Digital Restoration from Start to Finish

Ctein

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CHAPTER 10

Examples

The examples in this chapter are case studies in restoration. Each example takes a photograph, step by step, from its original form to its fully restored glory. Within the limits of space I've left nothing out. No magic takes place behind the curtain.

As I said back in Chapter 1, what I enjoy most about doing photo restoration is going for "the best of all possible prints" from a damaged photograph. I love to take the restoration process to its limits and see just how perfect a photograph I can get. The examples in this chapter are precisely these kinds of perfectionist performances. They aren't necessarily complicated, but they are all as masterful and complete as I know how to make them.

What I want to convey in this chapter is not a set of marching orders but some understanding of how one gets from A to Z. It's about more than noting the specific tools that I use to solve each problem in the restoration. It's as much about the order in which I tackle the problems, and how I decide what path to follow to get to my goal.

This doesn't mean you have to be a perfectionist! You needn't travel all the way from A to Z to get great results; you can stop at P and have restorations that are more than good enough to make most people very happy. Chapters 5 through 9 are filled with examples that don't go to the ultimate limit of the restoration art, but they still look good.

Always remember that these are examples, not prescriptions. Give the same photograph to 10 different restorers, and they will take as many different approaches to fixing it. When you read these examples, I hope you'll sometimes find yourself thinking, "Wouldn't it have made as much sense for Ctein to address this problem this other way?" The answer is very likely "Yes!" There is never one right answer, and the more right answers you can come up, with the more tools you'll have at your disposal when you encounter a new problem.

Example 1: Repairing an Old Glass Plate

The 4-inch by 6-inch glass plate negative shown in Figure 10-1-a was made in the 1920s in Venice or Lido, Italy. It's tarnished, but otherwise

Fig. 10-1-a This glass plate negative dates from the 1920s. The silver image is in excellent condition, albeit very dense, but the plate has been broken right down the middle!

the silver image is in great shape. While the negative is very dense, typical for photographs of the time, the edges of the plate are clear and only slightly yellowed. The only thing that prevents me from printing this plate conventionally on a Grade 0 paper is that it's broken in two!

After masking off the area surrounding the image on the plate (to reduce flare, see Chapter 4, Getting the Photo into the Computer, page 113), I scanned the plate at 1200 ppi in 16-bit RGB mode. As the scanner software histogram shows (Figure 10-1-b), almost all the tonal information is concentrated in the lower 20% of the scale. The scattering of values higher than that corresponds to light leaking through the cracks and some small missing patches of emulsion.

After a couple of trial scans, I settled on a white level of 100 and a midpoint (gamma) adjustment of 2.4. That's an extreme gamma, but experiments showed that it produced a good-looking negative on the screen. I wasn't too worried about the precise curve shape because I was working in 16-bit mode. Glass plates should be scanned with the emulsion side of the plate in contact with the platen because that's where the scanner's plane of focus is. That means a scan will come out left-right reversed, so after I completed the scan I flipped the image horizontally.

Figure 10-1-c shows the resulting scan; it's much clearer than Figure 10-1-a, which shows an unadjusted scan. The histogram in Figure 10-1-d shows that I have an acceptable range of information, with no clipping of the shadow or highlight detail in the photograph.

The RGB scan is nearly 200 MB, and there's no useful color information in the photo, so I used Channel Mixer to convert the scan to gray-

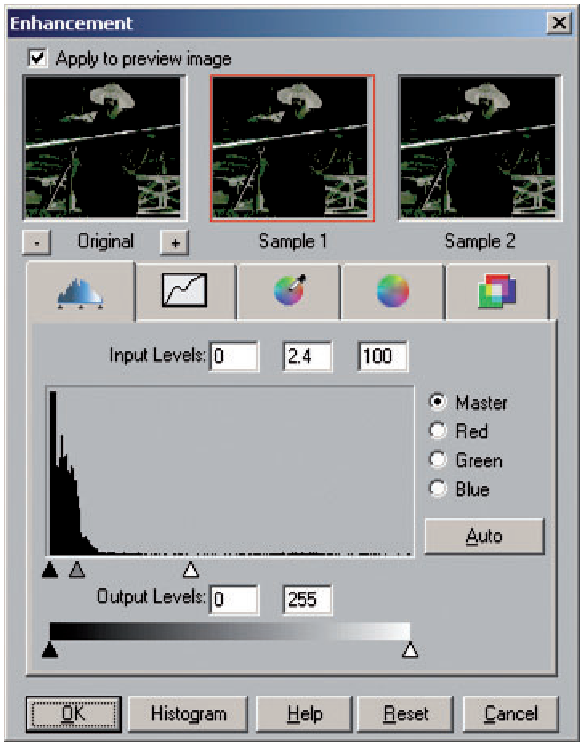


Fig. 10-1-b The scanner software histogram shows that this is a very dense negative. I moved the white slider all the way down to a value of 100 and the midtone slider to a setting of 2.4 to expand the tones in the dense parts of the negative as much as possible.

Fig. 10-1-c Scanning the glass plate with the settings shown in Figure 10-1-b produces a much-improved image. Now detail is clearly visible throughout the tonal range of the negative.

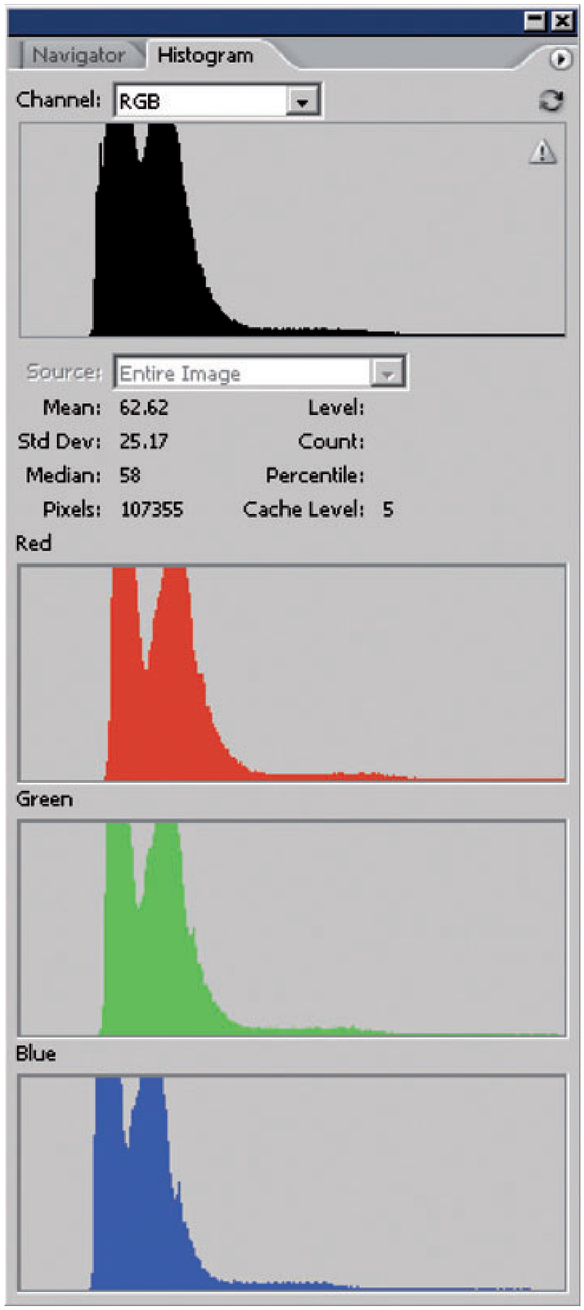


Fig. 10-1-d The histogram of the scan in Figure 10-1-c shows a considerably improved tonal range over the original. Although the range is still restricted to about one-third of the available values, there's enough data in a 16-bit scan for me to create a good finished print.

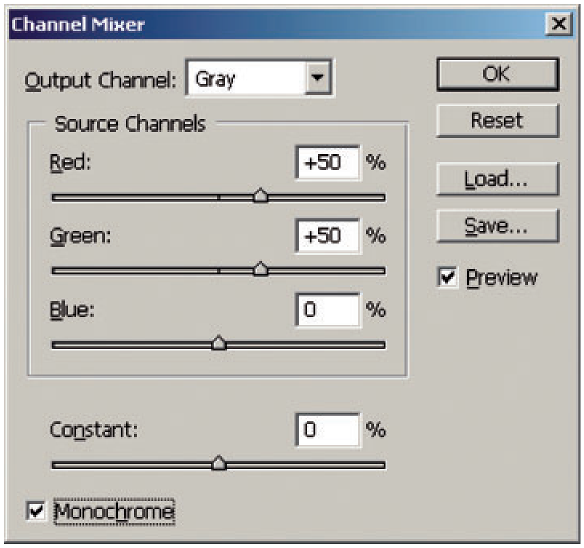


Fig. 10-1-e These are the Channel Mixer settings that convert Figured 10-1-c from RGB color to grayscale. I'm using a mix of 50% red and 50% green because these two channels have substantially less noise than the blue channel (see Figure 10-1-f), and the combination of the two produces better tonality than either of them alone.

scale to speed up further work. I used the Channel Mixer settings in Figure 10-1-e to mix equal parts of just the red and the green channels. Then I converted the RGB monochrome image to a grayscale one.

As you can see in the enlargement of the white dress and fingers in Figure 10-1-f, the blue channel is much noisier in this scan than the red and green channels, so eliminating it got me a monochrome image with better tonality and less noise than any of the individual channels. This is also a cleaner result than I would get by simply desaturating the scan or directly converting the mode to grayscale.

The two pieces of the plate were out of alignment by a few hundredths of an inch, so I created a selection around the top piece and nudged it into alignment with the bottom piece. I started by selecting the crack between the pieces. The pure white gap was easy to select using the Magic Wand tool (Figure 10-1-g). I used a broad tolerance setting of 20 with "Contiguous" checked, so that I didn't accidentally pick up any stray clear spots in the plate while grabbing as much of the crack as possible. A few clicks of the Magic Wand along the length of the crack selected it all.

I expanded that selection by 2 pixels to ensure that I had included all the glow at the edges of the crack and inverted the selection. That left me with the two pieces of the plate separately selected. Using the Lasso in subtractive mode, I circled the lower selection and eliminated it.

With the upper piece alone selected, I held down the control key, which turns the cursor into a nudging tool. I used to the arrow keys to nudge the upper piece a dozen pixels to the right and a couple of pixels down. Figure 10-1-h, right, shows the improvement in alignment.

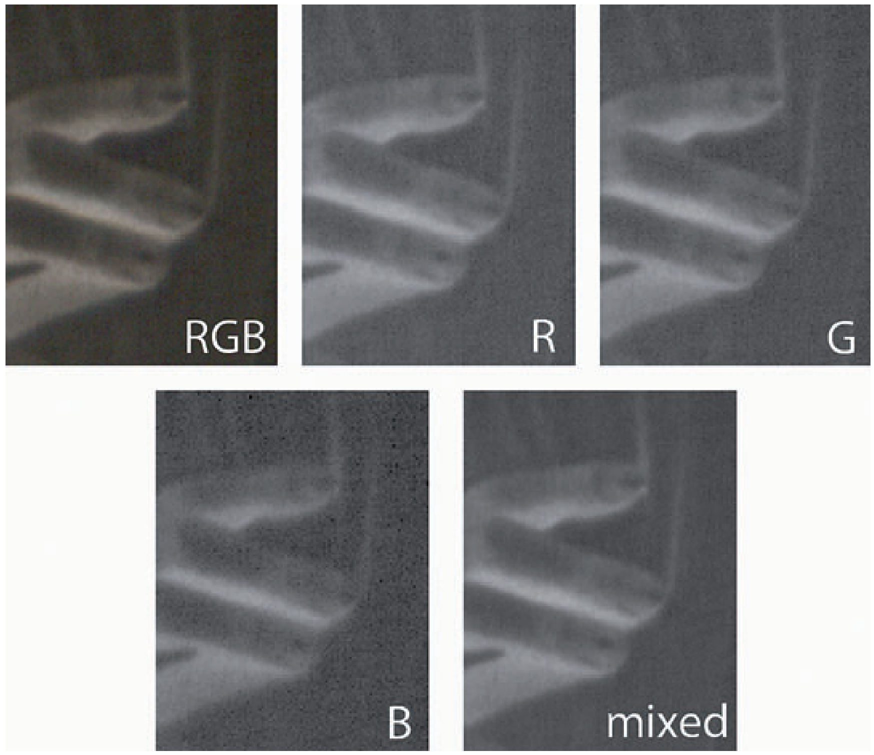


Fig. 10-1-f This enlargement of Figure 10-1-c shows how highlight detail is improved and noise reduced by using the Channel Mixer. The blue (B) channel has much worse noise than the red (R) and green (G) channels, so it gets discarded. Channel Mixer (see Figure 10-1-e) combines 50% red and 50% green channels to produce the mixed channel, lower right. This new grayscale image has better tonality and less noise than any of the individual RGB channels.

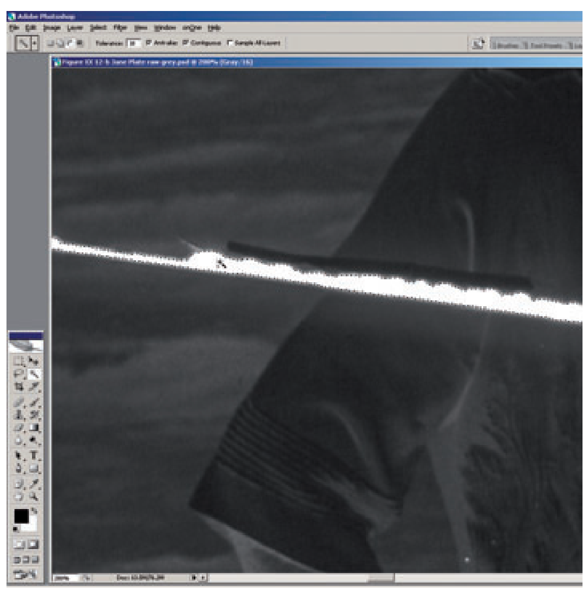


Fig. 10-1-g Selecting the crack between the plates is easy because it's pure white. I used the Magic Wand tool with a Tolerance of 20 in Contiguous mode. The selection is indicated by the dashed line in the screenshot. I expanded the selection by a couple of pixels to include the edges of the crack and inverted it to select the pieces of the glass plate and exclude the crack.

Fig. 10-1-h The figure on the left is the original scan. The two pieces of the plate are misaligned by a few hundredths of an inch. Applying the selection that I made in Figure 10-1-g to one of the pieces of the plate, I nudged the top half of the plate over until it was correctly aligned with the bottom half (right).

Because it's easier to see white spots against a dark background than vice versa, I decided to clean up the dust and scratches while the photograph was still in negative form. I used the Dust & Scratches History Brush trick from Chapter 8, Damage Control, page 268, with a 10-pixel filter radius and a threshold of 5.

Almost all of the garbage I had to clean up was lighter than the photograph, so I set the brush to Darken mode, which minimized its impact on fine detail and image grain. After working my way through the photograph and getting rid of all the light specks, I switched the brush to Lighten mode and picked off the few dark spots and scratches.

Next I inverted the image to produce a positive and cropped and rotated it to make the horizon line horizontal. That yielded Figure 10-1-i. I added a Curves adjustment layer with the settings shown in Figure 10-1-j. This approximated what a good print would ultimately look like, but it showed that there was considerable light falloff toward the edges of the plate (Figure 10-1-k). To even out the plate exposure I created a mask (Figure 10-1-l) for the Curves adjustment layer with the circular Gradient tool.

I set the foreground color to white and the background color to a gray with a luminance of 65 and drew a gradient line from the center of the image to the corner. This mask weakened the effect of the Curves adjustment layer toward the edges of the image, so that it darkened the edges less. The result, seen in Figure 10-1-m, is much more even. I can deal with the small amount of residual darkening in the corners by dodging the photograph later.

The increased contrast in the adjusted photograph revealed a new problem. The very bright light that shone through the crack during scan

Fig. 10-1-i Now that the scan has been aligned and cleaned, I've inverted it to produce a positive image. The photograph is very pale and flat; the Curves adjustment in Figure 10-1-j will fix that.

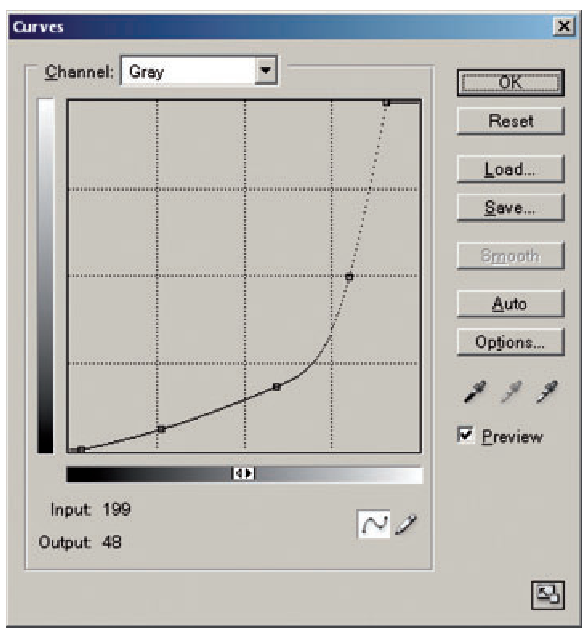


Fig. 10-1-j This Curves adjustment produces Figure 10-1-k. I moved the white point in to restore the highlights to near-white. This curve greatly increases contrast in the midtones and highlights in exchange for sacrificing it in the shadows. The midtones are what give the photograph brilliance and life, so good contrast there is more important than maintaining shadow contrast.

Fig. 10-1-k I applied the curve from Figure 10-1-j to Figure 10-1-i in a Curves adjustment layer. That produces very good tonal quality. Increasing the highlight contrast this much makes light falloff at the corners of the photograph very noticeable. I fixed that with an adjustment layer mask in Figures 10-1-l and 10-1-m.

Fig. 10-1-l I created this mask for the Curves adjustment layer in Figure 10-1-k using the circular Gradient tool. It fades the effect of the curve from Figure 10-1-j so that it doesn't darken the photograph as much in the corners.

had caused flare that created a dark halo around the crack in the positive image. This made the job of erasing the crack considerably more complex, so I tackled it in stages with several different tools.

The easiest step was removing the crack from the sky, where the crack was a thin line with very little halo. Since there was no sky detail other than grain, I just cloned the nearby sky into the crack to make it go away.

Next in difficulty was the ocean. There the crack was heavier and there was some evidence of a halo. There was also the blurry detail in the water to worry about. I decided first to reduce the strength of the crack.

Fig. 10-1-m The masked Curves adjustment layer does a nice job of restoring proper tonality to this photograph at the same time that it evens out the lighting. The residual darkening in the corners can be cleaned up with a little bit of dodging.

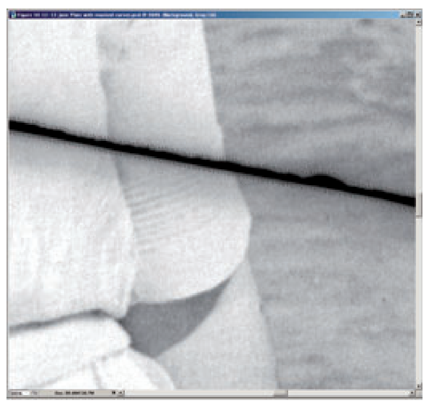


Fig. 10-1-n The first stage in repairing the crack in the plate is to select it using the Magic Wand tool. The selected area is outlined by the dotted line in this screenshot.

I selected the blackest parts of the crack with the Magic Wand, expanded the selection by 3 pixels, and feathered it by 2 pixels (Figure 10-1-n). I applied the Median filter with a radius of 85 pixels; that filled in the crack with the average brightness of the surrounding pixels (Figure 10-1-o). This made it easier to manipulate the crack in later steps.

Once I had minimized the intensity of the crack, the Spot Healing Brush in Photoshop CS2 was up to the task of erasing it from the water. I set the brush to a radius about 20% bigger than the halo with a hardness of 0. Brushing the tool along the cracks in short segments, it didn't take long to erase it.

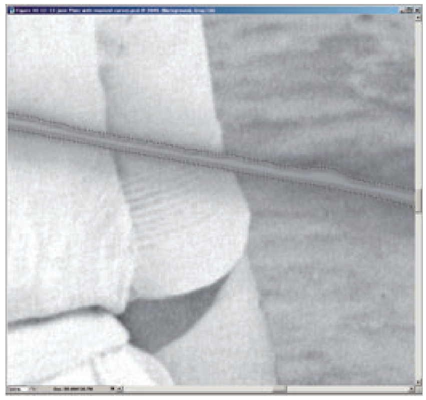


Fig. 10-1-o I applied the Median filter with a very large radius of 85 pixels to the selected crack. That filled in the selection with the average of the surrounding pixels. This makes it easier for other tools like the Spot Healing Brush to replace the selection with surrounding detail and blend it in.

Fig. 10-1-p The Spot Healing Brush has replaced the selected crack with wave details from other parts of the ocean. All that remains of the crack over the water area is a dark smudge.

Occasionally the Spot Healing Brush produced patterns and textures that didn't merge well with the surrounding waves. Usually I could make those go away with a second pass from the brush at a different angle. If the blend still wasn't perfect, I used the cloning tool at 30% strength to blend in the boundary between the healed area and the surrounding image.

