Issues in HDR Tone Mapping:
Capture Noise & Chromatic Aberration
CS4 Local Adaptation & Tone Mapping

Candyland
A preliminary high dynamic Range (HDR) image produced by CS4...

Capture Noise & Chromatic Aberration

Magic Hour, that hour around dawn and dusk, is the time when marvelous light truly enchants. High contrast, vibrant colors - dramatic sunrises and sunsets.

By its very nature, Magic Hour is captured with differing f-stops. Even with more advanced camera bodies containing high ISO sensors, images at lower f-stops can contain noise and chromatic aberration. If these images are processed without noise removal and defringing edges, further tone mapping modifications follow the dictum, *"Garbage in, Garbage OUT...!"*

HDR – CS4 vs. Photomatix and Chromatic Aberration

If a piece of software creates additional chromatic aberration from a pre-cleaned capture suite, then, it's more "Garbage in, Garbage out...!"

A recent workflow analysis of Photomatix indicates strong chromatic aberration when Tone Compressor processes five HDR images (-2 to +2 EV). After removing chromatic aberration in Lightroom 2, Photomatix should not create aberration, if you asked it not to.

Chromatic aberration is a blue-to-red color range discoloring boundaries.

As a result, we've begun using Merge to HDR in CS4.

This route has its own peculiarities; the first is successful negotiations with Local Adaptation to produce a 32-bit HDR image. Although CS4 allows you to consider a Tone Curve during Local Adaptation, Martin Evening clearly pointed out finesse is required to successfully modify the Tone Curve before Tone Mapping.

Now, let's identify steps between Lightroom 2 and CS4 which produced a preliminary pass at Tone Mapping HDR images.

Lightroom's 2:1 Inspection (I Do It Several Times during Image Development)

Check for seemingly small details by increasing image size 2:1. Both noise and chromatic aberration must be seen at a minimum of 1:1 (100% zoom). In the Library module, the Navigator panel contains a zoom control. The 4th icon has an up/down arrow. Choose 2:1!

Tap the Home key taking you to the top left hand image corner. Successively tap Page Down, which traverses the entire image in vertical columns from top to bottom – left to right.

Lightroom 2, Noise Reduction, and Chromatic Aberration

Carefully inspect the image; any outstanding features may need future fixes.

1. Lightroom 2
   a. Noise – usually blue channel in each HDR image; other channels contribute.
   b. Chromatic Aberration – distinct red/blue edge color changes.

You may find more features which need modification…

For Noise reduction you'll usually increase the Luminance slider. For chromatic aberration, you usually want to reduce the fringing. It's best to do this analysis at 2:1 zoom (200%).

Lightroom Noise and Aberration Check

Open all five images in LR2. Promptly make Virtual Copies (CTRL-') of all images to correct Noise and Chromatic Aberration on 'clean' images.

In Details tab for first image, LR2 lets you fix Noise and Chromatic Aberration.

Luminance noise is the usual culprit; move the slider until noise abates.

At the bottom, choose Defringe All Edges. Wiggle aberration sliders (red/cyan - blue/yellow) as much as necessary.

With pesky problems gone, select All Images and click Synchronize. A window comes up asking what features to Synchronize; if you changed either noise or chromatic aberration, first Clear All, then check noise and chromatic aberration to apply these settings to remaining images.

Merge to HDR in CS4

With all virtual copies selected in LR2, choose Photo> Edit in …CS4> Merge to HDR. When I perform this step, my computer goes away, thinks hard, and I can do other things for a while.

CS4 returns a 32-bit file. Ignore the fact it looks flat and uninteresting. After a bit of Tone Mapping effort, it will be both sharp and spectacular.

Save As .hdr

But first, save this image as .hdr… Why?

Because you may want to make several correction passes as you learn how to successfully Tone Map. I usually tag abbreviated keywords to the image title during Save to indicate the sometimes contorted path during its development.

CS4's 2:1 Inspection

Check for satisfactory details by increasing image size 2:1. In CS4, CTRL-+'s quickly take you to 200% zoom (2:1).

