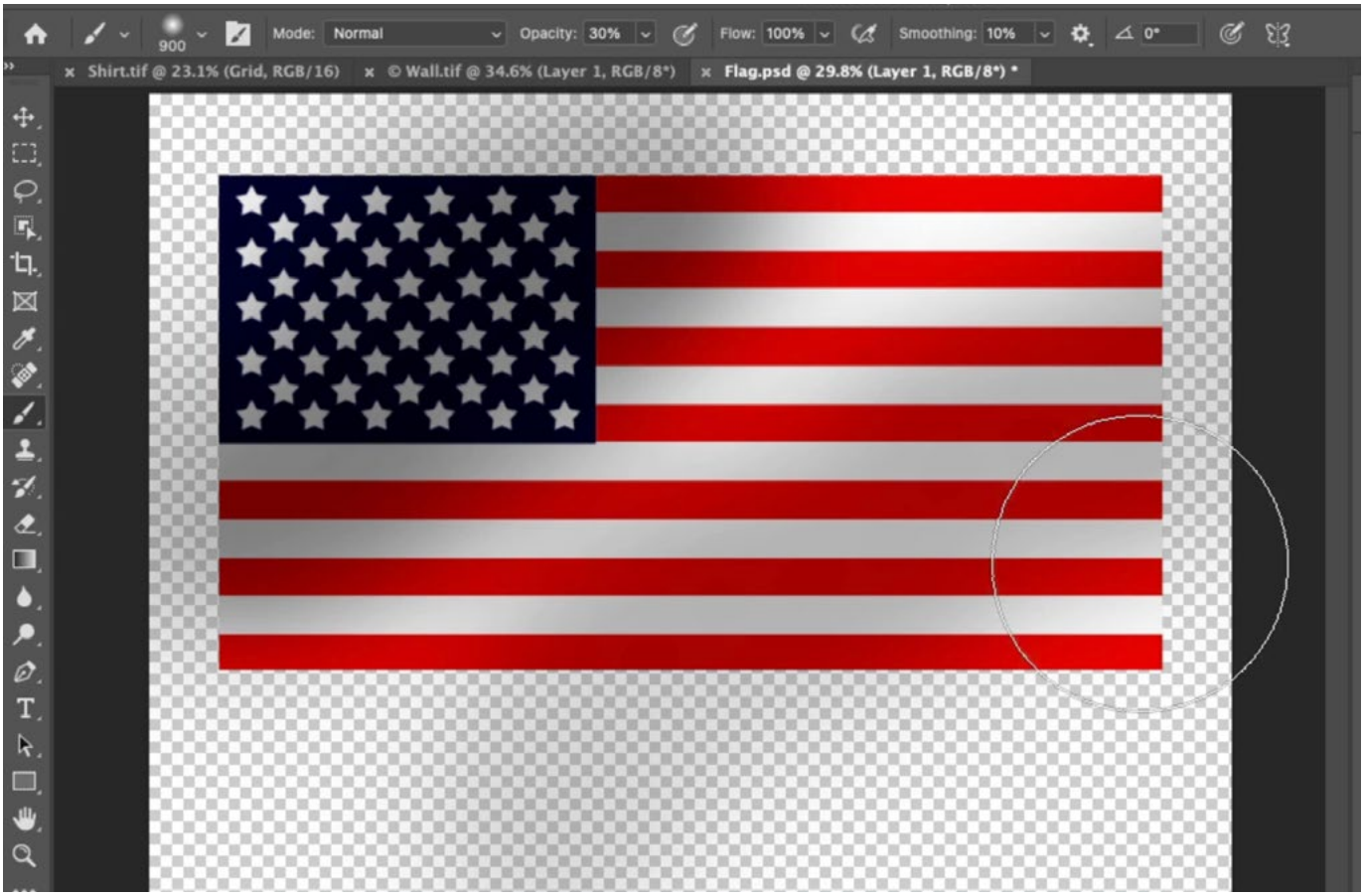
Create a displacement map We'll demonstrate the displacement map feature by taking a flag graphic and making it look as if it is wavy from blowing in the wind. Start by creating the displacement map, which describes where the image should look as if it's close to the camera and where it should look as if it's farther from the camera.

A displacement map will be used to bend this flag.

The displacement map will be made in an empty layer so create a new, empty layer at the top of the layer stack. Make sure you're working on this new layer. Activate the Brush Tool and make sure that you're using a large, soft-edged brush. Lower the brush opacity to about 30%. (The Brush settings can be found in the Options Bar).

