Annex 3
Adjusting Images with Pronounced Colour in Camera Raw

Since the essay was published on July 25th, inevitably there has been some discussion about the influence of the selection of images on the results. In particular, on ACTL Dan Margulis suggested three kinds of images that would reveal CR's "range setting" limitations. These are, quoting from Dan's message:

"1) They contain large, important areas of pronounced color that also carry important detail.
2) They have conflicting casts due to unusual lighting or reflections.
3) They have a single uniform cast, but also important detail that resides in several ranges."

I do not deal with item (2) here because I've already mentioned that CR is not configured to resolve this unaided by Photoshop. Item (3) isn't worth evaluating further, because it describes routine conditions - almost every image needs some white balancing, contains detail along the tonal range worth preserving and gets adjusted very satisfactorily in CR with "room to spare" for further work in Photoshop. If desired, we eliminate the cast with the White Balance tool, perhaps further tweaked by the Temperature and Tint sliders. Then we implement the luminosity adjustments as appropriate. Item (1), however, is of interest, because in some of these images there is a risk of losing detail by implementing increases of contrast which trigger enough of a saturation boost to suppress image detail. I believe this is what Dan means by "damage" to the image.

I created an image which I believe fits the description of item (1), but further challenged it with the "single uniform cast" element of item (3) – so double-billed challenge. This is a photograph of oranges and grapefruits – Citrus 5165 - (pronounced orange and orangey-yellow), with much texture on the surface of the peel, sitting in a basket under 400 watts of halogen illumination, which has a strong warm cast. Apart from grey-balancing, it needs considerable adjustment because it is both somewhat underexposed and lacks enough contrast to be a visually appealing photograph. It was made with a Canon 1Ds, set at ISO 400, hand-held 1/60th of a second at f/4, 58 mm focal length, quite close-up, therefore some depth of field constraint, but enough in-focus areas for present purposes. The image is not sharpened and not noise-reduced.

The object of the exercise is to see whether in CR we can neutralize the cast and produce satisfactory contrast without blown highlights, plugged shadows, excessive saturation and sacrificed detail on the peel. One advantage making these adjustments in CR is that all of them are sets of meta-data instructions performed on the raw image data before rendering; the original raw file never gets damaged. The approach here is the same as that which I implemented for the other demos in the paper. All CR renderings are in ProPhoto RGB space, 16-bit depth. The image starts life as shown in Figure 1. Figure 2 shows Figure 1 after white-balancing done by clicking the CR white balance tool in the second lightest grey square of the Color-Checker. The colour cast is now neutralized – notice Temperature was reduced from 3200 to 2450 and Tint changed from -14 to 0.

