Blend and Tonally Match

by Malcolm McElvaney

BTM is a solution found for a problem in a quest to photograph in all light conditions; however, it isn't a perfect result and as such has limits because other conditions like wind may be an issue. It is my goal in writing this guide to make the process easier to understand and pass on my point of view on the bracketed images I use. I am not sure how original my discovery is to me or if the wheel was reinvented but at the core of this is how I look at the exposure and what I need to capture at the time to achieve the results in post processing. In my mind the neutral image directs the camera to capture the overall data I might need in the bracketed set. The condition to most likely to test my skills is more direct light so an attempt is worth the try. A bracketed set is multiple images over time so alignment issues and artifacts due to objects changing positions is a drawback or perhaps the chance to salvage the attempt and be artistic with the results. In either case I find that each attempt is an opportunity to learn something new and work toward the greater goal of “in all light conditions”.

First allow me to completely lose you by summarizing the process at a glance then I will break down the steps in far more detail and build up that detail in the order it will make better sense.

Exposing the image - Upon finding a scene where I can only capture the shadows or highlights completely then I have to exposed for one and lose details in the other, both can't fit in the range of light my camera can capture. The solution for me is to protect the shadows (i.e. Black Point) and bracket at plus or minus two stops to capture the lost details in post. Recovery isn't absolute but I can in post processing try to complete those highlights from the underexposed image.

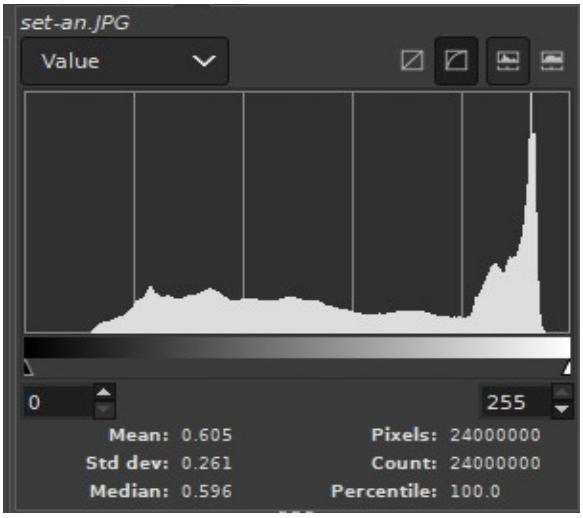
The theory - The process isn't about blending layers together but instead creating a mask from my neutral image to select only the area in the underexposed image to replace the lost detail in my neutral image. It isn't a simple operation but within reason can be stitched together to form one image from the fragments of the two. I can only display up to 256 shades of grey and it is at 255 that the blown out details occur, as a region of white limited to 255 as a value and unable to go higher. That extra value above “255” is stored in the underexposed image at the same regions as the neutral image; however, figuring out how to compress and mask off the fragments so both can be presented on screen in that limited value range and be seamless is tricky.

When the camera stays still and the scene doesn't change then bracketing captures different values for an object withing each image captured but only the exposure changes reducing or expanding the information captured regarding that object. The

overlap is why blending the images work in the first place. A shared placement of scene elements across the image set but three potential different values to mix and blend is the benefit of using the bracketing at time of capture.

The process – I use a simple threshold at 255 on the neutral image to select that blown out area and it becomes the mask I use to combine the two fragments into one image. Levels adjustment allows me to compress / remap the area not blown out so the tonal values run together more seamlessly. The tools used and order of layers are not complicated but to go any further without the details wouldn't be practical. The software used doesn't have to be advanced and I manually find that seam while zoomed in on the most effected areas. The mask has hard edges and they show up along with any differences between images in the set so dictate the degree of “invisible” seams.

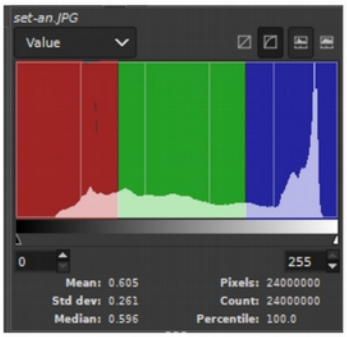
On the next pages I will attempt to break down some of the basics and introduce the concept of where this new technique started from.