Tap the Home key taking you to the top left hand image corner. Successively tap Page Down, which traverses the image in a column from top to bottom.   CTRL-PageDown always moves right to next column. Alternate PageUp and Page Down to traverse the rest of image, depending on where you end. I know; you really love LR 2 and CS4 requiring different keystrokes for the same process.

Carefully inspect the image; any outstanding features _things which catch your eye_ may need future fixes.

1. CS4
    a. HDR Local Adaptation effects.
        i. Carefully maintain highlights and shadows – any reduction of white or black points may tend to 'blow highlights or shadows' later.

ii. CS4 allows Black & White point choice on 32 bit HDR files. You can slightly color balance the HDR, with a caveat: 32 bits tends to mask your usually sharp 16 bit LCD graphic.
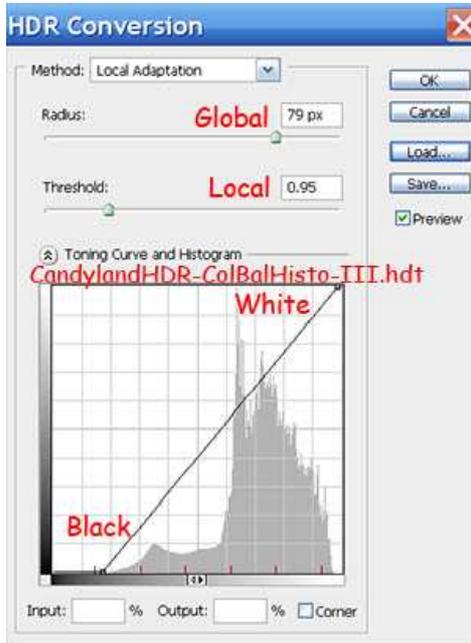
iii. The White point can be more critical; blowing out areas in highlights which can't be masked later.

iv. CS4 lets you set a Clipping warning. Simply moving Black or White point transforms the image to
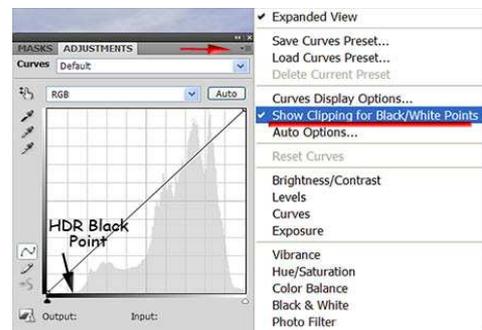
show where clipping begins in the image. This image shows various channels being clipped by Black point motion.

b. Color Range Masks in the Adjustments Curves Panel – sets Sky vs. Ground mask opportunities.

i. Fuzziness 3 – Range 6 ~ limits mask size but requires carefully choosing of all sky. This tight range may require repair in sky (white) and ground (black) portions of the channel mask.
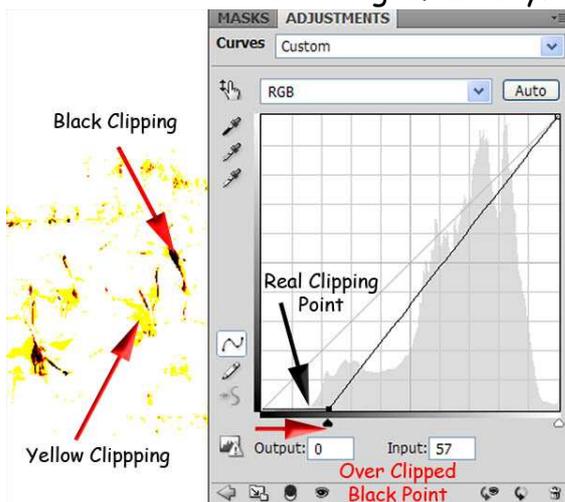
ii. Make mask – eval @ 200% zoom to remove obvious Color Range misfits. Use broad brush (white, black) at 100% Opacity and 50 % Hardness, repairig on channel mask.

      iii. Check mask fit – eval @ 400% or more for 3 px Quick Mask corrections around the boundary between Sky and Ground.
      iv. Save mask as Sky.
      v. Dupe channel, name Ground, and Invert.
      vi. Save file with both masks in Channel palette.
    c. Content Aware Scaling – can create subtle cloud 'jaggies'.
      i. Carefully clone skies to repair.