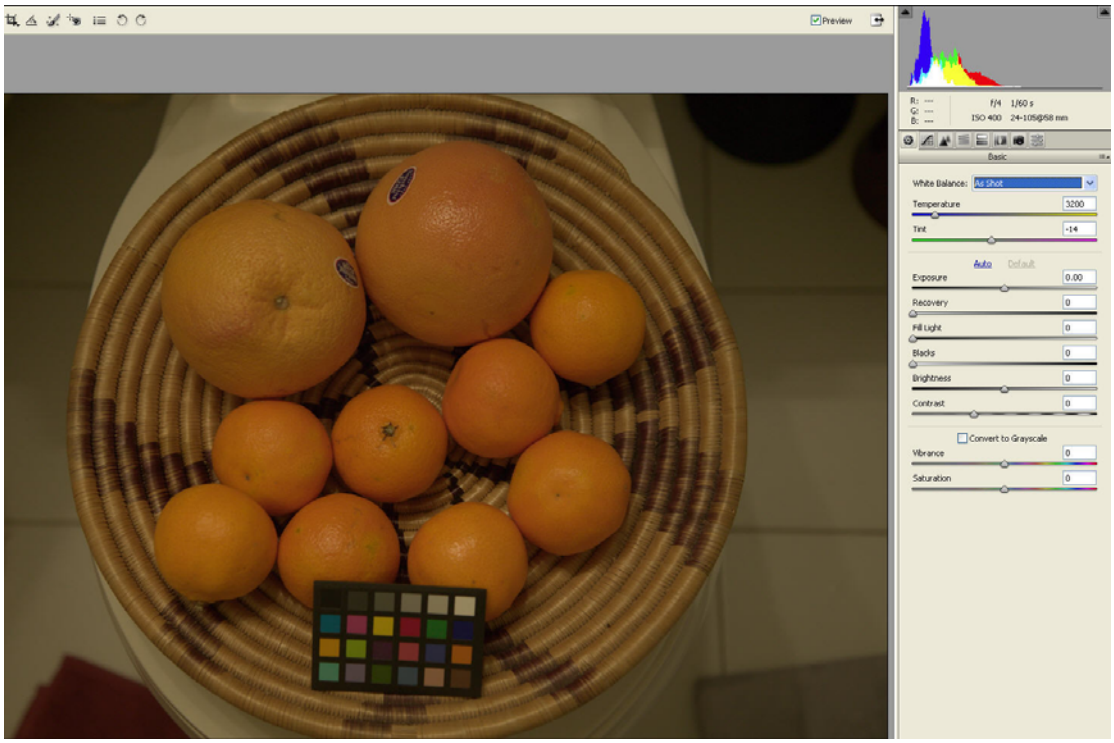

Figure 1. Initial Conditions

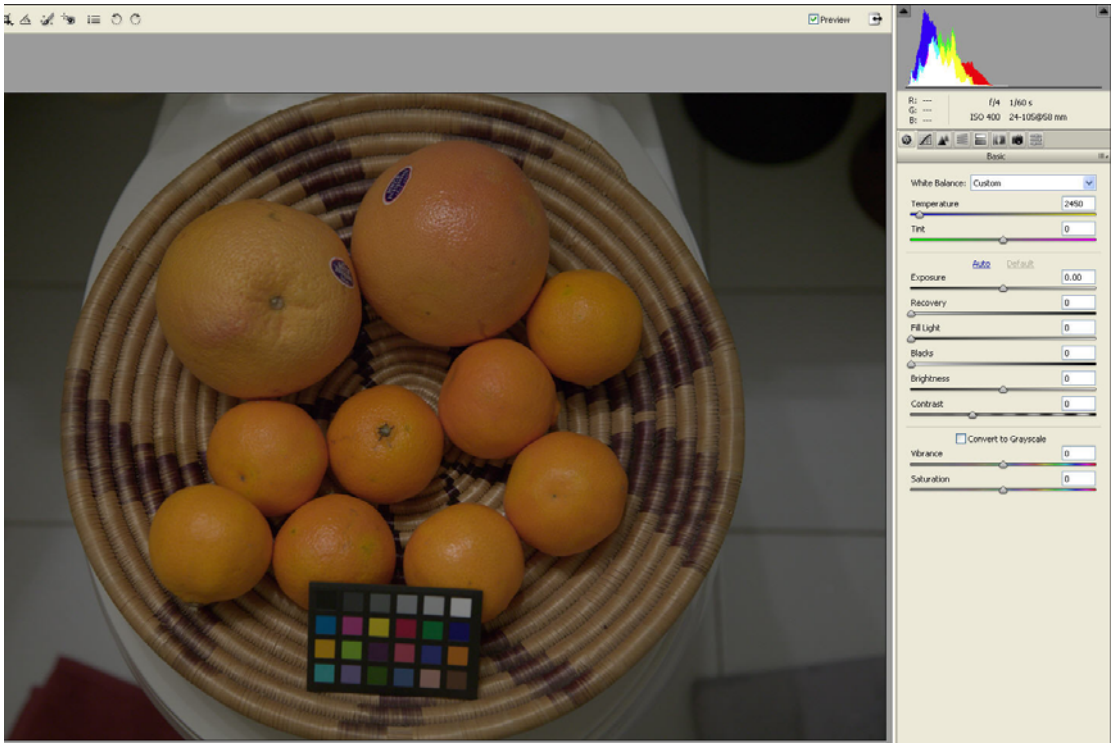

Figure 2: Figure 1 with White Balance

The next adjustment is to correct the exposure. With the clipping warnings on, I increased the Exposure to +1.75., the result being Figure 3.

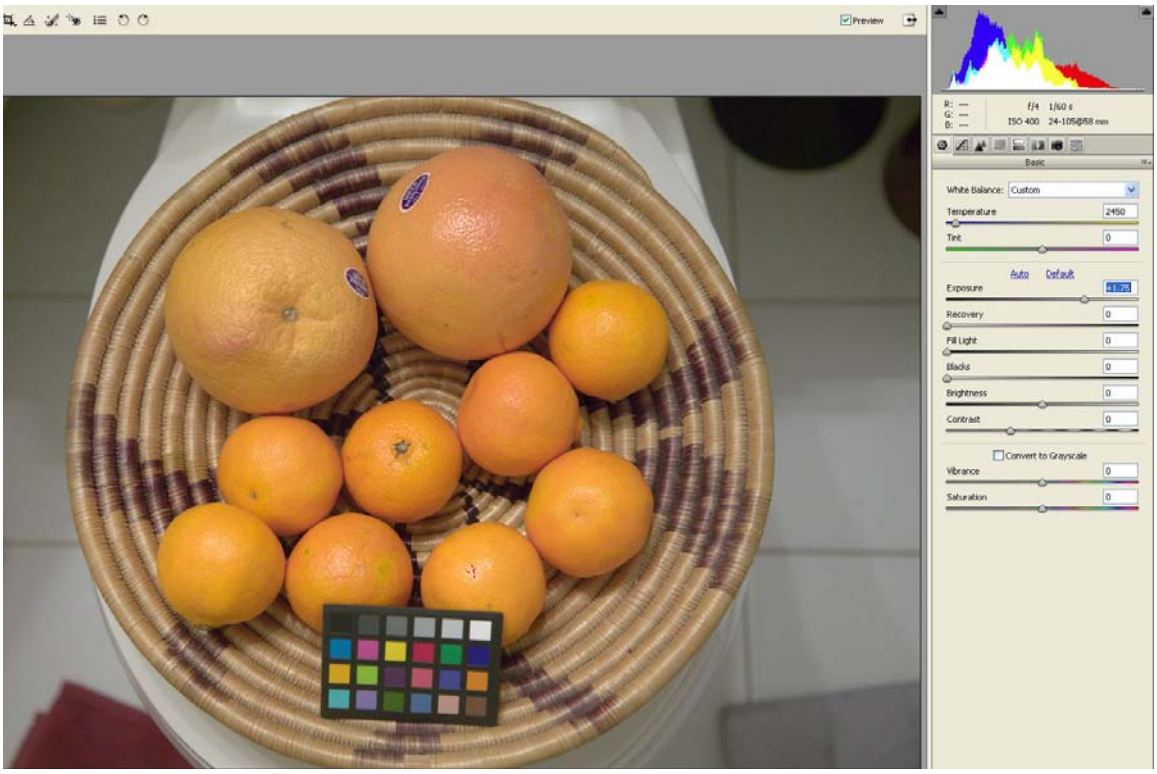

Figure 3: After WB and Exposure Correction

Notice there is just a faint trace of specular highlight clipping in the right-hand orange just behind the Color-Checker. That's fine. Not only because this basket of citrus sits on a toilet seat (sorry, that's where the strong halogen lighting was) it really isn't too appetizing yet because it lacks adequate contrast. So I adjusted the Parametric Curve to create a sufficient "S" for adequate contrast, as shown in Figure 4. The result is an image with more "pop", open shadows, no clipped highlights (except for the unimportant specular highlight), a saturation boost and very good detail retention.

