If you’ve made it this far, then you’ve made it past the hardest stuff. If the concept of an image channel is still not clear in your mind then now would be a good time to review the previous lessons, especially the first tutorial. If it’s starting to make sense to you then it’s time to move on to the practical side of things. But before we jump in, there’s one more bit of understanding we need to acquire.

How do blending modes do what they do? The only available source of information to help answer this question is found in the Canvas User’s Guide. Some of the explanations are sufficient, but I feel some are insufficient. For example, there is no mention of which modes will clip values. It is also useful to see the actual formulas used, so I have decided to add these in the User’s Guide description. I have borrowed some of these from Photoshop Channel Chops (where they match the math used by Canvas). You will see them, and my own notes in red.

Descriptions of Calculate blending options

You can select various blending methods in the Calculate Image dialog box.

Normal.
Places Source 1 over Source 2 at the specified opacity. 100 percent opacity replaces Source 2 with Source 1.

Multiply.
Creates a darker channel than the source channels. Black areas in either source create black areas in the resulting channel. White areas do not affect the result.

(Pixel Value A * Pixel Value B) / 256 = New Pixel Value
Screen.
Creates a lighter channel than the source channels. White areas in either source create white areas in the resulting channel. Black areas do not affect the result.

\[255 - \left(\frac{(255 - \text{Source 1})(255 - \text{Source 2})}{255}\right) = \text{New Value}\]

Overlay.
Places Source 1 over Source 2 without destroying the shadows or highlights of Source 2.

The dark areas of Source 1 are multiplied onto Source 2, while the light areas of Source 1 are screened onto Source 2.

Soft Light.
Lightens or darkens pixels in Source 2 depending on the brightness value of the corresponding pixels in Source 1. Pixels in Source 1 that are lighter than 50% black lighten Source 2. Pixels in Source 1 that are darker than 50% black darken Source 2.

Hard Light.
Lightens or darkens pixels in Source 2 depending on the brightness value of the corresponding pixels in Source 1. Hard Light works similarly to Soft Light. However, black in Source 1 produces black in the resulting channel and white produces white.

Darken.
Replaces pixels in Source 2 with the corresponding pixels in Source 1, if the pixels in Source 1 are darker.

Lighten.
Replaces pixels in Source 2 with the corresponding pixels in Source 1, if the pixels in Source 1 are lighter.

Add.
Creates a lighter channel than the source channels. Add is similar to Screen but usually produces a higher-contrast image. If you select the Add option, you can enter a Scale value from 1 to 2 with a precision of three decimal
places. To calculate the average brightness value of two channels, choose Add and enter a Scale of 2. You can brighten or darken the resulting channel by specifying an Offset value. To lighten the overall image, enter an offset from 1 to 255. To darken the image, enter an offset from -1 to -255.

\[(\text{Source 1} + \text{Source 2}) / \text{Scale} + \text{Offset} = \text{New Value}\]

Add makes things brighter. The result can go no higher than pure white (255).

Subtract.
Creates a darker channel than the source channels. Subtract is similar to Multiply. However, corresponding pixels of the same color produce black in the resulting channel. If you select the Subtract option, you can enter a Scale value from 1 to 2 with a precision of three decimal places. You can brighten or darken the resulting channel by specifying an Offset value. To lighten the overall image, enter an offset from 1 to 255. To darken the image, enter an offset from -1 to -255.

\[(\text{Source 1} - \text{Source 2}) / \text{Scale} + \text{Offset} = \text{New Value}\]

Subtract makes things darker. The result can go no lower than pure black (0).

The Add and Subtract modes use Scale and Offset like the Custom filter.

Difference.
Compares the color value of each pixel in Source 1 with the corresponding pixel in Source 2, subtracts the darker value from the lighter, and then uses this difference in the resulting channel.

\[\text{Lighter Pixel Value} - \text{Darker Pixel Value} = \text{New Value}\]

Identical pixel values result in pure black (0). The greater the difference between compared pixels, the lighter the result.

Ok, that should give you something to think about. You probably noticed the descriptions for Add and Subtract are somewhat more complex than the others, with the inclusion of the Scale and Offset options. These two options only become active in the Calculate dialog when Add or Subtract is selected as the blending mode. These options also give these two blending modes an amazing degree of flexibility, and tremendous power as mask building tools. They can be used to create stunning effects!
**Normal**

The Normal mode is the first one we will look at, and that look will be brief because this is the least useful of the blending modes. Virtually every effect it can produce can now be produced more easily with a variety of newer Canvas tools. The only thing the Normal mode does is replace pixels in the target channel with those of the source. The only parameter that can be controlled is opacity, and it’s a purely linear application of opacity. The Normal mode offers us nothing to get excited about, so let’s move on.

**Multiply**

The Multiply mode has long been one of my favorites because of how well it can blend two images together, while preserving so much of the detail of both images. So let’s start by examining what gives the Multiply mode this ability. This is the simple formula that Multiply uses.

\[
\text{New Pixel Value} = \frac{\text{Pixel Value A} \times \text{Pixel Value B}}{256}
\]

This simple formula, although accurate, doesn’t tell the whole story. As is, the formula is unconditional and would apply to any pixel. In reality this isn’t always the case. The Multiply mode is *conditional*. It compares the pixels of both sources and will only apply the formula when a pixel in source 1 is equal to, or darker than the corresponding pixel in source 2. So armed with this knowledge let’s expand this formula.

If \( A \leq B \) then \( \frac{\text{Pixel Value A} \times \text{Pixel Value B}}{256} \) = New Pixel Value

If \( A > B \) then skip this pixel.

