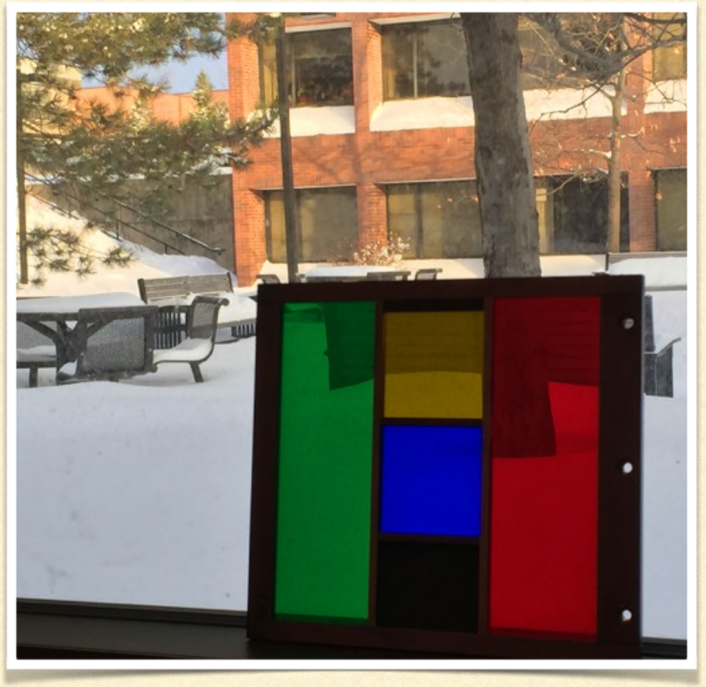
Program of Color Science / Munsell Color Science Laboratory

Annual Report 2014

DIRECTOR'S MUSINGS: Living in Each Season

As I write this, more than a foot of snow just fell on my yard and Punxsutawney Phil somehow still managed to see his shadow under a solid overcast sky, condemning us to six more weeks of winter. As the new calendar year starts, those of us in the beautiful Finger Lakes Region of Central and Western New York can't help but to think about the seasons passing with faithful optimism that the days will continue to increase in length and our beautiful springs, summers, and falls will return. Perhaps Henry David Thoreau captured it as well as anyone. "Live in each season as it passes; breathe the air, drink the drink, taste the fruit, and resign yourself to the influence of the earth." The Program of Color Science and Munsell Color Science Laboratory (PoCS/MCSL) passed through a winter of its own last year but with the faith and hard work of many people (mentioned throughout this report) experienced a strong and inspiring "spring" in 2014. I can most assuredly say that the lab and program have returned to health, stability, and peace after our "relaunch" of the last few years. I want to most sincerely and deeply thank all of our supporters, both within RIT and externally, who have made this success possible.



Some highlights of the past year include:

~ Our return to an Annual Report schedule after our one-and-only 2012-13 Biennial Report last year.
~ We admitted our first class in two years of four outstanding new Ph.D. students from one of our largest pools of applicants ever.
~ Preliminary indications are that we will have an equally good admissions season this year.
~ We created and filled our new PoCS/MCSL Board of Counselors.
~ We are on track to graduate 4-5 newly-minted Ph.D.s this academic year.
~ Yixuan Wang brought a new baby color scientist into the world!
~ Dr Susan Farnand joined us this academic year as a Visiting Assistant Professor.
~ Dr. Michael Murdoch, of Philips Research in Eindhoven, will be joining us as our newest faculty member in July 2015.
~ And we expect to continue building our faculty over the next 2-3 years.

On a personal note, I had a very productive year publishing our recent research on observer variability and color in nature. I also had the interesting experience of being interviewed for an NPR story on the nature of color perception. That story can be read and listened to at <http://www.npr.org/blogs/health/2014/11/10/361219912/if-the-same-shade-looks-both-yellow-and-gray-whats-color>.

As always, we thank those who have provided financial and in-kind support over the year including Scot Fernandez, Hallmark, Konica-Minolta, and Technicolor. I also appreciate the commitment of those who agreed to join our new PoCS/MCSL Board of Counselors this year: Ellen Carter, Scot Fernandez, Francisco Imai, Tom Lianza, M. Ronnier Luo, and Ricardo Motta.

In this report you can find lists of our students and alumni, brief research highlights from ongoing projects, a list of publications over the last year, and a directory of our people. We have kept it brief and visual. There is much more information about PoCS/MCSL on our website and we invite you to explore <*mcsl.rit.edu*>.

Thank you to everyone who has supported the lab and our students in various ways over the years. Please enjoy this report and let me know if you have any comments, suggestions, or questions. Stay tuned for our next adventures…

Sincerely,

Mark Fairchild
Associate Dean of Research and Graduate Education, College of Science
Professor and Director, Program of Color Science / Munsell Color Science Laboratory

STUDENTS & ALUMNI

Current Students
Yuta Asano, PhD, CS
Ben Bodner, PhD, CS
Brittany Cox, PhD, CS
Maxim Derhak, PhD, CS
Nargess Hassani, PhD, CS
Jennifer Kruschwitz, PhD, CS
David Long, PhD, CS
Alex Pagliaro, MS, CS
Ashley Penna, MS, IS
Nannette Salvaggio, MS, CS
Rachel Schwen, MS, CS
Alicia Stillwell, MS, CS
Chris Thorstenson, PhD, CS
Yixuan Wang, PhD, CS
Joel Witwer, PhD, CS

Alumni

2014
Farhad Abed, PhD, CS
Stephen Dolph, MS, IS
Adria Fores Herranz, PhD, CS

2013
Justin Ashbaugh, MS, CS
Lin Chen, MS, CS
Benjamin Darling, PhD, CS
Susan Farnand, PhD, CS
Jun (Chris) Jiang, PhD, CS

2012
Ping-Hsu (Jones) Chen, MS, CS
Simon Muehlemann, MS, PM

2011
Anthony Blatner, MS, CE
Brian Gamm, MS, CS
John Grim, MS, CS
Marissa Haddock, MS, CS
Dan Zhang, MS, CS

2010
Bingxin Hou, MS, IS
Suparna Kalghatgi, MS, IE

2009
Erin Fredericks, MS, IS
Rodney Heckaman, PhD, IS
Mahnaz Mohammadi, PhD, IS
Shizhe Shen, MS, CS

2008
Stacey Casella, MS, CS
Ying Chen, MS, CS
Mahdi Nezamabadi, PhD, IS
Abhijit Sarkar, MS, CS
Yang Xue, MS, IS
Hongqin (Cathy) Zhang, PhD, IS
Yonghui (Iris) Zhao, PhD, IS