You may find more features which need modification…

Local Adaptation in CS4

Here's an image screenshot after HDR post-processing in CS4.

After saving 32 bit HDR image, open image again at HDR conversion point. Image> Mode> 16 Bit brings this image back to 32 bit format where you can now begin to adapt it for 16 bit output.

Most text books suggest using Local Adaptation for conversion. Two parameters provide initial control:

Radius is the global curve correction control (usually a large pixel number).

Threshold is the local curve correction control (I prefer a small pixel number at the scale of the sky ground interface).

Akkkk… is this colorless façade all CS4 can do for HDR?

Inspection of the CS4 result should include very little noise or no noise (Hurrah...), jaggies (if using Content Aware Scaling), blown highlights or shadows, and evaluation for remaining chromatic aberration (there wasn't any).

It's worth mentioning - on a prior 2:1 pass, trying to move white point limits blew out the whites for the highlights tone curve.

Editing the HDR Conversion

Martin Evening, *Adobe Photoshop CS4 for Photographers*, page 376-382 provides additional suggestions for Merge to HDR, Local Adaptation, even Manual Tone Mapping. His cogent remarks are on p. 380;

"The hard part is getting Tone Curve editing right. You normally want to maximize the tone curve across the whole of recorded scenic tone range. *Editing the HDR conversion tone curve is quite UNLIKE using the Photoshop curves dialog.* You usually need to add lots of control points and use the corner checkbox to convert some control points to corner points. These can anchor selected control points and preserve the tone curve shape above or below the selected point."

Evening did not touch on using Curves Black/White points – the first step in color balance. It was Evening's cogent HDR conversion sentence which helped break my CS4 Tone Mapping logjam.

Earlier, I was reading in *Real-World Adobe Photoshop CS3*, et al. Fraser. On page 413, Fraser said,

"You *MUST* master Levels, Curves, and Hue/Saturation to consider yourself any kind of Photoshop user!"

To which I add *Masks*…

Amen...!

A final 2:1 pass convinced me I could convert this 32-bit effort to a 16-bit tif. Lightroom 2 obligingly stacked this tif in my working HDR CS4 collection set.

Color Matching HDR to 0EV Capture

UGH… (or maybe ugly)!

The HDR image just doesn't appeal at all, does it?

So what are the good steps; what must you do to return this image to near the first image captured in the HDR sequence?

Open Maska panel and choose Color Range. Color Range brings up a dialog box with Fuzziness and Range variables. Fuzziness is the global value whereas Range is
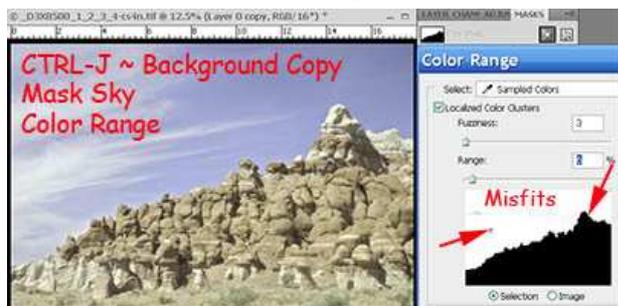
the local constraint to fit a strong interface such as sky and ground.

I want the Sky selection to fit the sky ground interface within just a couple of pixels. To get this done, first I click in the image, then set Fuzziness at 3 pixels and Range at 6%. Then, I

moved the cursor all around the sky, collecting different sky colors (and an occasional ground color).
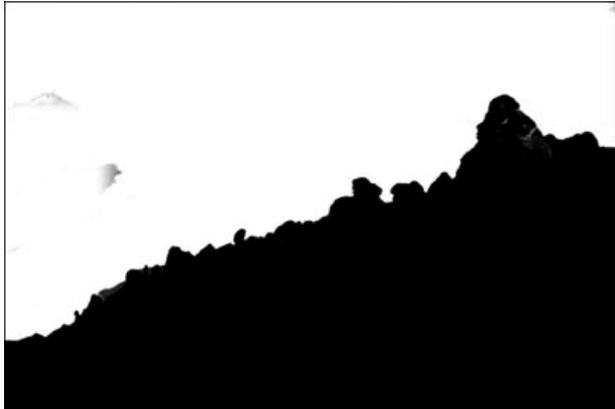
The black and white represents the Sky channel (black is ground). There are minor misfits in sky (gray areas) and one on ground (gray again). Using brush tool O=100% and Hardness=50%, quickly paint these regions in sky or ground.