Now I was ready to tackle the residual halo where the crack had been in the ocean and the halo around the crack in the dress (Figure 10-1-p). Dealing with that required nothing fancier than the Dodge tool. I set the tool diameter to about the width of the halo, the hardness to 50%, and the strength to 7%. I ran this tool back and forth along the halo until it was mostly gone, being careful not to overdo it. Then I dropped the radius down to about a fifth of the width of the halo and carefully brushed out the residual bits, including the strong dark edge right next to the crack across the dress (Figure 10-1-q).

Fig. 10-1-q Dodging the dark smudge in the previous photograph completes the task of erasing the crack from the water. The Dodge tool was also effective at removing the dark halo that borders the crack over the woman's dress.

Fig. 10-1-r Now that I reduced the crack to a thin white line in Figure 10-1-q, it's a simple matter to erase it entirely from the blouse using the Clone tool.

This left a simple, narrow blank area running across the dress that I could easily fill in with the Clone tool. I made a few more light passes with the Dodge tool to remove the last traces of shadows from the repaired area, which gave me the seamless image in Figure 10-1-r.

Now I turned my attention to making the photograph look as good as possible. I used a Dodge tool of large radius to reduce the light falloff at the edges and corners of the photograph. I didn't eliminate it entirely, because a small amount of vignetting focused attention on the central subject of the photograph. I just reduced the darkening enough so that it wasn't an obvious artifact and distraction.

There was some residual garbage in the sky—light scratches, small defects in the emulsion, that sort of thing. I used the Magic Wand to select only the sky and shrank the selection by 6 pixels to ensure that I had not captured any of the foreground. Then I applied the Dust & Scratches filter with a radius of 20 and threshold of 2. Since the sky held

Fig. 10-1-s This photograph is fully repaired. The crack is gone, and the dust, dirt, and scratches are all cleaned up. The tonal rendition is good, and I've done some dodging and burning-in to even out the lighting a little more. Just a few more finishing touches will make it perfect.

no fine detail, the large radius didn't destroy anything except defects, and the threshold of 2 preserved enough of the grain so that there was no visible difference in texture between the filtered and unfiltered parts of the photograph.

Figure 10-1-s shows a fully repaired photograph. I saved this version as a good record of the original photograph; now I wanted to take it to the next level and come up with a good "print" of it, just as I would in the darkroom.

I used the Burn tool set to 6% and a very large radius to lightly burn in the top half of the sky and the foreground sand. That further focused the viewer's attention on the subject of the photograph. The change was very subtle, almost subliminal, but it made a big difference in the aesthetics.

Next I switched to the Dodge tool and with a brush of small radius lightened the woman's face where it was shadowed by her hat. I paid special attention to her eyes, giving them a little more dodging to bring them out and lightly dodged her hair to better separate its tones from her hat. I also lightened the shadow under her nose that fell across her upper lip and her teeth. Lastly, I dodged the right side of her face and her neck to open up the tones there.

My goal in all of this was to produce a more pleasing but still accurate rendition. I didn't cosmetically alter her appearance or eliminate the look of someone posing in the bright sun, rather I produced a rendering that was more attractive because it was more like what we would see. Figure 10-1-t shows a close-up of her face before and after these simple but important local corrections. These final adjustments produced Figure 10-1-u, a lovely and flawless photograph from a "lost" glass plate.

Fig. 10-1-t On the left is an enlargement of Figure 10-1-s. The direct sunlight produced a harsh photograph and buried much of the woman's face in shadow. Judicious use of the Dodge tool opens up the shadows and evens out the lighting on her face just enough to make it look more natural to our eyes. Little touches like this make the difference between a good and a great restoration.

Fig. 10-1-u The final print! Some minor adjustments to the Curves layer perk up the whites in the woman's dress and make her stand out more clearly from the background. Burning-in the sand at the bottom and dodging her face add to her sense of presence. This file makes a wonderful-looking print.

Example 2: Repairing Color with a Good Scan

Throughout this book I've emphasized the importance of getting a good scan to make your restoration job easier and better. This example is a most extreme case of that; getting the scan right got me 90% of the way to great tone and color (see also Chapter 6, Restoring Color, page 183).

The original was a 3-inch by 5-inch color snapshot made in 1966 (Figure 10-2-a). It was in very good shape for a 40-year-old color pho-

Fig. 10-2-a This mid-1960s color photograph is yellowed and significantly faded but otherwise is in very good physical condition. A careful scan can correct most of the fading.

tograph. It was little bit dirty and slightly cracked, and there were some paper fibers stuck to the surface but little physical decay. The print had a moderate amount of yellow staining and overall had faded considerably but uniformly.

I scanned the photograph on my flat-bed scanner with the Input Levels settings shown in Figure 10-2-b. I set the sliders for the black and white end points in the red, green, and blue channels so that they tightly bracketed the histograms. That wiped out the highlight stain and gave me a good range of tones from near-white to near-black. Pulling in the blue channel's "white" point far enough to eliminate the yellow stain, however, made the print come out too blue overall, so I raised the midpoint on the blue levels to make the color balance more neutral. The finished scan, in Figure 10-2-c, is an amazing improvement, just from a carefully adjusted scan!

I decided that the color was not saturated enough and the overall hue was a little bit pink for my taste. So I added a Hue/Saturation adjustment layer (Figure 10-2-d) and played around with the settings until I got

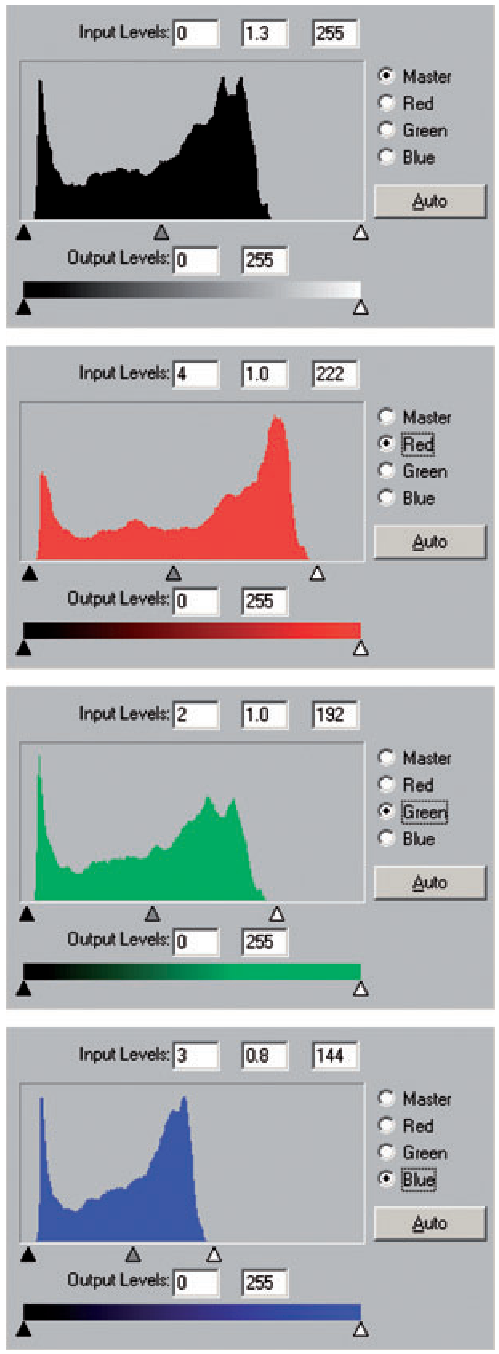


Fig. 10-2-b These are the scanner software histograms and Input Levels settings that produce Figure 10-2-c from Figure 10-2-a. I adjusted the black and white sliders to bracket the range of tones in each color channel. I also shifted the midtone slider for the blue channel to 0.8, which improved the color balance.

Fig. 10-2-c This corrected scan of Figure 10-2-a looks very good. It's most of the way toward having fully restored and corrected color.

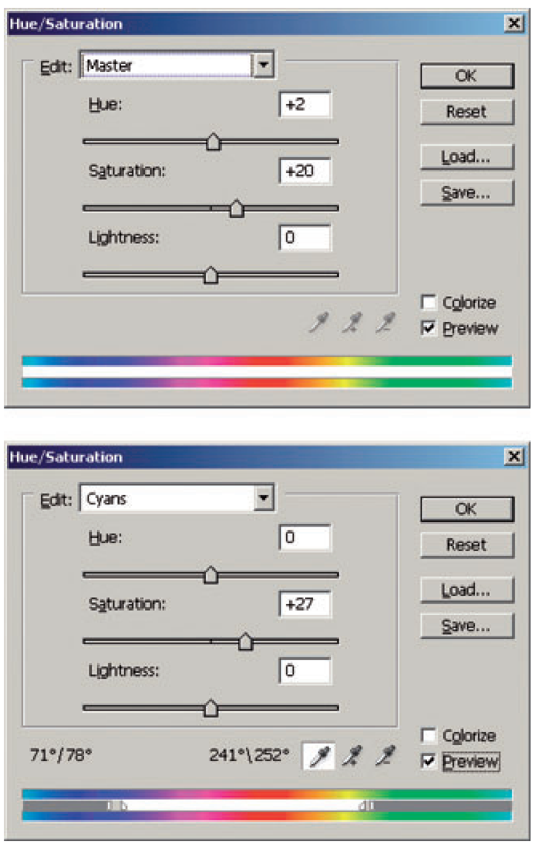


Fig. 10-2-d These Hue/Saturation adjustments, applied in an adjustment layer, further improve the color, producing Figure 10-2-e. The Master adjustment improves the overall saturation and makes the skin tones a little less pink by shifting the Hue +2 points. The Cyans adjustment substantially increases the saturation in the greens and blues because they were very weak even in the corrected scan.

Fig. 10-2-e Improved saturation helps this photograph a lot. The color balance, though, is just a bit off—it's a little too rosy. The Curves adjustment in Figure 10-2-f fixes that.

Figure 10-2-e. The Master saturation is up 20 points, and I shifted the hue by +2 degrees, which moved the pinks and the reds a little bit toward the yellow and warmed up the print. That Hue adjustment would also move the greens and blues a little bit toward the purple, but there was so little of that in the photograph that I didn't care about them. The greens and blues, though, were still undersaturated, so I went to the Cyan channel and moved the spectrum sliders at the bottom so that all colors from green through blue were selected. Then I increased the saturation by 27 points. This pumped up the colors in the quilt and added a bit more variation to the background (Figure 10-2-e).

I didn't have to use an adjustment layer for this, by the way. It made it easier for me to fiddle around with the Hue/Saturation settings to figure out what I wanted.

The color was almost there, but it was a bit too rosy for me. Moving the eyedropper around the picture confirmed that impression; even the white shoes had red values that were substantially too high (meaning there wasn't enough cyan in the image). So I launched the Curves tool, pulled up the red channel, and made the single-point adjustment you see in Figure 10-2-f. That tempered the rosiness a bit to give me the very natural color you see in Figure 10-2-g.

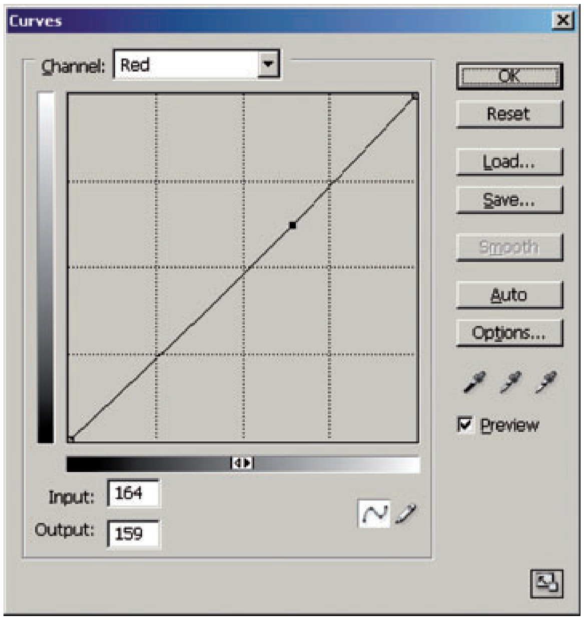


Fig. 10-2-f This single-point Curves adjustment gets rid of the excess pink from Figure 10-2-e, as shown in Figure 10-2-g.

Fig. 10-2-g This photograph has excellent color. The Curves adjustment from Figure 10-2-f makes the whites neutral and gives the tot a natural, childlike complexion. Everything is done except a small amount of damage repair and detail enhancement.

Fig. 10-2-h This enlargement from Figure 10-2-g shows the white paper fibers that are stuck to the print (top). It took very little work to clean them up with the Dust & Scratches filter. I just assigned the filter to the History Brush, reverted to the previous History State, and brushed out the clumps of fibers. The result is shown in the bottom figure.

The next-to-last thing I had to do was clean up the garbage. I used my favorite tool for that, the Dust & Scratches filter applied via the History Brush. I set the filter for a radius of 10 pixels with a threshold of 4. That aggressively wiped out all of the dust and dirt and most of the paper fibers. Setting the History Brush to that state, I painted the filter over the background. I could use a very large-radius brush because the background was out of focus and the filter had no effect on it except for correcting the damage.

Cleaning up the child and the quilt required the usual small-radius brush so that I didn't accidentally wipe out real details, but since the background constituted more than half of the photograph, I spent relatively little time on cleanup. Figure 10-2-h is an enlarged section of the photograph that shows what the dirt and paper fibers looked like before and after cleaning up with the Dust & Scratches filter brush. The filter didn't erase larger fiber clumps, but it wasn't much work to obliterate those using the Clone tool.

This file was ready to archive and print out at its original size, but I decided to add one last refinement—enlargement. When I saw what a high-quality, clean scan I could get from this photograph, I decided to scan it at 1200 ppi instead of the 600 ppi that would've been more appropriate. The 1200-ppi scan didn't hold more image detail than a 600-ppi scan would; there wasn't any finer detail to be captured. What it did was capture four times as many pixels for Focus Magic to chew on (Figure 10-2-i).

Fig. 10-2-i Focus Magic can improve the sharpness of this photograph to make it even better than that of the original print. Setting the source for Grainy Image minimizes enhancement of noise and film grain. That's important in this photograph because I want the child's skin to remain baby smooth.

Fig. 10-2-j This enlargement from Figure 10-2-h shows the photograph before (top) and after (bottom) running the Focus Magic filter from Figure 10-2-i. See how much better the detail in the eyes and mouth is! This photograph can be enlarged 50% to 100% when it's printed out, and it will still look nice and sharp.

I set the Focus Magic image source to “Grainy Image” because that minimizes the filter’s sharpening of fine grain and noise. I didn’t want to exaggerate textures in that smooth baby skin. I turned on “Remove Noise” just in case there were some dirt specks I missed, set the Blur Width to 7 pixels, and let the filter run. What a difference that filter made (Figure 10-2-j)! Now the photograph is sharp enough to take up to 6 inches by 10 inches and still stand up to close inspection.

Example 3: Mother and Child—A “Legacy” Restoration Job

In this example, the original photograph (Figure 10-3-a) was made by a chain department store’s portrait studio over 20 years ago. Poorly processed and taped into a cheap cardboard matte, the print hung on the family home wall for two decades. Consequently, it had faded something terrible. Although it looks like a nearly monochrome red image, there was enough color information left to do an excellent digital restoration.

When I started doing professional-quality restoration in 1998, this was the first job I ever did. The computer was slow with little memory, I could only work with 8-bit files, and all the work was done under Photoshop 4. That meant no adjustment layers, no History States, no Healing Brushes, and no clever third-party plug-ins. That’s why I’m

Fig. 10-3-a This is a chain-department-store portrait made in the 1970s. It hung on a wall in this oval matte for 20 years before I received it for restoration.

Fig. 10-3-b Removing the matte reveals that the photograph has faded unevenly. Where it was struck by light, the fading is more severe.

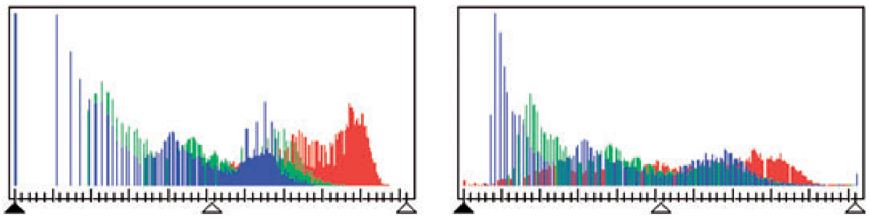


Fig. 10-3-c The scanner software histogram on the left, for Figure 10-3-b, illustrates the severe color shift in this photograph. The blue channel hasn't faded much, but the green channel has lost considerable shadow density, and the red channel barely spans the upper half of the histogram range. The histogram on the right shows the improvements possible with the adjusted scan of Figure 10-3-d; now all three color channels have data that spans most of the range of values.

including it in this book. The methods and tools I used to restore this photograph are available in just about any image processing program; this is as close to "generic" technique as you can get.

Figure 10-3-b shows an uncorrected scan of the unmounted print. There was almost no information in the red channel below middle gray, and the green channel showed considerable loss, as can be seen in the scanner software's histogram (Figure 10-3-c, left). The cyan dye image had faded the most, plus there was some dye loss in the magenta. Stain-

Fig. 10-3-d The adjusted scan has considerably better tone and a wider range of colors than the original photograph. The outline of the oval matte is very obvious; that's what needs to be fixed first.

ing had given the print an overall orange cast as well. I adjusted the scanner level sliders, expanding the red and green ranges to compensate for the dye loss and setting the white points for the green and blue ranges to compensate for the yellow-magenta stain. There was now a much better overlap between the three color channels, and the red data was spread out enough to give a decent range of tones to work with (Figure 10-3-c, right), indicating that I'd get a much more neutral overall color rendition in the scan (Figure 10-3-d).

The part of the photograph hidden by the cardboard matte had faded differently from the central oval exposed to light. In preparation for eliminating that difference, I created an oval mask (Figure 10-3-e) that precisely matched the outline of the faded area in the photograph. The Elliptical Marquee tool created a selection that approximately fit the oval. I saved that selection in its own channel and made it visible as an overlay on top of the photograph. I used white and black Brush and Pencil tools to refine the edge of the mask so that it exactly matched the oval area in the photograph.

After selecting the central oval area, I pulled up the Curves tool and created customized red, green, and blue curves to correct the differential fading. To begin with, I picked adjacent near-black areas in the tree on either side of the oval boundary and added adjustment points to the

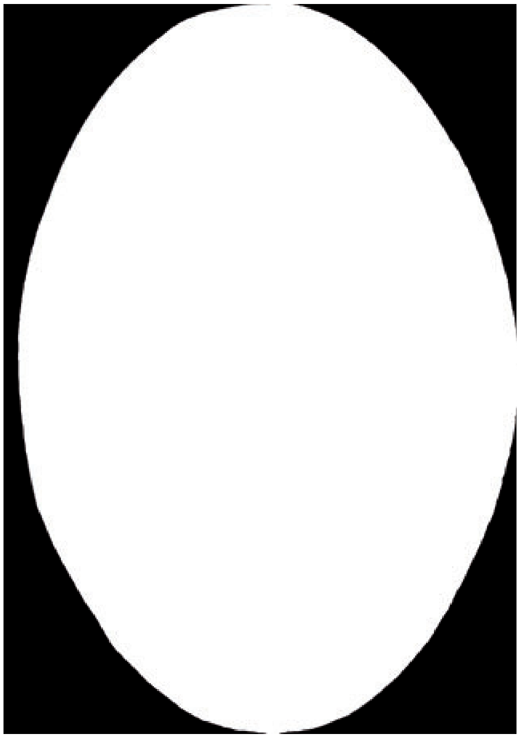


Fig. 10-3-e I created an oval matte using the Elliptical Marquee tool in Photoshop. The oval matte cutout isn't a perfect ellipse, so I painted along the edge of the mask with a hard-edged brush, using white and black tones, until I had an outline that precisely matched the cardboard matte.

individual curves corresponding to the values in the area inside the oval. I lowered those adjustment points until the areas inside and outside the boundary matched.

Next I picked a dark midtone area in the mountains in the backdrop and added adjustment points to the three color curves corresponding to the values there. I raised or lowered those points until the mountain tones matched.

I added adjustment points for an area in the sky, in the light sweater, and finally in the clouds. At each stage I adjusted only those points corresponding to the target areas to bring those areas into a good match on both sides of the oval. In this manner I worked my way up the tone scale from black to white to produce a complicated custom curve set (Figure 10-3-f) that would bring all the tones and colors together. The faded oval area was almost completely invisible in the resulting photograph in Figure 10-3-g. Now I had a uniformly degraded photograph to work with, and I could start correcting the overall tone and color.