2007
Kenneth Fleisher, MS, CS
Jiangtao (Willy) Kuang, PhD, IS

2006
Yongda Chen, PhD, IS
Timothy Hattenberger, MS, IS
Zhaojian (Li) Li, MS, CS
Joseph Stellbrink, MS, CS

2005
Maxim Derhak, MS, IS
Randall Guay, MS, IS
Jim Hewitt, MS, IS
Justin Laird, MS, CS
Erin Murphy Smoyer, MS, CS
Yoshio Okumara, MS, CS
Michael Surgeary, MS, IS

2004
Rohit Patil, MS, CS
Sung Ho Park, MS, CS
Xiaoyan (Yan) Song, MS, CS

2003
D. Collin Day, MS, CS
Ellen Day, MS, CS
Scot Fernandez, MS, IS
Edward Hattenberger, MS, CS
Steve Jacob, MS, IS
Xiaoyun (Willie) Jiang, PhD, IS
Garrett Johnson, PhD, IS
David Robinson, MS, IS
Mitchell Rosen, PhD, IS
Deniz Schildkraut, MS, CS
Qun (Sam) Sun, PhD, IS

2002
Arturo Aguirre, MS, CS
Jason Babcock, MS, CS
Anthony Calabria, MS, CS
Jen Cerniglia Stanek, MS, IS
Scot Fernandez, MS, CS
Jason Gibson, MS, CS
Shuxue Quan, PhD, IS
Yat-ming Wong, MS, IS

2001
Alexei Krasnoselsky, MS, CS
Sun Ju Park, MS, CS
Michael Sanchez, MS, IS
Lawrence Taplin, MS, CS
Barbara Ulreich, MS, IS

2000
Sergio Gonzalez, MS, CS
Sharon Henley, MS, CS
Patrick Igoe, MS, IS
Susan Lubecki, MS, CS
Richard Suorsa, MS, CS

1999
Gus Braun, PhD, IS
Barbara Grady, MS, CS
Katherine Loj, MS, CS
Jonathan Phillips, MS, CS
Mark Reiman, MS, CS
Mark Shaw, MS, CS
Di-Yuan Tzeng, PhD, IS
Joan Zanghi, MS, CS

1998
Scott Bennett, MS, CS
Fritz Ebner, PhD, IS
Garrett Johsnon, MS, CS
Naoya Katoh, MS, CS
David Wyble, MS, CS

1997
Peter Burns, PhD, IS
Christopher Hauf, MS, CS
Brian Hawkins, MS, CS
Jack Rahill, MS, IS
Alex Vaysman, MS, IS

1996
Karen Braun, PhD, IS
Cathy Daniels, MS, CS
Yue Qiao, MS, IS
Hae Kyung Shin, MS, IS

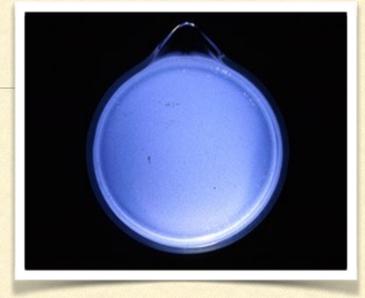
1995
Richard Alfvin, MS, CS
Seth Ansell, MS, CS
Susan Farnand, MS, IS

1994
Taek Kim, MS, IS
Audrey Lester, MS, CS
Jason Peterson, MS, IS
Debra Seitz Vent, MS, IS
James Shyu, MS, CS

1993
Nathan Moroney, MS, CS
Elizabeth Pirrotta, MS, CS
Mitchell Rosen, MS, IS

1992
Mark Gorzynski, MS, IS
Rich Riffel, MS, IS
Brian Rose, MS, CS

1991
Yan Liu, MS, CS
Ricardo Motta, MS, IS
Amy North, MS, CS
Greg Snyder, MS, IS
Michael Stokes, MS, CS

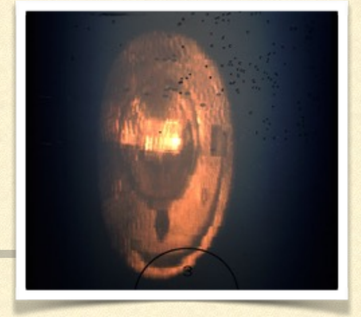


1989
Mitch Miller, MS, IS
Kelvin Peterson, MS, IS
Lisa Reniff, MS, CS

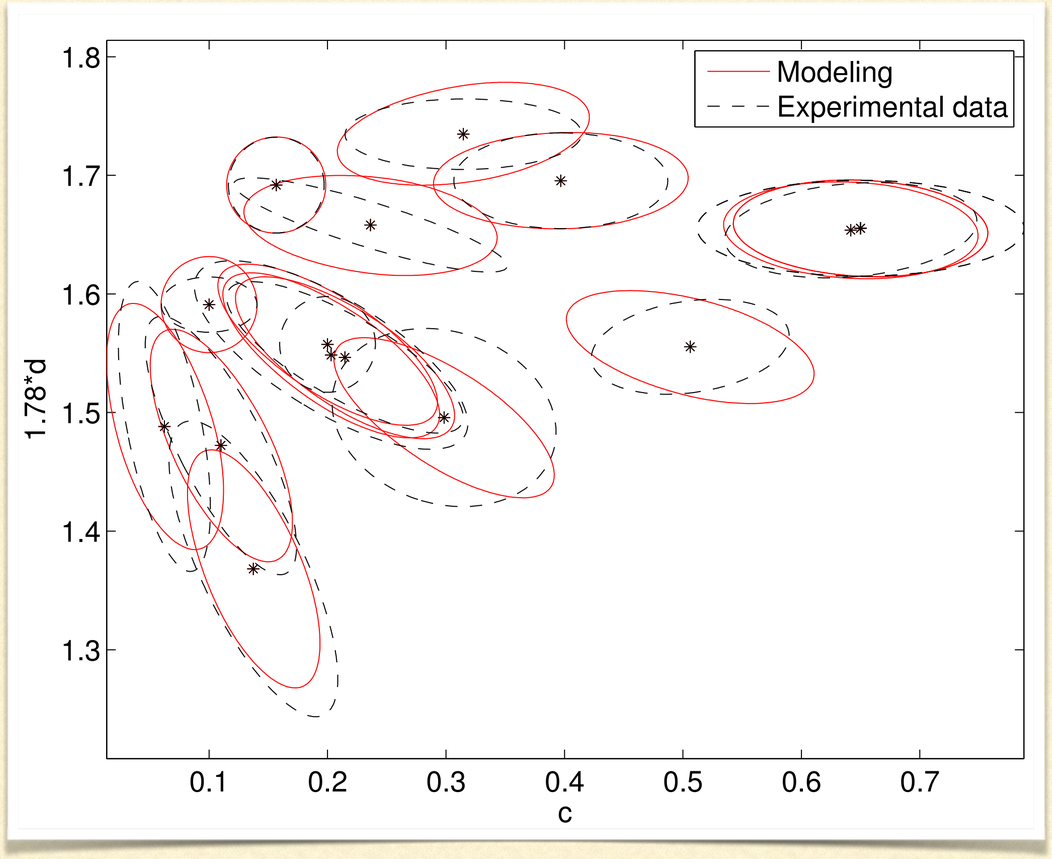
1987
Denis Daoust, MS, IS
Wayne Farrell, MS, IS