Figure 5 shows this result as a rendered PSD file (brought into JPG format for reproduction here). The red-circled reference points are to be used below for HSB measurements. Figure 5 takes the contrast and brightness of this image as far as my taste (and comparison with the original subject) tells me it should go. Examination of the Parametric Curve in Figure 4 shows that indeed one could make far more radical adjustments. There is no question that excessive contrast increments will increase saturation to the point of blocking image detail we wish to preserve. This is shown in Figures 6, 7 and 8. The point is though, that more often than not one wouldn't want to do this and needn't. Figure 8 is a blow-up comparison at 100% of the impact on detail of the Figure 5 mild "S" curve versus the Figure 7 strong "S" Curve. Figure 8-Left shows that while texture in the grapefruit is well preserved, it suffers in the oranges. But Figure 5 is a better photograph than Figure 7.

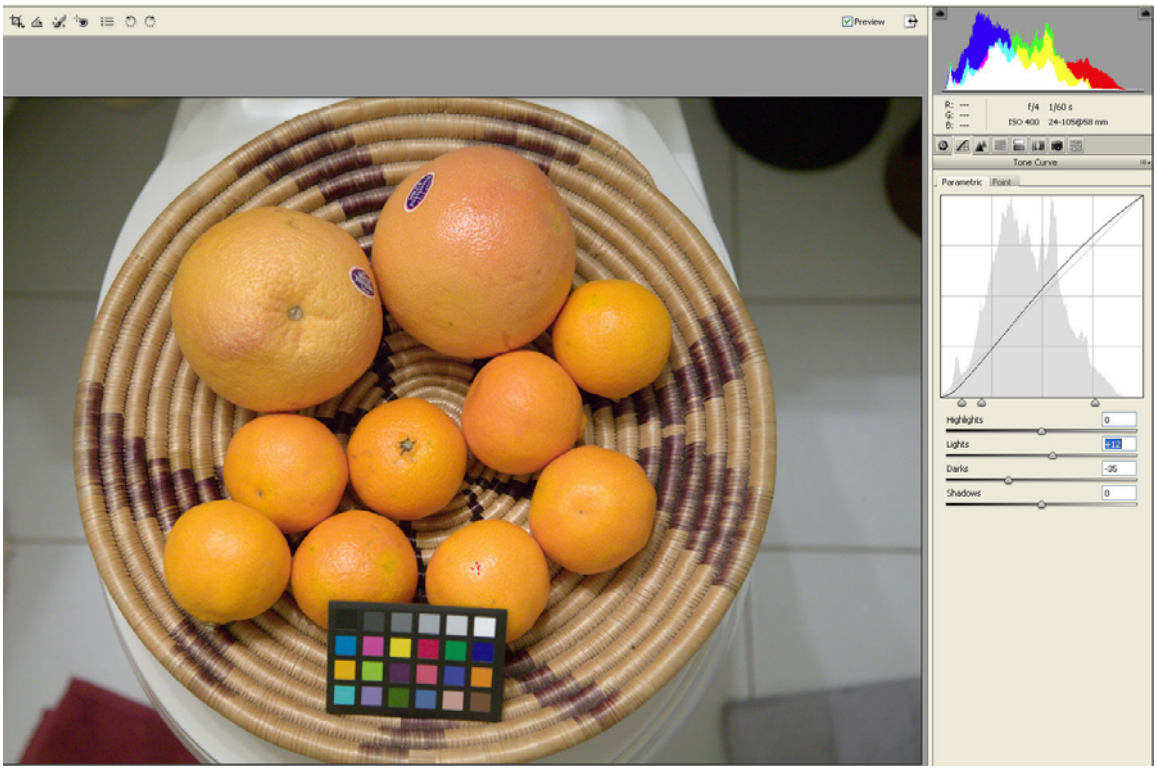

Figure 4. Figure 3 with Contrast Boost

Figure 5. Rendered version of Figure 4

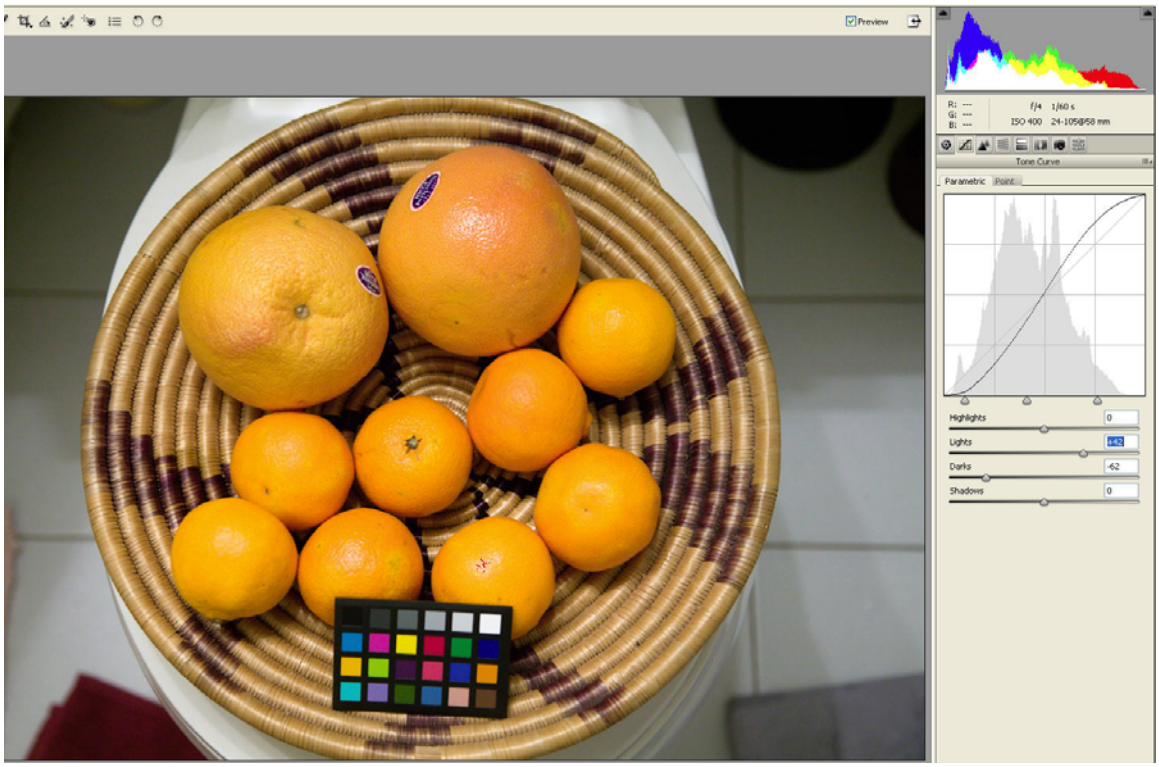

Figure 6. Figure 4 with much deeper CR S Curve

Figure 7. Rendered version of Figure 6

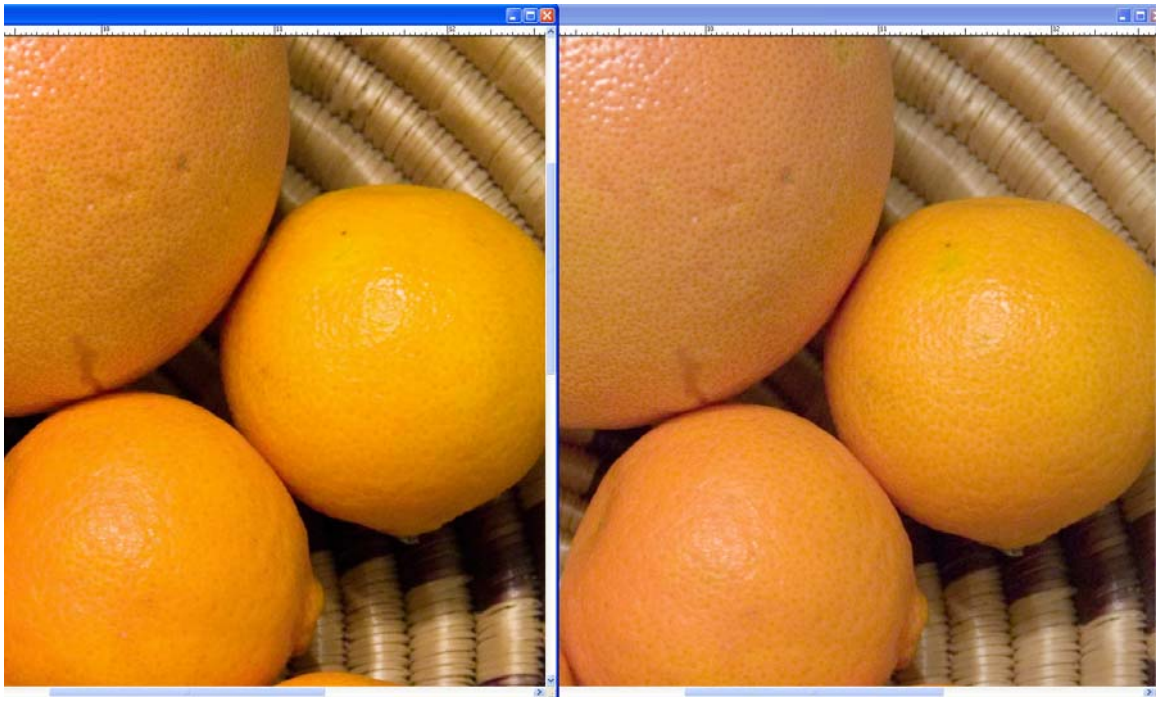

Figure 8. Left: Figure 6 deep “S” Curve; Right: Figure 4 moderate “S” Curve

Figure 8-Left is too saturated, but one may still want the contrast; so can we hold the contrast but reduce the saturation and recover the peel texture in CR 4.x? Two ways of doing this are either to reduce Vibrance (Basic Tab) or reduce saturation of Oranges, Reds or Yellows (HSL Tab). I reduced Vibrance to -20, resulting in Figure 9.

Figure 9. Vibrance -20 on Figure 7

Those who like stronger images may prefer Figure 9 over Figure 5, or perhaps something in-between. At this point, it's a matter of taste. Figure 10 shows that the solution offered in Figure 9 recovers peel texture lost in Figure 8-Left.