Figure 10-3-g was dark, red, and lacked saturation. I improved the brightness and got rid of most of the red cast with the curves in Figure 10-3-h. The green curve adjustments made the shadows more neutral without affecting the middle and highlight tones. Dropping the midtone

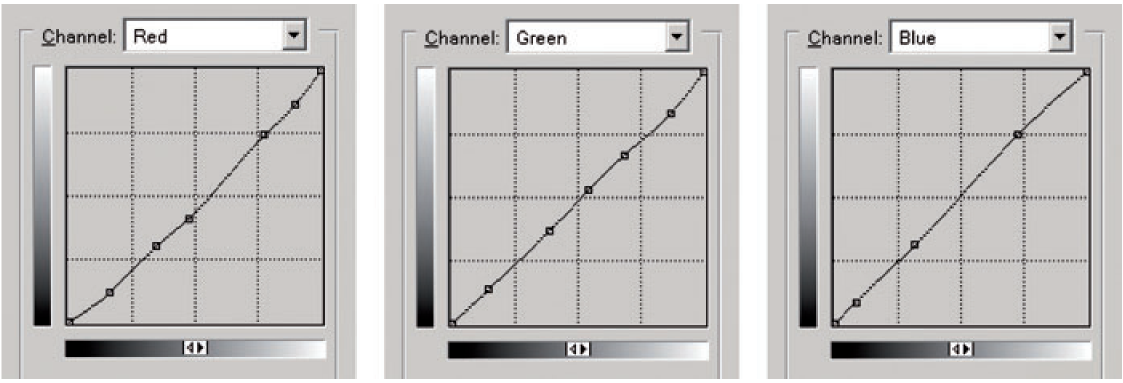


Fig. 10-3-f This is the Curves adjustment I made to Figure 10-3-d, masked with the oval mask from Figure 10-3-e. It makes the tones inside and outside of the masked area match nearly perfectly (Figure 10-3-g).

Fig. 10-3-g After the masked Curves correction from Figure 10-3-f, this photograph is uniform enough in appearance for me to begin serious color and tone restoration.

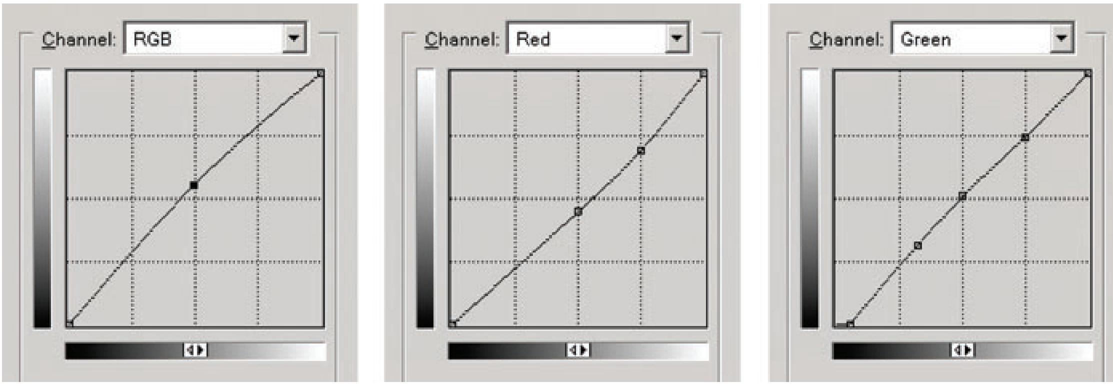


Fig. 10-3-h I made this Curves adjustment to produce Figure 10-3-i. The RGB curve lightens the photograph, while the red curve adds cyan to eliminate the reddish cast. The green curve makes the shadows more neutral by eliminating a green bias in the darker tones.

and higher red values and raising the midpoint in the RGB curve substantially improved the picture.

I followed that change with a saturation boost of 36 points to get Figure 10-3-i, which has fair overall color balance for the mother and child, but serious problems remained. The background looks far too brown. The clothing and highlights are dull and gray. The average skin tone is correct, but it’s blotchy and harsh. From this point on, I worked on the photograph piecemeal, using masks. I decided to attack the background problem first.

I carefully traced around the mother and child with the Lasso tool to create the mask shown in Figure 10-3-j. I inverted that mask and applied it to the photograph to select the background. I used the Curves and Hue/Saturation tools on the background to reduce the amount of red, increase the overall contrast, and improve the saturation. I fine-tuned color curves to make the clouds neutral, the sky blue, and the foliage dark green to black (Figure 10-3-k). Then I increased the saturation by 20 points, which got me to Figure 10-3-l.

Streaks, blotches, and other defects such as surface cracks became all too visible after so much enhancement. I had to do a large amount of touch-up work with the Clone, Dodge, and Burn tools to correct the color and tone artifacts. I used the Clone tool to remove the most obvious of the cracks. I followed that with a 1.5-pixel-radius Gaussian Blur to the background to subdue noise and cracks in the background.

Having finished with the background, I deleted the selection and made some minor adjustments to the color and contrast to make the picture a bit more snappy. Next I focused my attention on the mother and child. The most evident flaw was the harsh and blotchy skin tones. Figure 10-3-m shows a full-color close-up of the faces along with the

Fig. 10-3-i As a result of the Curves adjustment from Figure 10-3-h and a 36-point increase in contrast, the mother and daughter are looking pretty good, but the background is definitely off-color. It's time for another mask, so that I can work on the two regions of the photograph separately.

Fig. 10-3-j I drew this mask by hand, using the Lasso tool to carefully follow the outline of the mother and child. It lets me perform separate corrections on the background and the people. I applied it to Figure 10-3-i and inverted it to select the background.

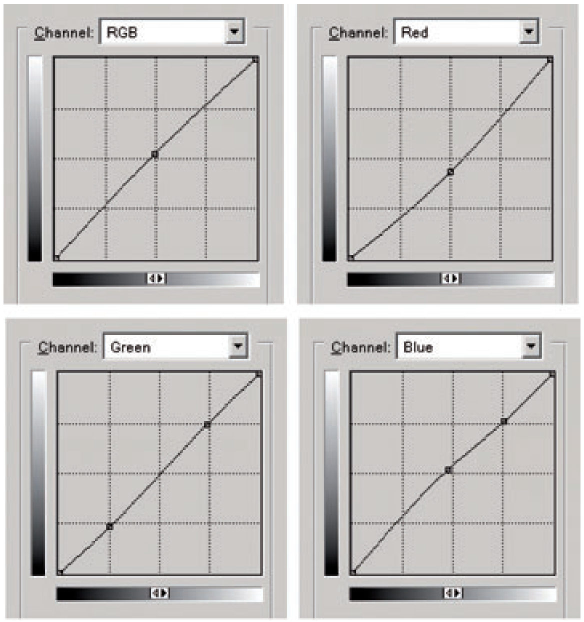


Fig. 10-3-k This is the Curves adjustment I used to correct the background. I applied this adjustment, using the mask in Figure 10-3-j, to produce Figure 10-3-l. These curves lighten the background slightly and make it substantially bluer and more cyan. The green curve eliminates some color crossover, making the shadows less green and highlights less pink, as shown in Figure 10-3-l.

Fig. 10-3-l The masked Curves adjustment from Figure 10-3-k, plus a saturation boost of 20 points, improved the background a lot. The sky in the backdrop is now a shade of blue instead of muddy green, the clouds are closer to neutral, and the tree branch is more green than brown.

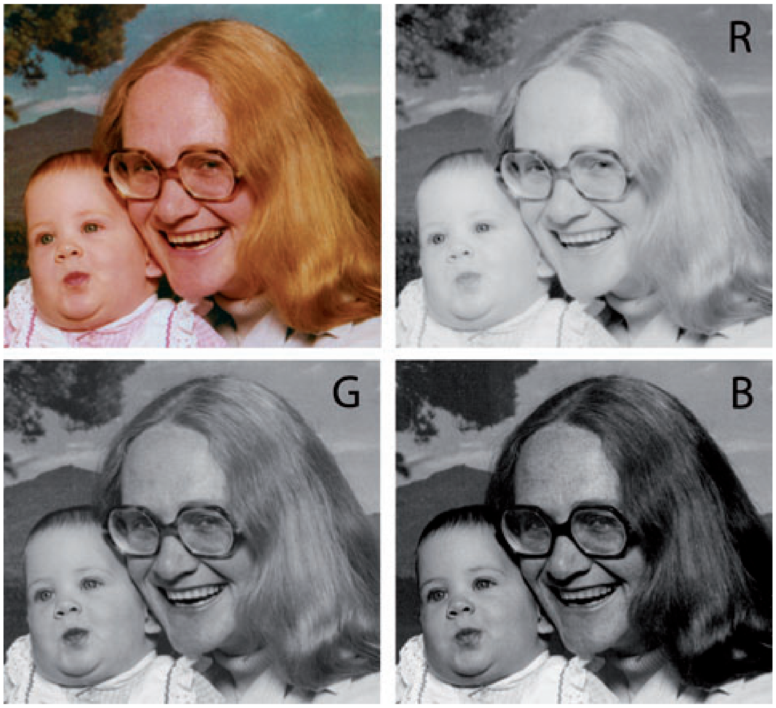


Fig. 10-3-m This close-up of the faces shows the need for some skin tone corrections. The skin color is uneven and blotchy. The individual color channels indicate that the problem is not with the red channel, which has smooth and even tones, but with the green and blue channels. The green channel is a particular problem because it has too much midtone contrast; that's what makes the skin color vary from flushed to sallow.

individual red, green, and blue channels. The green channel (lower left) made it clear that most of the problem was due to excessive contrast in the magenta. That exaggerated modest variations in the rosiness of the skin tones such that they ended up with sallow and flushed complexions.

To fix this, I traced out a new mask with the Lasso tool, shown in Figure 10-3-n, to let me work on skin tones and nothing else. I created a set of curves (Figure 10-3-o) to correct the blotchiness. The green curve left most tones unchanged, but it reduced the contrast in the green values between about 120 and 170, which corresponded to the range of values in the face. To a lesser degree, the blue curve lowered the contrast of the yellows, eliminating the sallow quality in the shadows and making the highlights less pink. A very slight raising of the midpoint of the RGB curve lightened the skin tones overall.

This was all it took to produce a much improved complexion for both mother and baby (Figure 10-3-p). There were still some yellow and pink blotches, especially in the shadows. I eliminated them by grabbing a good average skin color with the eyedropper and using the airbrush tool set to Color at a few percent strength to spray in that hue without altering the brightness in those areas. I also used the airbrush set to Darken to mute the highlights on the faces.

Fig. 10-3-n This mask, hand-drawn with the Lasso tool, allows me to correct the skin tones in Figure 10-3-l without altering the rest of the photograph.

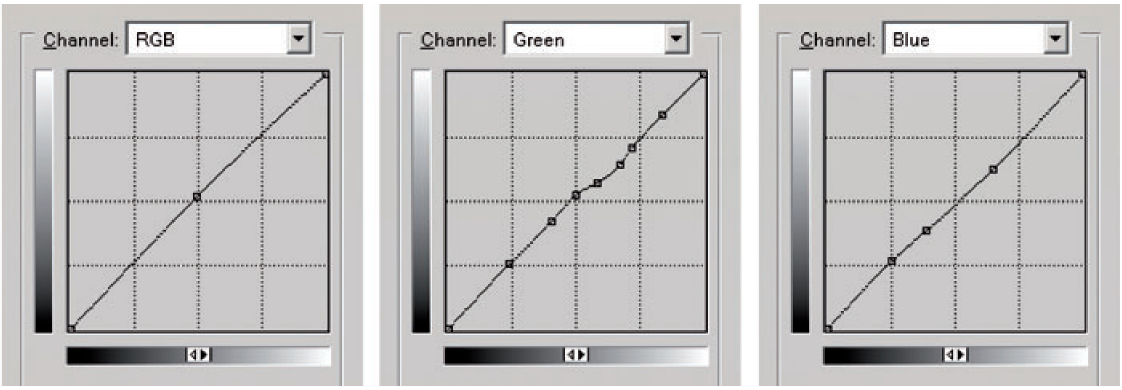


Fig. 10-3-o This Curves adjustment, applied through the mask from Figure 10-3-n, eliminates the blotchy skin tones (see Figure 10-3-p). The RGB curve lightens the skin tones slightly. The major correction is to the green curve, which substantially lowers contrast in the range of the magenta tones shown in the face. The blue curve adds a bit of yellow to the highlights, so they're less pink, and subtracts a little from the shadows, making them less brown.

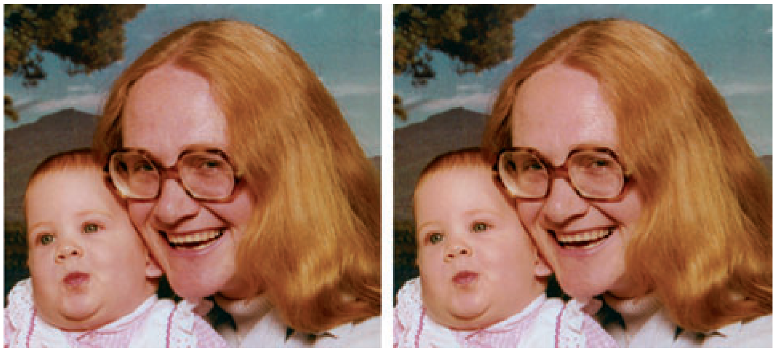


Fig. 10-3-p The enlargement on the left is from Figure 10-3-l before correction. The enlargement on the right shows the effect of the Curves adjustment from Figure 10-3-o. It really improves the skin color.

Fig. 10-3-q Here's the final restoration, after some final local color adjustments, dodging and burning-in, a little bit of airbrushing to get rid of the worst hot spots on the skin, and a thorough cleaning up of dirt, cracks, and minor physical damage. Yes, that flaming red hair is correctly colored . . . and natural, to boot!

I corrected the slightly flat and bluish highlights in the clothing by applying the foreground mask and kicking up the RGB highlight value in the Curves tool while dropping the blue highlight value a notch. I switched to the background and slightly darkened it to bring it into better compositional balance with the subjects.

The color was now almost on target except for two items—the woman's hair and her teeth. She's a brilliant redhead, not the reddish blond in the photo. I fixed that with the Burn tool set to a value of 10%

Fig. 10-4-a This is a 50-year-old Ektachrome (E-1) slide. It's lost a great deal of cyan dye and has developed an overall red stain. In addition, it has a bad case of the "measles"—there are yellowish spots all over the background.

for the midtones. In the channels palette I made the green channel the only active one (but left all the channels visible, so I could judge the full-color photograph) and gave the hair a couple of passes with the Burn tool. The results were perfect!

As for her teeth, which were excessively dark and yellow in the restored photograph, I first dodged them lightly overall and then dodged only the blue channel to remove some of the yellowish cast.

The final cleanup wasn't difficult, but it was very time consuming. I went over the picture at 100% magnification using the Clone, Dodge, and Burn tools to eliminate any blotches, scratches, dust specks, and artifacts along the boundary between the oval area and the surrounding area that my initial adjustments missed. The finished restoration (Figure 10-3-q) is impressive, especially considering that very little of what I did was an arbitrary application of tone and color to the image—95% of what you see truly was a restoration from data contained in the original print.

Example 4: A Faded E-1 Slide

The 1950s medium-format Ektachrome slide shown in Figure 10-4-a is very badly faded. Process E-1 slide films have proven very unstable. This slide has lost about two-thirds of its cyan dye; the maximum density of the cyan image is only 1.0 density units—a terribly low number!

Fig. 10-4-b
Enlargements of the red (cyan dye image) and blue (yellow dye image) channels from Figure 10-4-a show the "measles." The spots are missing cyan dye and have excess amounts of yellow dye, making them a lighter orange-yellow in the photograph.

To make matters worse, the slide is pockmarked with orange-speckle "measles" damage (Figure 10-4-b), regions where the cyan dye image has faded even more and serious yellow stain has occurred. And if that were not enough, the amateur camera and flash that made this photograph produced severe vignetting and chromatic aberration (color fringing).

Right out of the gate, I ran into another obstacle: making a good scan was going to be extremely difficult. This is exactly the kind of slide I warned about back in Chapter 4, Getting the Photo into the Computer, page 119. There's so much density loss in one dye layer that it makes it very difficult for the scanner to collect good tonal information from all the dye layers. The magenta dye layer is nearly intact, with the result that scans that produced acceptable cyan information completely wiped out the magenta midtone and shadow detail (Figure 10-4-c). Without magenta tonal separation, it would be impossible to accurately restore color in the midtones and shadows.

One way to acquire the whole density range would be to make several scans at different exposures and combine them using Picture Window's Stack Images Transformation, as I illustrated in Figure 4-31. Chapter 9, Tips, Tricks, and Enhancements, page 316, tells you how to do this. For this particular restoration job, though, I solved my problem with the scanner's built-in DIGITAL ROC software. Actually, I ran the full DIGITAL ICE^3 suite to clean up dirt and scratches and suppress film grain, but ROC was the essential tool. DIGITAL ROC in the scanner has access to the raw scanner data, so it can make use of all that raw shadow information that a straight scan has trouble retaining (Figure 10-4-d). ROC substantially corrected the color but the high magenta densities cost me some shadow detail and made the image a little noisy, so I made

Fig. 10-4-c The magenta dye image makes it tough to scan this slide; it has so much density in the shadow areas—especially compared to the cyan and yellow dye images—that a normal scan cannot capture all three layers successfully. A scan that records the other two dye layers correctly completely blocks up the shadows in the magenta layer, as pictured here.

Fig. 10-4-d DIGITAL ROC to the rescue! ROC normalizes the densities in all three dye images as it does its color analysis and correction. It pulls in much better shadow detail in all the channels that any straight scan would.

Fig. 10-4-e Scanning with 16× sampling does an even better job in the shadows. Compare the detail in the cabinet in the background in this photo with the one in Figure 10-4-d. More detail's visible here, and it has less noise. The color produced by ROC in the single-sampled scan, though, is better than in the 16× scan. Combining the two scans in layers gets me the best of both (see Figure 10-4-f).

a new scan with 16× multiple sampling turned on. In this mode the scanner makes 16 measurements of each pixel instead of one, which substantially reduces noise and extracts more shadow detail, but also greatly increases scan time.

The shadow tones were substantially improved (Figure 10-4-e), but strangely ROC did not do as good a job of color restoration as it did with a single-sampled scan. The easiest way to fix this was to combine the best of both. I made a layered file with the 16×-sampled scan as the background layer and the single-sampled scan as Layer 1 and set the blend mode for Layer 1 to Color. That produced an image combining the luminance values from the 16× scan with the color values from the single-sampled scan (Figure 10-4-f). I flattened that file to reduce bulk and saved it.

Before correcting the chromatic aberration, I cleaned up the dust and scratches. If I corrected the chromatic aberration first, the point-light specks would be converted to colored smears that would be harder to get rid of, as illustrated in an earlier chapter (Figure 6-51). To clean up the scan, I used my usual method of applying the Dust & Scratches filter, assigning this to the History Brush, reverting to the previous state, and painting over the defects with the brush (Chapter 8, page 268).

I saved the retouched file as a TIFF file so that I could import it into Picture Window, whose Chromatic Aberration correction tool is much better than Photoshop's (Chapter 6, page 220). The control window is

Fig. 10-4-f To create this photograph, I copied the single-sampled scan into a background layer in a new file. I copied the 16× scan into Layer 1 and set the blend mode to Color. That merged the color rendition of Figure 10-4-d with the tonality of Figure 10-4-e, producing this result, which is superior to both.

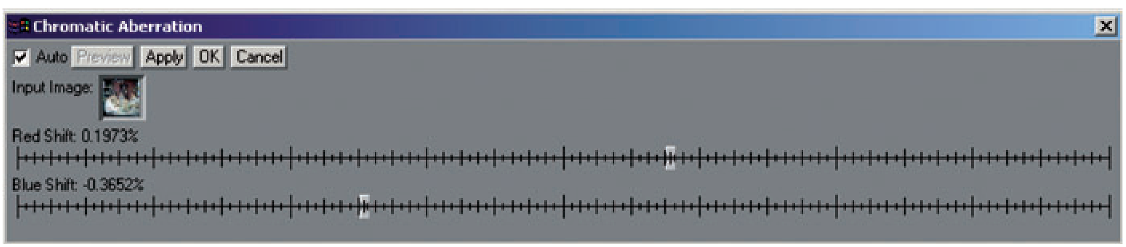


Fig. 10-4-g Picture Window has a better tool for fixing chromatic aberration than Photoshop. The resizable Chromatic Aberration control window lets me make much finer adjustments to correct color fringing. The result of this fix is shown in Figure 10-4-h.

resizable (Figure 10-4-g), so I stretched it out horizontally to give me much finer control. I saved the corrected TIFF file (Figure 10-4-h) and returned to Photoshop.