1986
Mark Fairchild, MS, IS

Key:
CS: Color Science
IE: Industrial Engineering
IS: Imaging Science
MS: Master of Science
PhD: Doctor of Philosophy
PM: Print Media



RESEARCH HIGHLIGHT: Improving the Perceptual Uniformity of a Gloss Space



The dimensions of Lightness (L), contrast gloss (c), and distinctness-of-image gloss (d) were used to define a three dimensional perceptual gloss space in Pellacini et al. 2000.

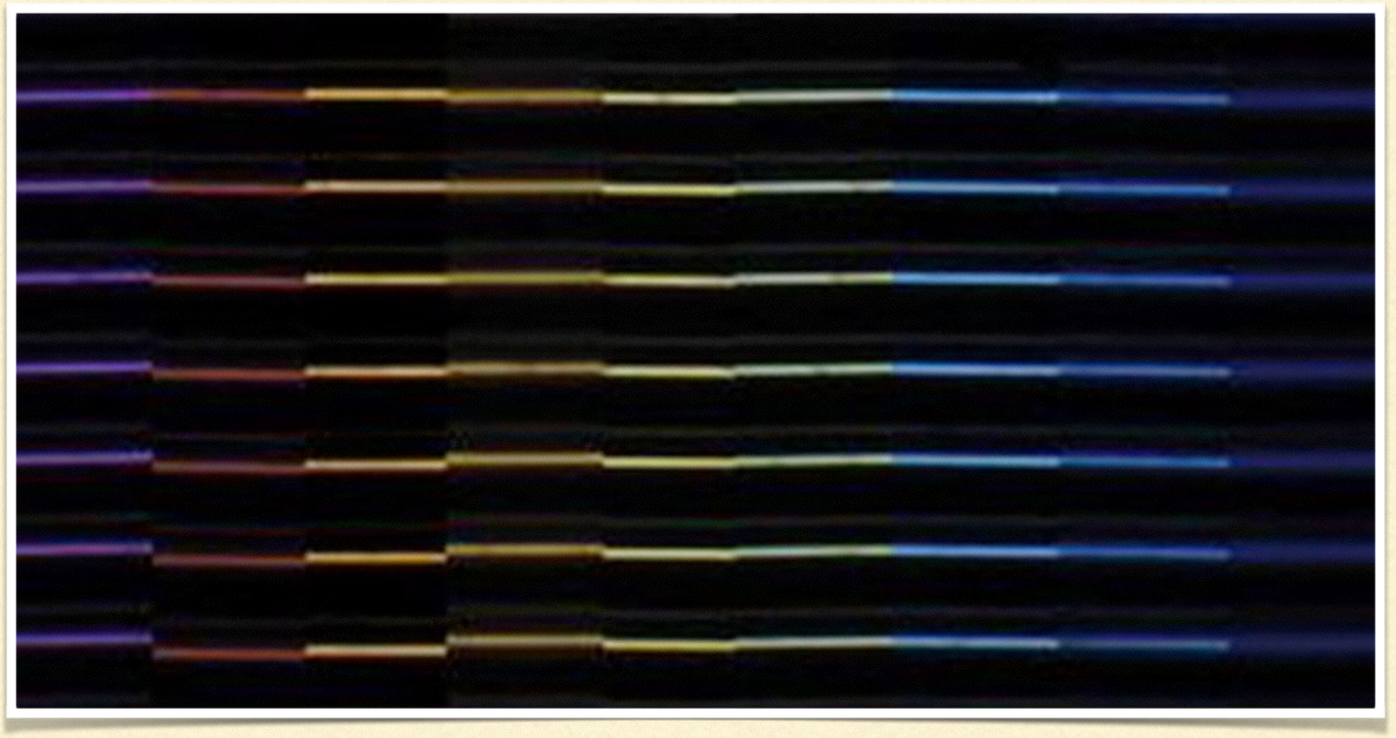
In this work the space uniformity around sixteen positions in the gloss space was evaluated in a psychophysical study to assess the overall space uniformity. The space was found to be perceptually non-uniform outside the samples used when the space was created. The plot on the left shows the ellipses obtained from the psychophysical experiment (dashed black lines) and the result of using the improved gloss difference equation derived (red). The gloss difference equation presented shows a statistical significant improvement over the current gloss difference equation of the space and reduces the STRESS value from 39.76 to 22.96.

