

Realistic Mapmaking for Fantasy and Science Fiction Worlds

A Comprehensive Tutorial for the Creation Of Photorealistic Maps

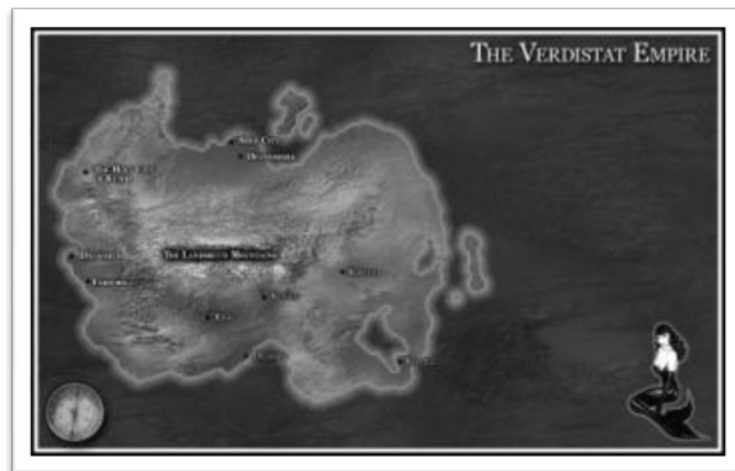
v 1.0

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Photoshop Tutorials

By

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AUTHOR'S NOTE:

The USGS website provides images of the earth free of charge. All images pulled from the website are under a public domain license, and may be used for commercial or private use. For more information on their policies, please visit http://www.usgs.gov/laws/info_policies.html. Email correspondence with the USGS outlining the use of images from the Seamless Survey website can be found here: <http://www.cshawnsmith.com/pstutorials/maps/>.

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INTRODUCTION

Hand drawn maps are great, but why settle for two dimensions, when you can have three? Why settle for pyramid-shaped mountains or dome-shaped hills when you can have something photorealistic which appears to have been taken from satellites high in orbit?

In this tutorial, I'll show you how to do just that.

What you will need:

1. Photoshop (CS or better)
2. Internet access (briefly)
3. Basic working knowledge of geology and tectonics

Suggested:

1. Wacom Tablet (or similar)
2. Pot of Coffee
3. Patience

This tutorial assumes the use of Photoshop CS3 on a PC, and basic understating of the variety of brushes. Other programs – Paintshop Pro, etc – will have many similar tools.

I suggest the use of a Wacom Tablet because it'll be much easier getting some of the more subtle features to display with the varying brush pressure available on tablets. Decent tablets can be purchased for less than \$100US. For this tutorial, I am using a slightly older version of the Wacom Bamboo Fun:

(http://www.wacom.com/bamboo/bamboo_fun.php), which I purchased on sale for \$99US.

Tutorial Conventions:

Important information will be contained in a box as follows:

Important: This is important information that may save you a headache or two.

And a quick word of warning: SAVE, SAVE, SAVE! As a digital artist, I find it helpful to choose SAVE AS and give the filename something like _001.psd, _002.psd, etc, rather than just saving the document. If your computer or program crashes, you'll have an updated save point and won't lose quite as much of your hard work, or if you do something you don't like it'll be easier to get back to an earlier state. I'd also suggest changing the number of undos in preferences to as high a number as your system can handle. If you're going to have the map printed out on a large format printer (poster-sized stuff), be careful of setting the undo levels too high – with PPI settings above 72, your system will bog down after you build up a number of undos and layers, and may even crash.

Let's get started ...

STEP 1: Internet Access



<http://seamless.usgs.gov/>

First go to the USGS website. You'll see a map of the Americas and a map of the world on the left hand side of the page. I prefer to use the Asian continent for topology as it is rich in various types of terrain, but you can use whichever you prefer.

After clicking on your destination of choice, you'll be confronted with a color map. On the right hand side of the screen, you'll see an area marked "Display," with some dropdown boxes. Click on "Boundaries" and uncheck National Atlas States and Countries Line.

To the left side of the screen, you'll see a palette with various buttons. Leave the Zoom tool selected, and drag a box around as large of a portion of land as possible, being sure to get plenty of mountains and valleys.

It helps if you load the Seamless Survey in a full-screen browser. We'll be taking a screenshot of this in a moment, and you'll want as much information as possible in the screenshot.



Here, I've chosen an area that encompasses India, Pakistan, Afghanistan, China, Mongolia, and the Vietnam peninsula. The scale at this distance is enormous, but we're not going to worry about this.

Hit PRINT SCREEN on your keyboard (or use your favorite app to capture a screenshot), load Photoshop, and create a new document from clipboard. You should see your browser window

complete with the map of the area you selected. Crop the image to just the map itself. This will be your template file for painting the terrain onto your fantasy map.