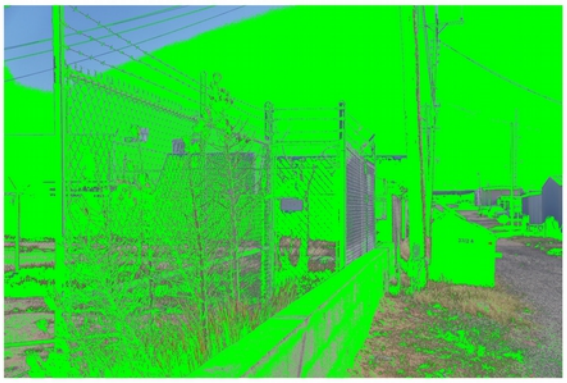


The histogram is a tool both available on my camera and in Gimp, the software I do my post processing in. Its value is that it breaks down the distribution of the tonal values within the image I'm look at on the LCD screen and regardless of the brightness of that screen is more accurate. I gauge my exposure based on how close to 0 (black point) and how close to 255 (white point) the values fall. What you are looking at when used is the distribution of each possible tonal value and how often that it occurs to one another. It doesn't relate to how the image looks visually so much but more the overall impression tonally.

In this example my exposure chosen was able to fully capture the overall light in the scene. While not pictured here a solid line at 0 indicates areas of the scene lost and presented as solid black. The opposite is possible at 255 and areas here will be blown out, in theory just as lost and showing up as solid white. Worst case scenario your image could be both lost and blown out. How to adjust and adapt is upto the photographer using camera in hand.

Shadows (0 to 85)





Midtones (86 to 170)

Highlights (171 to 255)

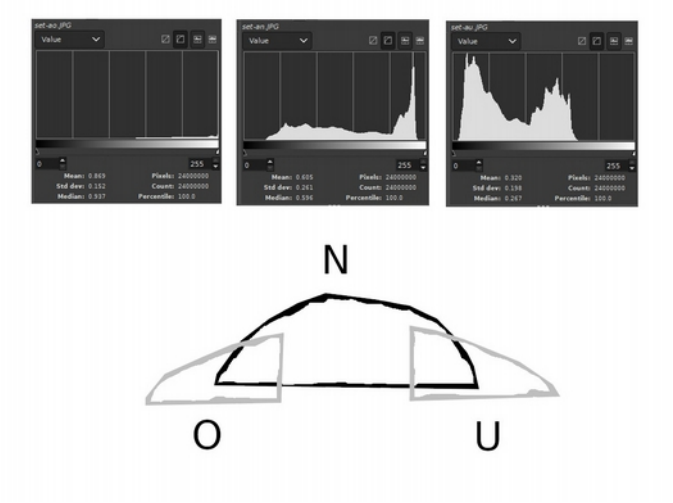
Exactly how the values on the histogram split out isn't so critical but in general one can start at the assumption on where I have indicated for the shadows, midtones, and highlights as they are color coded. When reading the histogram I can figure how weighted to the shadows or highlights my scene overall maybe. How weighted to either end or to the midtones maybe simply what you have to work with or an artistic choice.

Pictured here is a bracketed set that was technically taken at plus and minus two stops over three images (2EV3), further the camera took these one after the other so changes between shots is minimized. Bracketing in general allows the photographer get multiple exposures for multiple reasons like fine tuning an exposure or in my case I aim to capture extra data to fill in shadows and highlights in post processing. It is a feature I once had to manually do to get each set so continuous shots are appreciated.

What I manually and loosely follow is a basic tone map found online when I started manually capturing my bracketed set, I bring this up in passing as it requires consistent commonality in each image. That commonality is the same focus, settings, camera in same position, scene staying stable, etc; however, by changing only the shutter speed and altering the exposure in essence you bring in more of the shadows or highlights at the cost of the other. These alternative versions therefore are useful to photographer later.