Adria Fores Herranz, Mark Fairchild

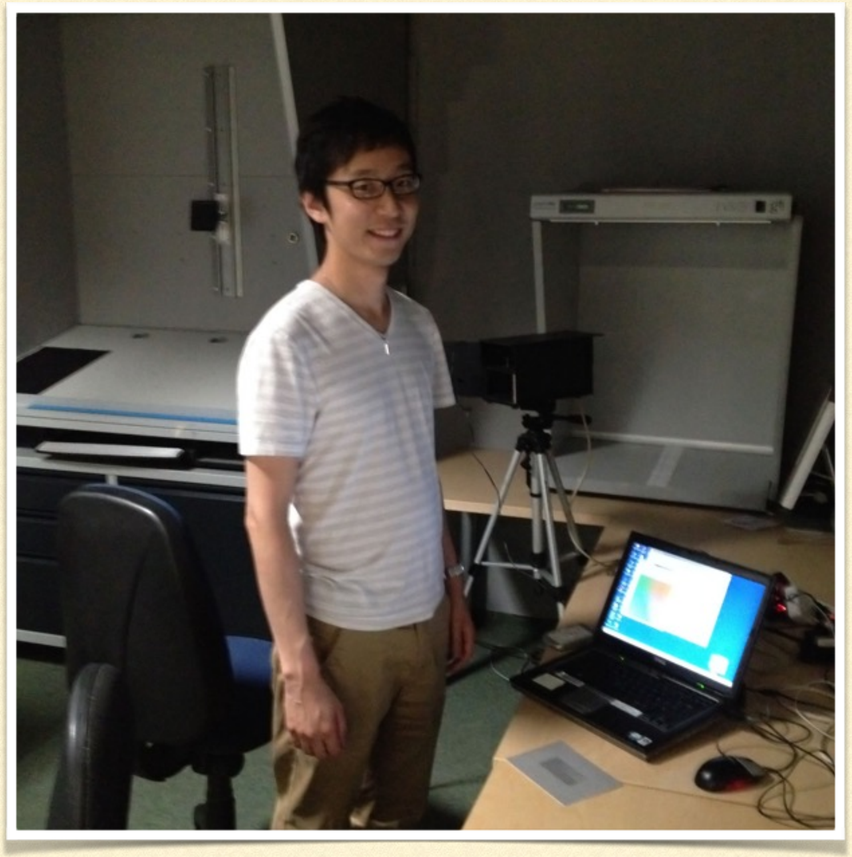
RESEARCH HIGHLIGHT: Reflectance Microscopy Color Target

A reflectance color target for use with microscopes was developed utilizing optical interference coated micromirrors. These micromirrors are arrays of cylindrical microlenses coated with an opaque, metal-dielectric multilayer coating that produces a chromatic color as a reflected specular highlight when illuminated. Colors can be created to significantly expand the colorimetric gamut from traditional painted or paper targets. Spectral reflectance shapes can also be optimized to reduce the number of training samples necessary for spectral reconstruction imaging techniques.

Jennifer Kruschwitz, Roy Berns



RESEARCH HIGHLIGHT: Observer Metamerism and Individual Color Management



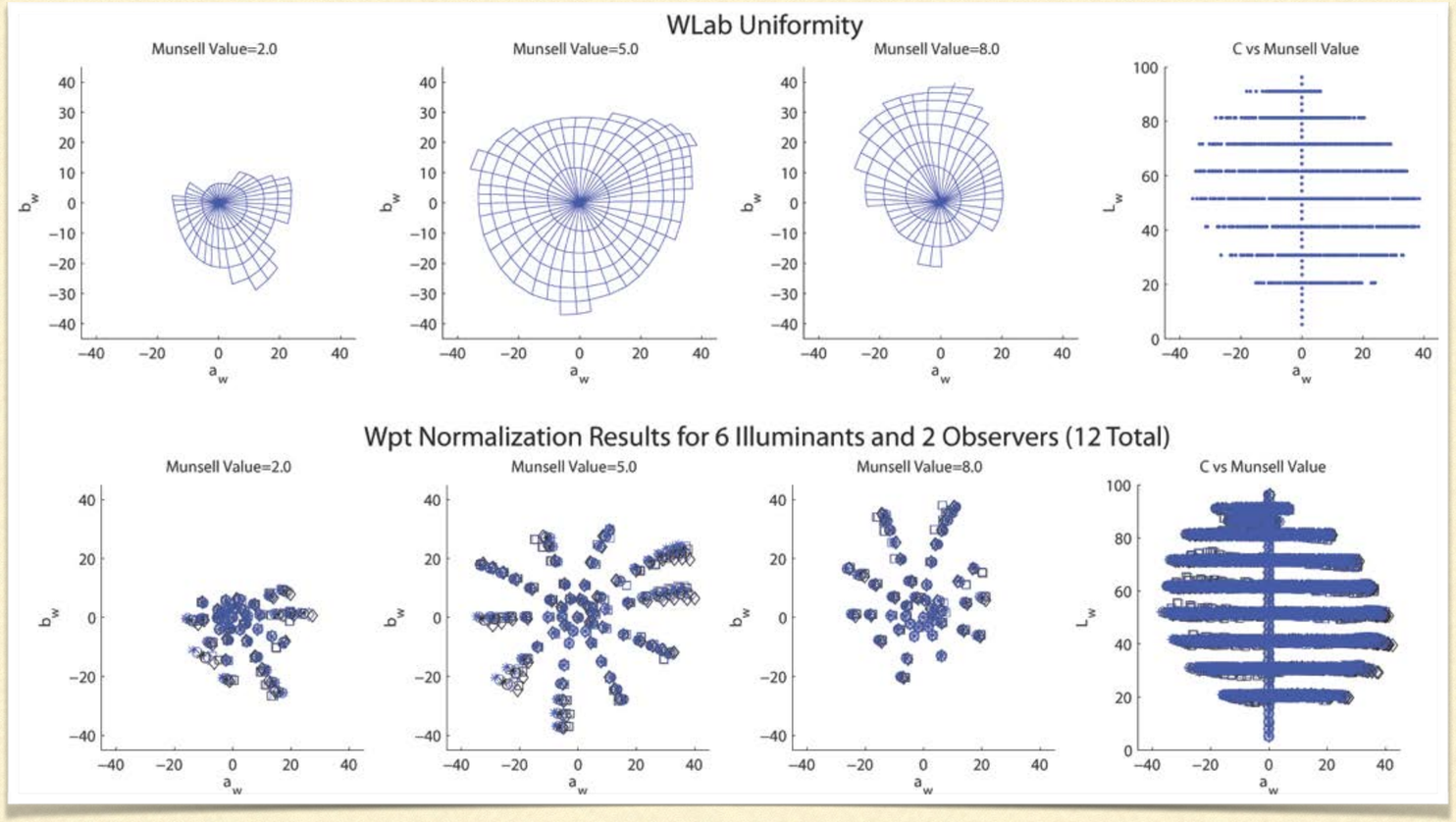
As part of his dissertation research on measuring and modeling individual differences in color vision, Yuta Asano has had two internships at the sponsor, Technicolor in rennes, France. While there, Yuta mad an additional trip to visit FOGRA in Munich, Germany to conduct collaborative research on observer metamerism in soft-proofing. Details of project can be found here: http://www.fogra.org/en/fogra-research/prepress/research-projects-prepress/softproof-standardization/experiments-ssp/study-on-observer-metamerism.html