IMPORTANT! Take a quick note of where the light is coming from in your reference material as well. The USGS website has the light coming from the western direction and slightly north. Later on when we begin to carve in your terrain, you'll want to keep this in mind, because we may be spinning the map around a bit.

The only time this will not be important is if you are using the heightfield maps from the USGS website (or you've created your own), as outlined in *The True 3d Option*. Lighting will be provided for by the Lighting Effects filter.

SAVE THIS FILE!

Now that we have this done, we can close out the USGS website. However, before we do, take a note at the upper right hand corner of the page where it discusses "scale." The scale I typically use is 1:119,589,411, which is the third vertical line from the left. You can get a bit closer if you prefer, but be aware that the closer you get the more pixilated the reference image will become. If you do prefer the smaller scale, you can get around the pixilation by temporarily reducing the size of the reference image (IMAGE > IMAGE SIZE), and then re-enlarging it using BICUBIC SMOOTHER on the resampling option. Please note it is best to reduce/enlarge images either 25%, 50%, or 75%, as the pixels stand less of a chance being distorted at these specific numbers.

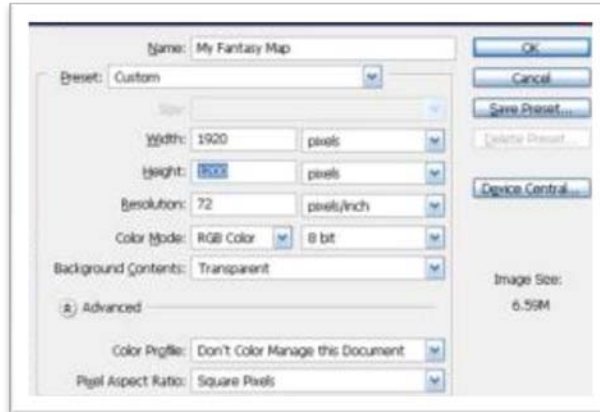
I haven't gone very deep into the USGS website, but it appears to have a wealth of information. If you find higher resolution color imagery at smaller scales, by all means drop me a line and let me know ☺.

STEP 2: The Lay of the Land

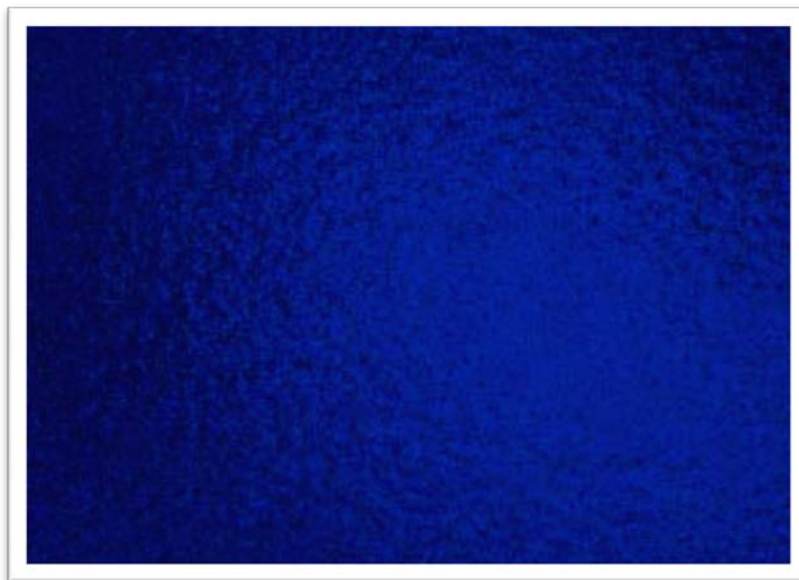
Now that we have our template that contains all the terrain we need, let's create a new document. You'll want to make the dimensions of the document as high as possible, for a variety of reasons. First and foremost is detail – the higher the dimensions, the better detail you'll get. Second, if you eventually want to have your map printed as a poster (which can be done at any local sign shop), you'll need a larger file to prevent the image from becoming pixilated. Also, if you want it printed, make sure the PPI setting is at *least* 180, with 300 being preferred. Most local sign shops can handle PSD files, but for their sake, save it in PSD, TIFF, and BMP so they can figure out which one suits them best in their workflow.

If you have a low-end system, keep the PPI at 72. After you're done creating the map, you can flatten the image and save it as a .jpg, and then resize the document by entering 300 in the PPI setting. Be sure to checkmark the Resample Image box and choose Bicubic Smoother. This will enlarge the document and smooth out the pixels as noted above.

In the example here, I'm not going to have the image printed, so I'll leave the PPI at 72 (screen resolution), and the dimensions set to my desktop setting (1920x1200). I've also left the background to transparent.