Next, paint with black in any area you want the flag to be farther away from the camera. In the video example, we painted two diagonal strokes that will end up being bends in the flag. Since the brush opacity is lower, the black won't be applied at full strength. You can paint over one of the strokes a second time in order to make it even darker and therefore make it appear to be farther from the camera.

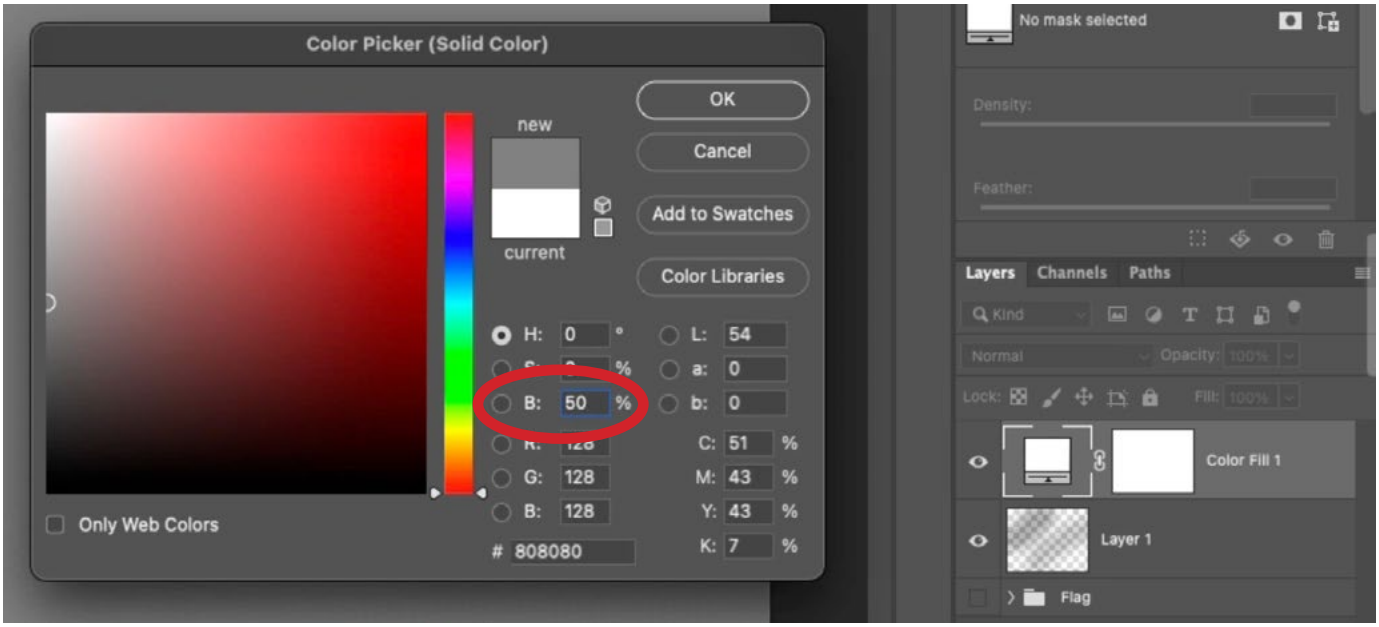
Next switch the foreground color to white in order to change the color you're painting with. White is going to push things closer to the camera. Paint over the flag in the areas where it should be closer to the camera.



The Brush Tool is being used (on an empty layer) to paint black and white strokes on the image. These will determine what areas appear closer and what areas appear farther.

Because the brush opacity is lower, it might be hard to see how the strokes are affecting the image. Temporarily turn off the visibility for the image layer. This will leave you with the paint strokes set against the transparent checkerboard background. You'll want to place these strokes on a background that is 50% gray. That is the one shade that is not going to attempt to bend the flag at all.

Click on the Adjustment Layer icon at the bottom of the Layers Panel and choose Solid Color from the pop-up menu. The Color Picker will appear. Type 50% into the B field. Leave the H and S fields at 0 and then click OK. This will fill the layer with 50% gray. In the Layers Panel, position this layer just beneath the one you were painting on.



ABOVE: A solid color adjustment layer is being created and the layer is being filled with 50% gray. LEFT: The 50% gray layer is placed beneath the layer with the paint strokes. This is the complete displacement map.