I decided not to fix the vignetting with the vignetting correction available in Photoshop's Lens Distortion filter, because the edges were not just darker but also more green-cyan. I wanted to correct both the tone and color, so the right solution was a Curves adjustment layer (Figure 10-4-i) with a radial gradient mask to restrict the effects to the periphery. I modified the mask a bit with a black airbrush in the lower

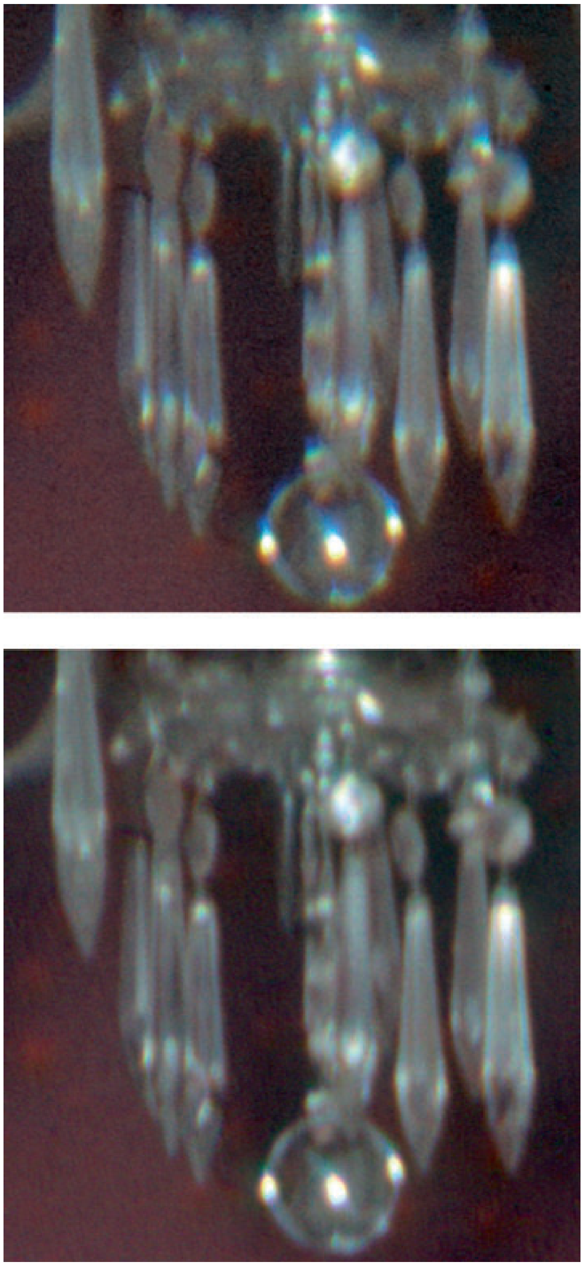


Fig. 10-4-h This enlargement of the chandelier from Figure 10-4-f shows how Picture Window's Chromatic Aberration tool gets rid of the color fringing. The upper figure is the photograph before correction; the bottom one is the same photograph after I've removed the chromatic aberration.

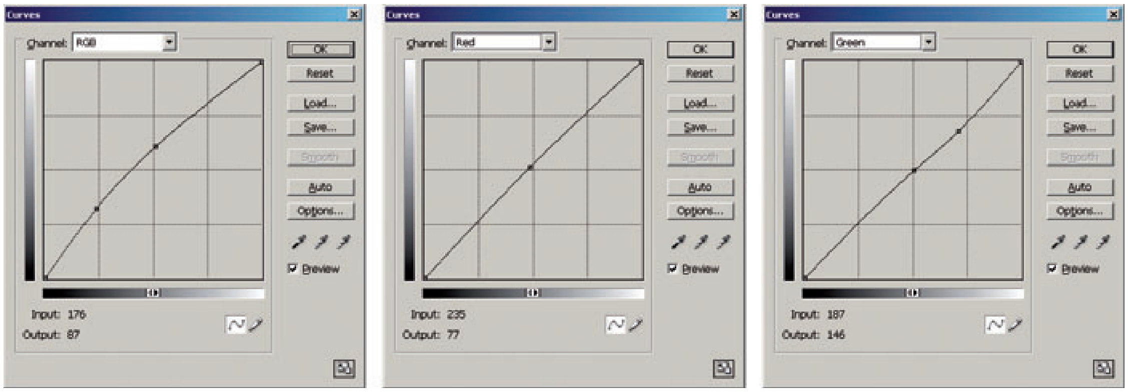


Fig. 10-4-i A Curves adjustment layer containing the mask in Figure 10-4-j corrects the vignetting that's visible in Figure 10-4-f. It also removes the slight greenish tinge from the darker edges of the photograph.

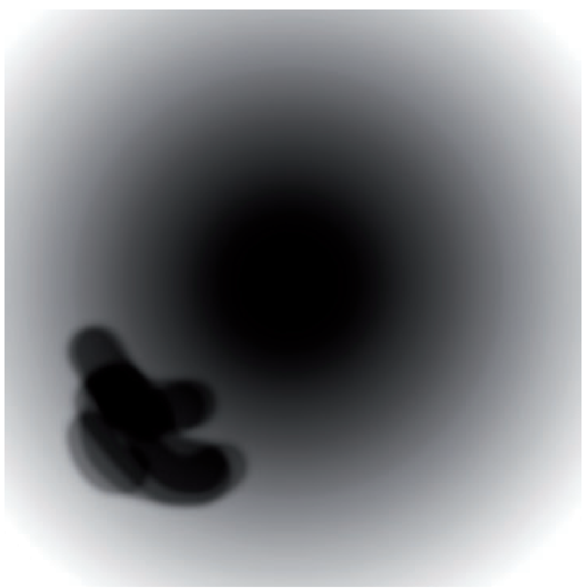


Fig. 10-4-j This is the mask I used in the Curves adjustment layer that contained the curves from Figure 10-4-i. The main component of the mask is a circular gradient running from black at the center to white in the corners. The dark splotch in the lower left portion of the mask corresponds to the bright white shirt in the photograph. I didn't want that shirt to get any lighter, so I blocked the effect of the Curves adjustment there.

left portion so that the white shirt wouldn't be further lightened (Figure 10-4-j).

Next I darkened the foreground to reduce the uneven flash illumination, using another Curves adjustment layer (Figure 10-4-k) with the mask in Figure 10-4-l. A bit of highlight burning-in on the white shirt in the foreground and some cloning work along the edges to clean them up took me to Figure 10-4-m.

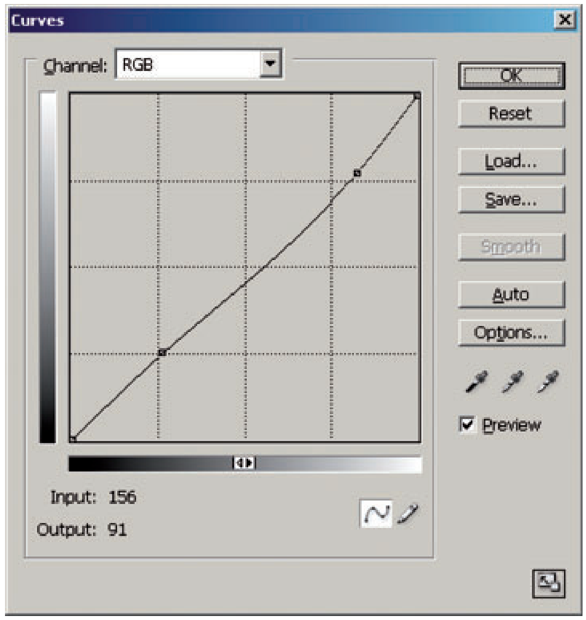


Fig. 10-4-k This Curves adjustment burns in the foreground of the photograph, which was brightly illuminated by the on-camera flash that made the photograph. I used this curve in an adjustment layer with the mask from Figure 10-4-l.

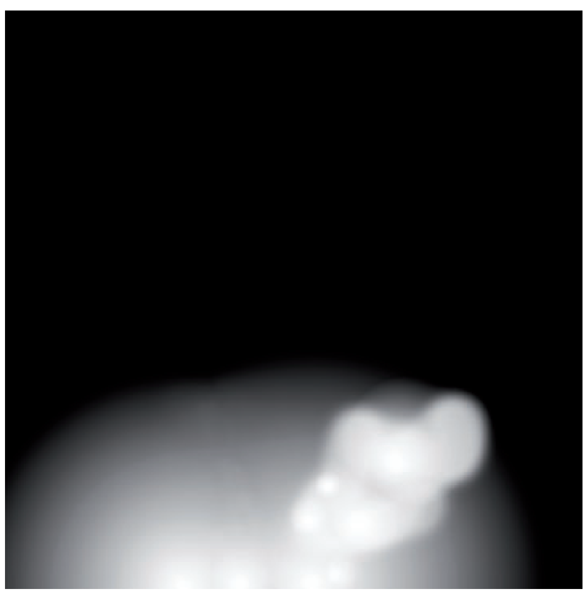


Fig. 10-4-l The mask for the foreground burn-in layer that evens out the illumination in the photograph by eliminating the hot spot on the tablecloth and the planter.

Fig. 10-4-m This is how the photograph looks after correcting the vignetting and the bright foreground with two Curves adjustment layers. Compare it to Figure 10-4-f; the lighting looks much better in this photograph.

It was time to deal with the orange-speckle problem. I wanted to create a mask that would select for them to avoid having to deal with each and every speckle individually. Since each speckle was minus cyan and plus yellow, I started by subtracting the blue channel from the red channel. I made a copy of the full-color image and used the Channel Mixer with the settings shown in Figure 10-4-n to subtract the channels and double the contrast.

This did a pretty good job of grabbing the speckles, although it retained some image detail. I made a Levels adjustment on that image to bring the speckles up to white and pushed everything else as close to black as I could without clipping off too many of the speckles (Figure 10-4-o). I copied that grayscale image into a new channel in the original file for use as a mask.

I loaded this mask as a selection and created a new Curves adjustment layer. I adjusted the red and blue curves to make as many of the speckles as possible blend into the background (Figure 10-4-p). This was highly successful, but some speckles were missed, and other parts of the image that were retained by the mask were slightly altered.

I fixed that by retouching the layer's mask. Using a white airbrush set to about 20% opacity I spotted out the few unrepaired speckles by adding gray and white dots to the mask. Switching the brush to black, I filled in the parts of the mask that erroneously selected real image detail, switching back and forth between viewing the mask and viewing

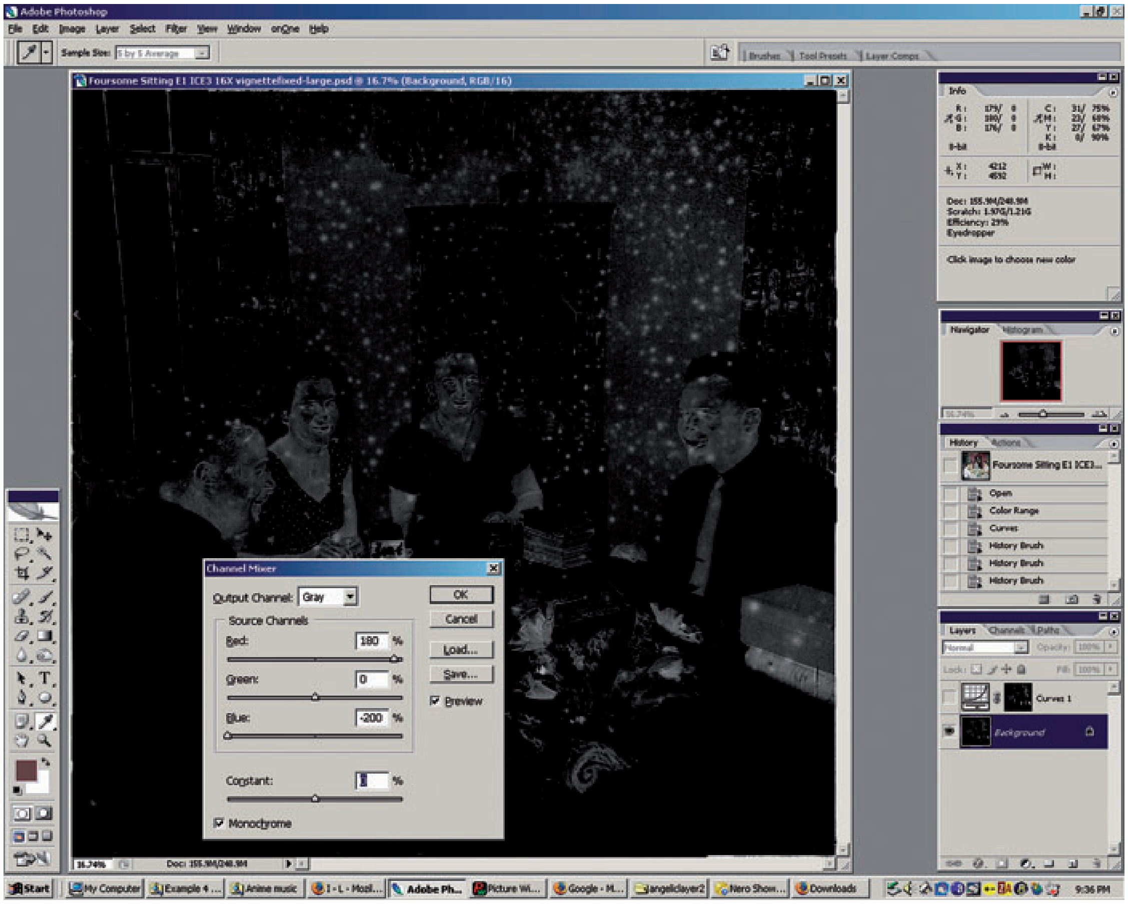


Fig. 10-4-n I used Channel Mixer to create a mask that selected for the “measles.” Since the measles are light in the red channel and dark in the blue, relative to the rest of the photograph (see Figure 10-4-b), I set the blue channel to –200% and adjusted the red channel until I got maximum contrast between the measles and the rest of the photograph (180%). That created the low-contrast mask in the background of this screenshot.

the photograph to catch areas I had missed. It took me over an hour to get to the finished mask in Figure 10-4-q, which is much less time than it would have taken to attack all the speckles by hand. Figure 10-4-r shows an enlarged portion of the photograph before and after speckle elimination.

Now we’re on the home stretch of the damage repair. There are some yellow stains in the man’s shirt in the foreground and some cyan stains on the other man’s left shoulder. I eliminated those easily by using the Clone tool set to Color mode to clone the color from the neutral part of the shirt over the stains. They disappeared entirely.

Fig. 10-4-o I used a Levels adjustment to greatly increase the contrast of the mask, making the majority of measles pure white and most of the rest of the photograph solid black.

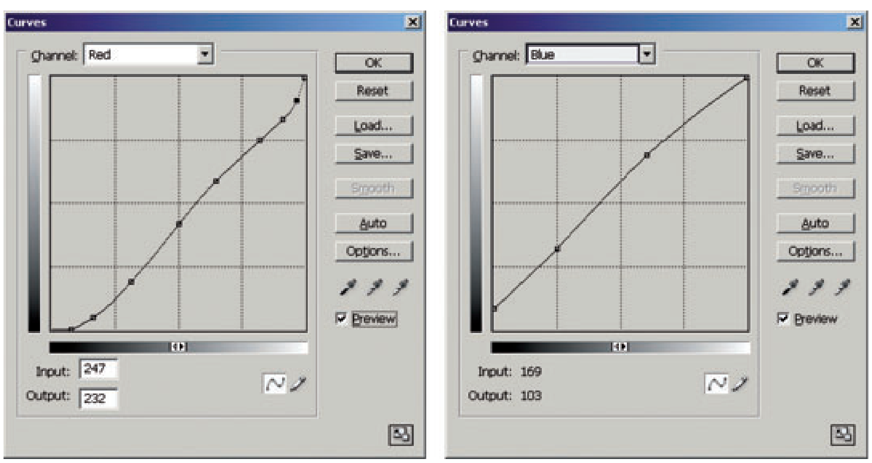


Fig. 10-4-p To attack the measles, I used these curves in a Curves adjustment layer that was masked with Figure 10-4-o. The red curve increases the amount of cyan in the measles, while the blue curve reduces the amount of yellow. I adjusted the curves by eye to eliminate as many speckles as possible. It did not do a perfect job; a few measles slipped past the adjustments, and some other parts of the image were affected.

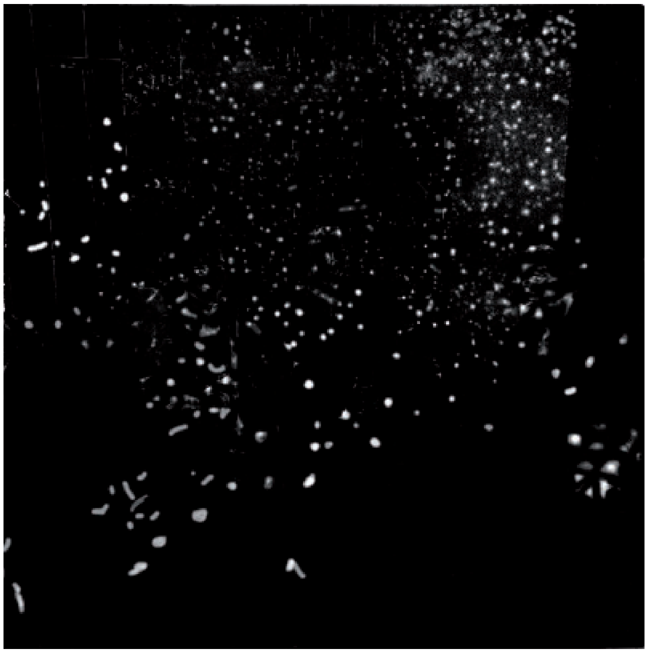


Fig. 10-4-q I hand-retouched the mask with white and black brushes to completely block out the photographic image and to pick up a few speckles that the Channel Mixer mask missed. This mask got rid of the measles most effectively (see Figure 10-4-r).

Fig. 10-4-r Before and after measles eradication! The figure on the left is enlarged from Figure 10-4-m. The figure on the right shows how well the Curves adjustment layer erased the measles entirely. Now that the photograph's been cleaned up, it's time to make the final tone and color adjustments.

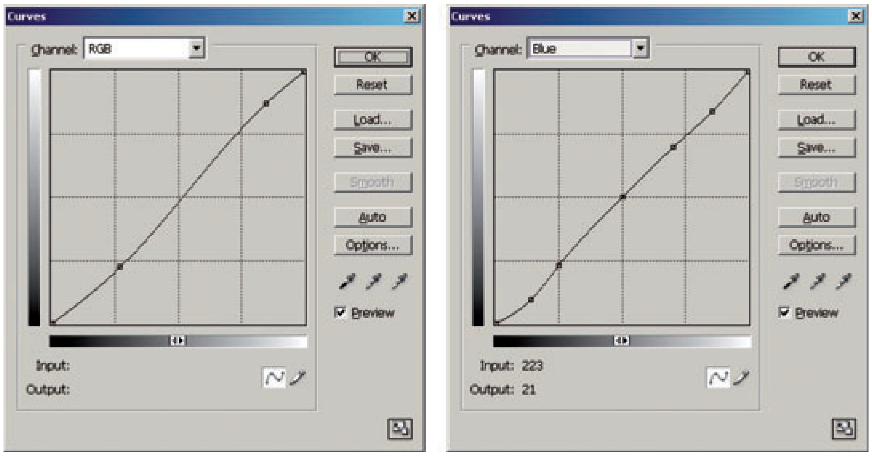


Fig. 10-4-s The RGB curve, a modest S-shaped curve, gives the midtones a little more brilliance and darkens the photograph slightly. The blue curve leaves the midtones alone but removes a small amount of blue color cast in the highlights and shadows (see Figure 10-4-t).

The burgundy wall in the background needed a little bit of cleanup to eliminate scan noise and slight tonal irregularities that were left behind by the orange-speckle elimination. Because the wall was distinctively colored, I could easily select for it using the Magic Wand with only a little bit of Lasso work to eliminate spurious selections in the curtain and china cabinet. I shrank that selection by 15 pixels and feathered it by 10. That was to avoid a sharp demarcation line between the selected area and the rest of the picture. Applying the Dust & Scratches filter with a radius of 50 pixels and a threshold of 5 cleaned up the wall very nicely.

Having completely cleaned up the damage, it was time for me to refine the tone and color. The photograph was dull and desaturated, problems easily fixed with a Curves adjustment layer that increased the midrange contrast (Figure 10-4-s). I also used this layer to refine the color in the highlights and shadows.

The skin tones still lacked a certain richness, so I increased saturation by 14 points and assigned that change to the History Brush. I reverted to the previous state and painted in the increased saturation on the folks' skin to get Figure 10-4-t.

Next I zoomed in on the faces and did a little cosmetic work. On-camera flash tends to blow out the highlights in a face and often produces sallow, even cyanotic, skin tones, depending on just how the light reflects off the skin. The two women look distinctly jaundiced, and the five-o'clock shadow on the man in the foreground had an unhealthy greenish cast. Hair highlights were also unrealistically blue.

I fixed all of this with the Burn tool set to an exposure of 5% for the midtones. First I switched to the green channel and brushed a bit of "blush" into the skin tones that were especially sallow. That also took care of the green five-o'clock shadow. Then I switched to the blue

Fig. 10-4-t This is how Figure 10-4-m looks after I've cleaned up the yellow stains and made the Curves adjustment from Figure 10-4-s. The colors look better, and the faces no longer look flat and pasty.

channel and ran the Burn tool over skin tones that were too pink and over the hair.

The trick is to not overdo this. I didn't want to wipe out the variations in tone and color, which would have made the faces look unnaturally flat. The objective was to narrow the range of colors and center all of them around a healthy look.

As a finishing touch on the faces, I used the Brush tool set at 5% strength to carefully brush some tone into the strong highlights on the faces. I used the eyedropper to sample the tones near the areas I wanted to soften. Just as with burning-in, it's important not to overdo this. A little bit goes a long way. Figure 10-4-u shows how much these little adjustments improved the people's appearance.

My very last action was to burn in the highlights and the midtones in the foreground by about 10%. This kept those broad light areas from dominating the picture so much, and it focused attention better on the people. The result is in Figure 10-4-v.