Once the document is created, open your layers panel and rename Layer 1 to “Water.” In your color selector, choose a light blue and black for the foreground and background color, respectively. Go to FILTERS > RENDER > CLOUDS, and your Ocean layer will fill with a cloudy blue texture. Then go back to FILTERS, and this time go to DISTORTION > OCEAN RIPPLE. Play with the settings until you get a nice “wavey” type texture for your ocean.



Portion of the water layer

I've also created a handy CS3 action to automate the entire process, which can be downloaded here:

<http://www.cshawnsmith.com/pstutorials/>

If you download and use this action, do NOT rename Layer 1, as the macro needs it to figure out where to apply the filters. This action applies a couple of extra filters not covered under this tutorial.

Creating Land from Scratch, No Reference:

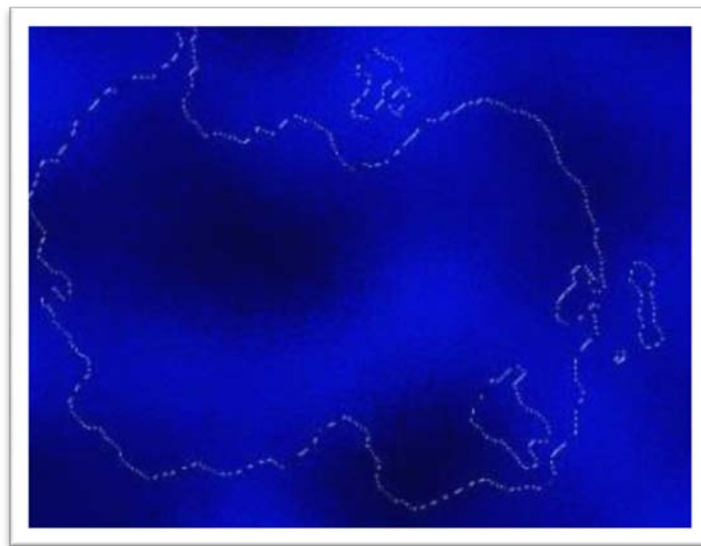
Now create a new layer, and name it “Land Area.” Select your freehand marquee tool,

and begin drawing an outline of your continent, island, or whatever you want. When you're satisfied with the results, go to SELECTION > SAVE SELECTION (you might need this later), and name it appropriately.

Creating Land from Hand-Drawn Reference:

If you scanned your map, you'll want to import it into a new layer beneath the Land Area layer. Name it "HDTemplate." Because of the nature of scanning, you'll want to first DESATURATE the layer (IMAGE > ADJUSTMENTS > DESATURATE), and then play with the BRIGHTNESS/CONTRAST until your sketch lines are very black and all other areas are very white. Examine the layer closely, and if you see any broken lines around the coastal area of the map, fix them first so that the line is continuous. Otherwise when you select the water area, you'll likely get the land area as well. You'll also want to make certain you have no errant lines, dots, or other things in the ocean/water areas.

Using the Magic Wand tool, select the ocean/water area, and then go to SELECTION > INVERSE (CNTRL-SHIFT-I on a PC). Your continent/island should now be completely selected and ready for use.



In this image, I've had to increase the contrast a bit to show the marquee selection.

With the Land Area layer selected, fill the selection with white. Then CNTRL-A to select all, CNTRL-C to copy it, and then click on the CHANNELS palette and CNTRL-V to paste the selection into an ALPHA LAYER.

Important: After pasting, be sure to turn on the RGB channels and turn OFF the alpha channel.

Reselect the land area and fill the area with a medium grey (50%). We're going to start suggesting where we want the mountains and valleys using the Burn and Dodge tools, so feel free to create a duplicate of this layer, or rename it "Topology Template." This will just be a reference layer, so

don't worry about getting things perfect. For both brushes, you'll want to set the hardness to a very low number (0% preferably) and the brush size to about 1/10th to 1/5th of your document size.

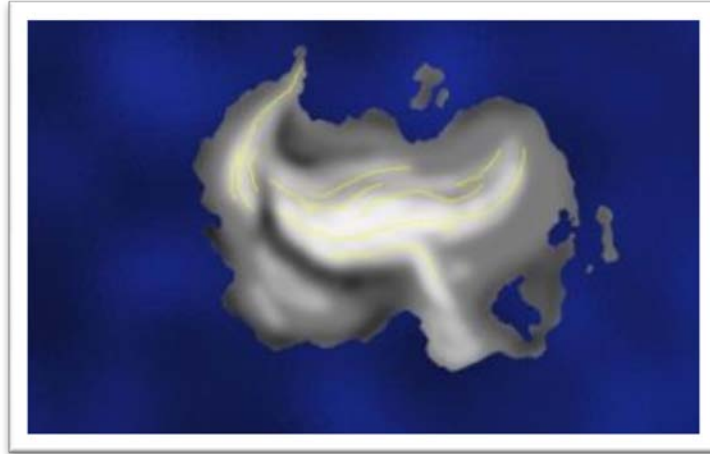
You'll also want to start thinking about tectonics. Plate tectonics determine where mountain ranges develop, as well as placement of islands, volcanoes, etc. A quick Wikipedia search will give you the basics on the geological consequences of plate tectonics. With the Paintbrush or Pencil tool and a bright color (I like to use yellow or red), quickly sketch in where you want tectonics to play a role in the formation of mountains and valleys. You may want to do this on a separate layer above the Topology Template area.