Yuta Asano, Mark Fairchild

RESEARCH HIGHLIGHT: WLab for Material Adjustment Transforms

A normalization methodology has been developed that linearly transforms sensor values / cone excitations (or linear transforms of sensor excitations) into a material color equivalency representation that can be used as a waypoint for defining Material Adjustment Transforms. The normalization process adjusts for the white point and independently preserves the perceptive aspects of lightness, chroma, and hue resulting in an opponent like coordinate system designated by the axes W, p, and t. Additionally, a set of invertible non-linear transforms was derived that adjusts Wpt (Waypoint) coordinates to and from a more perceptually uniform coordinate system (WLab or Waypoint-Lab) that allows for the advantageous features of Wpt to be directly applied to situations where other standard color spaces are typically used with Euclidean distances comparable to ΔE94 and CIEDE2000. The top graphs demonstrate WLab's uniformity and placement of Munsell Renotation colors. The bottom graphs demonstrate the resulting level of constancy that Wpt Normalization provides.

Max Derhak, Roy Berns



RESEARCH HIGHLIGHT: Multiprimary Projection Display System

Inside view of 7-channel multiprimary projection system built to investigate observer metamerism. The 7 color filters represent an idealized abridged spectral reproduction set determined from ongoing color vision research in the Program of Color Science. The 7 beams can be combined to form a uniform spectral stimuli to be compared to various traditional 3-channel additive reproductions. As RGB display technology pushes to more monochromatic primaries and larger color gamuts, metameric reproduction of reference colors are prone to exaggerated variability amongst color-normal observers. The 7-channel system helps to quantify observer metamerism failures in 3-channel LCD, LED and laser-based technologies.

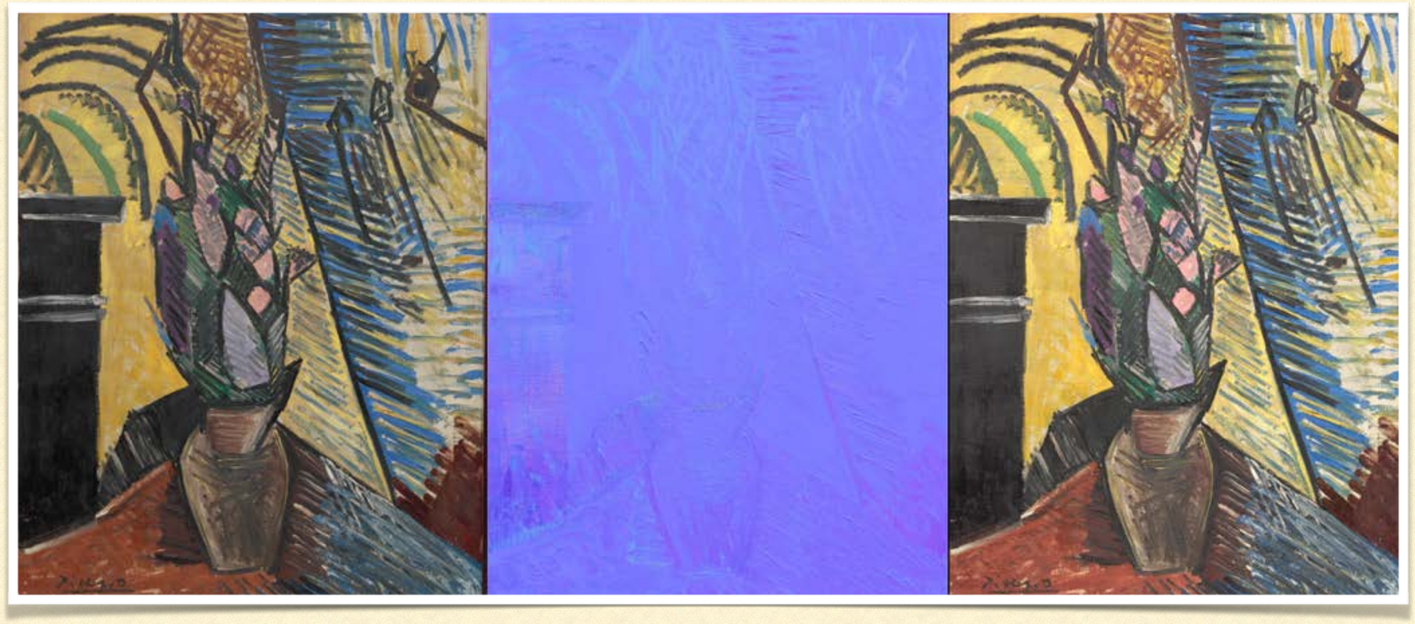
David Long, Mark Fairchild

RESEARCH HIGHLIGHT: Illuminating Paintings to Capture Texture

Many fine art archiving guidelines insist upon the uniform illumination of artwork when capturing digital representations. Such procedures produce quality images that are useful for archiving purposes, but are largely flat and void of valuable visual cues demonstrating attributes such as texture and brush strokes (top image). Lighting paintings at grazing angles accentuates the texture and brush strokes, but creates light fall off which invalidates the images for archiving purposes (middle image). It was found that flat fielding the image captured with grazing illumination preserved the texture and brush stroke accentuations, while achieving uniform illumination, meeting the criteria set in place for archiving (bottom image).