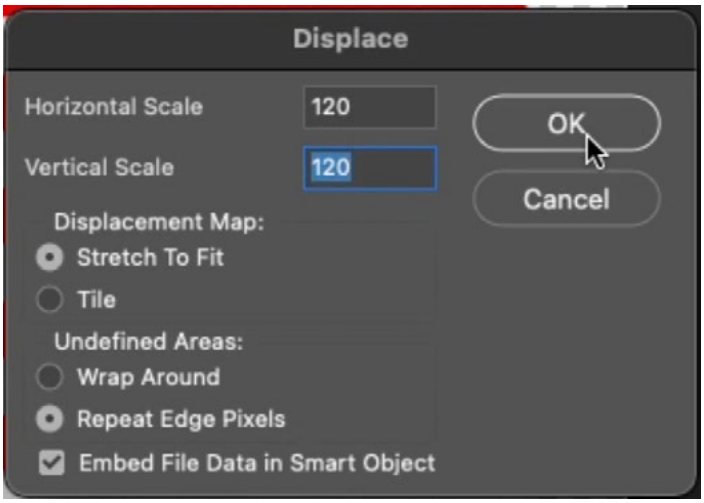
Now it's time to save out this image so that it can be used as a displacement map. Click on the File menu and choose Save As. In the Save As dialog, name the file and place it somewhere you'll remember on your hard drive. Make sure the Format menu is set to Photoshop and then click the Save button.

Now that the you've saved the image, you can turn off the visibility for the two layers that were used to create the map. (This is the layer you painted on and the 50% gray layer.) Turn on the visibility for the flag image layer.

Apply the displacement map You'll want to convert the image layer into a smart object and you can do that by clicking on the Layer menu and choosing Smart Objects > Convert to Smart Object. (Alternatively, you could click on the Filter menu and choose Convert to Smart Filters. It does the same exact thing.) You can tell that a layer is a smart object because a little icon will appear in the bottom corner of the layer's thumbnail in the Layers Panel.

The icon in the bottom right corner of the thumbnail indicates that the layer is a smart object.

At this point, you can apply the displacement map. Click on the Filter menu and choose Distort > Displace. The Displace dialog box will appear.



In the Displace dialog, the Horizontal and Vertical Scale fields determine how strongly the image will bend.

Note: This filter only works on 8-bit images. If you happen to be working on an image that is 16 bit, you will encounter an error message.

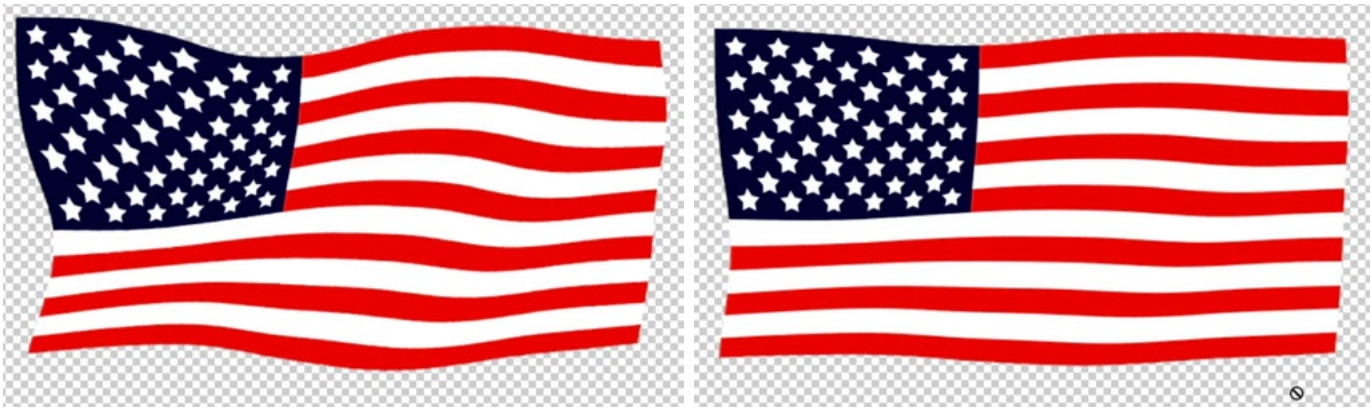
The Horizontal Scale and Vertical Scale numbers determine how strongly the displacement map will bend the image. You can enter any number between 0 and 999. It may take some trial and error to figure out how "mountainous" you want the bends to be.

I like to enter the same number for the Horizontal and Vertical fields, and I used 120 in the video example.