Here I sketched in a rough estimate of where I wanted mountains. There are two tectonic plates meeting on this continent: one to the north, and one to the south.

Your mountains and valleys will also determine placement of forests, deserts, etc, so be careful in their placement. It doesn't have to be perfect (most of your readers won't really care one way or another), but keeping these things in mind could make for some very interesting plot devices in your stories.

Use the Dodge tool to place your mountain ranges, following your tectonic lines. Set the opacity to around 25%, and the Range to Midtones. The higher the mountains and ranges, the "whiter" the area will need to be, so you'll want to go over these areas a few times. Using the Burn tool with similar settings, block in the valleys and lowlands, as well as the coastal areas that will contain the beaches. If you have a mountain range bordering the coast, do not burn these areas – in Step 3 The Hands of the Gods, we'll use features from the USGS website to create these areas.



Mountain ranges and valleys/coastal areas blocked in.

Don't worry about rivers at this point, although you may want to burn in a lake or two if they're important. To do this, use your Lasso tool to "draw in" the lake, and the burn tool to burn it down into an area that's completely black (this will be important for the alpha layer later on in the tutorial). Optionally, with the lake selected, just delete the area to allow your water layer to show through.

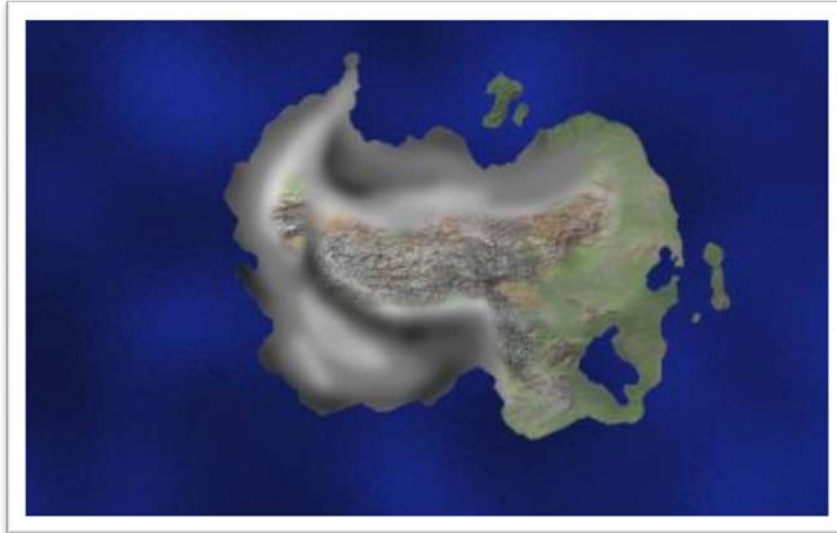
This layer will be used a little later with some modification, so it would be a good idea to place it in a folder in the layers palette for safekeeping.

We can already see how the world is coming alive at this point. The mountain ranges in the center, which will contain the highest peaks, will be natural barriers for any kingdoms or empires in the north, east, and south. In a scifi setting, an industrious nation might use the mountains to conduct secret atomic research, and the coastal plains to the east would make an excellent base for a spaceport.

STEP 3: The Hands of the Gods

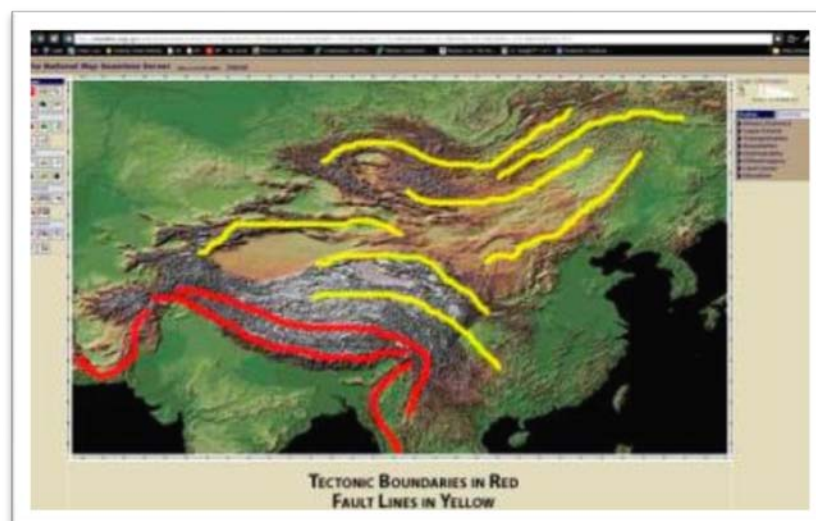
In this step, we'll be playing the gods of your world. We'll create mountains and highlands, and carve out rivers, valleys, and canyons.