Joel Witwer, Roy Berns

RESEARCH HIGHLIGHT: Imaging and Rendering Picasso



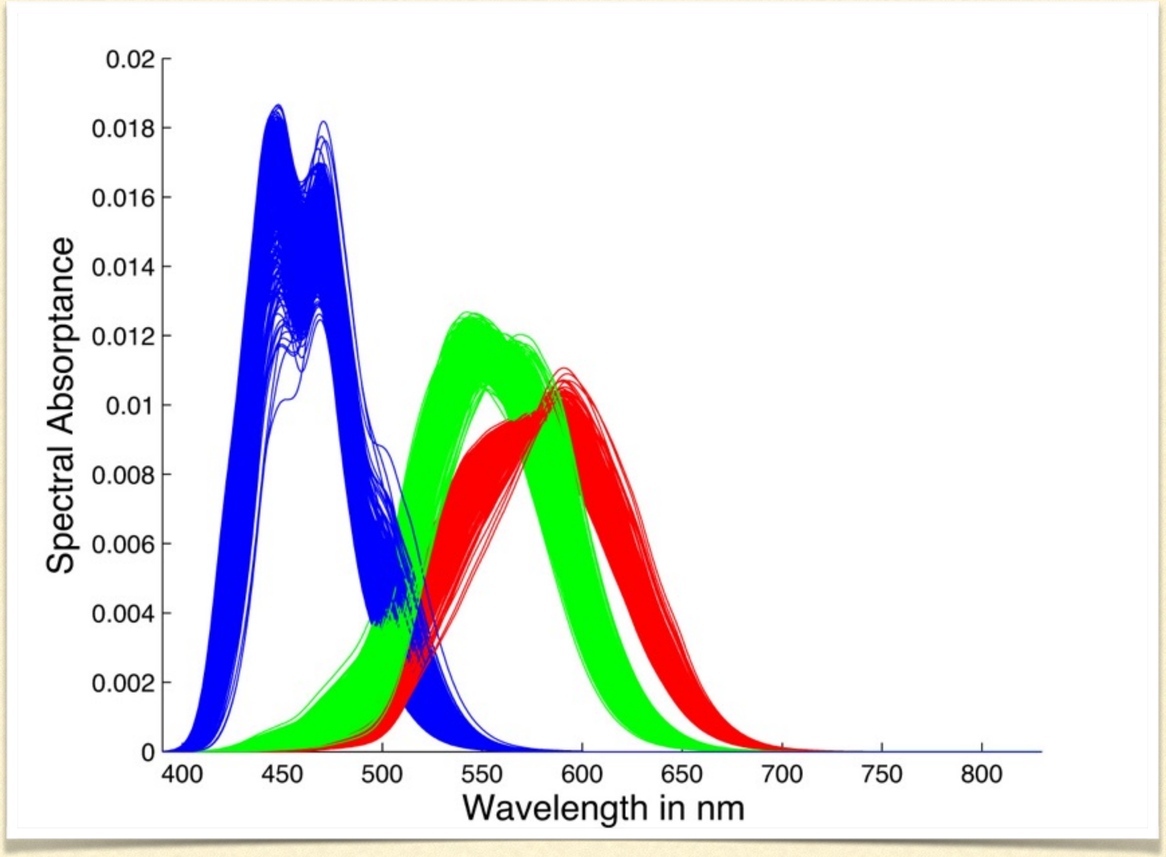
The Munsell Color Science Laboratory visited the Museum of Modern Art to observe typical imaging practices performed by the Department of Imaging and Visual Resources and to demonstrate the Four-Light Simplified (4LI-S) technique developed at MCSL coupled with a rendering workflow, still in development. The Four-Light Simplified technique is based on the 4LI system developed in 2012 at MCSL. The simplified technique replaced polarizers in the imaging sequence with a threshold method in post processing. The image on the left of Vase of Flowers by Pablo Picasso is a photograph taken by the MoMA's photographer according to their imaging standards. The image in the middle is a normal map calculated from images taken with the 4LI-S system. The image on the right is a rendered reproduction of the painting using the normal map and diffuse color map from the 4LI-S system and Maya® and mental ray as the rendering software.

Brittany Cox, Roy Berns

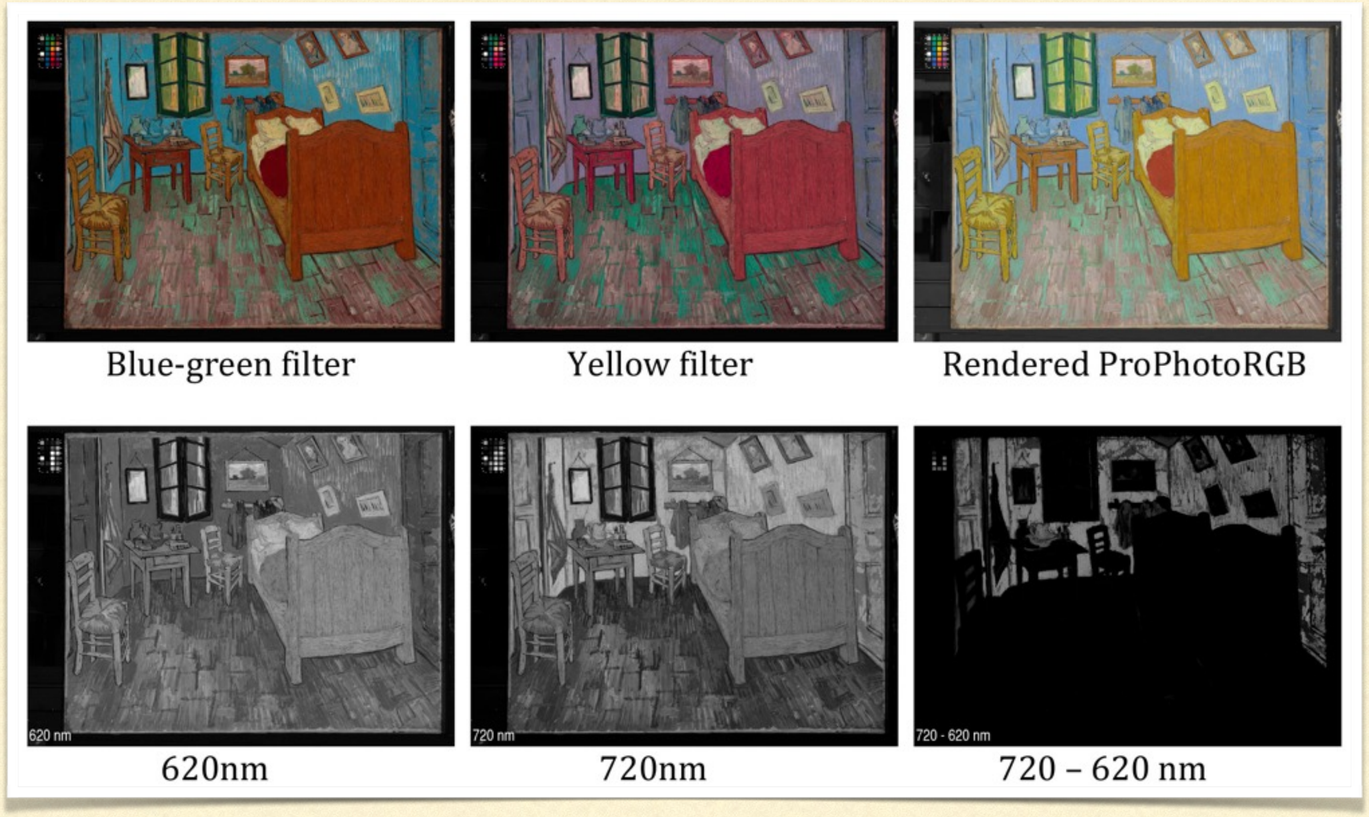
RESEARCH HIGHLIGHT: Variable Observers go to Monte Carlo