Figure 10. Detail from Figure 9

As the discussions have focused on questions of loss and recovery of detail from contrast adjustments in CR, I thought it interesting to dig deeper than Figure 10 above, and examine what happens to detail in individual channels from one image state to the next. While orange and orangey-yellow dominate this image, the most pronounced image detail lives in the blue channel, with image brightness contributed by the red channel (and some by the green channel). I compared red and blue channel behaviour as I moved between various states of the image's contrast and saturation adjustments.

For convenience, I recall the hierarchy of states for these images:

- Figure 2: Initial conditions in CR after White Balance only.
- Figure 3: Figure 2 with CR Exposure correction of 1.75.
- Figure 5: Figure 3 with CR Parametric S contrast boost; Light +12; Dark -35.
- Figure 7: Figure 5 with Parametric S strong contrast boost; Light +42; Dark -62.
- Figure 9: Figure 7 with Vibrance reduced by 20.

Since the main focus of concern here is the impact of curves movements on contrast, saturation and detail, the interesting comparisons are between Figures 3 ~ 5, 5 ~ 7, and 7 ~ 9. In all cases the light and dark grayscale images below are extracts at 100% magnification of the red and blue channels respectively.

Figure 11. Red and Blue Channels from Figure 3 (WB and Exp Adjusted)

Figure 12. Red and Blue Channels from Figure 5 (S Curve on Figure 3 State)

These are best viewed on a monitor with the document view expanded to “page width”, or more, as some of the differences are indeed quite subtle. There are only subtle changes between Figures 11 and 12: red channel detail has become very slightly less and blue channel detail slightly more pronounced, explaining why detail preservation between figures 3 and 5 looks good.