Bring your USGS reference forward, and select the Clone Stamp tool. Set the opacity to approximately 10%-20%. We don't want a 100% opacity because that will not enable us to "blend" the terrain properly. Select a spot on your reference material that contains mountains, hold the alt-key down, and click the left mouse button. Now bring your map file forward. Create a new layer above your Dodge/Burn template, and begin painting in the mountains. The more you stroke over an area, the more opacity that area will have. I like to have both images viewable so I can see from the reference what will be painted onto my map.



Here I've begun painting in the mountains and coastal areas to the east at a very low opacity. The more I paint over an area, the more opaque that area becomes. This allows for the perfect blending of different types of terrain to give you even more options.

A good thing to keep in mind at this point as well is the “direction” the mountain’s “flow.” For example, if you study the area on the USGS reference around the Himalayan mountains, you’ll see most of the mountain ranges follow a clear line east and west. Remember when I had you draw out your tectonic lines? There’s a meeting of two tectonic plates in the Himalayas (actually there’s three or four, but why quibble?). If you have a vertical tectonic meeting, you may need to go back to your USGS reference and Rotate the image some. Don’t go beyond 90-degrees, however, as that will affect the lighting and make your map look odd. You’ll notice in my map above, I have one chain of mountains that run north and south, which flows into the central mountain ranges. I’m going to spin the USGS reference clockwise approximately 40-degrees in order to paint this area.



In the image above, I loosely drew in the tectonic plate boundaries and where natural buckling of the topology will occur as a result. These aren't 100% accurate by any means, but they give you an idea.

You can also see the flow of the mountain ranges using these lines.

As you get closer to the coastlines, you'll want to be especially careful. Your mountain ranges will generally follow the angle and curve of your coastline. To make them appear slightly sea-worn, select an area of lowlands (colored green in the map above), and decrease your brush size considerably. Lightly paint in at the coastline, being careful to maintain a very light opacity to make the transition smooth. If you mess up or get it too opaque, just select an area of the mountains and paint over it a little.

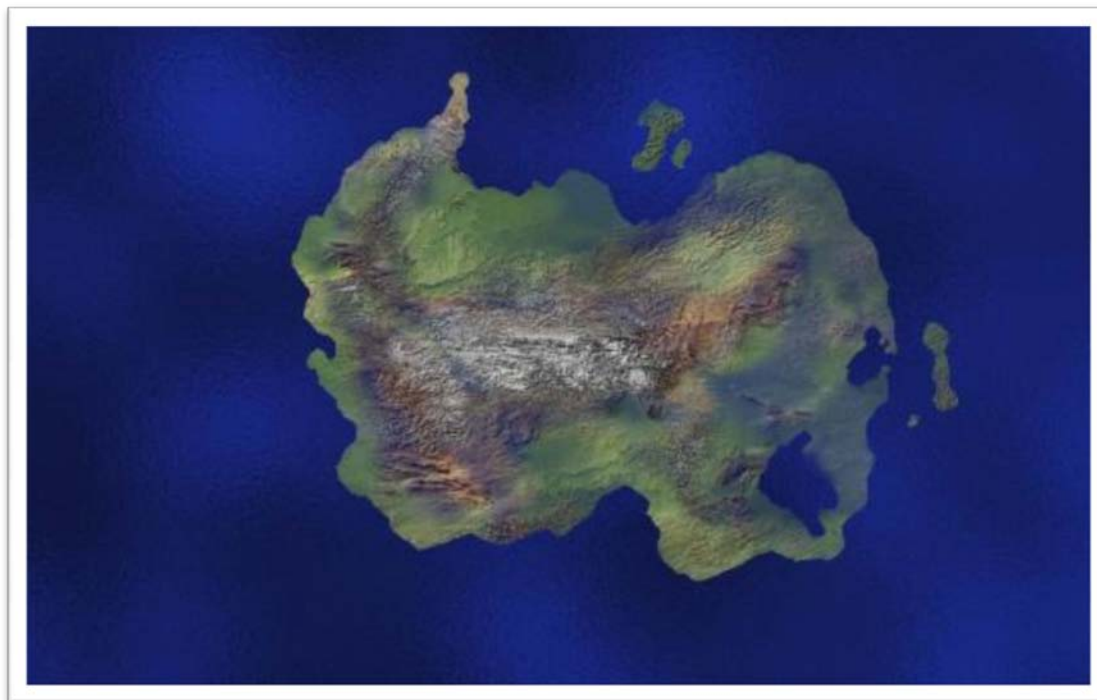
You may also want to sample different areas of mountain ranges and paint over your original mountains. This will add some variety to the range. In the image above, you'll notice the Himalayan range is generally a grayish color, while mountains closer to Russia are brown. This helps differentiate the overall "height" of the range.