In a color matching experiment, the colors of two stimuli might match perfectly to one observer. However to another, those same two stimuli might not match depending on the spectral characteristics of the two stimuli and each of the observers' visual responses. This phenomenon, that any two observers perceive color matches differently, is termed observer metamerism. Only recently have differences in the factors that affect the spectral response of the human eye been quantified to a degree such that observer metamerism can be realistically modeled over a representative population of human observers. From the statistics of these factors, 1,000 such observers – each said to be metameric to a standard – were created in terms of LMS cone spectral responses.

Rodney Heckaman, Mark Fairchild



RESEARCH HIGHLIGHT: Vincent van Gogh's Bedroom



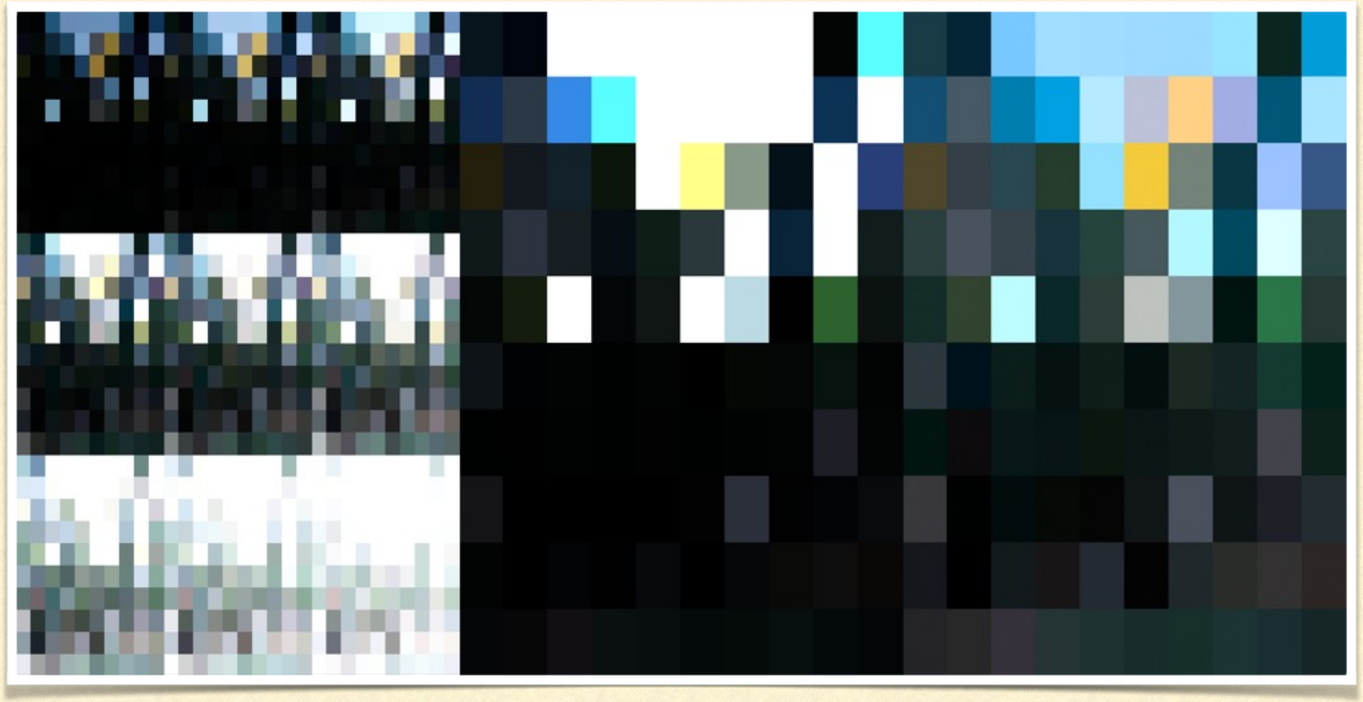
During December 2014 at the Art Institute of Chicago, Roy Berns used a Sinar CTM system, based on RIT patented technology developed by Francisco H. Imai and Berns, to image one of three paintings executed by Vincent van Gogh of his bedroom in Arles, France. The Dual-RGB data were transformed to a spectral image. Subtracting the 620nm image from the 720nm image reveals a mapping of cobalt blue in the walls and doors.

Roy Berns

RESEARCH HIGHLIGHT: The Colors of Nature

In a paper entitled "Seeing, adapting to, and reproducing the appearance of nature" Mark outlined the process of color capture and perception. The perception of color in nature is a complex multi-dimensional phenomenon. The vast range and high dimensionality of the light stimulus in a natural scene is reduced in range and dimension by the human visual system. The color experience is reduced to the appearance attributes of brightness, lightness, colorfulness, chroma, saturation, and hue from the spectral energy distributions in the scene while the vast range of light levels present in the world is reduced to a more manageable perceptual range through local adaptation. These processes set the stage for our efforts to capture, process, and reproduce the colors of nature as well as make artistic interpretations of them. This reviews the challenges involved in accurately capturing and reproducing optical phenomena observed in nature.

Mark Fairchild



RESEARCH HIGHLIGHT: Vertical X-Y Camera Rig for The Metropolitan

In May 2014, Susan and seven students from the Kate Gleason College of Engineering delivered and installed a Vertical X-Y Camera Rig the students designed and built for the Metropolitan Museum of Art in NYC. The museum is using the mobile unit for photographing large, permanent installations. Having previously worked with Barbara Bridgers, general manager for imaging, and Scott Geffert, imaging systems manager for the museum, on an Andrew W. Mellon foundation sponsored color reproduction project, Susan was familiar with the museum's imaging needs. She was also aware of the capabilities of students in the Multidisciplinary Senior Design program at RIT, in which students from the various engineering disciplines work together to complete design projects. She served as the Guide for this Camera Rig project.