The remainder of the settings in the dialog will not matter if the displacement map document is the same size as the image document you're going to apply it to. If it was not the same size, the underlying settings will control whether the map is scaled or tiled and how any undefined areas (after bending) should be treated. In our example, the displacement map document IS the same size as the image document, so these extra settings won't matter.

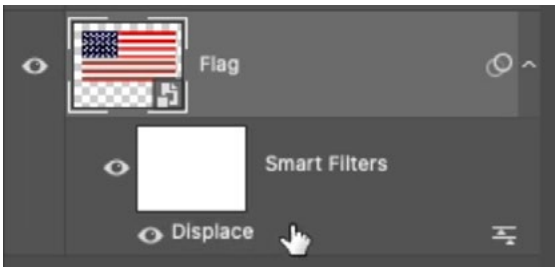
One final check box will appear if you have converted the image layer into a smart object. It's at the bottom of the dialog and turning it on will "Embed File Data in Smart Object." This is an advanced feature that is slightly beyond the scope of this lesson, but it basically means that you can change the contents of the layer and it will still have access to the grayscale displacement map image because it would be embedded in the file.

Click the OK button to exit the Displace dialog, and you will be prompted to navigate to the location of the displacement map image file on your hard drive. Choose the image and then click the Open button. The displacement map will then be applied to the image, and you can see that it will bend based on what areas were lighter and darker.



In the image on the left, the Horizontal and Vertical Scale fields were set to 120. In the image on the right, the Scale fields were set to 50. You can see how this affects the waviness.

In the Layers Panel, you can see that the Displace filter was applied as a smart filter because it shows up as a thumbnail indented below the image layer. With smart filters, you can double-click on the name of the filter in order to call up the filter dialog and make changes to the settings. This makes it easy to experiment with different horizontal and vertical scale settings. With the Displace filter, just be aware that you will again to navigate to displacement map file on your hard drive.

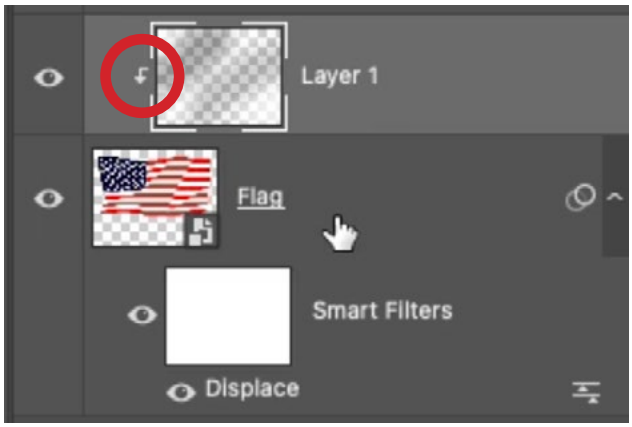


The Displace filter was applied as a smart filter, so it appears as an indented thumbnail beneath the image layer.

Add shading In the case of an image like the flag, the one thing we're missing (after creating the waves) is the shading. When an object is bent, there will be highlights and shadows in different areas. Because you created the displacement map within the same document as the image layer, you can easily use that displacement map layer to create the shading.