Example 5: Reassembling an Astronomical Glass Plate

I made the photograph shown in Figure 10-5-a, my first astrophotograph, back in high school in 1966. Back then all serious astrophotography was done on special glass plates that were only about half the thickness of the old pictorial photography glass plates. Twenty years ago

Fig. 10-4-u The enlargement from Figure 10-4-t, on the left, shows some unattractive hot spots on the faces, and the skin colors are slightly blotchy. The figure on the right shows the improved faces after a little retouching work with the Burn and Brush tools, as described in the main text.

Fig. 10-4-v Here's the finished restoration. The color looks good and natural, there's plenty of highlight and shadow detail, and I've attractively softened the harsh lighting of the original photograph. Plus, all the measles are gone!

my photograph got broken into eight fragments during a move. Now it's time to fix it.

Fortunately, all the breaks in the plate were very clean, so I was able to reassemble the pieces on the platen of the scanner in positions very close to where they should be in the repaired photograph. Unlike the antique glass plate in Example 1, this was an easy scan with no unusually high densities, so I didn't bother masking off the edges of the plate.

Fig. 10-5-a I made this photograph of the North America Nebula 40 years ago on a glass plate. It got broken in a move about 20 years ago. I'm glad I saved the pieces, because now I can repair it digitally.

My plate recorded a lot of sky glow in the "black" parts of the sky, so I adjusted the levels in the scanner software and the gamma to lighten up the scan (Figure 10-5-b). I also made some modest adjustments to the curves to open up the tones a bit more. None of this was strictly necessary, and a straight 16-bit scan would have been entirely adequate, but it never hurts to improve things early on.

I scanned the plate in 16-bit RGB mode at a resolution of 1200 ppi. In Photoshop, I flipped it left to right and used the Channel Mixer (Figure 10-5-c) to blend all three channels into a monochrome image and converted it to the grayscale file you see in Figure 10-5-d.

My next task was to reassemble all the fragments into as perfect a fit as possible before repairing the cracks. Because of my careful scan, there were almost no gaps between the fragments. The best tool for outlining each fragment as a selection was the Magnetic Lasso tool. Beginning at the lower right corner of the plate, I pinned the Lasso to the start of the edge of the long shard and dragged it along the crack, setting curve points as I went. When I finished selecting this long, thin knife-shaped fragment, shown against the pink mask overlay in Figure 10-5-e, I saved that selection as a mask in a new channel (Mask 1 in Figure 10-5-f).

Next, I used the Magnetic Lasso tool to pick out the horizontal crack that bisected the plate, selecting for the two fragments in the top portion

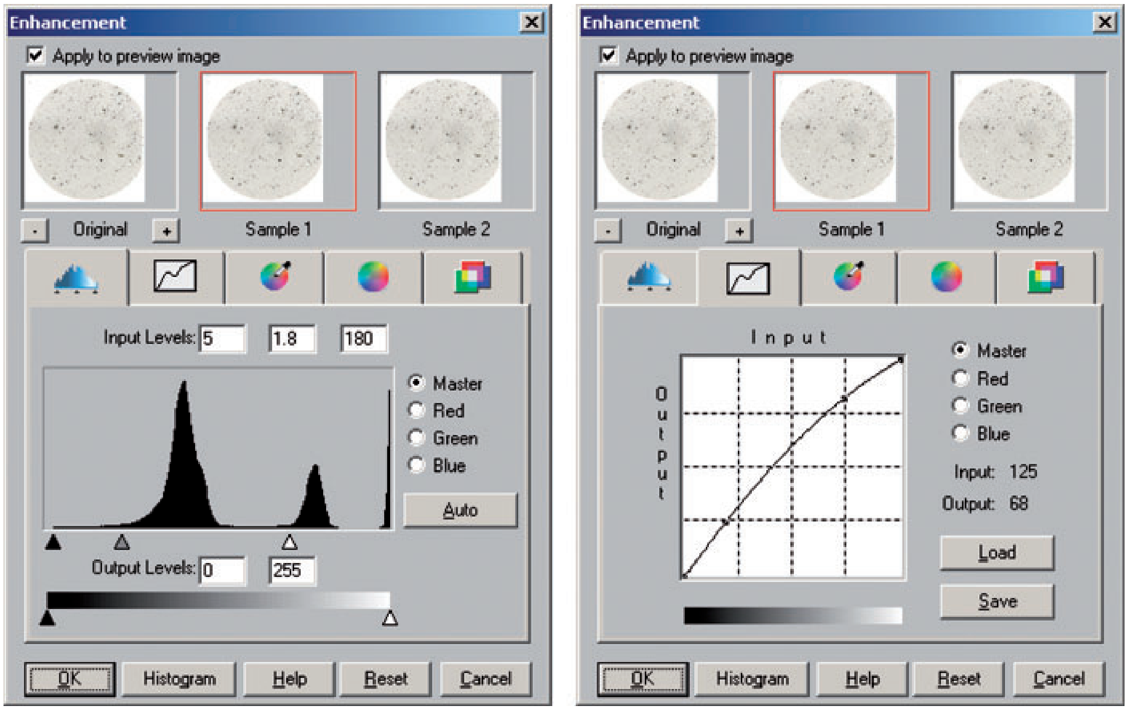


Fig. 10-5-b These are the scanner settings I used to produce Figure 10-5-d. They remove the overall fog and stain from the plate and increase the contrast in the dense parts of the negative, which correspond to the real astronomical details.

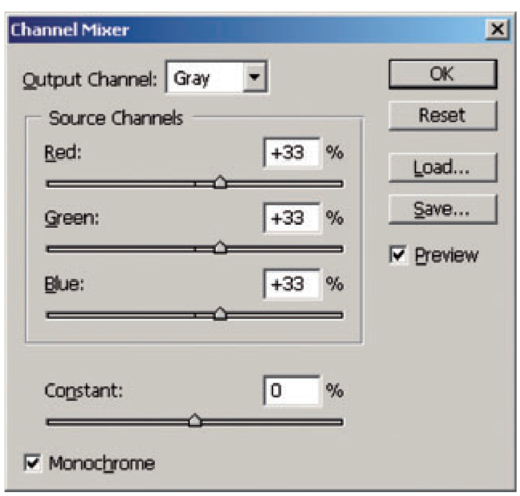


Fig. 10-5-c These Channel Mixer settings combine equal amounts of the RGB components of the scan to produce a grayscale image (Figure 10-5-d). This gives me maximum tonal information with minimum noise for this photograph.

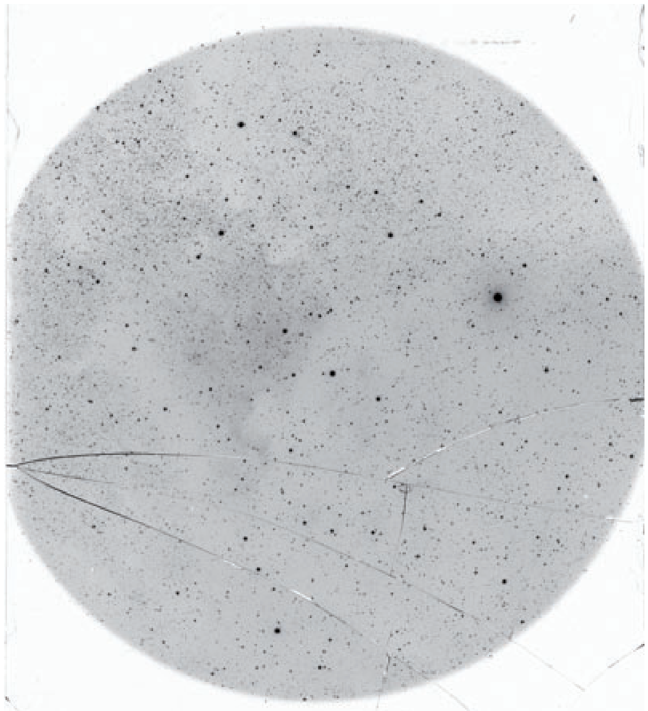


Fig. 10-5-d The adjusted scan of Figure 10-5-a, converted to grayscale. I positioned the shards of glass in approximate alignment on the scanner platen before making the scan. I'm going to have to digitally move them around like pieces of a puzzle to get the alignment perfect.

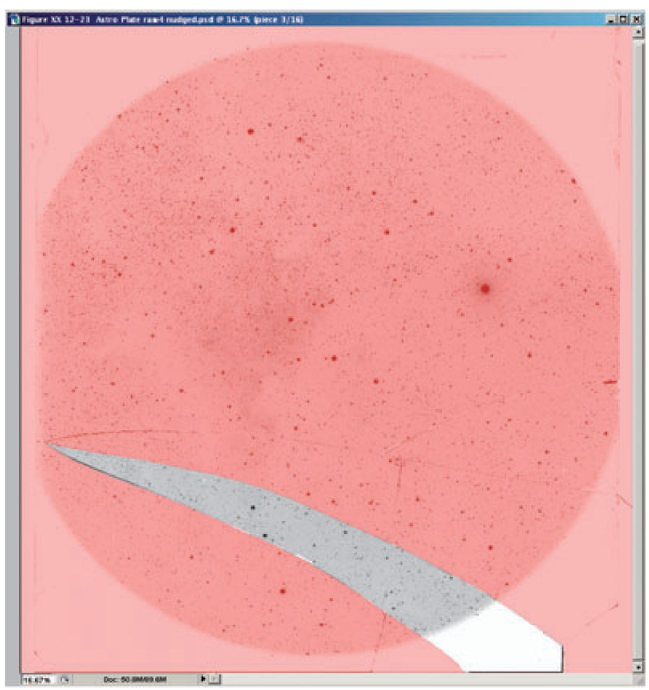


Fig. 10-5-e I use masks to isolate each fragment of the plate, so that I can nudge it into the exactly the right position. I made the mask, shown here as a pink overlay on the photograph, using the Magnetic Lasso tool to trace the boundary of this shard.

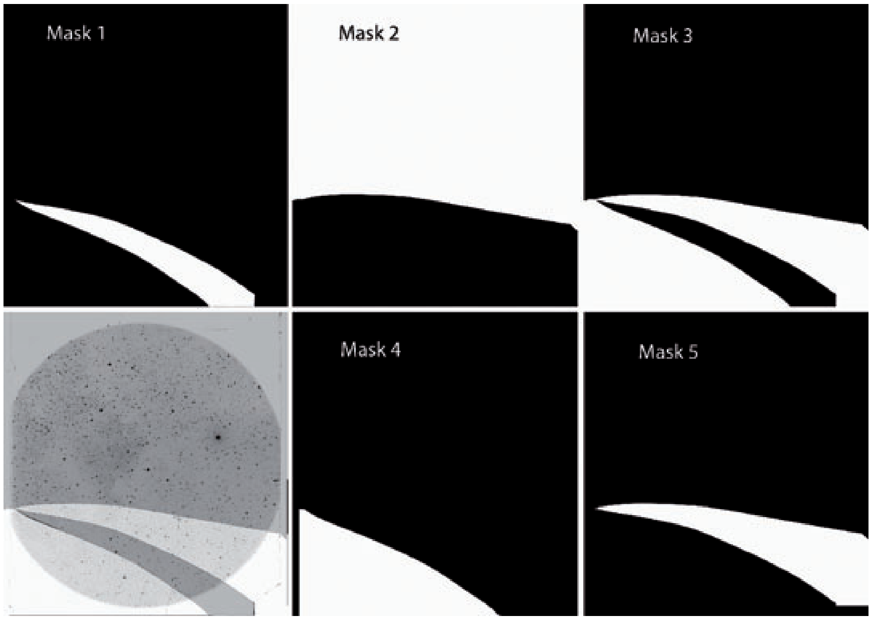


Fig. 10-5-f Mask 1 is the mask I created in Figure 10-5-e. I made Mask 2 by tracing the long horizontal crack with the Magnetic Lasso tool. Inverting Mask 2 and subtracting Mask 1 from it, using the Load Selection dialog, produced Mask 3, shown superimposed on the original photograph at the lower left. It selects two areas of the plate, each of which contains two fragments. I isolated those areas with the Lasso tool and saved them as Masks 4 and 5. I subdivided those masks using the Magnetic Lasso tool to give me four more masks (not pictured) for those individual fragments of the plate.

of the plate. I saved that mask in another channel (Mask 2, Figure 10-5-f).

I can combine masks in a variety of ways, so I can isolate some pieces of the plate without having to retrace their edges by adding and subtracting masks. For example, I loaded the first mask and inverted it; that selected everything but the thin knife-shaped shard. Using the Load Selection dialog, I inverted the second mask and added it to the selection I'd already made.

That composite selection I made subtracted out the knife-shaped shard and everything in the top of the plate (Mask 3, Figure 10-5-f). It neatly selected two areas, each containing two fragments, as you can see in Figure 10-5-f, lower left, where I've overlaid this selection on the original scan. Using the regular Lasso tool, I selected each of those areas in turn and saved them as separate masks (Figure 10-5-f, Masks 4 and 5). Now the plate was subdivided into sections containing one or two fragments. I used the Magnetic Lasso tool to select each individual fragment out of those masks. I used the large unbroken top half of the plate

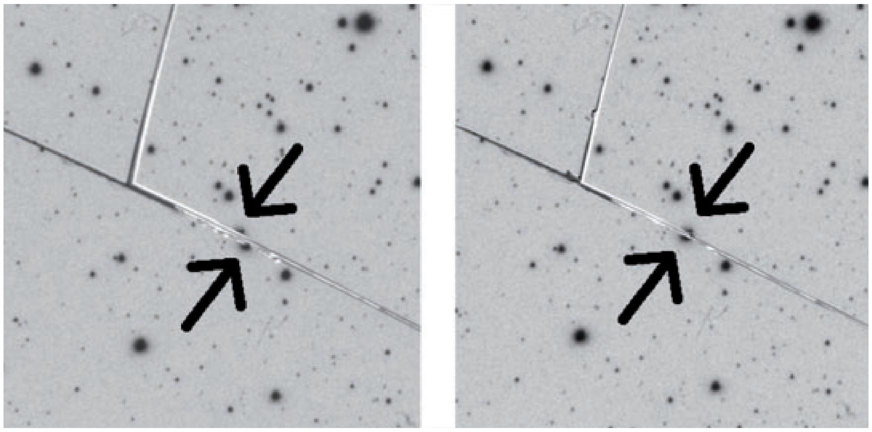


Fig. 10-5-g To find the correct alignment of the pieces of the plate, I looked for star images that straddled a crack and used them to match the two fragments. The arrows here point to the halves of such a star image in the unaligned (left) and aligned (right) images.

as a fixed base, loading the masks that selected the fragments that bordered that half and nudging them into alignment with it. I looked along the cracks for the occasional star image that straddled a crack (Figure 10-5-g). Those images worked like registration marks to let me guide the pieces into pixel-perfect alignment with each other. (*An aside:* If I were trying to preserve this as a scientific record, rather than just a nice picture, I would skip the whole next step of eliminating the cracks because that would erase real stars.)

Having "repaired" the plate, I erased the cracks themselves. The Median filter was ideal for this purpose because there was little or no detail along cracks that needed to be preserved, and the background was very uniform in average density. I set the filter with a wide radius (Figure 10-5-h) to completely obliterate the cracks.

I assigned the Median filter History state to the History Brush and reverted to the history state just before I applied the filter. That undid the global effect of the filter, so that I could use the History Brush to paint over the cracks

I attacked the cracks in two passes. The cracks themselves scanned as dark, but associated with them were clear parts where the emulsion of the plate had broken away. Those areas were all very small and whiter than the image and had no useful information, so I quickly painted them in with a large-radius History Brush set to Darken.

I zoomed in to 100% on the screen image and set the History Brush back to Normal with a radius of 5 pixels and 50% hardness. At that magnification, the cracks were long, shallow arcs for the most part. That permitted me to use shift-clicking to quickly select lengths of the crack and cover them over. I clicked the brush on the crack, moved the brush down the crack a short distance that corresponded to a "straight" segment, and shift-clicked the brush. The brush painted a straight line

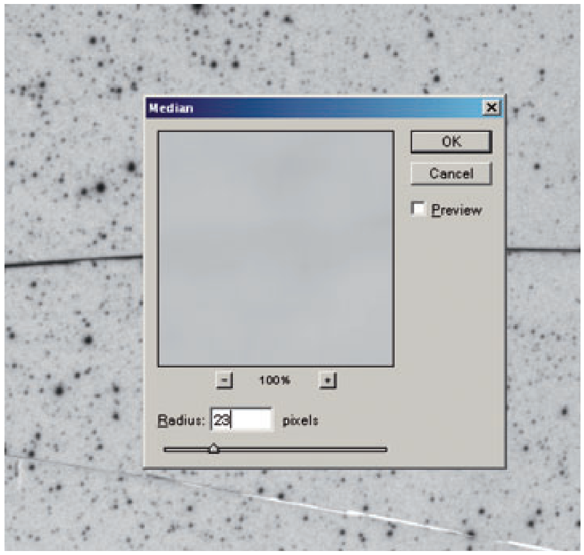


Fig. 10-5-h The Median filter, set to a wide radius, is a good way to erase the cracks. Here I've superimposed the Median filter preview on the corresponding area of the image. Observe how the dark horizontal crack's turned into an almost-invisible faint shadow. Painting in this filter with the History Brush eliminates cracks efficiently.

of Median filtering that nicely obliterated the short segment of the crack. I shift-clicked my way along the crack in short jumps, wiping whole sections with a single mouse-click. This was much faster and more accurate than manually painting along the length of the crack.

While I was at it, I used the Median filter History Brush to wipe out the scratches and dirt specks as well. Once the photograph was clean and crack-free, I cropped it and inverted the tones so that I could start working on it as a positive (Figure 10-5-i).

I used the eyedropper to spot-check the values in the darkest parts of the sky over the field of view. Near the center of the plate the blackest areas had a value of 88; this fell off radially to a value of 78 at the perimeter. I created a Curves adjustment layer to make the blacks darker and to even out the exposure.

First I created the adjustment layer with the curve settings shown in Figure 10-5-j. That layer dropped the values for the blacks by about 60 points. I wanted to darken the blacks at the perimeter about 10 points less than at the center to even out the exposure. That's five-sixths as much of a change at the edges as at the center.

To achieve this I added a radial gradient mask to the layer. I set the foreground color to 100% white, the background color to 85% (five-sixths) white, set the starting point of the gradient at the center of the circular image, and drew a gradient line out to just beyond the edge of the field of view. That produced the mask shown in Figure 10-5-k, which reduced the effect of the layer by just the right amount to give me a uniform exposure over the entire plate (Figure 10-5-l).

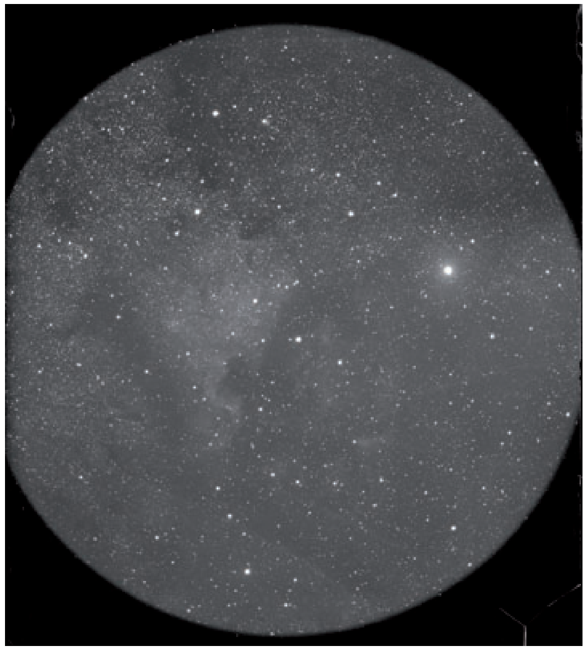


Fig. 10-5-i Here's the plate, repaired, cleaned up, and inverted to make a positive image. Now it's time to improve the tonality and clean up residual artifacts left from the repair job.

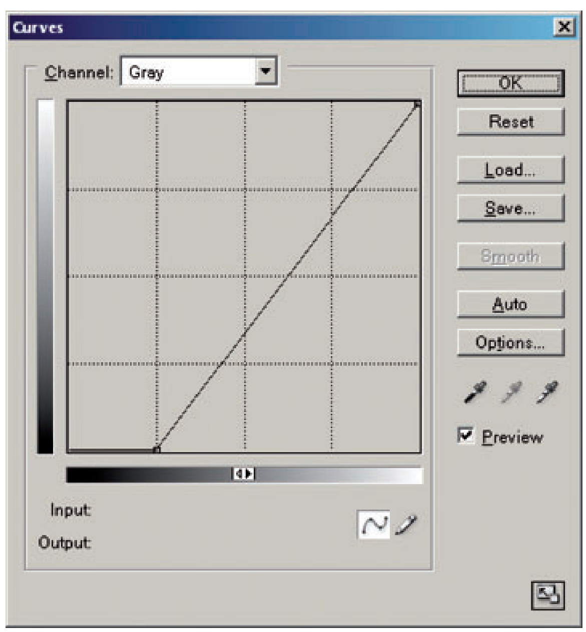


Fig. 10-5-j This Curves adjustment takes the sky background down to a dark charcoal gray in Figure 10-5-l. I used it in conjunction with the mask in Figure 10-5-k to even out the light falloff at the edges of the image.

