The Reconstruction of the Portrait of Albert H. Munsell

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Professor Albert H. Munsell

The Munsell Color Science Laboratory (MCSL), located in the Center for Imaging Science at the Rochester Institute of Technology, is the premier facility in the United States for the study of Color Science. The laboratory's name reflects it's lineage back to Professor Albert H. Munsell, the originator of the Munsell Color Order System. Unfortunately, the MCSL did not have a quality portrait of A.H. Munsell to hang in the laboratory to remind students, faculty, and guests of the good professor and the lab's heritage. A project was begun to remedy that deficiency.

The only known picture of A.H. Munsell was in the various editions of his book, A Color Notation. While this picture was of moderate quality, a search was made to find a better original to copy. The halftoned photograph in the book was likely to have been initially shot on large format film (8X10 or larger) and would have, undoubtedly, been gorgeous by photographic standards. After many phone calls and letters to such places as the Munsell division of GretagMacbeth, no original photographs could be located. There was a story of portraits hanging on the walls of the Baltimore office of the Munsell division of GretagMacbeth but it was closed around 1990 and that lead was a dead end as well.

With the limited resources available for the project, it was finally conceded that the picture in A Color Notation would have to suffice. A generally better reproduction of Munsell appeared in book editions of 1971 and prior. The 1988 edition of the book had a picture which had been more tightly cropped but, unfortunately, had highlights which were lacking tonal separation. It did have smoother, less mottled midtones and shadows, however, than the earlier editions. It was apparent that a new plate had been made for the 1988 edition. The printer might have had an original portrait on file but we were unable to follow this potential lead. Ultimately, the picture of A.H. Munsell in the earlier editions of his book was the one chosen for reconstruction.

The picture in A Color Notation is about 4 1/4 X 5 5/8 inches in size and was measured as being screened at 133 lines per inch with a traditional round dot halftone screen. At this point the decision to use optical or digital methods had to be made. Some pilot experiments indicated that it might be possible to get better results removing the halftone screen digitally rather than with conventional photographic copying with a slight, intentional defocus to blur the screen. The screened book photo was scanned on a Hewlett-Packard 4c scanner at a non-interpolated 600 pixels per inch in gray scale mode.

In gray scale mode, the scanner collects 10 bits of intensity information and outputs a file with "best" 8 bits from the data collected (probably simulating something close to a lightness function).

Since the HP 4c scanner does not include descreening software, several alternate methods were investigated to remove the halftone screen from the scanned photo. In the human visual system, the screen drops below the visibility limit when it is no longer resolved (is blurred). Pixel averaging, a type of blurring or low pass filtering, over the scanned image was somewhat successful but did not remove quite all screen frequencies, even at the optimum averaging radius of 6 pixels. No commercial packages were found that could descreen in the Fourier domain with a selective "notch" filter for the screen frequency. Time did not permit writing an original computer program to do this. Also, past experience has shown that sharp cutting "notch" filters of this type sometimes produce other, undesirable, image artifacts. Some alternate scanning software was purchased for its descreening function but this did a poorer job than straight pixel averaging. Finally, an inexpensive software package called ScanLikePro was purchased which produced superior results. This software plugs into Adobe Photoshop's actions menu. It utilizes a proprietary ratio of Photoshop's gaussian blur (which does most of the job) and image size reduction (removes any residual screen frequency).

The tone scale of the image was expanded to fill the 8 bit digital count range and the "gamma" was increased slightly to obtain better tonal separation in the shadows at the expense of a little separation in the highlights. It was hoped that some image sharpening could be applied at this point. However, much of the Munsell image included dark areas. Even though reproduced on glossy paper in the book, there was significant image noise, apparently introduced by nonuniform ink-paper fiber interactions. This image noise precluded sharpening since it was increased whenever Photoshop's unsharp masking was invoked, regardless of frequency (pixel radius).

At this point, the image was taken to an Eastman Kodak facility to be printed. D. Mark Reiman, another MCSL graduate student and Kodak employee, did the final image processing in preparation for printing. First, the image size was interpolated up to fit the width of the picture frame and was cropped slightly to remove the foreground clutter. Most of Munsell's arm reflection in the shiny table top was saved but the lower out-of-focus areas were removed for better composition. Several major white dust spots were removed at this time as well. The tone scale was modified to best fit the dynamic range of the output device, a Kodak PS8650 thermal dye sublimation printer.

The first print was quite good but the overall "halated look" of the photo was a bit too apparent. The picture in the book shows the effect. It is probably due to the fact that most films around 1918 had little or no antihalation protection. The image was darkened slightly which reduced the halation effect but didn't affect the highlight brilliance too severely. The slightly darker print also helped to mask another defect. The lack of shadow detail, which was present in the book reproduction, looks odd in Munsell's silver hair. The slightly darker print helped this area blend more naturally into the dark backdrop in the scene. The final print was output at 300 d.p.i. on Kodak Ektatherm CMY media with a protective overcoat (laminate) layer at 8 1/2 inches wide (2550 pixels) by 9

1/4 inches in height (2761 pixels). This represents about a 2X enlargement over the book's reproduction. It is about the maximum size which looks acceptably sharp without using image sharpening algorithms.

The print was framed and now hangs in the main laboratory room of the MCSL. It also includes the following brief inscription: Professor Albert H. Munsell -- Born in Boston, Massachusetts on January 6th, 1858 and died June 28th, 1918 at age 60, he was the author of A Color Notation (1905) and the Atlas of the Munsell Color Order System (1915). Both an artist of distinction and gifted teacher of art, he developed the first widely-accepted color order system to make the description of color accurate and convenient and to aid in the teaching of color. The Munsell color order system has gained international acceptance and has served as the basis for other color order systems. -- Albert Munsell founded the Munsell Color Company in 1917. Later, in 1942 The Munsell Color Foundation was formed by the company to promote the advancement of the science of color. Ultimately, the Munsell Color Foundation led to the founding of this laboratory, the Munsell Color Science Laboratory, in 1983, at the Rochester Institute of Technology.

The framed portrait of Albert H. Munsell looks quite good considering the limited resources available for the reconstruction work. If time permits in the future, some advanced image processing could yield an even better result. In particular, tone-scale-related image sharpening could be of value. The shadow areas which show the most image noise could be low-pass filtered (blurred) slightly to reduce the effect while the highlight areas could be sharpened since they are relatively noise free. Also, it may be possible to combine the best parts of the Munsell images from the different editions of A Color Notation. The highlights and midtones from the earlier edition could be combined with the shadow areas of the newest edition. Ultimately, if a first generation photographic original becomes available, it would solve most of these problems. Please contact the MCSL if you know of one.

It would be desirable to show the reconstructed portrait of Albert H. Munsell here on the pages of COLOR Research and Application. However, due to space constraints, it would have to be reduced in size and would have to be rescreened in the graphic arts process. As a better alternative, a jpeg-compressed copy is being placed on the Internet website of the MCSL. In this form, it does not need to be screened. View the image using the appropriate link below. A special note of thanks is due Cal McCamy for loaning his 1971 edition of A Color Notation for the project.

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