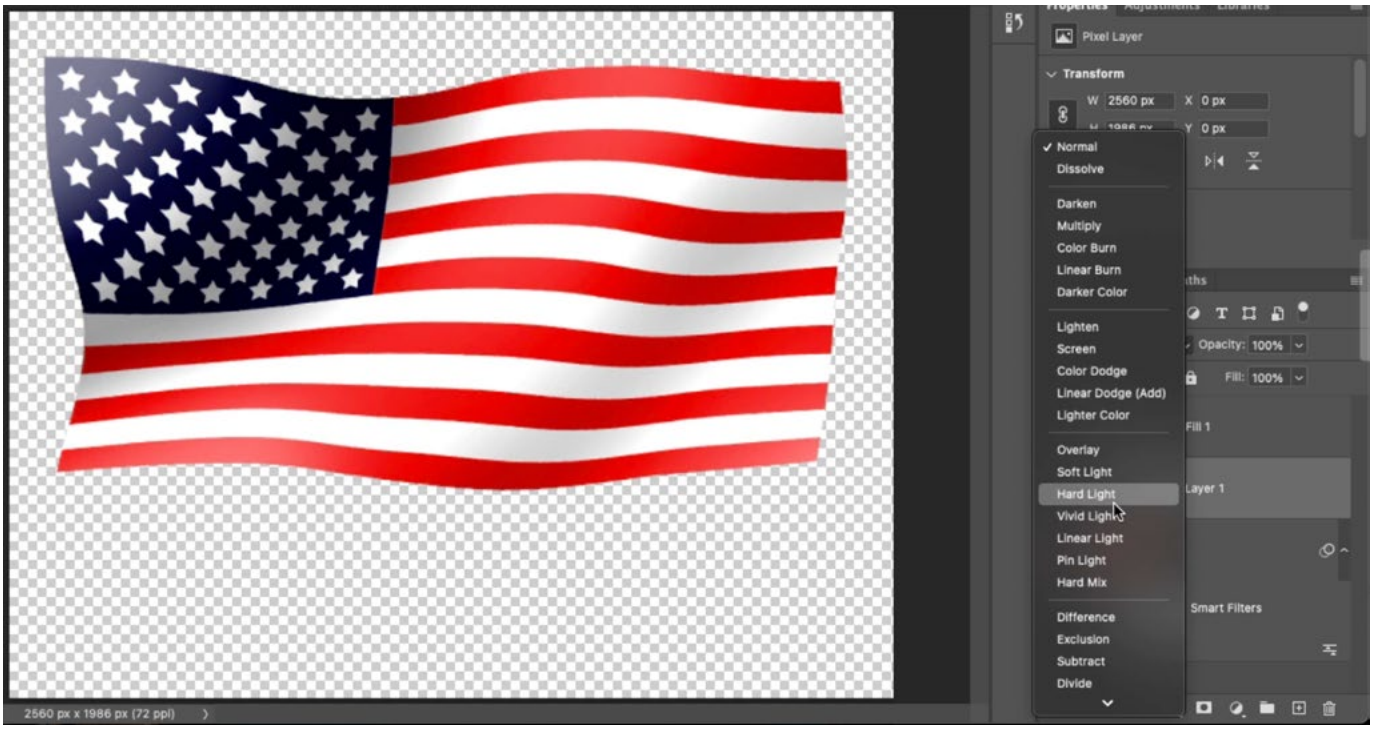
Turn on the visibility for the displacement map layer and position it so that it sits just above the image layer. Then, you'll clip the layer so that it only shows up where the image layer is visible. That's how a clipping mask works. It takes the clipped layer and makes it so that it can only be visible where the underlying layer is visible.

There are a couple of methods for clipping a layer. You can hover your cursor over the line between the two layers, hold down the Option key (Alt on Win) and then click on the line. You will see the clipped layer becomes indented, with a down-pointing arrow to the left of its thumbnail. The other method would be to click on the Layer menu and choose to Create Clipping Mask.



The shading layer has been clipped to the flag layer.

You can change the blending mode of the shading layer in order to make the effect look more realistic. The Blending Mode menu can be found at the top of the Layers Panel. I like to use the Hard Light mode, but experiment with the others by hovering your cursor over the other modes and watching the effect in the image window.



Here, we're making the shading look more natural by changing the layer's blending mode to Hard Light.

Use Texture Image as a Displacement Map (13:38)

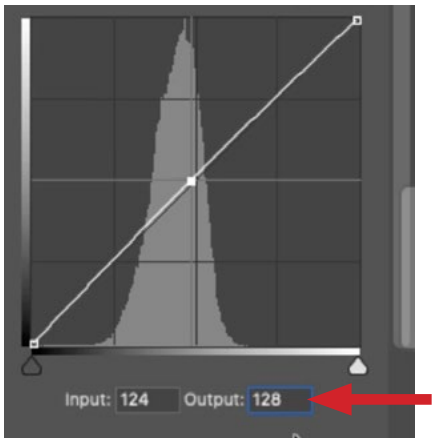
Displacement maps can also be used to make it look as if an image is printed on a textured surface. In the video example, we're going to take a graphic and make it look as if it was painted on a highly textured wall. We'll place the graphic layer above the textured wall image layer in a single Photoshop document.

You can actually use the texture image as the displacement map and that's what we'll do with the wall image.

A displacement map will be used to make it look as if the graphic is printed on the textured wall. In this case, we'll use the wall image AS the displacement map.

Remove color from displacement map If you have a color image, the various colors in the image will change the way the image is bent, so it's a good idea to remove any hint of color before saving the image as a displacement map. To do this, create a Black and White adjustment layer and place it directly above the image/texture layer. (The Adjustment Layer menu can be accessed by clicking on the circular icon at the bottom of the Layers Panel.)