Figure 13. Red and Blue Channels from Figure 7 (Steeper S Curve on Figure 5 State)

Figure 14. Red and Blue Channels from Figure 9 (Vibrance Reduced on Figure 7 State)

Comparing Figure 13 with Figure 12, there is moderate “bleaching” of detail in the red channel and “muddying” of detail in the blue channel, all told contributing to an appearance of reduced image detail in the composite image. However, comparing Figure 14 with figure 13, the reduction of Vibrance reduces the bleaching in the red channel and brightens the detail in the blue channel, contributing to the appearance of restored detail in the composite image. Because all of these changes are sets of meta-data instructions performed on the raw image data before rendering and the original raw file never gets damaged by these instructions, each state of the image is opened in Photoshop “undamaged” (but the viewer may not like some of the renderings’ appearance – a different matter altogether). One may always revert to the raw image and change the instructions – non-destructively. In this sense the raw converter is the true non-destructive image editor to the extent it can perform these editing functions.

It now remains to report some measurements of hue, saturation and brightness through the stages of this editing process, in order to evaluate how CR 4.0 performs in these respects on this image with a pronounced area of strong, bright colour. The images selected for these measurements are the PSD files of Figures 2, 3, 5, 7 and 9.

Figure 15 shows the image at the Figure 2 stage with the measurement points: (1) the grey tile floor, (2) the grapefruit, (3) an orange, and three measurements of the Color-Checker (Yellow, Orange and Blue). Figure 16 shows where four of these points would sit on a linear curve for Figure 5. Figure 17 is the table of measurements.

Figure 15. Measurement Points

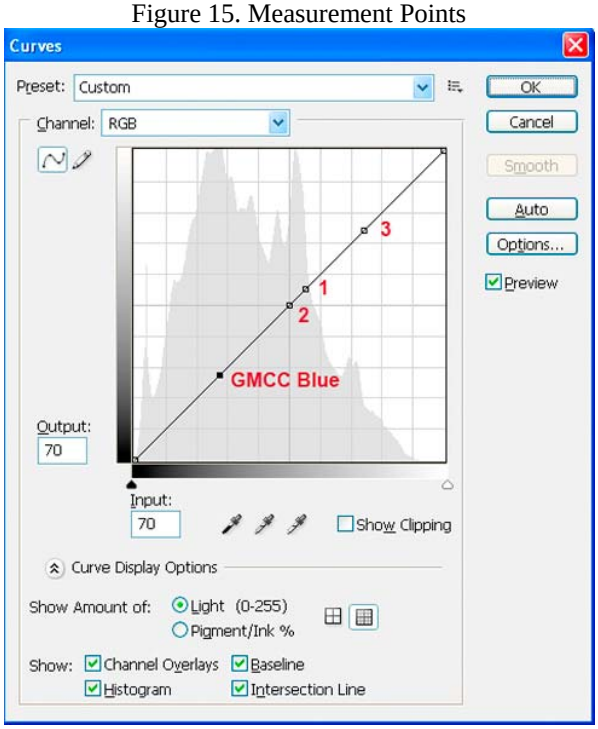

Figure 16: Point Positions on Curve for Figure 5

Figure	Point	H	S	B
2	**1**	91	1	25
	2	29	61	31
	3	32	50	44
	yellow	56	65	34
	orange	35	68	29
	blue	244	45	22
3	**1**	91	1	50
	2	29	60	62
	3	31	50	87
	yellow	56	65	67
	orange	35	69	57
	blue	244	46	44
5	**1**	204	3	56
	2	29	62	67
	3	31	45	90
	yellow	57	66	73
	orange	35	72	63
	blue	244	51	49
7	**1**	205	4	57
	2	31	74	73
	3	32	50	96
	yellow	57	77	80
	orange	37	83	67
	blue	244	64	48
9	**1**	205	3	57
	2	29	65	71
	3	31	43	95
	yellow	57	68	79
	orange	37	76	65
	blue	244	55	46

Figure 17. HSB Measurements

Hue preservation is generally well achieved. However, there is a huge measurement anomaly affecting Point # 1 (the grey tile floor), which switched from 91 degrees in Figures 2 and 3 to 204~205 degrees in Figures 5, 7 and 9. This latter hue value defines a shade of cobalt, but the floor is not cobalt, it doesn't look cobalt in the photographs and the RGB readings indicate it is grey – in Figure 5, for example the RGB values are 139, 141, 142 – just about neutral. So I don't understand why the measurement is incorrect.

More often than not, saturation increases with brightness, but the relationships are not simply correlated, and this does not always happen; very often the saturation changes are modest in comparison to the brightness changes. Care is needed making comparisons. Figures 3 to 5 and 5 to 7 compare curve shifts, while 2 to 3 involve Exposure and 9 - Vibrance. Also there may be issues under the hood with the HSB measurement in Photoshop.

As a final photographic comment on the citrus example, one could largely avoid hue and saturation effects by adjusting this image using a PS-RGBc Curve in Luminosity Mode. Figures 19 and 20 show what the results look like under two sets of rendering conditions:

(a) After WB in CR, Exposure in CR is increased to 1.75, the image is rendered in PS and a PS-RGBc “S” Curve (Figure 18a) is applied in Luminosity mode resulting in Figure 19. (b) Only WB is adjusted in CR, the image is rendered in PS and brightness and contrast are both adjusted using Levels (Figure 18b) for a brightness/contrast boost and the “Figure 18a” PS-RGBc “S” curve for a contrast boost, both in Luminosity Mode, resulting in Figure 20. While Figure 19 has satisfactory contrast and saturation, it is clear comparing contrast and saturation in Figure 19 (or 9 or 5) with that of the under-saturated result in Figure 20 why the Adobe programmers created a default relationship between Contrast and Saturation.