Regain Color of Sky and Ground

Once you've completed the Sky mask, simply duplicate the channel, invert it, and save as Ground mask.

Place each of these masks on separate Hue/Saturation adjustment layers.

For an initial estimate of richly colored HDR images, experiment with hue, saturation, and lightness in each masked HSL element.

When you're satisfied, I would categorize this as step one of Tone Mapping in CS4.
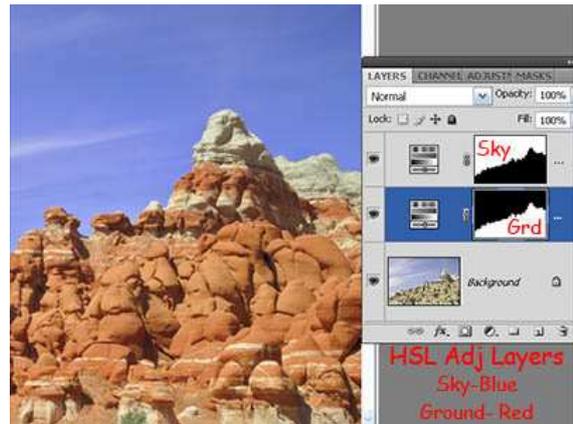
HSL Tone Mapping in CS4 – Step 2

Let's change the HDR image with Hue/Saturation. First, morning rocks were red – not blah. Raising just Red saturation did not make the needed change on the Ground mask.

But, moving Hue slider to a blue-green position began red rock enhancement using the Ground mask.
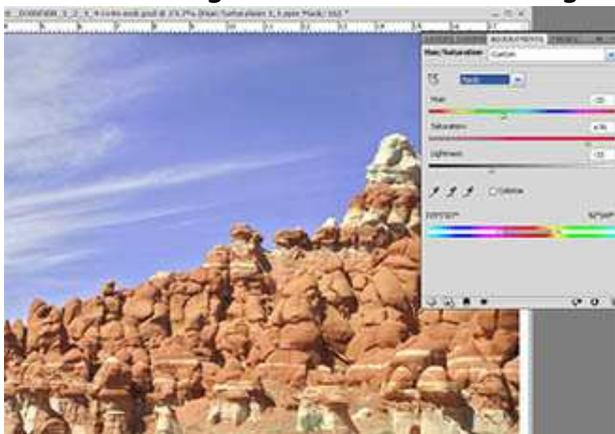
A similar change with Blue saturation on a masked gray, light-blue sky added blue.

Final Tone Mapping Pass - LR2

LR2 has a pretty simple structure for final workflow. For me, key successive steps involve different Tabs and sliders:

1. Basic - clipping, contrast,

saturation, sharpness, clarity, and vibrance.
2. Tone Curve - contrast, highlights, lights, darks, and shadows (TAT).
3. Details - sharpening (we've already considered noise and chromatic aberration before creating HDR tif). These individual steps are global.
4. HSL - hue, saturation, and luminance (TAT).
5. Selective Color – use RGB color wheel to modify each color independently.