Once you've blocked in your mountains, go back to the USGS reference and select an area that looks like lowlands or plains. Alt-LMB to select the area, and return to your map. Begin painting in the lowlands.



Continuing with the painting.

Now that we have most of the land area covered, it's time to hide our Topology Template layer to see where we are at. Areas in which the water is showing too much will need to be made more opaque. To do this, create a layer beneath your color map. Reselect the land area, and choose a color for the area you need to fill in (green for the lowlands and brown for the mountains). With your paintbrush tool at 100% opacity, fill in those areas until the map is 100% opaque.



The "Topology Template" layer has been hidden here to see what areas need to be worked on.



The final painted version.

Now that we've got this done, merge the underpainting with the topography.

Now let's add a little coastal water effect. Create a new layer beneath your topology, and reselect your land area. Fill the land with any color you like. In the layer properties palette, set the FILL option to 0%. This will insure there is nothing displayed except for the special effects we're going to be adding to this layer. Double click to the right of the layer name, and your effects panel should pop up. First, we want to "Outline" the land area, so check mark the Stroke box at the bottom. Your land will suddenly have a red border, so let's change that to a light blue.



The coastline is added.

Not bad. Now let's add some wave like effects around this. Back in the effects palette, check mark Outer Glow. Change the color to a blue similar to what you picked for the coastline. Change the blend mode to Normal and drop the opacity to around 75-80%. Under the elements box, change Technique to PRECISE and reduce the Spread to 0%. For the size, this will be your own personal preference. In this version of the map, I put it around 59 pixels. Now increase the noise a bit until the outer glow begins to fade well into the Water layer background. Play around with the quality settings if you like, as well.

You can leave this as is and it will look very nice. However you may want to add some rippling effects to the coastal waves. First, make a copy of this layer in case things get fouled up, then hide the layer. Next, create a new layer beneath the original and merge the layers. This will in essence "commit" the layer effects to the layer. Now, go to FILTERS > DISTORT > OCEAN RIPPLE. Increase the size a bit so it'll show up better.



Coastal waves added.

At this point, we're pretty much done. We now want to go over each area of the map with a fine tooth comb, making certain all the colors blend fairly well. If you find some spots you don't like, you can use the Clone Stamp tool to repaint those areas, or create a new layer above the land area, set the layer properties to either color or overlay (I find overlay works best), and lightly paint in the colors you want to improve upon.

Optional:

This section is still under development. The current technique isn't perfect in creating the continental shelf. As soon as I come up with a better way to do it, I will post an addendum to this tutorial.

Want to truly blow the minds of your readership? Load the Land Area alpha, and expand the selection a number of pixels (10-20) if you created a continent (this will in effect create your "continental shelf.") Create a layer BENEATH the land and water layers, then turn off the water layer. Fill the new selection with a grey base color, deselect and choose a slightly darker grey color, and fill the rest of the layer. Create a new layer on top of this one and set the opacity to 50%. Next, using the steps above, you can begin blocking in underwater terrain. Keep the terrain details subtle ... too much will overpower the land area, which is your ultimate focus. When you're done, Merge the new layer with the grey layer, then turn on the water layer and lower the opacity to taste.

In the image below, I didn't spend any real time making the underwater topology very accurate. It'll need to flow in a similar manner to when you were painting the land terrain.



Underwater topology added.

STEP 4: The Gods are in the Details

This short step will add all the minute details that will make your world come alive. If you're creating a continent, we won't worry about creating forests or jungles in detail, but we'll suggest them with color hints and slight modification to terrain.

Remember that Topology template layer I had you save? Copy it to a new layer above the Land Area layer. Set the properties to Overlay, and reduce the layer opacity a bit. Some of the lowland areas will get some nice darker shading, while the mountains get a bit lighter. If you add some Gaussian noise to the layer, you'll get some interesting effects.