Fig. 10-5-k This faint circular gradient mask, used in a Curves adjustment layer with the curve from Figure 10-5-j, produces the uniform and good-looking photograph in Figure 10-5-l.

Fig. 10-5-l Here's the photograph corrected with a Curves adjustment layer using the curve from Figure 10-5-j and the mask from Figure 10-5-k.

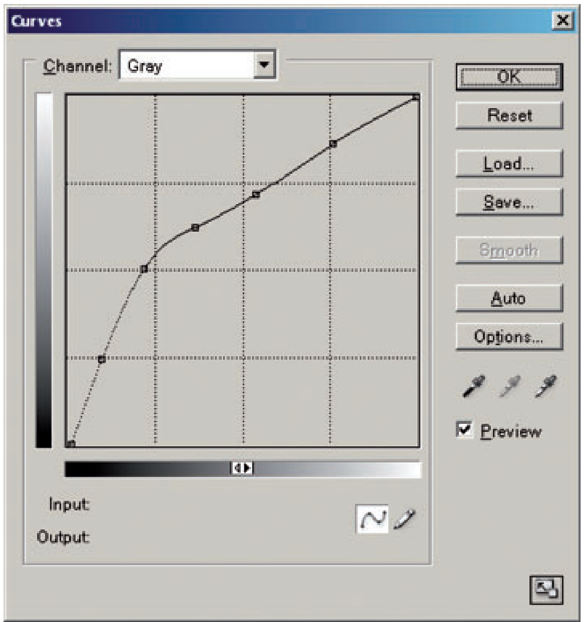


Fig. 10-5-m This Curves adjustment enhances contrast in the shadows, bringing out faint nebulae and detail in Figure 10-5-q.

I added a second Curves adjustment layer (Figure 10-5-m) that made the blacks a little richer and greatly boosted the contrast in the shadows to bring out the faint nebulosity without sacrificing detail in the star images. From an overall pictorial point of view this looks great, but the heavy contrast boost made it clear that more work was needed to blend the erased cracks into the image. Figure 10-5-n shows a particularly bad section that I selected with the Lasso tool for correction.

Image Doctor is very good at dealing with this type of problem. Its Smart Fill function does a better job of synthesizing complicated random-looking textures than the Spot Healing Brush in Photoshop or manual cloning and blending. Image Doctor only works on 8-bit images, though, which is the reason I didn't apply it earlier. I wanted to do as much tonal correction as I could to the photograph before reducing the bit depth from 16 to 8 bits.

After converting the photograph to 8 bits, I applied Image Doctor's Smart Fill to the area I selected (Figure 10-5-o). That produced almost the effect I wanted (Figure 10-5-p), but some areas that should have been filled with faint nebulae were filled with darker sky areas.

I corrected that using the History Brush. I assigned the Smart Fill operation to the brush, and reverted to the previous history state. I set the brush to 100% strength and Lighten and painted over the selected area. That laid down the random star images that Smart Fill had created for me. Then I switched the brush to Normal and 40% strength and

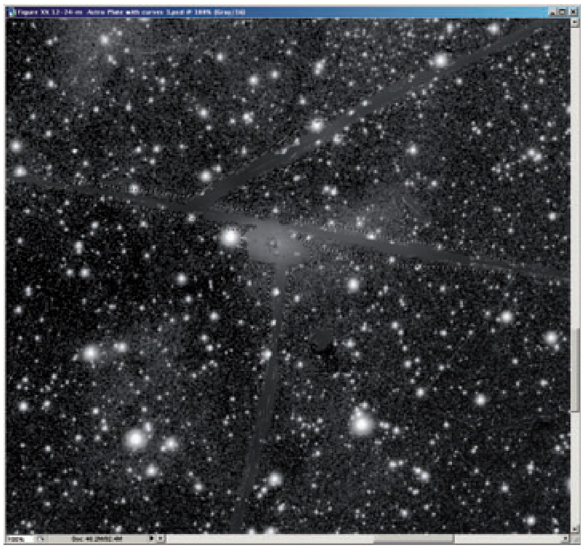


Fig. 10-5-n This screenshot shows an enlargement of the plate where four shards come together and some of the emulsion was flaked off (down and to the right of center in Figure 10-5-d). Here, the Median filter created a blur that has a distinctly different look and texture from the surrounding star field. I selected that region with the Lasso tool for repair by Image Doctor.

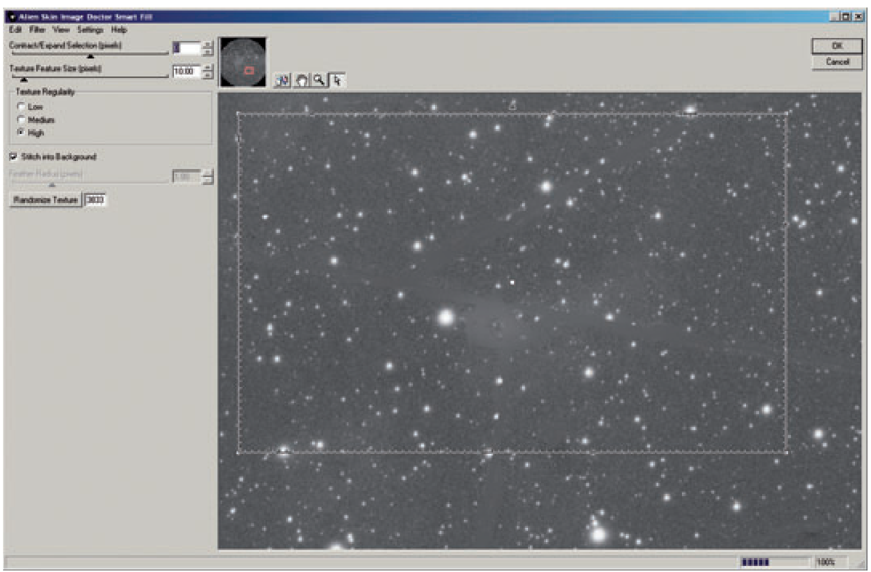


Fig. 10-5-o Image Doctor analyzes the star field inside the rectangular region that bounds the selection in Figure 10-5-n. It synthesizes texture and detail from that information to fill in the selection area (Figure 10-5-p).

started painting in the crack, applying more strokes of the brush to the darker areas and fewer to those where I wanted to retain more of the nebula's glow. That did an almost perfect job (Figure 10-5-q). In this manner I was able to work over all the obvious cracks and blend them almost invisibly into the background. The finished photograph is shown in Figure 10-5-r.

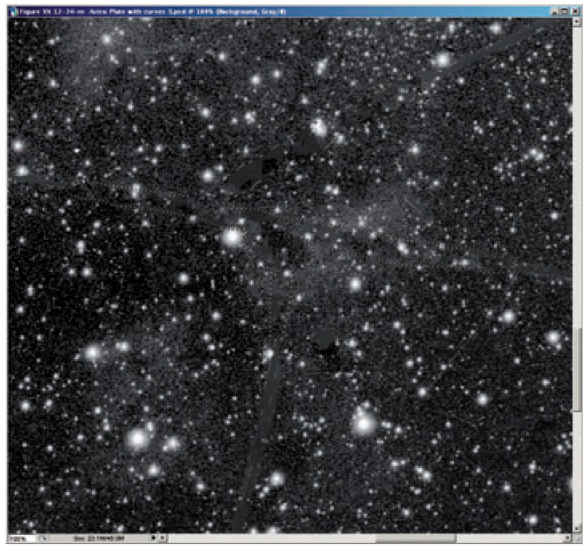


Fig. 10-5-p Here's the repair job that Image Doctor did. I left the dotted selection line on to make it easier to see the repaired region. Note that the stars and nebulae that fill the repaired area are not real. They're inventions of Image Doctor. This kind of repair would not be acceptable if the restoration were meant to have historical or scientific value.

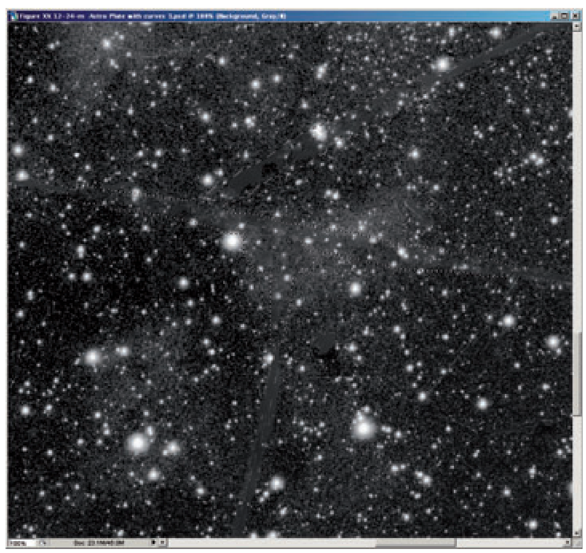


Fig. 10-5-q Image Doctor didn't produce precisely the effect I wanted in Figure 10-5-p, so I assigned that result to the History Brush and reverted to the previous state. I used the Brush in Lighten and Darken modes to paint in Image Doctor's corrections with just the strength needed to make it blend into the surrounding image.

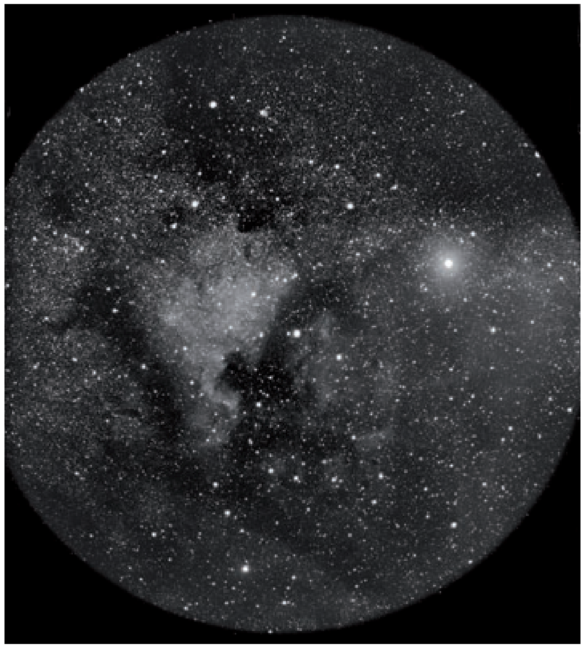


Fig. 10-5-r The finished photograph, after the Curves adjustment from Figure 10-5-m. I not only completely repaired the cracks, but with the assistance of Photoshop's tonal-control tools, I made a photograph that looks better than the original print I had made from the unbroken plate in the darkroom.

Example 6: A Rare and Historic Old Polaroid

I made (I've never liked the phrase "taking" pictures—I don't take' em, I make' em.) this Polaroid photograph (Figure 10-6-a) as a teenager more than 40 years ago. What makes it historically interesting is that it's a portrait of the world-famous physicist, Dr. Richard P. Feynman. What makes it rare is that it shows him with a mustache, a short-lived "look" for the brilliant scientist. For those reasons, I wanted to make minimal changes to this photograph when I restored it. I did not want to obscure or alter some detail that might be of importance to a future viewer.

Where the lacquer didn't sufficiently protect the silver from oxidation, the Polaroid had turned yellowish, but that hadn't gotten so bad yet that it substantially altered densities. Since the blue channel didn't provide any detail that wasn't in the red and green channels and it was the one that showed the color shift most strongly, I used the Channel Mixer to combine equal parts of the red and green channels to make a new monochrome image, just as I did in Example 1 (Figure 10-1-d).

Next I cleaned up the white spots, which were places where the Polaroid image hadn't transferred to the receiving sheet when it was made. I did that using the Dust & Scratches filter, set to a radius of 7 and a threshold of 12, and assigned to the History Brush. The reason I

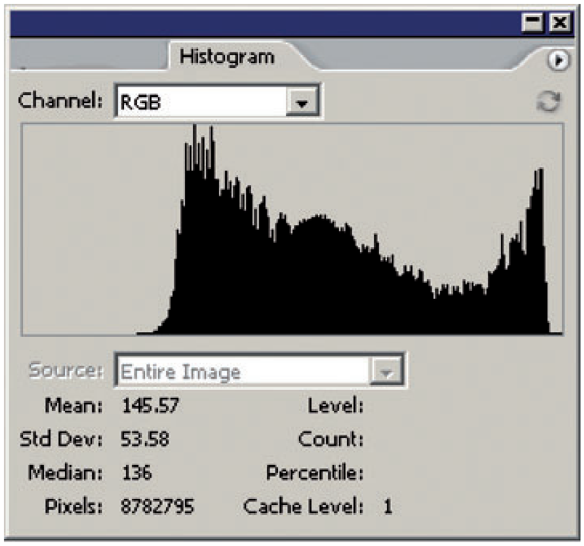
Fig. 10-6-a This 40-year-old Polaroid photograph of Dr. Richard P. Feynman sporting a mustache was made by the author as a teenager. It has faded and needs restoration, but because it has historical value I want to alter the image as little as possible.

Fig. 10-6-b This grayscale scan is a mix of 50% red and 50% green channels. It has good tones, but it lacks contrast, as shown by the histogram in Figure 10-6-c.

used that high threshold was to make sure that the Dust & Scratches filter wouldn't alter any of the grain in the photograph.

I used the History Brush in Darken mode to paint out the white specks. The background was out of focus, and the filter hadn't changed any of the grain in the photograph, which allowed me to use a very-large-radius brush to eliminate all white specks in the background with only a few strokes. There was no fine image detail there that I had to be worried about obliterating.

Now I had a pretty clean photograph (Figure 10-6-b), but the contrast was flat, and it didn't have good blacks. The histogram in Figure 10-6-c,



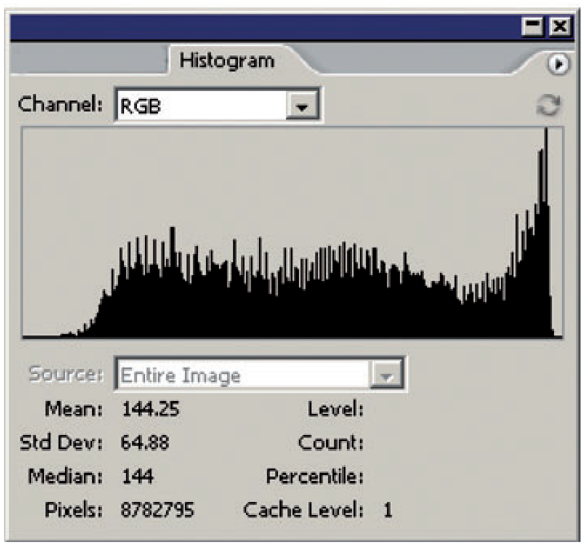


Fig. 10-6-c The top histogram, for Figure 10-6-b, shows that the whites are pretty good, but the blacks are substantially lacking in density. That leads to the correction curve in Figure 10-6-d. Applying this curve produces Figure 10-6-e, whose histogram is shown in the lower figure here.

top, showed that I wasn't using the lower 25% of the tonal range effectively, so I applied the curves in Figure 10-6-d. The adjusted photograph (Figure 10-6-e) looked a lot better, with the histogram in Figure 10-6-c, bottom. That's a much better distribution of tones.

Overall, though, I felt the photograph was a bit harsh; and had that "amateur look" characterized by poor tonal separation in the highlights and shadows. The shirt in particular looked blown out. It was time to use Photoshop's Shadow/Highlight adjustments (Figure 10-6-f; see

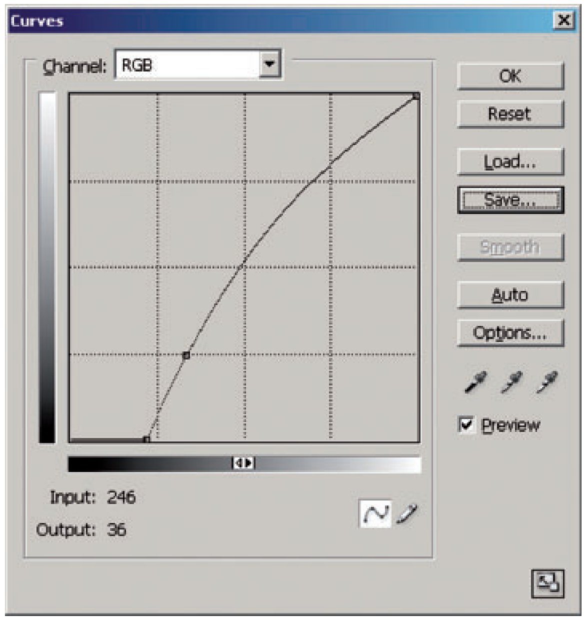


Fig. 10-6-d In this Curves adjustment, I've pulled the black point way in to improve the tonal range in the photograph. I bowed the curve upward to maintain midtones at the same level because they looked good in Figure 10-6-b. The result is Figure 10-6-e.

Fig. 10-6-e The tonality is considerably improved, but I'd like the detail in the highlights and shadows to be a bit better. I can enhance this with the Shadow/ Highlight adjustment (Figure 10-6-f).

Chapter 5, Restoring Tone, page 145, for a full explanation of how to use this tool). I set the Shadow Amount at 24% and the Tonal Width to 16%, to restrict the change to the deepest shadows. I added just a bit of highlight correction—only 5% over a Tonal Width of 29%—but even that small amount made a big difference in the results, as you can see in Figure 10-6-g. Shadows are opened up, there's much more detail

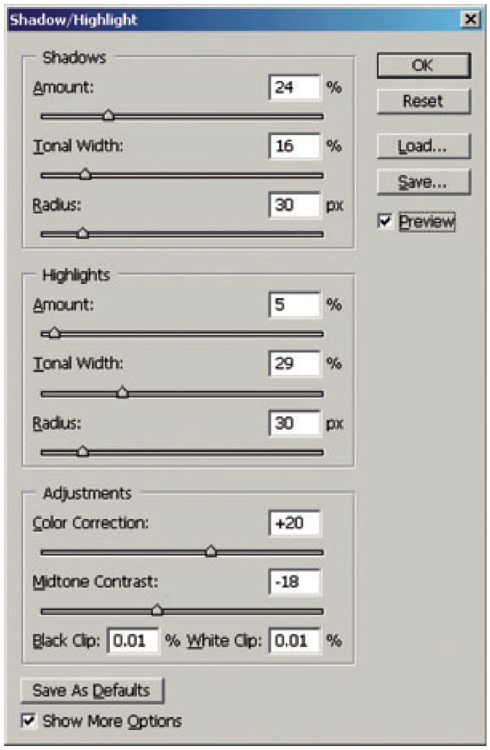


Fig. 10-6-f This Shadow/Highlight adjustment produces Figure 10-6-g. I applied a substantial amount of shadow adjustment, but I kept the tonal width small, so only the darker shadows were affected. I added in a little bit of highlight adjustment to improve detail in the shirt and dropped the midtone contrast substantially to give the photograph a more pleasing, linear tonal scale overall.

Fig. 10-6-g The improvements produced by the Shadow/Highlight adjustment in Figure 10-6-f are subtle, but they make the photograph look noticeably better than Figure 10-6-e. Highlight and shadow detail are definitely improved.

Fig. 10-6-h The tone- and contrast-enhanced photograph is fairly grainy, as can be seen in the left figure. I used DIGITAL GEM to suppress the grain without sacrificing fine detail (right).

visible in the shirt, and the overall tonality looks a lot smoother and more professional.

I could have stopped at this point, but I wanted to see if I could suppress the grain in the photograph a bit. This was a small (less than 3 inches long) photograph made on Polaroid 3000 speed film. Consequently the photograph was grainy to begin with, and correcting and enhancing the contrast only accentuated that (Figure 10-6-h, left).

Because of the historical value of the photograph, I didn't want to do any grain reduction that would reduce image detail in the slightest. After experimenting with the blurring and noise reduction filters in Photoshop and Picture Window, I concluded that the best way to suppress the grain without destroying any detail was with a third-party plug-in. Two that did a good job on this photo were PixelGenius's PhotoKit Sharpener edge-protected smoothing brush and Kodak's DIGITAL GEM (Figure 10-6-i), discussed in Chapter 3, Software for Restoration.

I went with GEM. The settings were the default ones except for blending, which I reduced to 55%. (I could have accomplished the same thing by applying the filter at full strength and fading it back to 55% afterward.) This softened the grain without compromising image detail (Figure 10-6-h, right).

As the finishing touch, I burned in the sky and the background along the right edge with a 5% highlight burn. That darkened those areas just enough to direct the focus of attention onto Dr. Feynman (Figure 10-6-j). A subtle change, but one that substantially improved the composition for me without compromising its accuracy.

Fig. 10-6-i The DIGITAL GEM plug-in, shown in this screenshot, substantially softens the grain without destroying fine detail.

Fig. 10-6-j This fully restored photograph looks much better than the original Polaroid print in Figure 10-6-a, and I achieved these improvements without changing any important details in the photograph. The restoration looks much better than the original, but it is still historically accurate.