Set overall tone to 50% gray It's also a good idea to make sure that the overall tonality of the texture image is near 50% gray. You can use a Curves Adjustment Layer for this. After creating a Curves Adjustment Layer, the Properties Panel will appear, containing the curves settings. Activate the Targeted Adjustment Tool (it looks like a little hand icon on the left side of the panel) and click on an area that displays the average tonality of the image. This will place a point on the curve, representing that tone. Next, type 128 into the output field just below the curve chart. This is the halfway point between 1 and 255, which is the range of tones you can

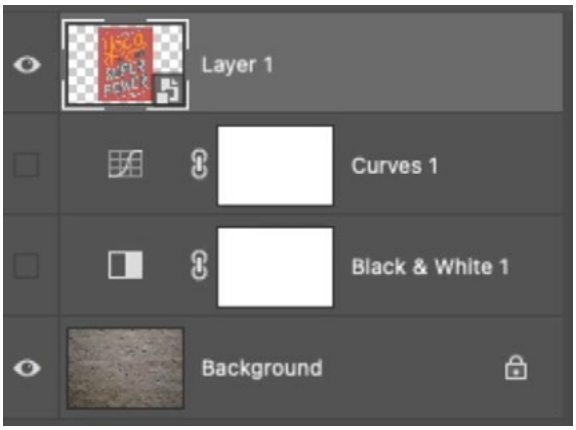


We targeted the overall tone of the image and set the Output number to 128.

work with in Curves. Therefore, 128 represents 50% gray. The tone that you targeted will now be 50% gray.

Save displacement map document Now it's time to create the displacement map. Make sure that the visibility for the graphic layer is turned off. You should only be seeing the gray textured image. Click on the File menu and choose Save As. In the Save As dialog, set the Format menu to Photoshop and type in a name for the document. Save the image somewhere on your hard drive that you will remember. I just use the desktop in the video example.

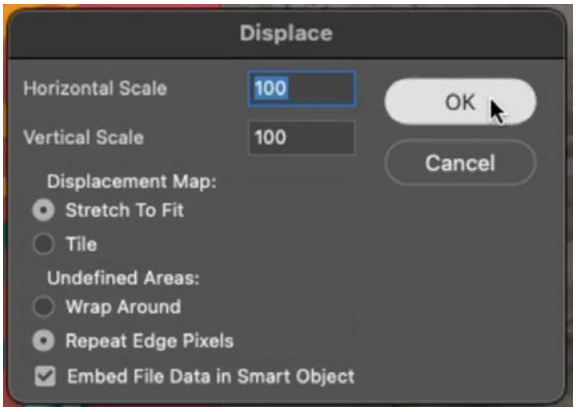
Back in the image document, turn off the visibility of the adjustment layers. They were only created to optimize the displacement map. Turn the visibility ON for the graphic layer[s] and convert it into a smart object (Layer > Smart Objects > Convert to Smart Object).



Before applying the displacement map, we turned off the visibility of the adjustment layers, activated the graphic layer and converted it into a smart object.

Note: If the graphic consists of one layer only, it's not imperative that the layer be converted into a smart object. I just like to do this because it provides more versatility. If the graphic consists of more than one layer, you will need to convert them into a single smart object in order for them to be bent as one item.

Apply the Displace filter With the graphic layer active, click on the Filter menu and choose Distort > Displace. In the Displace dialog, enter in numbers for the Horizontal and Vertical Scale fields (I used 100 in the example) and click OK. You'll be prompted to navigate to the displacement map image on your hard drive.

