Photoshop Variations Quantified

Ever since I first saw the IMAGE>ADJUST>VARIATIONS in Photoshop, I've wanted to be able to define exactly what Variations does in a quantitative manner. That is, how can one simulate what Variations does via other Photoshop tools, which can be quantified. I've posed that question in the Adobe Photoshop forum/newsgroup, but no one had any answers on that. But, as a curious person/engineer, I wanted to know. Also, this will allow those who don't want to use the Variations window to stick with the color balance window for their activities in this area.

There are two basic functions that Variations has. It changes the color balance, and also can lighten/darken the image. It took a bit of searching and experimenting, but I've learned how to simulate all functions of Variations, and it's all done via the IMAGE>ADJUST>COLOR BALANCE window.

There are six positions in the Variations window "slider". At the extreme left, there is no change imposed. As the slider is moved to the right, the amount of color change in the "ring-around" gets greater, and the lighter/darker selections become more pronounced in their lightness/darkness. All the tests were done by taking a test image and selecting about half it. Then I'd make changes to it, using the variations window to change the selection in the image. Then I'd go to the color balance window, and see what was needed to undo the change that variations made. By hiding the marching ants, it was very easy to compare the original image with the changed portion, to exactly restore the changes made by variations.

In both Variations and color balance windows, Midtones were selected for all my tests. But, I would expect that choosing Shadows or Highlights would produce the same results. But, to get proper correlation, the setting must be the same in Variations and the color balance window.

COLOR BALANCE
The color ring-around produces linear changes as the slider is moved. Starting at the left side of the slider, each step produces a color change equal to 15 units in the color balance window. That is, if the slider is positioned in the center (3 steps from the left end), then each of the 6 ring-around images will have the equivalent of 45 units in the color balance window. **NOTE: the preserve luminosity box must be checked**. This way, only the color will be affected. The image will not get darker or lighter. Neglect the + and - signs on the sliders in the color balance window. To get more cyan, drag in the cyan direction. For more blue, drag in the blue direction.

LIGHTER/DARKER
Unlike the color balance, which is a linear change, the lighter/darker function is a geometric change. I presume that is because exposure in photography is geometric. Going from f 4 to f 5.6 is a change of 2 times in the exposure, just as going from f 8 to f11 is also a 2 times change. Each f stop change is an exposure change of 2 times. So, Adobe made the effect of the slider in exposure geometric also. Here again, the color balance window is the place to do the equivalencies. But, for lighter/darker, **the preserve luminosity box must be unchecked**, as that's what we'll be doing, changing the luminosity.

For darkening the image, use equal settings of CMY. For lightening the image use equal settings of RGB

Slider Position in Variations	L. Edge	1	2	3	4	5	R. Edge
Setting for RGB or CMY in Color Balance	0	10	17	32	56	100	177*

*Since the color balance slider will only go to 100, do the operation twice. Use 100 the first time, and 77 the second. Also, if one should use this extreme amount, some out-of-gamut errors may be encountered.

I have carefully verified all the material above, and I believe it to be very accurate.