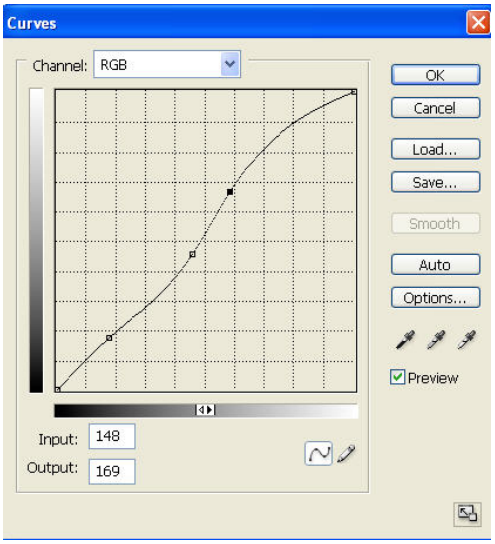

Figure 18a “S” Curve in Luminosity Mode

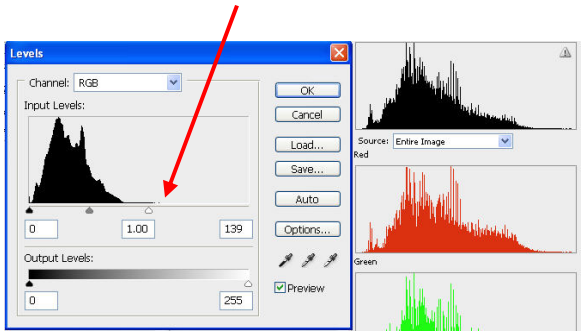

Figure 18b – Levels Shift for Figure 20

Figure 19: WB and Exp in CR + PS-RGBc “S” Curve in Luminosity Mode

Figure 20. WB only in CR; All luminosity edits in Luminosity Mode

To conclude this discussion, because red flowers with detail re-emerge as a compelling issue (ref. Chapter 16 of Dan Margulis "Professional Photoshop 5th Edition and recent related discussion on ACTL), and given what I've said before about possible issues with reds, I shall now touch upon reds. I shall not delve into the extensive kind of analysis I did with the citrus case above; my objective is simply to show whether CR can achieve satisfactory colour, contrast and detail retention for red-dominated images. Unfortunately, at this time I cannot use the same images that Dan used, because the images on the CD-ROM accompanying Dan's book are protected by a Terms of Use Agreement which need interpretation relative to the purpose at hand. No matter, other images serve as well.

Figure 21 is a CR view of a reddish flower with fine line detail in the leaves, taken outdoors in normal mid-afternoon daylight with a Canon 1Ds, 1/250th at f/6.3. In Figure 22 I imposed a CR Parametric "S" Curve strong enough to increase saturation to the point of suppressing some of the fine detail. In Figure 23 I recovered the detail by de-saturating the Reds 12 points in the CR HSL Folder, Saturation Tab.