It is this conditional application of the Multiply formula that helps it to create such natural looking effects. If it were unconditionally applied, then it would
simply darken things in a uniform fashion and subtle details would quickly be lost. This conditional approach forces Canvas to ignore areas which are already dark. To darken them further would most likely destroy any detail they contain. The other thing worth noting is that the result of the multiplication is then divided by 256 (to keep the result within the range of brightness values). This also has a less harsh impact on the darkening effect by preventing pixels from going completely black. Consider this for example: Take two pixels that are each 50% gray (128) and apply the Multiply mode to them. You might think that you would get 100% gray, but you would be wrong. In reality you will get 75% gray. That’s only half of the darkening effect that you might expect.

The formula looks like this: \[(128 \times 128) / 256 = 64\]  
\[64 = 75\% \text{ gray}\]

This is a good thing, as I have alluded to. It allows you to apply very subtle and selective darkening to an image. In reality, the effect may be so mild on some images that you may need to apply the Multiply mode more than once if you want to achieve a really dark effect. Further, you can also control the opacity of the applied effect, but there’s more. With tools like Color Range, High Pass and Low Pass filters, you can easily isolate (select or mask) specific areas of an image to be affected by the Multiply mode. For example, it would be easy to isolate only the midtones and apply the Multiply formula to them. This offers greater control than the Levels command is capable of. So that’s what’s happening behind the scene with the Multiply mode.

As promised, starting with this tutorial, I will be presenting real world examples. Wherever applicable I will be presenting two types of examples. One example will be masking / selection / alpha channel related, and the other will a practical procedure for an image, usually some sort of effect or compositing technique.
Masking with the Multiply mode

No complex explanation is required here. We have two very simple alpha channels that we use as our sources. When we Multiply them at 100% opacity we get this result. The Multiply mode is an ideal tool for building solid masks (no transparency). In this example, geometric shapes were used. These can easily be produced with the Canvas paint object selection tools, or with the vector tools. Text objects can also be used. Yet another option is to create complex shapes based on image data that you extract from images using any sort of method. Regardless of where or how you create these shapes, as long as they are opaque, the Multiply mode can combine them in this fashion.

Now let’s look at another very useful application of the Multiply mode, an image correction technique for overexposure called density building.
Sometimes a picture is worth a thousand words, so instead of writing a long description of what density building is, here’s a look at a simple grayscale example of density building. It makes the concept obvious.

### Density building with the Multiply mode

<table>
<thead>
<tr>
<th>Source 1</th>
<th>Source 2</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>50% gray</td>
<td>50% gray</td>
<td>75% gray where there is overlap</td>
</tr>
</tbody>
</table>

The area where the overlap occurs has increased darkness, or density. This has a resemblance to the Mix option of the Combine command, but other than producing a similar darkening effect, the two have little in common. Density building can be used on paint objects to create some very complex effects that cannot be easily achieved any other way.

At this point we run into a considerable problem. The Calculate command has a severe limitation. It can only combine individual image channels. That may be fine for producing special effects, masks, or examples like the one above. For doing color density building this won’t always suffice.
There are many occasions when density building requires us to work on the composite image alone, or in cooperation with individual channels. The Calculate command cannot perform operations on composite images. However, there is another Canvas tool that can. Sprite Layers (transparency palette). Here’s a sample workflow that starts with the Calculate command to build a custom density image, then passes it to the Sprite Layer tool for final blending with the overexposed image.

**Part I (calculate operation)**
1) Place image (paint object) in edit more.
2) Open Channels Palette and examine channels. Create alpha channels and/or mask if required.
3) Invoke the Calculate command and perform the required operation.
4) Copy the result of the operation to the clipboard.
5) Paste the Calculation result into your document as a new paint object.

**Part II (sprite layer operation)**
6) Select your original image and this new paint object and align them vertically and horizontally.
7) Hit ESC three times to deselect everything.
8) Select the top paint object (should be the newly pasted paint object).
9) Open the Transparency Palette and apply the Multiply mode with the desired opacity setting.

There are a few noteworthy things in this workflow. First, your paint objects must be stacked one on top of the other in perfect alignment. Second, it makes a difference which paint object is on top and which is on the bottom. Remember, the Multiply formula always compares the top image to the bottom. So if the top pixel is darker, or the same brightness as the bottom pixel, the Multiply effect is applied. If the top pixel is lighter than the bottom pixel, then the effect is not applied. As you can see, the stacking order can have an influence on the application of the Multiply formula. Typically you would want to have the result of the Calculate command on top of the stack. Placing it on the bottom may not produce the desired result.
What I often hear is “why not simply make a copy of the original image, align it on top of the original, and apply the Multiply mode through the Transparency Palette; isn’t that density building?“ Yes, that does qualify as density building, but only in a very limited form. This approach is uniform and treats the entire image equally. In real life, not all images are equally overexposed. The more elaborate method described on the previous page offers you a great deal of control over the density building process. It not only allows you to control how much density to add, but also which areas of the image to add it to. That way you only add density where it is needed.

As I was writing this, I was thinking to myself that this is a rather long procedure, and wondered if there might be a shorter method. This thinking got me to examine the Sprite Effects palette for a better solution. Unfortunately, Sprite Effects are restricted to composite images, which means no access to the Calculate command.

So despite the incredibly advanced tools of Canvas 8, in many cases there is still no substitute for the tried and tested tools of a decade ago. I must commend the programmers who build Canvas, for they have done a superb job of linking up these old tools with the new ones in a way that allows Canvas users to easily work around inherent software limitations. Consider how the Transparency palette offers very easy access to the features of the Channel palette required for masking, and the blending modes. The biggest omission I can mention is the lack of a direct way to move channels from one image to another. Routing them through the clipboard remains my favorite work around, but you could also turn them into Macros for long term storage, and for cross document access.

Coming up next will be the Screen and Overlay modes.