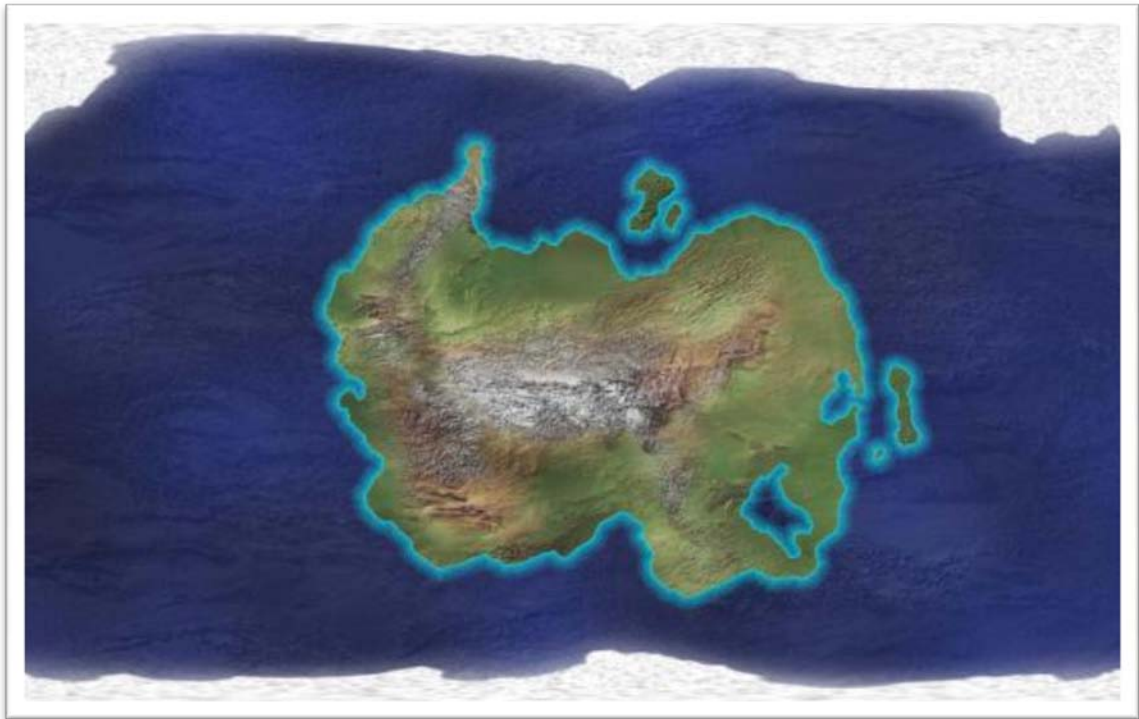
If you want to add more variety, use the Dodge and Burn tools on this layer to further add details. If you reduce your brush size to 3 or 4 pixels, you can burn in rivers, etc, if you like. I do not suggest "painting" rivers in, as they tend to look fake if you do.

Add a new layer above this one, and rename it "Color Enhancement." Change the Blend Mode to Overlay. Select darker greens for your forest, and with a 20% opacity brush, begin darkening some areas where you want your forests. For deserts, choose a tan or brown color, and increase the opacity of the brush to around 40%. Make sure the brush hardness is set to 0%

A couple of friends wanted me to come up with a way to create polar ice caps as well. I haven't perfected this part yet, but it does yield some convincing results.

To begin, start a new document with the same dimensions as your map. Use the lasso tool to select a small area near the center of the image. Don't make it too big ... you only want a dozen pixels in width and height. Fill it with white. Now add a little bit of Gaussian noise (FILTERS > NOISE > ADD NOISE). If you add too much, you can go to EDIT > FADE NOISE to get it where you want it.

Now comes the fun part. Under FILTERS, go to DISTORT > POLAR COORDINATES. You may see a transparent box; just decrease the magnification until you can see your ice cap. Now click the radio box that says POLAR TO RECTANGULAR. Voila, the Arctic Circle! Copy this layer and paste it on top of your map, moving it into position. Repeat these steps to create the Antarctic Circle (you'll have to rotate the image 180-degrees to do the southern pole, or just use the transform controls to spin it around).



Polar caps added.

Personally, I prefer to leave the ice caps off, and decorate the map with fancy borders, artwork, etc.

STEP 5: Populating Your World

This is the step where all your hard work will pay off. Now you can begin placement of your cities, deciding on political and religious boundaries, and maybe even ethnic groups.

In fantasy worlds – or in any pre-industrial civilizations – mountains and rivers tend to create natural borders and barriers to political and religious boundaries. Post-industrial or Space Age civilizations generally don't have to worry about such boundaries, although populations will tend

that kind of patience, I highly recommend it to give your map a much better look and feel. This process could take several hours, or even days if you're creating a large continent or entire world.

Once you've cleaned up the heightmap layer, copy and paste it into the ALPHA layer of the Channels palette. Back in the layers tab, create a new layer and fill it with WHITE. With this layer selected, go to FILTERS > RENDERING > LIGHTING EFFECTS. A new panel will pop up. Change the Light Type to DIRECTIONAL. Adjust the light position to the upper left corner, adjusting the distance until you get something that looks good (an overall gray tone of about 50% works well). You may want to do this step over several different layers and adjusting their blending mode until you get something you like. Don't be afraid to experiment, but as I said before: SAVE OFTEN! You can also play with adjusting the brightness and contrast.