Notice the one bit of color in the top left corner of each image and how the section of fence doesn't shift in any of them. Be it at a pixel level or area as highlighted here elements and objects in the set can overlay each other and be blended between the three unique values. Think of it as a matrix of tree at x,y [underexposed, “properly” exposed, overexposed] and therefore underexposed times “properly” exposed equals a new visual value that didn't exist before in that potential final result. It is basically math we do in

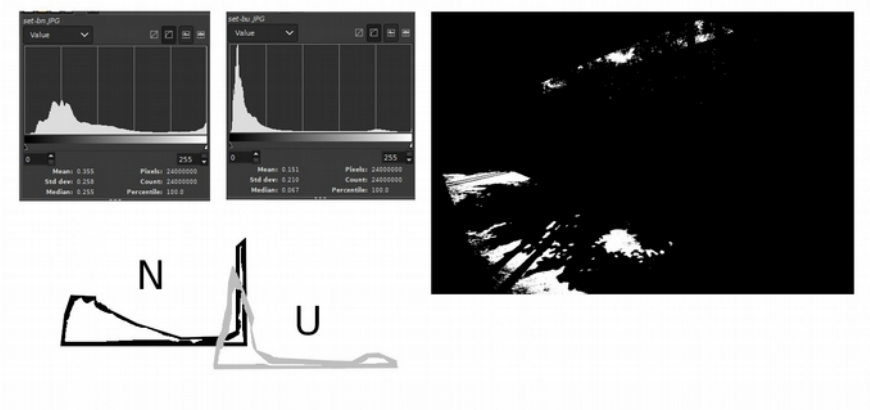
our photo processing software with pretty colors on top. Provide the data and the rest is hidden.



The next observation I would like to make is how luminosity isn't linked to the assumption of its part it plays. We have the shadows, midtones, and highlights in our histogram to consider so based on the neutral or “proper” exposure in the central histogram from the previous example set it is a good exposure. I see the gaps as a challenge to get a better range tonally in this image so I could get it closer to 0 to 255 respectively.

How I do this is blend in the underexposed image to expand the highlights and overexposed image to darken the shadows. The aspect of this that I had to figure out is why the brighter image goes toward my shadows and the darker image goes toward the highlights so I direct you to my included illustration. The shape formed is an enveloped shape with a starting point and end point peaking in the middle. It is the shape of the envelop of overexposed images histogram that is the key break through, its highlights are lost but the shadows was pulled forward two stops so I gained more detail in them. The curve visually matches in better at the starting point. The underexposed image has the curved shape going toward the end point and loses and pulls in the opposite of details needed. The overlap visually usually is blended in so just a curiousity in truth but it does explain how the observed luminosity levels don't logically follow the part played.

It is the black point as the starting point I evaluate and see if it can be shifted further left and white point as the end point that could be shifted further right that I aim to work with. The histogram of the results as I work and build the image up in Gimp is the other place I find this tool so useful.