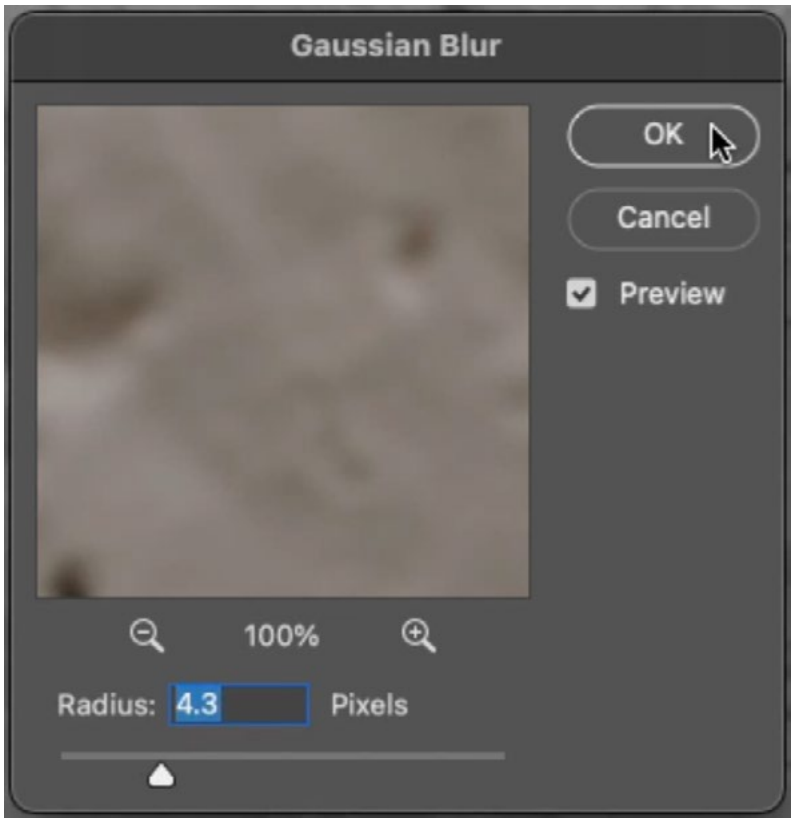


The Displace filter is being applied, with the scale settings at 100.

If you apply the displacement map and find that the graphic ends up looking overly messy, it could be that the textured image used to create the map was too busy, containing too much fine detail. Remember, any little changes in brightness are going to affect the way the graphic is bent.

You can correct for this by removing the fine detail in the displacement map. If you are using the image layer as the displacement map, duplicate that layer and then apply the Gaussian Blur filter (Filter menu > Blur > Gaussian Blur). In the Gaussian Blur dialog, move the Radius slider up just enough that you get rid of any fine detail. You still want to be able to see the larger shapes. When you're done adjusting the Radius slider, click OK to close the Gaussian Blur dialog. Now you can save a new version of the displacement map document (File > Save As).

Here, the result of the Displace filter was very messy. That's because the textured wall used to create the displacement map has too much fine detail.



The Gaussian Blur filter is being used to blur the displacement map image, removing fine detail.

Once again, toggle the visibility icons in the Layers Panel so that you are only viewing the textured image layer and the graphic layer above it. If the graphic is still messy from the first time you applied a displacement map, you can simply double-click on the Displace smart filter in order to run it again. This time, choose the new (blurred) displacement map file. The result should look much smoother. You can re-run the filter as many times as is necessary, adjusting the horizontal and vertical scale settings until you have the ideal amount of bend in the image.

After removing fine detail from the displacement map, the Displace filter was applied to the graphic.

The graphic is bent now, but you still need to change the blending mode so that it looks as if it's truly printed on the wall. If you want it to print like ink, the Multiply blending mode works well.

Another option would be to duplicate the textured image layer and place the duplicate above the graphic layer in the Layers Panel. Clip the duplicate texture layer to the underlying graphic layer (Layer menu > Create Clipping Mask) and then change the blending mode of the texture layer. When using this method, I like the blending modes of Overlay, Soft Light and Hard Light. You can also adjust the opacity to achieve the optimal effect.

A duplicate of the texture layer was placed above the graphic and the blending mode was changed to Hard Light.