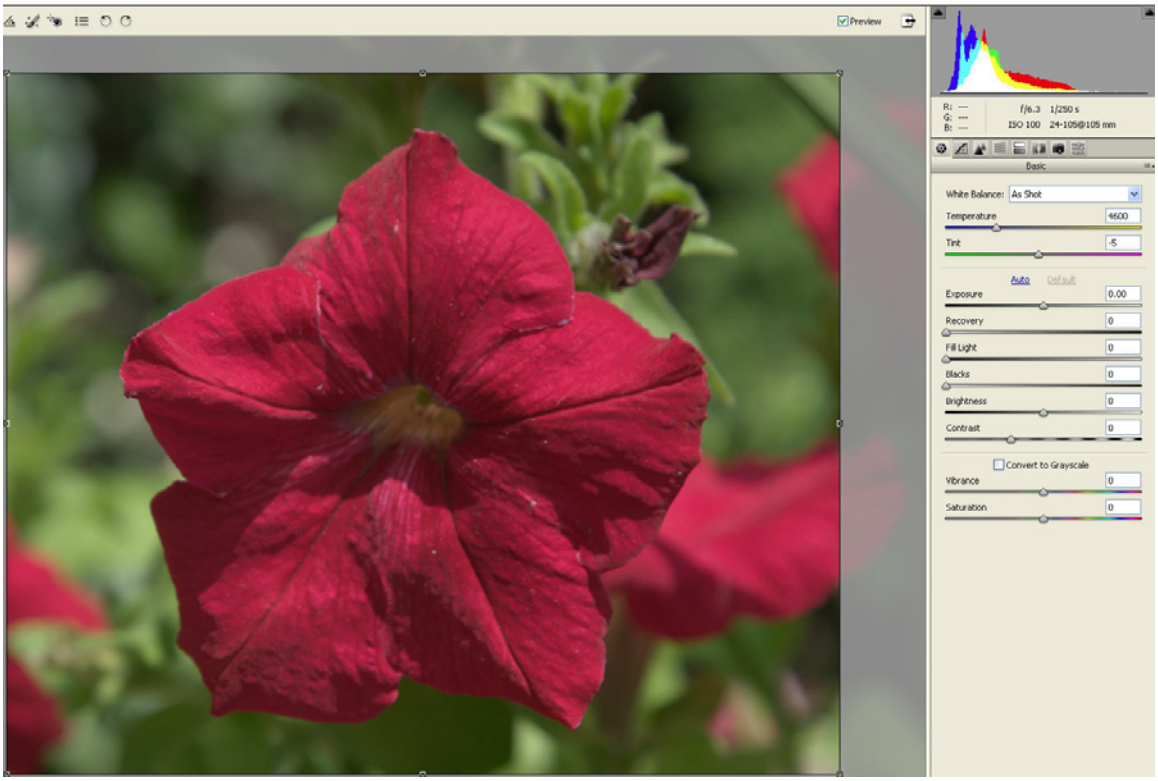

Figure 21. Red Flower 5158 Initial Conditions

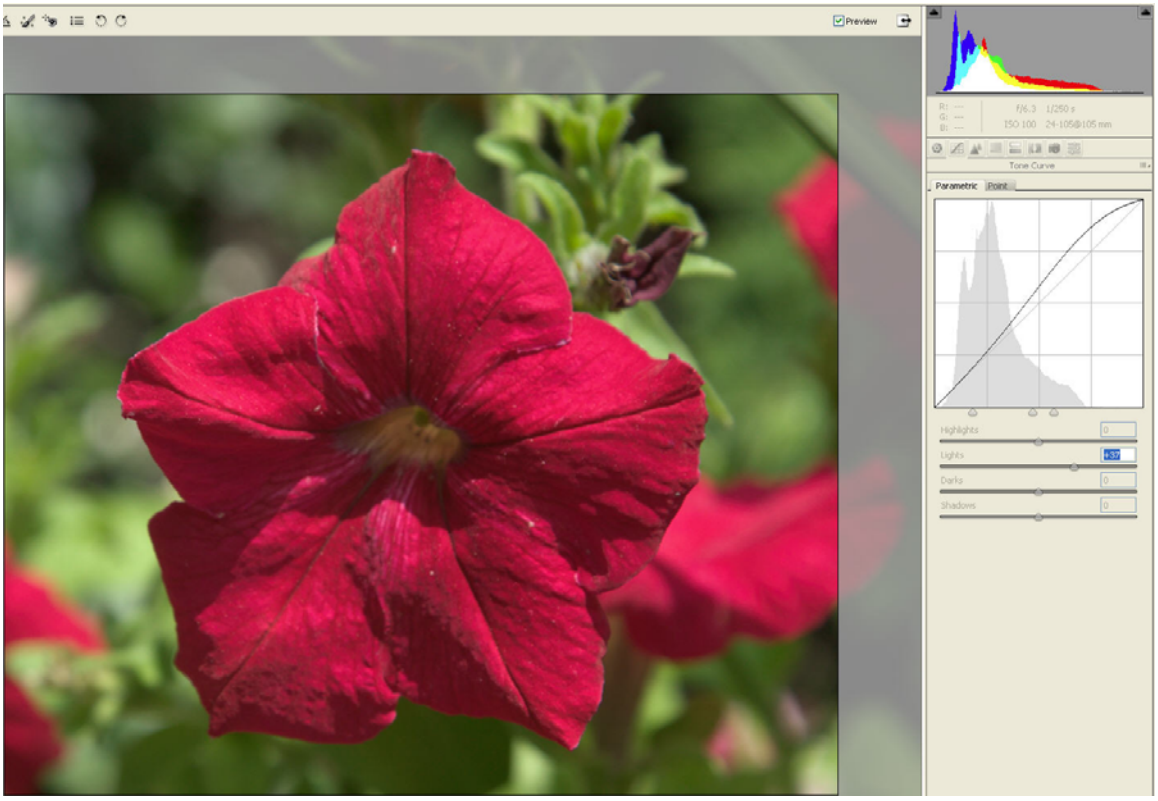

Figure 22. Red Flower with Apparent Suppression of Fine Detail from “S” Curve Contrast Boost

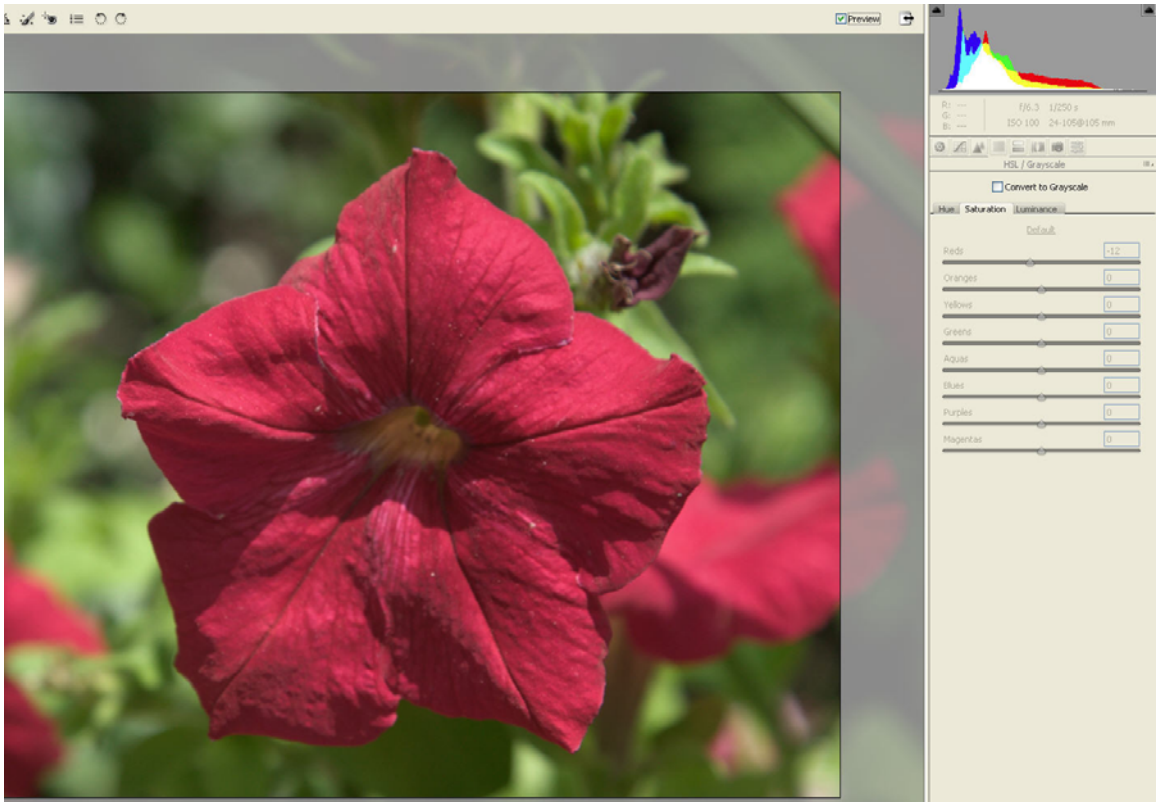

Figure 23. Red Flower with Fine Detail Recovered in CR

Figure 23 is brighter with more contrast than is Figure 21, while image detail is retained.