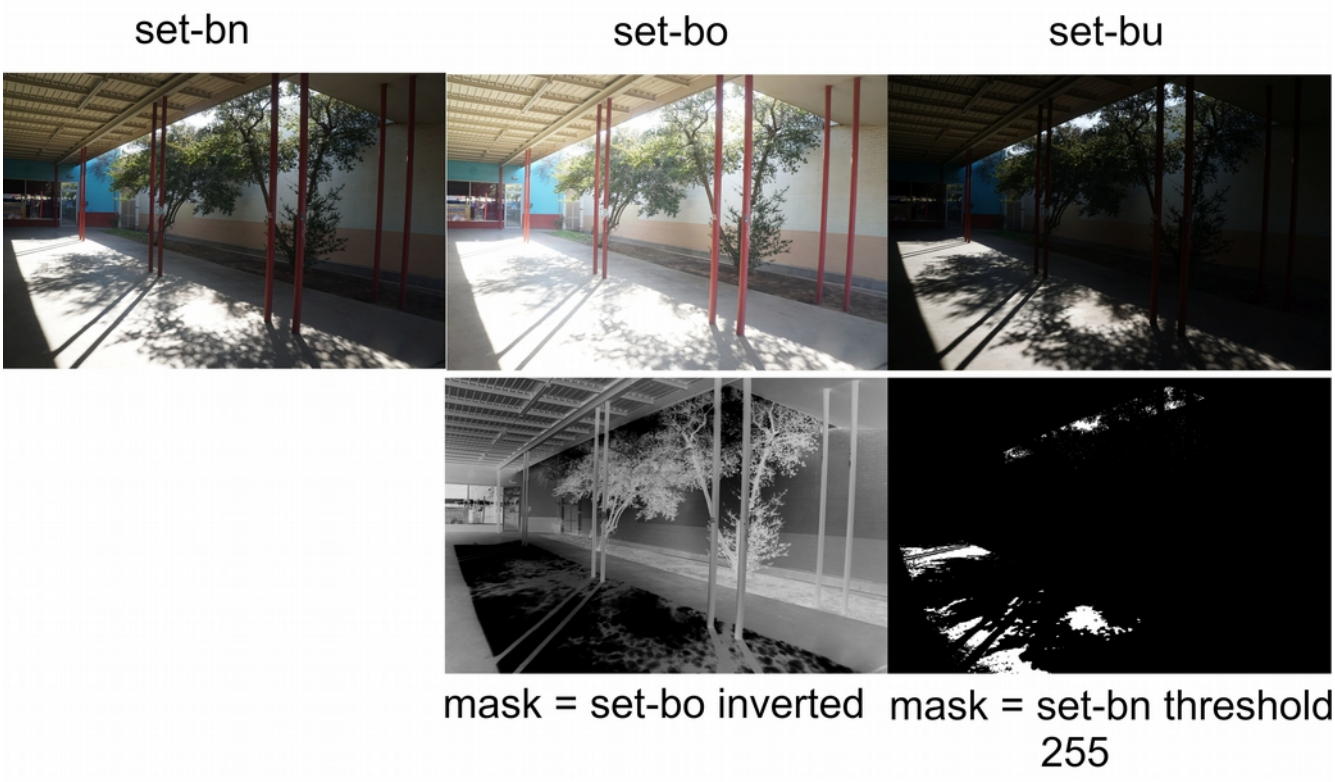
This histogram set is from the next example set I will be processing to demonstrate the blend and tonally match technique and helps illustrate why a new approach was needed here. On the right side is a mask I will explain later but it is threshold of the neutral image at 255, the nice solid line as indicated on the right. The amount of area lost could in truth be acceptable and I could move on but it can be recovered so why not try. The idea of being blown out to be avoided if possible or having to accept and work within that limit is a challenge unto itself.

I would like to provide a new point of view to consider here and maybe it is something you might find useful. That area shown above isn't a loss but rather a key to replacing lost detail in one image with the gained detail of another in the set, so it is not math solely that solves the problem but combining pieces of the two images and creating another problem in the process to solve. This same key when inverted acts as a bypass so both blending and combination of two images is possible. You will see the other problem created soon enough.

Like my example before this, as illustrated, the underexposed images histogram matches the correct part of that truncated envelop and it is that missing piece it contains I utilize. That mask simply allows me to select only the areas of the scene in common between the two I need.

Hopefully at this stage I haven't lost you yet again but putting two unlike processes into one is very possible, introducing the third problem that is harder to solve and finally must be accepted. Images in a set can and usually will have artifacts and mismatched element so an ideal image may not emerge but one that works can. Now I will show you the process I perform in Gimp to make the magic happen.