Pay special attention to the little circle left of Hue. It's the Targeted Assessment Tool you're familiar with from Tone Curves. Basically, choose TAT, move your cursor over a color in the HDR image, and roll your mouse wheel to add or subtract hue, saturation, or luminosity until you re-create your memories delight! In effect, that's like having your own personal cursor slider (at least it's not a cursed slider).
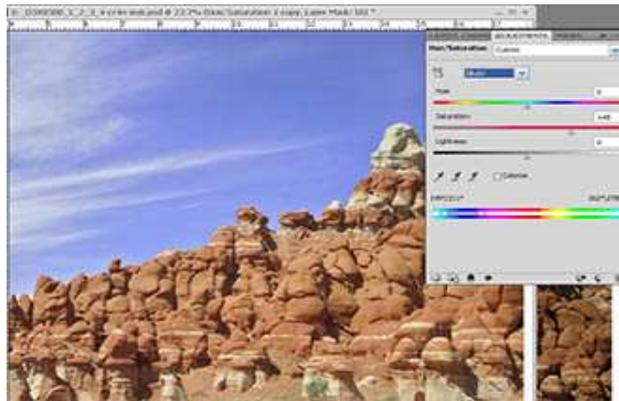
LR2 Color Balance and Sharpening

Final tone Mapping begins in the Basic Panel. To add contrast, I clipped the blacks (13) and moved some shadows toward midtones with Fill Light (20). Lowering Brightness (-20) and adding Contrast (+15) helped. Final step; Clarity (30) and Vibrance (15 – this slider can make big changes with small movements); be careful!

Ahhh – now to Sharpen.

I applied the LR2 preset Landscapes which moved Amount, Radius, and Detail. I then held down ALT and moved the slider until black began to appear in the inset.

Presto ~ Change-o

Now, you can slip-slide your way to a very pleasing, yet dramatic HDR rendition of your image.
1. Here's our work flow with

shorthand steps as titles.
2. HDR Capture
3. LR2 Noise and Chromatic Aberration
4. CS4 Local Adaption
5. Initial CS4 Hue/Saturation Tone Mapping
6. LR2 Tone Mapping touch up
7. LR2 Sharpen

Pictorial HDR Workflow

This image shows workflow steps from capture to Local Adaptation to working JPEG. White labels are a shorthand form for each successive step applied in LR2.

Yep, you got to know a couple of things, but guess what,

"You've globally taken care of noise, fixed chromatic aberration, created an HDR image, masked sky from ground, put individual tones back into your musical challenge, and...

"Now, you're ready for the final Tone Mapping stages; 3D Sharpening and 3D Dodge and Burn (our remaining color challenges!)".

HDR Tone Mapping; Art and/or Science

While I feel some hesitancy in using the diminutive term Quick and Dirty, I've come to regard my Photomatix HDR experience as Q & D. After running an experiment where I cleaned noise and chromatic aberration from five captured

HDR images - when Photomatix put in chromatic aberration - somewhat tremulously, I sought another path.

While Photoshop CS4 does HDR from aberration-clean images, chromatic aberration is lacking. The successful path to a dramatic HDR is more convoluted.

If you're anticipating professional HDR prints in the range 20 x 24 to be viewed by

judges in a juried competition, you're going to want to remove both noise and chromatic aberration somewhere before you print that final image.

With Lightroom 2, globally I can both reduce noise and attempt to remove chromatic aberration from captured images.

Powerful Merge to HDR capabilities in CS4 helps maintain that strict sense of technical requirement. The Local Adaptation experience in CS4 is certainly not nearly as simple as that of Photomatix. The initial 16 bit CS4 image, flat and slightly blurred, can seem daunting – little worth much more effort. You still have to go through Tone Mapping with properly masked Hue/Saturation to 're-color' the flatness.

In Lightroom 2, which easily relies on advanced Adobe Camera Raw tools, you can provide additional color thru Brightness, Contrast, Clarity, and Vibrance.

A recent TV one-liner said, "If you're a Hammer, everything looks like a Nail!" I suggest Fraser might have really liked that phrase; paraphrasing his lingo, "If you don't use Hue/Saturation, you can't create a proper fine art HDR image from your visual memory!"

Software usage requires a scientific approach. Fine art creates nuances in subtle, yet dramatic color interpretations.

I guess I've come to this dictum,

"HDR is a creative fine art endeavor. With Photoshop as your digital darkroom, virtually anything is possible. Just stop _before you breach virtual reality.

"Citing Robert Frost, 'and I..., I Took the Road Less Traveled!'"