Andre Dumas kindly loaned me another red flower image which I thought useful in this context. It demonstrates that CR4 can process strong red tones retaining detail while allowing a range of saturation settings to taste. Figure 24 shows the initial conditions of this raw image brought into CR4 with all luminosity settings at zero and the tone curves linear. Figure 25 shows the effect of increasing Exposure by 0.75 and introducing a parametric “S” curve to slightly boost contrast and strengthen the colours. Figure 26 is a comparison of how three Vibrance settings (0, -15 and + 15) affect fine detail. In evaluating this comparison, it is useful to bear in mind that this is an enlargement of a small section of the image, it has not been sharpened, not treated for noise, and is a pre-rendered capture of the raw image section converted to JPEG for pasting into this document. All this considered, these captures indicate that the detail which would be visible in a sharpened and noise-reduced A3 print of the whole image would be largely retained with all three Vibrance settings.

My overall impression is that CR4 handles delicate details in bright reds well, while providing high image quality in terms of brightness, contrast and colour rendition. Furthermore, working intelligently with this module, one retains sufficient “headroom” to perform additional satisfactory edits in Photoshop, for example as I find always necessary once in Softproof mode. (Highest on my “wish-list” for CR is the ability to make all these luminosity and colour adjustments using my printer profile as a softproof.)

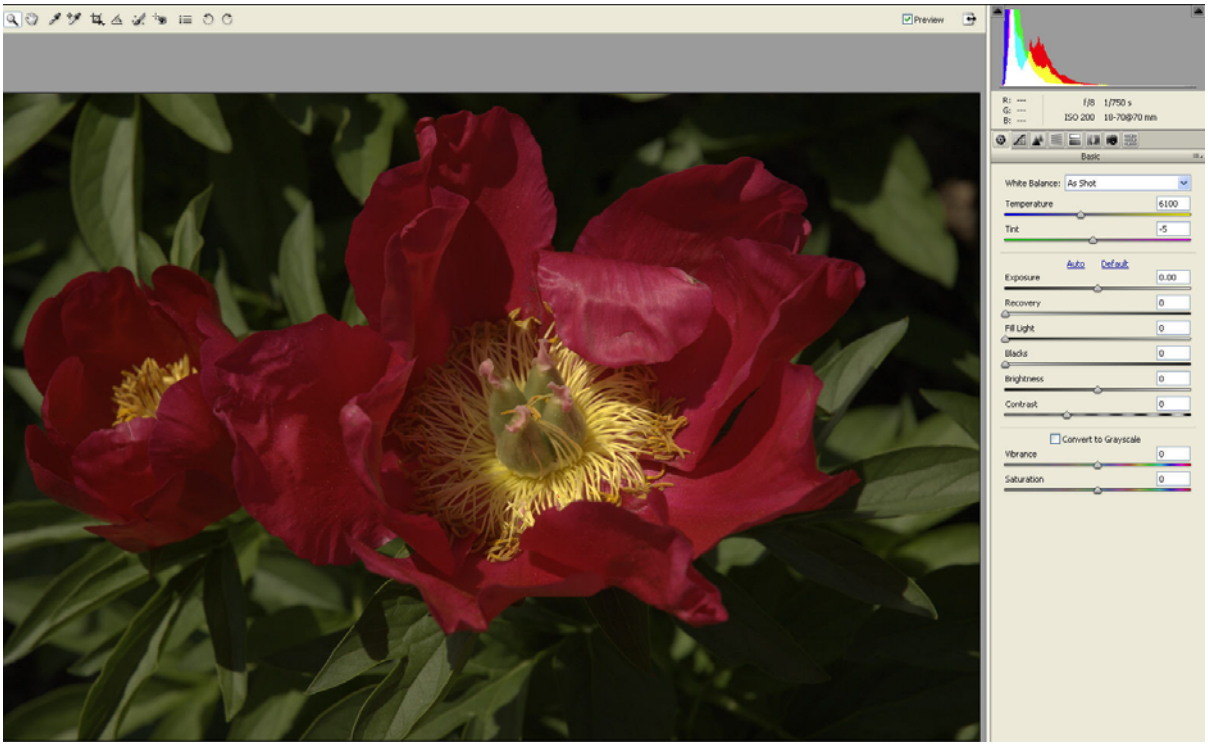

Figure 24 A.D. 2007-06-10.NEF Initial Conditions

Figure 25. A.D.2007-06-10.NEF Exposure +0.75 and Parametric S Curve

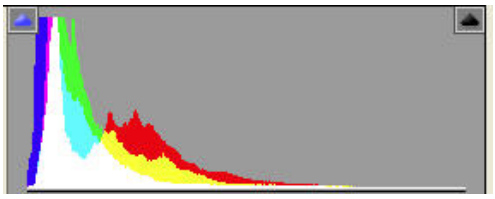

Figure 26. AD1 Detail; Vibrance -15

Vibrance 0

Vibrance +15

Conclusions

Near the beginning of this essay, I said that the object of the exercise is to see whether in CR, for images with areas of pronounced bright colour, we can neutralize a single cast and produce satisfactory contrast without blown highlights, plugged shadows, excessive saturation and sacrificed detail.

I conclude from the foregoing that we can do so – in a highly satisfactory manner. The set of tools in CR 4.0/4.1 is varied and powerful enough to achieve this. Generally speaking, these tools do not duplicate each other –some may seem to do similarly labeled things, but they do so in different ways to different effect. Combining the use of these tools in a logical manner creates many possible sets of adjustments which help achieve the objectives for the image at hand, be it for dynamic range, local contrast, brightness, hue and saturation, without sacrificing necessary image detail.

That said, it is possible to create unsatisfactory renditions (say in terms of saturation and loss of detail) by pushing adjustments in CR beyond what is reasonable or appropriate for the image. Most important, however, within CR all of these changes are sets of meta-data instructions performed on the raw image data before rendering and the original raw file never gets damaged by these instructions. Each state of the image is opened in Photoshop "undamaged" (but the viewer may not like some of the renderings' appearance – a different matter altogether). One may always revert to the raw image and change the

instructions – non-destructively. In this sense the raw converter is the true non-destructive image editor to the extent it can perform these editing functions.

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