How many of you reading this use Gimp I can't say but it is the software I use and I will be framing the technique in terms of it. Further I have yet to really use the advanced features of it but one can do so much with layers, masks, blend modes, and opacity. The good thing about this is it should translate to any software you may use.



key = set-bn with a threshold of 255

Layer 4 = set-bu / mask = key / blend mode = multiply with 36 percent opacity
Layer 3 = copy of layers 1 and 2 / mask = key inverted / blend mode = normal with 100 percent opacity (I applied a levels function of 0 to 254 with the gamma set to .9 and an output of 0 to 241)
Layer 2 = set- bo / mask = set-bo inverted / blend mode = multiply with 66 percent opacity
Layer 1 = set-bn / blend mode = normal with 100 percent opacity

You can't have an image to edit without a base for all the hidden math to initially operate on so I have the neutral image as base (layer 1). I used layer 2 to enhance the shadows by shifting that black point to the left, 66 percent as the opacity was where I didn't push it to far left to black. This is now my base image and it should be noted I get that key mask from the unedited neutral image.

Gimp doesn't yet support non-destructive edits so I create a visible copy of the bottom two layer to edit. This new layer is where I “tonally” match it to the replacement values in the underexposed image. The dual nature of two types of adjustments calls for the same key mask inverted to bypass the change made here and allow layer 4 to interact with the first two layers.

Staying with layer 3 and the levels setting I chose I have a reason that should make sense hopefully. I applied that threshold for the key at 255 so the area 255 is covered in the other image; therefore, I only need to work with 0 through 254 as my input, tweaking the central gamma to .9. Keep in mind I zoomed into the most effected area of the image blending and working this layer and layer 4 until the seam between is as close to a matched as possible.

Layer 4 thanks to the mask being used both as is and in layer 3 as an inverted copy, a bypass, allows me to multiply the darker values of the underexposed image into the base image and restore some detail more like Gimp would expect me to. I can adjust the opacity of layer 4 with the levels dialog open to adjust the portion of layer 3 not being bypassed.

As of the time of writing this four layer and a dual adjustment approach seems to be the formula that worked on multiple images fitting the blown out and higher contrast issue. The set and a couple of masks used in the process so I would like to show a few more of steps visually to help understand it better.

Layer 2 = set- bo / mask = set-bo inverted / blend mode = normal with 100 percent opacity
Layer 1 = set-bn / blend mode = normal with 100 percent opacity

Even with the mask to select the “shadows” only there isn't any blending going on here ...

Layer 2 = set- bo / mask = set-bo inverted / blend mode = multiple with 66 percent opacity
Layer 1 = set-bn / blend mode = normal with 100 percent opacity

... so multiply at 66 percent opacity and the shadows get darker but not lost. Not needed in theory but I like the contrast it creates.

Layer 3 = copy of layers 1 and 2 / mask = key inverted / blend mode = normal with 100 percent opacity

The yellow shows where the bypass to the bottom two layers happen needed for the layer above. I will show you the results of when I adjust this layer to match the one above.

Layer 4 = set-bu / mask = key / blend mode = normal with 100 percent opacity

Before I set the blend mode to multiply at 36 percent opacity this is how the image overall looks. The results are to be expected and the next step adjusting layer 3 and layer 4 in conjunction fix this.

Layer 4 = set-bu / mask = key / blend mode = multiply with 36 percent opacity
Layer 3 = copy of layers 1 and 2 / mask = key inverted / blend mode = normal with 100 percent opacity (I applied a levels function of 0 to 254 with the gamma set to .9 and an output of 0 to 241)

What I didn't show you was being zoomed in on the most effected area while the levels dialog box was open. I could play with the levels and also adjust the opacity of layer 4, a dual adjustment with a visual judgment as to what works best. Hopefully you get an idea of the stages that went into the final result and why the bypass was needed for the blending of layer 4 into layers 1 and 2 so any changes to layer 3 stayed isolated.

In conclusion the demonstration image (completed above) I chose has a subtle improvement and exhibits fewer artifact but the principle is the same and a starting point for future images that can be edited this way. Deviations will most definitely occur as I fine tune the process. More important to me is that I was able to see the blown out line on the histogram not as a negative but the key to using the details from two images in the set taken and making an image from it. In all light conditions becomes one step closer as I experiment and see data collected infield with a new point of view. Hopefully this made sense and you too see the bracketed set with a new point of view but we all have a different way to practice photography and thank you for allowing me to share a part of my way of practicing it.