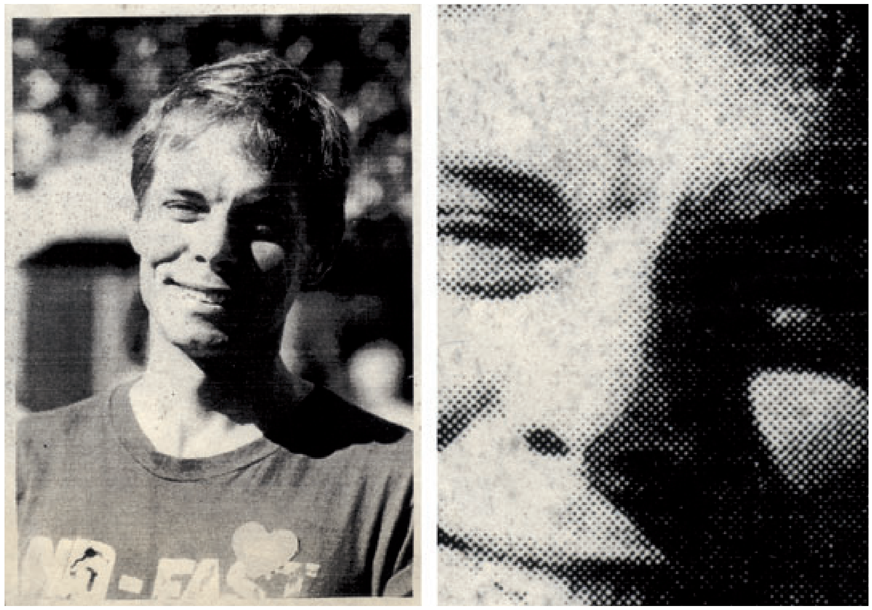


Fig. 10-7-a Photocopies of photographs can be restored! This memorial photograph from a color snapshot was screened and poorly photocopied onto nonarchival paper. After less than a decade, lots of dark spots have appeared.

Example 7: Fixing a Photocopied Halftone

The photograph in Figure 10-7-a is a clipping from a memorial service pamphlet that was printed in the late 1990s. It was not very good to begin with; the original photograph, presumably a color snapshot, was screened and poorly photocopied for the leaflet. During its short life it's gotten much worse, because the nonarchival paper started developing brown spots and freckles, which are easily seen in the enlargement on the right.

The first restoring step was to get rid of the halftone screen. I turned to the Focus Magic stand-alone program, which includes a Despeckle filter for eliminating halftone dots (see Chapter 9, page 321). Figure 10-7-b, top, shows the Focus Magic control panel. I selected a dot pitch of 17 pixels, which closely matched the spacing between halftone dots. Running the program produced the result shown in Figure 10-7-b, bottom.

The original halftone screen has been replaced by a low-contrast secondary pattern with a spacing of 8 pixels. I ran the program again with the settings shown in Figure 10-7-c and got a nearly dot-free result. The descreened photograph, converted to grayscale, is shown in Figure 10-7-d; compare it to Figure 10-7-a.

Next I went after the horizontal photocopy "scan lines" that are visible throughout the photograph. I created a Curves adjustment layer to use as a burn-in layer (see Chapter 5, page 160) with the curve shown

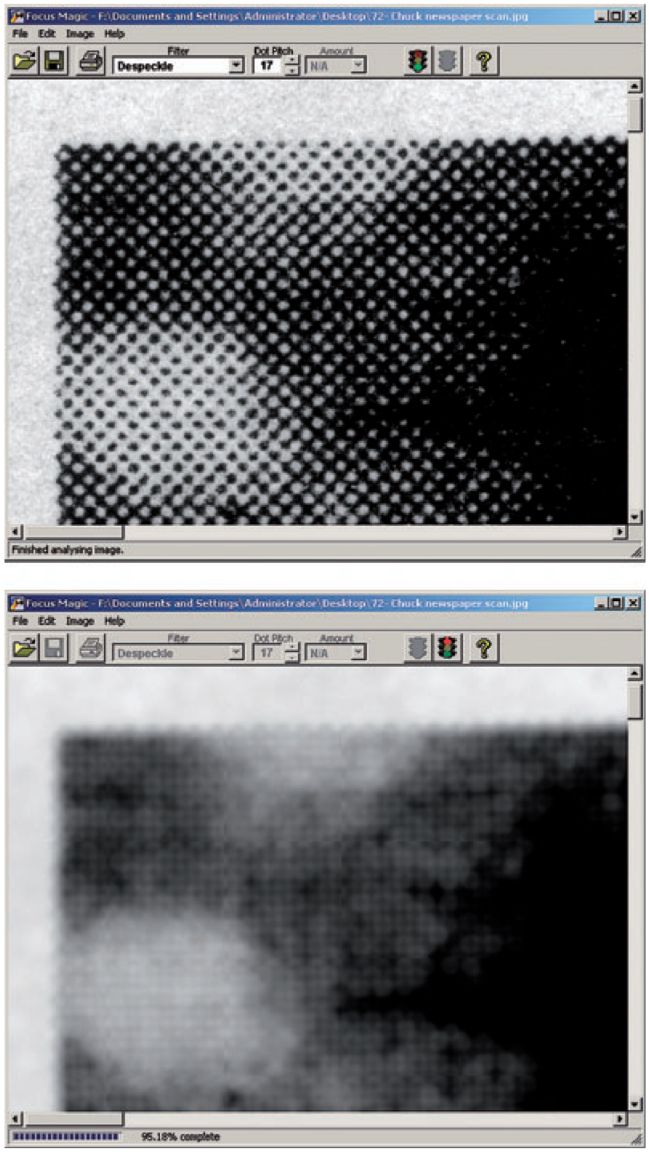


Fig. 10-7-b Focus Magic's stand-alone application is a good tool for eliminating halftone screens. The top figure shows the Focus Magic control panel previewing the upper corner of the photocopy before descreening. The bottom figure shows the photocopy after it's been "despeckled" with a 17-pixel radius. There's still some residual screen pattern.

in Figure 10-7-e. I filled in the mask channel for that layer with black and used a white brush to paint over the scan lines, darkening them until they blended into the surroundings. The finished burn-in mask is on the right in Figure 10-7-e. Figure 10-7-f shows an enlarged section of the photograph before and after burning-in, so you can see in detail how the mask worked to subdue the lines.

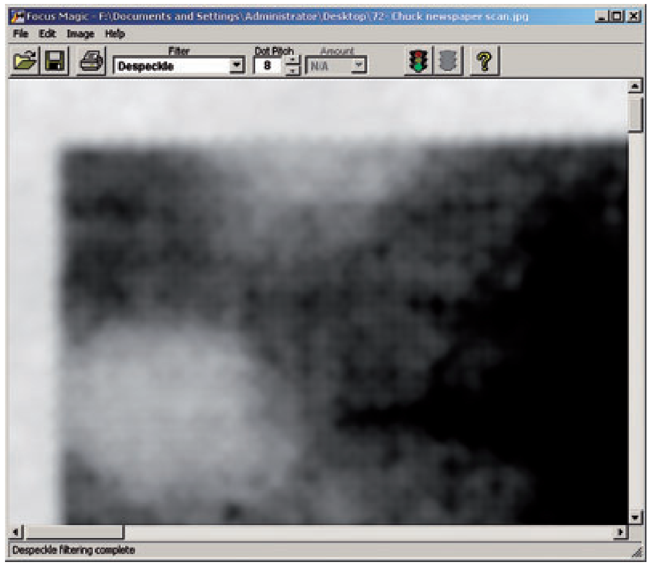


Fig. 10-7-c A second pass with Focus Magic, using an 8-pixel radius, completely removes the screen pattern. Figure 10-7-d shows the results.

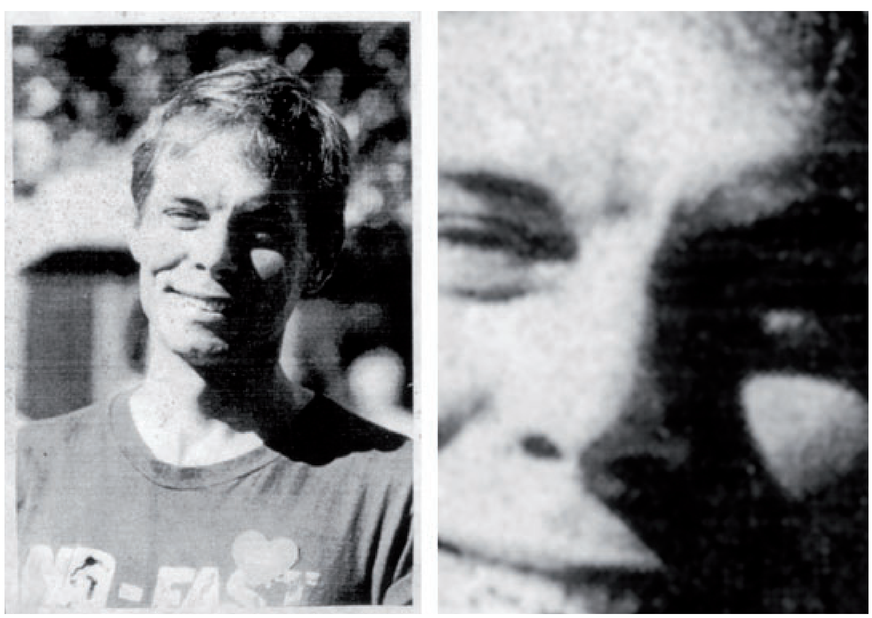


Fig. 10-7-d This is what Figure 10-7-a looks like after being descreened with Focus Magic and converted to grayscale. The photograph is almost as sharp as the original photocopy, but that annoying screen pattern is entirely gone. Copier "scan lines" mar the photograph, though.

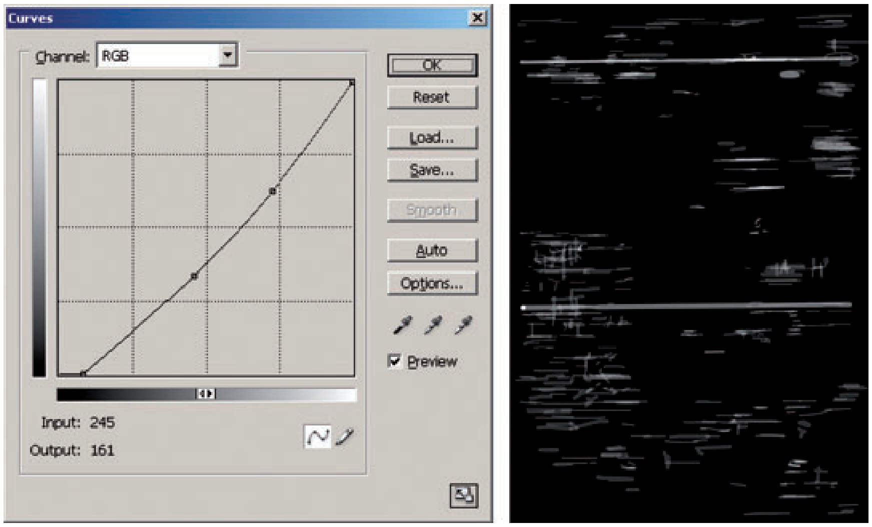


Fig. 10-7-e A burn-in Curves adjustment layer can get rid of scan lines like those in Figure 10-7-d. The burn-in curve that I used is shown on the left. After I brushed out all the scan lines, the finished mask for that adjustment layer looked like the right figure.

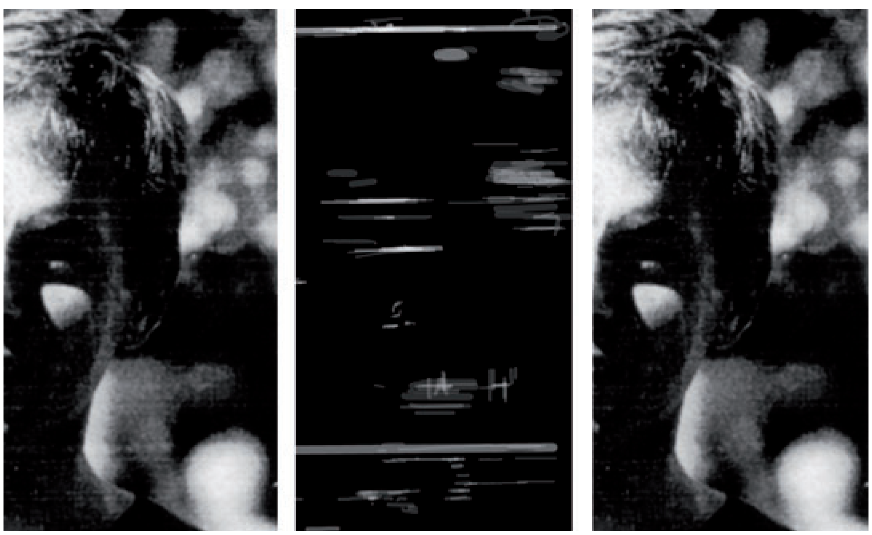


Fig. 10-7-f This enlargement shows how well the burn-in adjustment layer in Figure 10-7-b cleaned up the photograph in Figure 10-7-d. On the left is a section of that photograph before burning-in. In the center is the corresponding section of burn-in mask from the adjustment layer. On the right is the cleaned-up photograph.

I added another Curves adjustment layer to reduce the contrast of the spots in the photograph. The Color Range selection tool created a mask that selected only the light areas of the photograph (Figure 10-7-g, right). That layer's curve lightens and reduces the contrast in the middle-light tones to almost nothing. If there were any middle-light detail in the photograph, it would be completely suppressed by this curve. Since there isn't, it has almost no effect on the photograph proper, but it substantially subdued the spots.

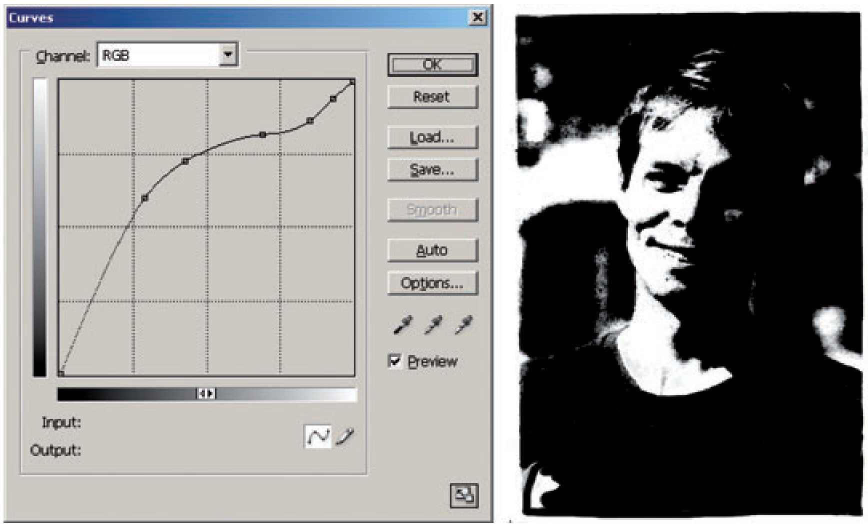


Fig. 10-7-g This Curves adjustment layer suppresses the dark "freckles" marring the paper by dropping the contrast in the middle highlights to nearly zero. The mask on the right, created with the Color Range selection tool, limits the effect of this curve to the highlight areas of the photograph.

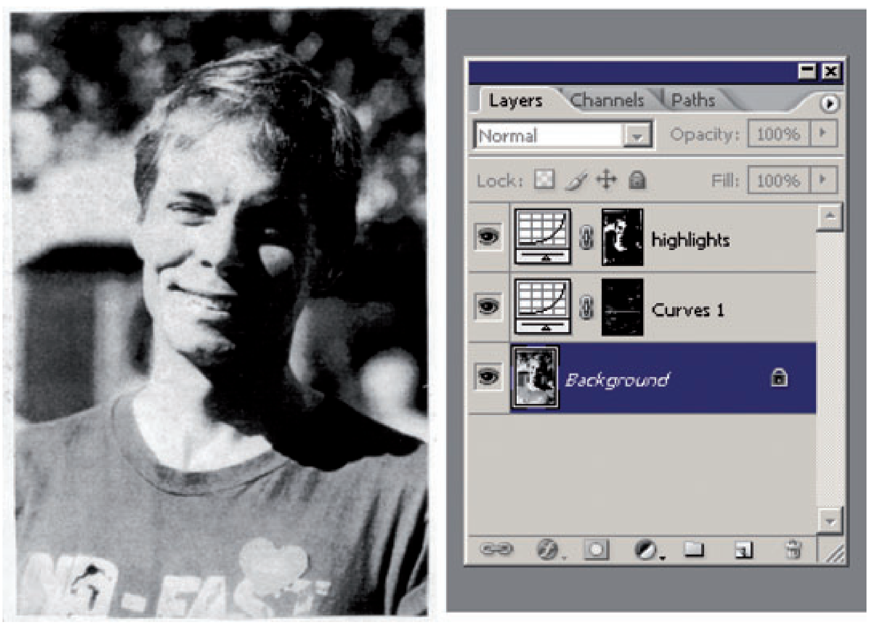


Fig. 10-7-h The photocopy after I've eliminated the scan lines and suppressed the freckles. The Curves 1 layer in the layer stack holds the burning-in that gets rid of the scan lines (see Figure 10-7-d). The highlights layer reduces the appearance of the freckles (see Figure 10-7-g).

Figure 10-7-h shows the result, with the layer stack on the right. Freckles are only visible in the light, featureless parts of the photograph, so I attacked them aggressively. I ran the Dust & Scratches filter with a zero-threshold and a 30-pixel radius. I assigned that filter to the History Brush, reverted to the previous history state, and painted over the blank, light parts of the photograph with the brush to erase the freckles.

Fig. 10-7-i In Figure 10-7-h, I used the Dust & Scratches filter with the History Brush to eliminate the freckles from the highlights. Then I used a 35-pixel Gaussian Blur filter with the History Brush to smooth out the background and make it less distracting. Just a bit more cleanup and a little tone correction, and this restoration will be complete.

I didn't like the distracting background, so I ran the Gaussian Blur filter with a 35-pixel radius, assigned it to the History Brush, and painted over the background. Those two operations got me to Figure 10-7-i, which looks pretty nice!

The last major thing I did to finish up the photograph was to enhance the detail and contrast to the highlights. I created another Curves adjustment layer with the curve in Figure 10-7-j. That curve leaves everything but the lightest tones untouched (see Chapter 5, Restoring Tone, page 148). It drastically increases the contrast in the tones with values above 200, darkening the lower values, lightening the higher values, and taking the lightest values up to almost pure white.

As a finishing touch, I lightly burned in the line of the jaw and curve of the cheek to define the face better. The final result is shown in Figure 10-7-k. I don't claim that this is a gorgeous photograph, but it is astonishingly better than what I started with. It should come as no surprise that it made the owner of the clipping incredibly happy.

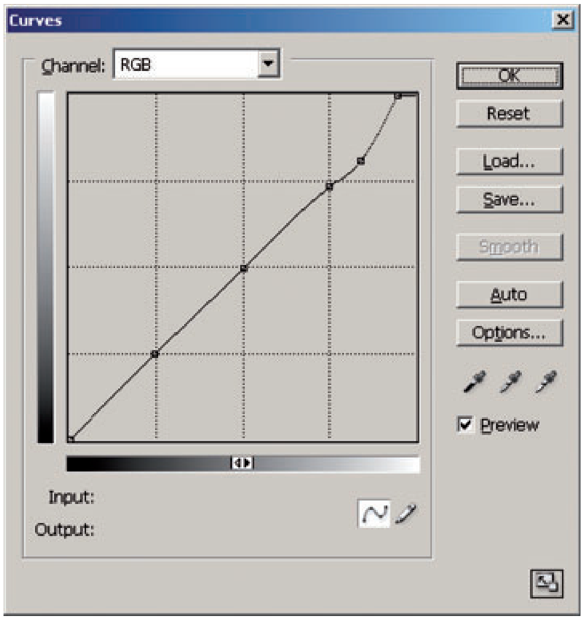


Fig. 10-7-j This Curves adjustment boosts the contrast in the highlights, helping to emphasize what little detail is present there. It also cleans up the whites, making them close to pure white instead of dingy gray, as shown in Figure 10-7-k.

Fig. 10-7-k The finished restoration. After applying the curve from Figure 10-7-j, I did a little bit of burning-in along the jaw line and the cheek to bring out some modeling in the face. Compare this to the original in Figure 10-7-a; it's an immense improvement!

Fig. 10-8-a It's hard to believe there's anything worth rescuing in this 1950s color snapshot. Hardly any detail is visible except in the shadows.

Example 8: Restoring an Almost-Blank Photo

Back in Chapter 5, Restoring Tone, on page 167, I introduced you to Figure 10-8-a, the most badly faded photograph I've restored to date. I showed you how a careful scan combined with DIGITAL ROC could restore some semblance of color and detail to the photograph (Figure 10-8-b).

This photograph is still extremely pale, so I added the Curves adjustment layer shown in Figure 10-8-c. The curve greatly darkens the photograph and increases the contrast in the highlights and midtones by a factor of three. I incorporated a radial gradient mask in the layer to eliminate light falloff in the original photograph. That falloff wasn't apparent until I applied the Curves correction, but as Figure 10-8-d, left, shows, it was there just waiting to come out. The gradient mask neatly eliminated most of it; I left some falloff to focus attention on the baby.