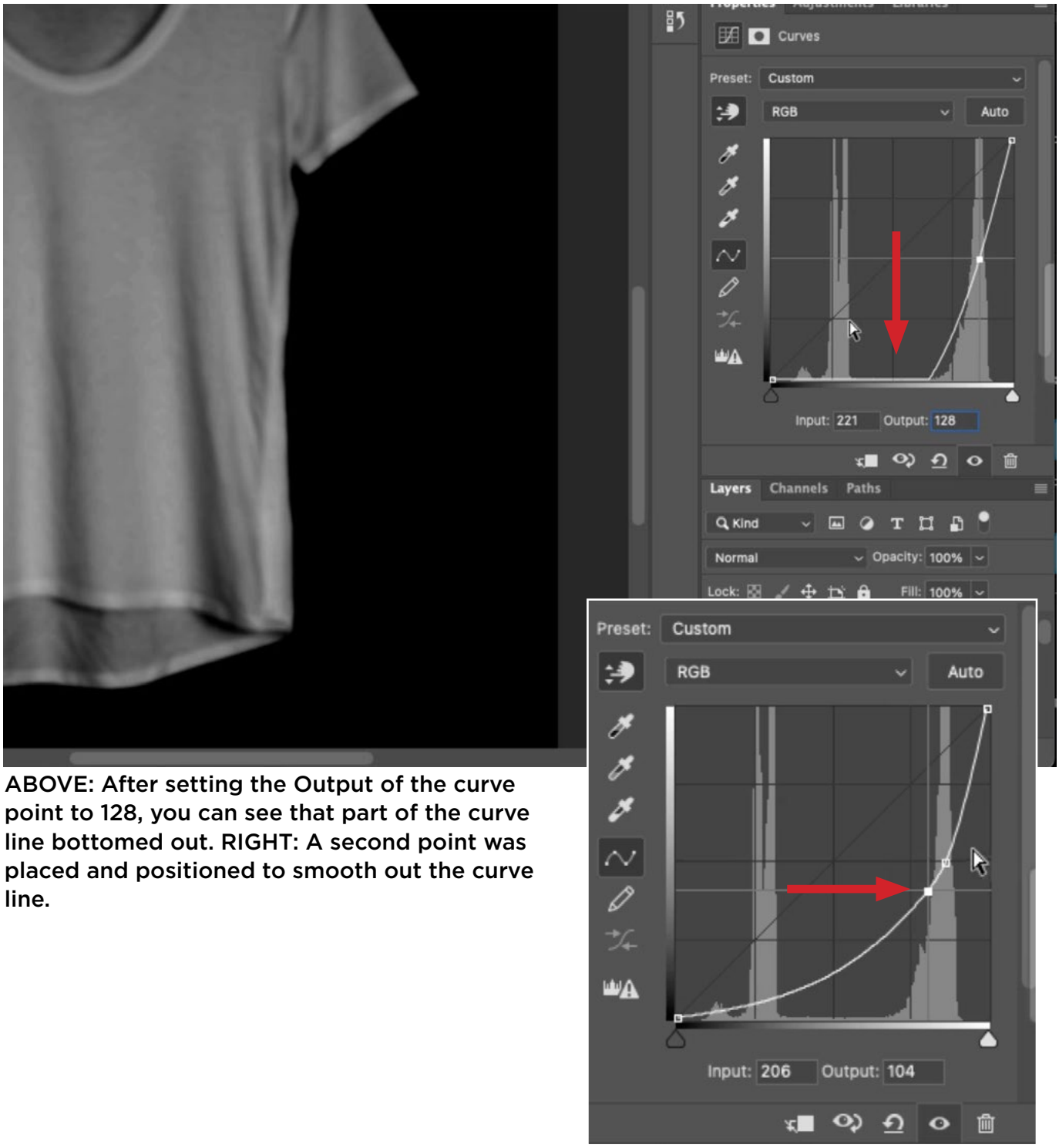
Tips & Troubleshooting (21:23)

Use a grid graphic as a guide and placeholder You can run the Displace filter on an image containing a simple grid in order to see how the bends in the map affect the image. The grid lines would serve as a visual guide. You can then easily switch the warping effect from the grid layer to the graphic layer you ultimately want to bend. You will need to convert the graphic into smart object. Then, you can simply drag the Displace smart filter from one layer to another.

The displacement map was first applied to a grid graphic, which helped us to see how the map was bending the image. Then, the Displace smart filter was moved from the grid layer to the graphic layer we ultimately wanted to use.

Correct unwanted shifting of the graphic layer If the graphic shifts after applying the Displace filter, it's because the overall tonality of the displacement map is not 50% gray. Earlier in the lesson, we learned that we can correct for this by using a Curves adjustment. In the Curves settings, you will use the Targeted Adjustment Tool to click on an area that is representative of the overall image tone and then set the Output field to 128. If the curve line bottoms out when you do this, you

might need to add an extra point and position it in a way that smooths out the curve (see screen shot). You will need to re-save the displacement map after applying the Curves adjustment.



ABOVE: After setting the Output of the curve point to 128, you can see that part of the curve line bottomed out. RIGHT: A second point was placed and positioned to smooth out the curve line.

Imperfect edges When it comes to displacement maps, you will notice that the edges of the graphics you're bending will not look perfect. The solution for this is to work on a much larger image than you truly need. This may mean that you scale your image to 200% before applying the Displace filter. Just make sure that you finalize the image before you scale back down to 50%. By saying "finalize," I mean that you would either select all layers and convert them to a single smart object or you would simply flatten the image.