To add color to the grayscale image, hide the relief layer and click on your heightfield layer. Click on the ADJUSTMENT LAYERS icon in your Layers palette, and select GRADIENT MAP. This will insert a new layer and a GRADIENT MAP window will open. Double click the gradient and the gradient layer editor will open.

Remember that your highest points (which you'll want to be white) will be on the RIGHT side of the gradient bar. Your lower areas (which will probably be your lakes/oceans), will be on the LEFT. Add new color points by clicking between the color boxes at the bottom of the gradient bar. Clicking on a color box will allow you to edit that color.

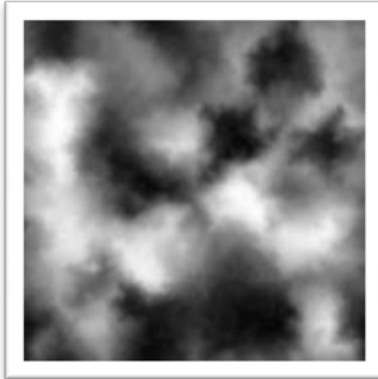
For mountains and highlands, you'll generally want to use light browns fading into darker browns. As they transition into plains, valleys, and lowlands, you'll want to use various shades of green. Also remember that this gradient is only used to represent various heights, not terrain features or nature.

The greater the distance between two color boxes, the gentler the gradient transition; the closer the boxes, the sharper the transition.

Once you're satisfied, go back to the Layers palette and make the relief layer visible. Choose LUMINOSITY as the blending type. Play with the layer opacity, and the SHARPEN FILTER.

The True 3d Option:

Terragen is a world creation 3d application that uses heightfields to generate realistic looking 3d terrain, using procedural textures (if you don't know what a procedural texture is, put simply it is a texture that is created mathematically to appear randomly generated. The most common procedural used to create heightfields is called Perlin Noise, but there are many others). Terragen has been used in a number of science fiction television shows and movies, as well as by some NASA artists. Although I'm familiar with the older pre-release versions, I cannot begin to advise on the use of the latest versions, however I imagine the latest version has the ability to export heightfields as .raw files.



Sample Heightfield created in
Terragen



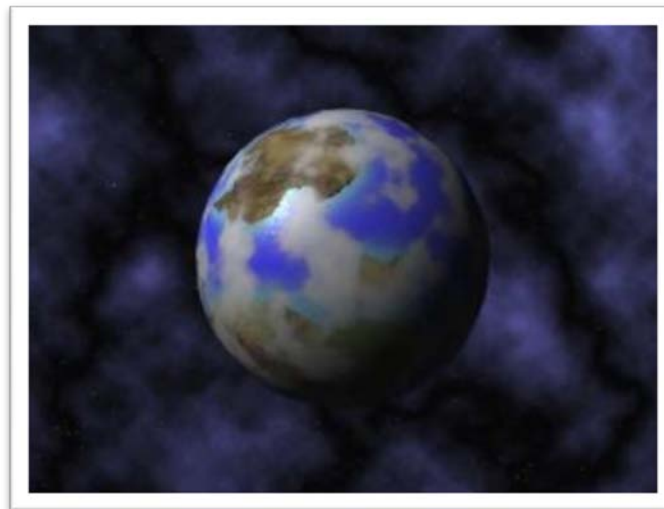
Photoshop Lighting Effects
Light direction upper left corner



Photoshop Lighting Effects
Light direction lower right corner

These raw files can then be imported into Photoshop and used as a heightfield, similar to what you find on the USGS website. What's more, you can generate the size of the terrain in its properties, allowing you to create terrain for an entire, seamless continent!

If you're familiar with 3d programs like Lightwave, Maya, 3dMax, and such, you can also create short rendered movies and images of your entire world. Just create a sphere and give it a UV texture. If it supports displacement or bump mapping, you can use your heightfield to give it a true 3d look. Add a procedural cloud layer, a starfield in the background, and render!



A quick and dirty 3d rendering of a world composed in less than an hour.
With more time, the cloud layer could be made more realistic.

I'll also add a quick plug here to the authors of Celestia, a free 3d program available at <http://www.shatters.net/celestia/>. Celestia is a relatively easy to use OpenGL astronomy program that allows the end user to visualize the universe. But what makes this program so wonderful, you can use your photoshop maps to create textures for the program, and create an entire planetary system. As the program expands and gets more involved, the potential power for the fantasy or

scifi artist is limitless. Check it out.

Conclusion:

I hope you enjoyed this tutorial. If you use it to create your own maps, feel free to drop me a line at css@cshawnsmith.com.

Happy MapMaking!

C. Shawn Smith, January 2010

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Photoshop Tutorials: <http://www.cshawnsmith.com/pstutorials/>