Now that I could more clearly see the photograph, not to mention the dirt and scratches, I cleaned it up with my usual technique. I applied the Dust & Scratches filter with a radius of 11 pixels and a threshold of 8, assigned that filter to the History Brush, and reverted to the previous History state. I set the Brush to Lighten mode and cleaned up the photograph. The Clone tool picked off the few blemishes that the History Brush missed.

Figure 10-8-e, left, shows what the photograph looked like after I'd cleaned it. It's apparent that the color is a little uneven; it's hard to make

Fig. 10-8-b A careful scan and DIGITAL ROC make a big difference. Now there's color and detail in the baby and crib. It's faint, to be sure, but it's something to work with.

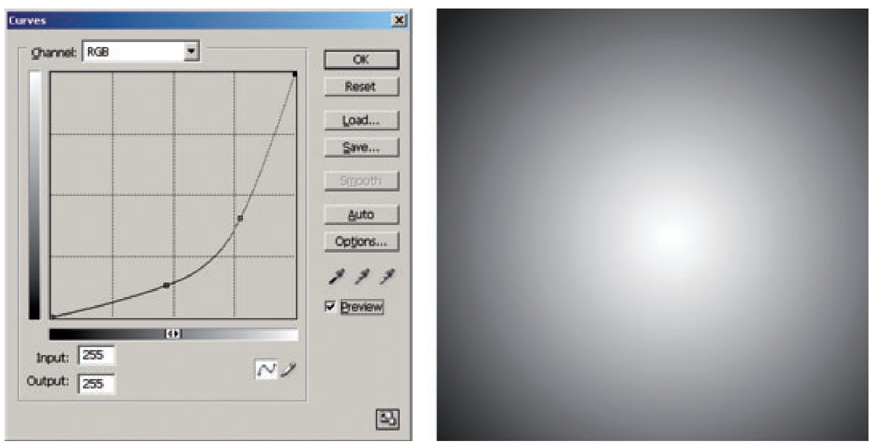


Fig. 10-8-c A Curves adjustment layer turns Figure 10-8-b into Figure 10-8-d. This RGB curve darkens the photograph and greatly increases contrast and detail in the highlights. The radial gradient mask for the layer evens out the exposure, eliminating the vignetting at the corners of the photograph.

out, so I added a Hue/Saturation layer set to +50 points. That amplified the color differences, producing the figure on the right. Now the pattern of red and green mottling is very clear.

I went after that with a couple of Curves adjustment layers. These work like the dodging and burning-in adjustment layers I introduced in Chapter 5, page 160, except that here I'm using them to correct color instead of tonality.

Fig. 10-8-d Here's Figure 10-8-b after applying the Curves adjustment layer from Figure 10-8-c. The photo on the left shows the effect of the RGB curve before I added the gradient mask; the photograph has serious light falloff at the edges. The mask evens out the lighting in the photograph (right).

Fig. 10-8-e The Dust & Scratches filter, used in conjunction with the History Brush, cleans up Figure 10-8-d very nicely. The photograph on the left has normal saturation. I added a Hue/Saturation adjustment layer with +50 points saturation to the photo on the right. This makes it easier to see the color blotches while I correct them with some adjustment layers.

First, I tackled the reddish tinge around the perimeter of the photograph with the curves in Figure 10-8-f. The green and blue curves shift the color toward the greenish-cyan, the complement of the color cast that I want to remove from the photograph. I filled in the mask channel for that layer with black, set the Brush tool to white, and painted out the unwanted tint. Just as in Chapter 5, I ignored what was actually happening in the mask channel; I only paid attention to the color in the photograph. The enhanced saturation produced by the Hue/Saturation layer worked like a kind of a magnifying glass for color; it was really easy to see subtle differences in the tint and paint them away. The finished mask is shown on the right.

Next, I went after the greenish-yellow splotches in the center of the photograph with the Curves adjustment layer in Figure 10-8-g. The red

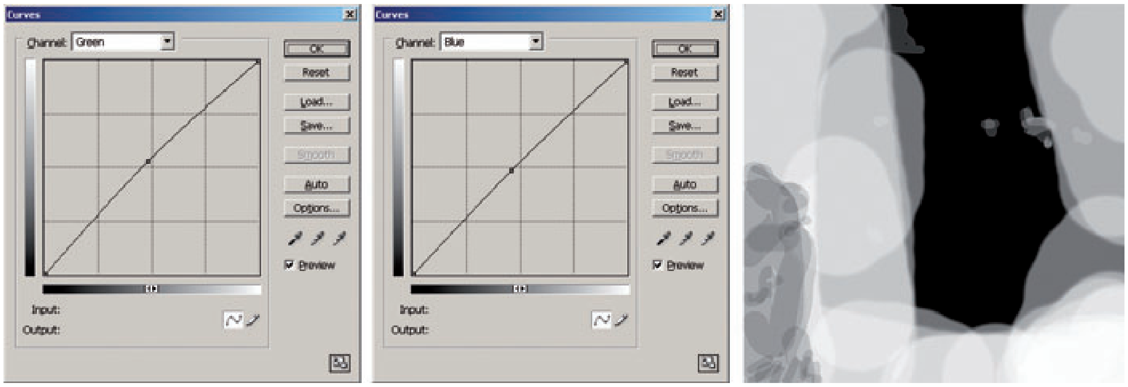


Fig. 10-8-f This Curves adjustment layer eliminates the reddish tinge around the periphery of the photograph. The green and blue curves shift the hue away from red. I hand-painted the mask on the right the same way I created burn-in layers in Chapter 5. The mask restricts the curves' effects to just those parts of the photograph I need to erase the unwanted red from.

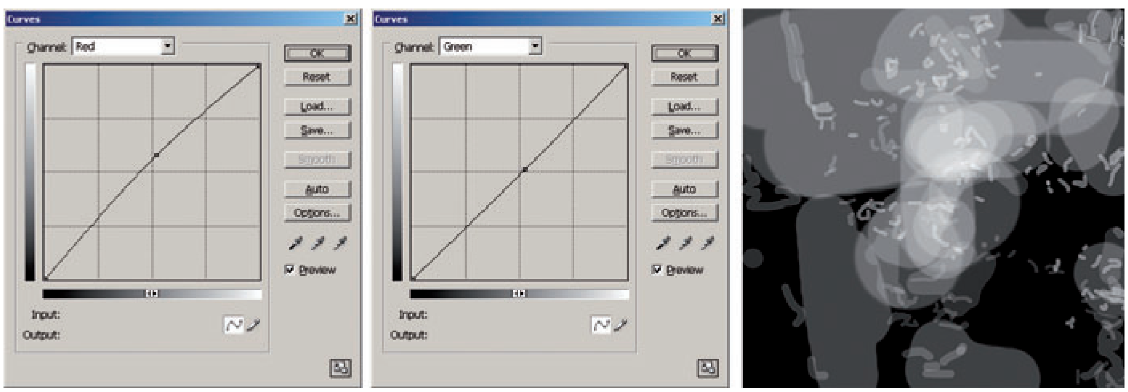


Fig. 10-8-g A second hand-painted Curves adjustment layer eliminates most of the green-yellow spots. The red and blue curves shift the color toward neutral. Figure 10-8-h shows the results.

and green curves shift the color toward red-magenta to cancel the color of the splotches. I painted in the mask channel wherever I saw that greenish-yellow tinge in the photograph until most of it was eliminated.

After I finished getting rid of the color mottle, I discarded the Hue/Saturation layer. The photograph that this color retouching produced, shown in Figure 10-8-h, has pretty good overall color balance but the saturation is very low. Also, there's a lot of grain and noise in the photograph, as is evident in the enlargement. Tackling that noise was my next challenge.

Fig. 10-8-h The two Curves adjustment layers in Figures 10-8-f and 10-8-g did a good job of eliminating the large areas of uneven color. As the enlargement on the right shows, though, there is still a lot of grain and color noise, especially cyan, in this photograph.

I turned to the Neat Image Pro+ plug-in (Figure 10-8-i). I selected an area on the back of the crib (gray square) and let Auto Profile compute the noise signature for the photograph. Then I ran Auto Fine-Tune to fine-tune the noise profile using the whole image. I applied that profile with the default filter settings to get Figure 10-8-j. The fine noise is gone, and the photograph looks a lot cleaner. The most distracting problem is an overall pattern of fine, slightly dark and bluish marks that obscure the delicate, light tones in the photograph. There's no way to filter those out; it's time for handwork.

The dark marks are very hard to see clearly, so I added a new Curves adjustment layer (Figure 10-8-k) to the photograph that greatly increases its contrast and darkness. Now the defects stand out, permitting me to retouch them the same way I corrected the large pink and green areas in the photograph. I created a dodging adjustment layer with the curves shown in Figure 10-8-l. The RGB curve lightens up the tones. Since the dark spots are, on average, a little cooler in color than the rest of the photograph, I also adjusted the red curve to remove a small amount of cyan. I filled in the mask channel with black and went to work with the white Brush tool set to an opacity of 20%.

It took me about 45 minutes to clean up the photograph, producing the mask in Figure 10-8-l, right. While doing this work, I noticed that there were some pink-green color variations that I hadn't completely cleaned up in Figure 10-8-h. I went back to the Curves adjustment layers that dealt with that and did a little more fine work on their masks. Adjustment layers are great that way; you're not locked into one set of corrections. You can modify or improve on them at any time.

The result of all that work is shown in Figure 10-8-m, left. The contrast-enhancing layer is still in place. The photograph doesn't look perfect; there's some residual tonal noise and variation visible in the

Fig. 10-8-i Neat Image is a great tool for fixing difficult noise problems. In the first control panel (top), I selected an area on the back of the crib to analyze for noise and grain, and ran Auto Profile and Auto Fine-Tune to create a noise profile for the photograph. In the second Control Panel (bottom), I applied that noise profile with the default filter settings shown on the right.

Fig. 10-8-j Here's Figure 10-8-h after Neat Image has finished with it. The grain pattern is completely gone, and the color noise is greatly reduced.

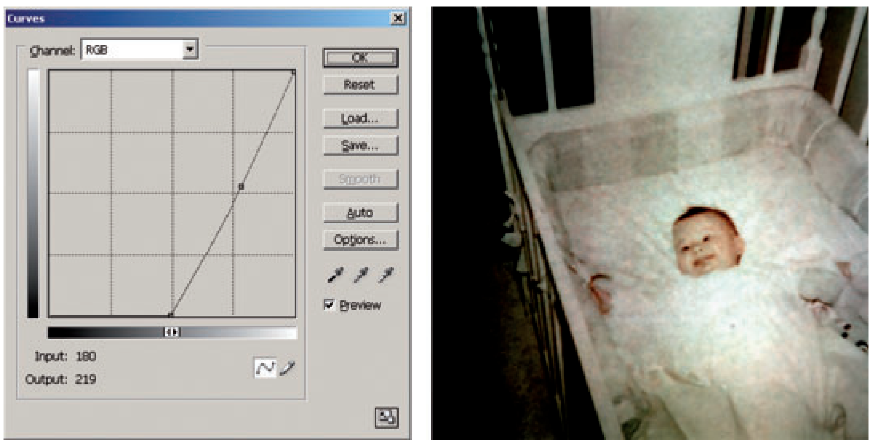


Fig. 10-8-k I added a Curves adjustment layer with the RGB curve on the left to the photograph, to exaggerate highlight contrast. This makes it easier to see the tone and color variations that I want to retouch out of the photograph.

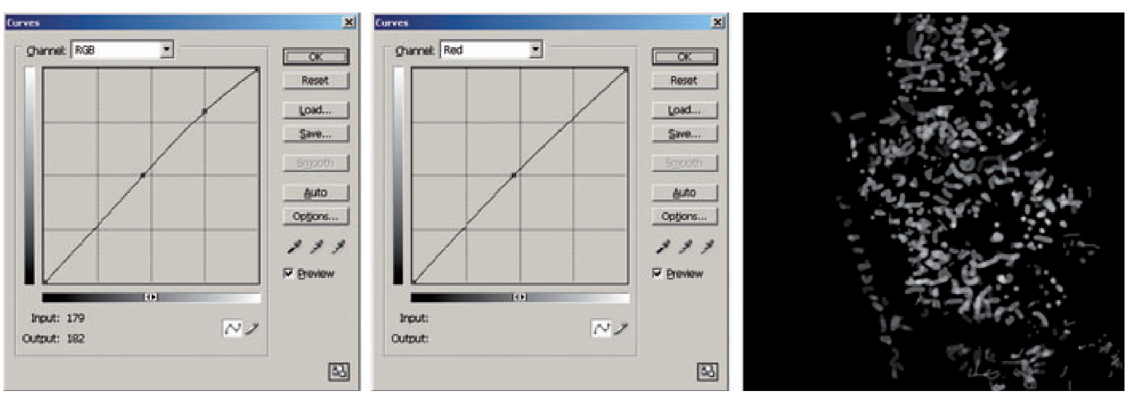


Fig. 10-8-l This Curves adjustment layer eliminates the pattern of faint dark spots that obscure the photograph in Figure 10-8-j. The curves lighten and slightly redden the parts of the photograph that the mask (right) allows to be affected. I hand-painted this mask to clear out those dark spots, producing Figure 10-8-m.

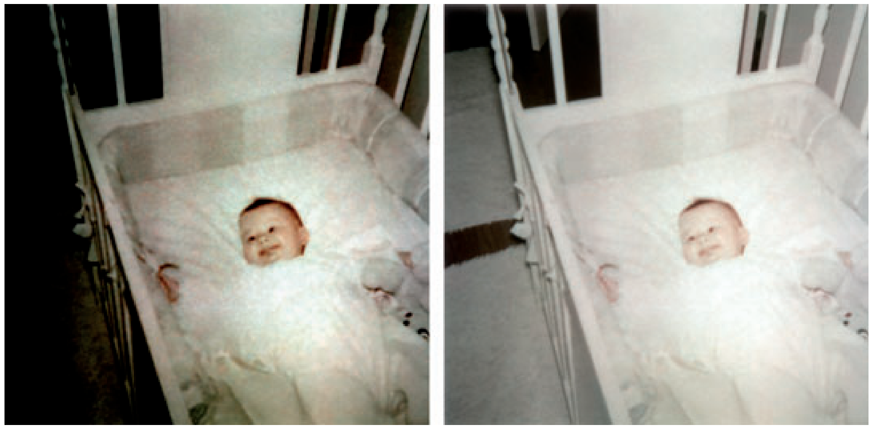


Fig. 10-8-m On the left is the retouched photograph, using the dodging adjustment layer from Figure 10-8-l. The contrast-exaggerating layer is still in place. Deleting that layer yields the figure on the right; compare this to Figure 10-8-j.

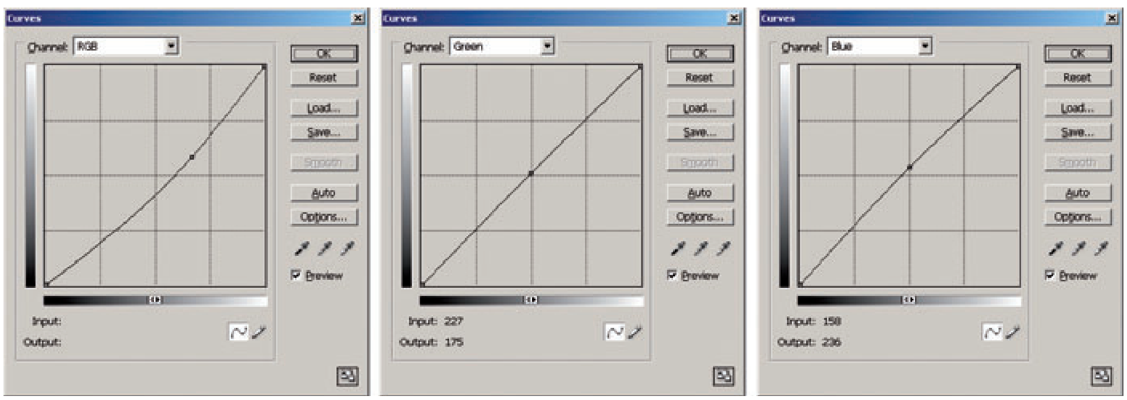


Fig. 10-8-n This Curves adjustment layer makes the final tone and color corrections to the photograph. The RGB curve darkens the photo a little and improves highlight detail, while the green and blue curves correct the color balance by removing a little yellow-orange cast.

photograph. But that's only visible because of the enhancing layer. As soon as I strip that off (right), the photograph looks nicely uniform and even. Compare this to Figure 10-8-j.

I finally have a clean photograph, and I'm on the home stretch. I'm ready to make the final tone and color adjustments to this photograph. I created a new Curves adjustment layer with the curves shown in Figure 10-8-n. The RGB curve darkens the photo a bit and increases contrast in the highlights. The green and blue curves remove a little bit of excess yellow-orange color and make the photo more neutral overall.

I felt the baby's face still lacked healthy color, so my final correction was to add the Hue/Saturation adjustment layer shown in Figure 10-8-o.

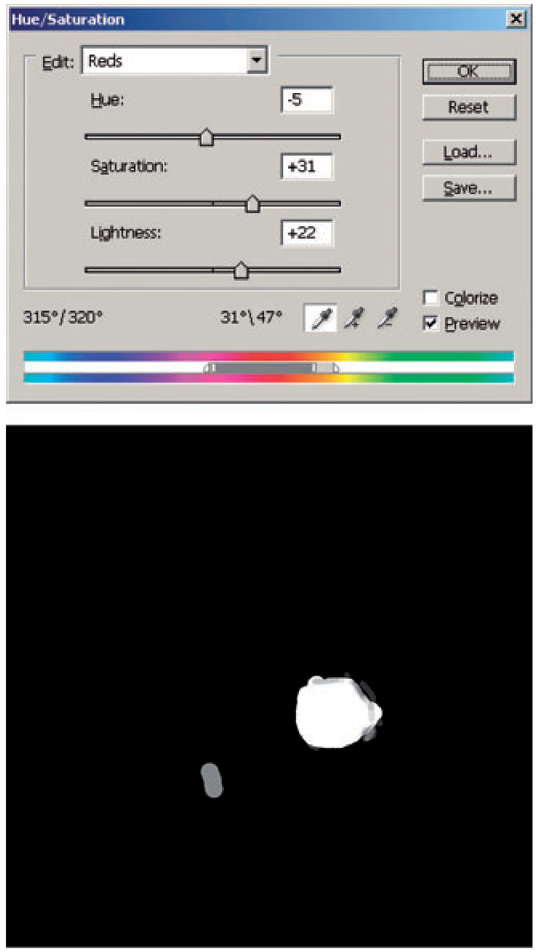


Fig. 10-8-o This Hue/Saturation adjustment layer improves the color in the baby's skin, making it lighter, pinker, and more saturated. The hand-painted mask prevents the rest of the photograph from being altered by this layer.

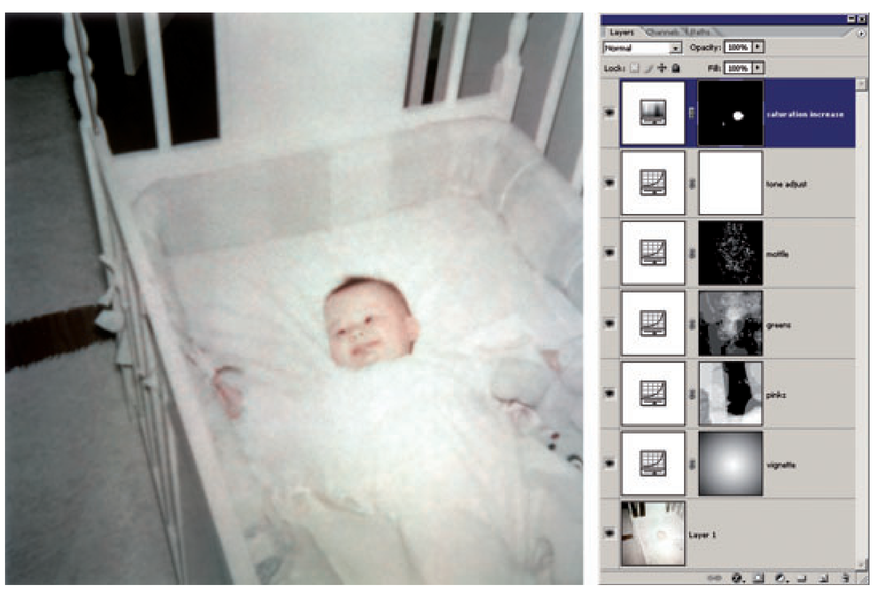


Fig. 10-8-p The finished restoration is an amazing improvement over Figure 10-8-a. It shows details I didn't even realize existed before I started the restoration. On the right is the layers stack that makes up this extraordinary reconstruction.

I corrected the reds, shifting the hue by –5 points, which made the skin tones a little pinker. I increased the saturation by 31 points and lightened the color by 22 points. That gave me nice baby skin tones. To restrict the effect of this layer to just the baby, I hand-painted the mask shown in the lower part of the figure.

The finished photograph is shown in Figure 10-8-p, along with its layer stack. It truly amazes me how much photographic information turned out to be buried in Figure 10-8-a. I never guessed I'd be able to do this much with that photograph when I first looked at the nearly blank square of paper.