The team members: Samuel Brown (Mechanical Engineering), Kyle Bradstreet (Mechanical Engineering), Brandon Strangman (Industrial and Systems Engineering), Zachary Sostack (Mechanical Engineering), Daniel Kearney (Electrical Engineering), Daniel Jang (Electrical Engineering) and Matthew Misiaszek (Mechanical Engineering).

A video of the camera rig is available at <youtu.be/E1sRO1m-s0g>, produced by Matthew Misiaszek. The team also won a Bronze Ribbon, selected by Harris Corporation, at the 2014 ImagineRIT Innovation and Creativity Festival.

Susan Farnand

2014 PUBLICATIONS

Books and Journal Papers

R. Cao, M. Castle, W. Sawatwarakul, M.D. Fairchild, R. Kuehni, R. Shamey, Scaling perceived saturation, Journal of the Optical Society of America A 31, 1773-1781 (2014).

M. Derhak and R.S. Berns, Introducing Wpt (Waypoint) - a Color Equivalency Representation for defining a Material Adjustment Transform," Color Research Application, in press, available on-line (2014).

M. Derhak and R.S. Berns, Introducing WLab—Going from Wpt (Waypoint) to a uniform material color equivalency space, Color Research Application, in press, available on-line (2014).

A. Elliott, M.D. Fairchild and A. Franklin, Eds. Handbook of Color Psychology, Cambridge University Press, Cambridge, UK in press (2015).

M.D. Fairchild, Color models and systems, in A. Elliott, M.D. Fairchild and A. Franklin, Eds. Handbook of Color Psychology, Cambridge University Press, Cambridge, UK in press (2015).

M.D. Fairchild, Seeing, adapting to, and reproducing the appearance of nature, Applied Optics 54, B107-B116 (2015).

M.D. Fairchild, The value of colorfulness, brilliance, and similarity, LD+A, Illuminating Engineering Society, 44:8 16-18 (2014).

M.D. Fairchild and R.L. Heckaman, Measuring observer metamerism: The Nimeroff approach, Color Research and Application, in press (2015).

M.D. Fairchild, A.M. Tourapis and D. Singer, New high dynamic range content based on still imagery, ISO/IEC JTC1/SC29/WG11 MPEG2014/mXXXX (2014).

S. Farnand and M.D. Fairchild, Designing pictorial stimuli for perceptual experiments, Applied Optics 53, C72-C78 (2014).

S. Farnand and M.D. Fairchild, Designing pictorial stimuli for perceptual experiments, Virtual Journal for Biomedical Optics 9, Issue 7, republication (2014).

J.D.T. Kruschwitz and R.S. Berns, First-order goniospectrophotometric spectral modeling of isotropic and anisotropic colorant mixtures, Applied Optics, 53(4):A131-A141 (2014).

J.D.T. Kruschwitz and R.S. Berns, Non-polarizing color mirrors on a high reflecting metal base, Applied Optics, 53(16):3448-3453 (2014).

D.L. Long and M.D. Fairchild, Modeling observer variability and metamerism failure in electronic color displays, Journal of Imaging Science & Technology 58, 30402-1-30402-14 (2014).

C.P. Sisson, S.P. Farnand, M.D. Fairchild and B. Fischer, Analysis of color consistency in retinal fundus photography: Application of color management and development of an eye model standard, Analytical Cellular Pathology 2014, Article ID 398462 (2014).

2014 PUBLICATIONS

Conference Proceedings

Y. Asano, M.D. Fairchild, and L. Blondé, Spectral pseudoisochromatic images: Vision test for color-normal observers, AIC2015 / MCS 2015, Tokyo, in press (2015).

Y. Asano, M.D. Fairchild L. Blondé and P. Morvan, Multiple color matches to estimate human color vision sensitivities, International Conference on Image and Signal Processing 2014, Cherbourg, France, 18-25 (2014).

Y. Asano, M.D. Fairchild, and L. Blondé, Development of a vision model for individual colorimetric observers, OSA Fall Vision Meeting, Philadelphia, (2014).

Y. Asano, M.D. Fairchild, L. Bondé and P. Morvan, Observer variability in image color matching on an LCD monitor and a laser projector, IS&T 22nd Color & Imaging Conference, Boston, 1-6 (2014).

B.D. Cox and R.S. Berns, Imaging artwork in a studio environment for computer graphics rendering, Proceedings IS&T SPIE Electronic Imaging Conference, Measuring, Modeling, and Reproducing Material Appearance, San Francisco, California, USA, in press.

A. Forés Herranz, M.D. Fairchild and I Tastl, An abridged goniometer for material appearance measurements, SPIE/IS&T Electronic Imaging Conference, San Francisco, in press (2015).

A. Forés Herranz, M.D. Fairchild and I. Tastl, Improving the perceptual uniformity of a gloss space, IS&T 22nd Color & Imaging Conference, Boston, 7-13 (2014).

A. Forés Herranz, M.D. Fairchild and I. Tastl, Perceptual gloss space BRDF projection, uniformity validation, and lightness distance metric, ACM Symposium on Applied Perception, Vancouver 136 (2014).

J.D.T. Kruschwitz and R.S. Berns, Imaging color target for off-axis illumination reflectance microscopy, Color and Imaging Conference, 2014, pp. 247-252 (2014).

D.L. Long and M.D. Fairchild, Modeling observer variability and metamerism failure in electronic color displays, IS&T 22nd Color & Imaging Conference, Boston, 14-20 (2014).

D.L. Long and M.D. Fairchild, Reducing observer metamerism in wide-gamut multiprimary displays, SPIE/IS&T Electronic Imaging Conference, San Francisco, in press (2015).

J. Preiss, M.D. Fairchild, J. Ferwerda, and P. Urban Gamut mapping in a high-dynamic-range color space, SPIE/IS&T Electronic Imaging Conference, San Francisco, doi:10.1117/12.2039747 (2014).

2014 PUBLICATIONS

Theses & Dissertations

F.M. Abed, Pigment Identification of Paintings Based on Kubelka-Munk Theory and Spectral Images, Rochester Institute of Technology dissertation, 2014.

A. Forés Herranz, Perceptual Modeling and Reproduction of Gloss, Rochester Institute of Technology dissertation, 2014.

Technical Reports

F.M. Abed and R.S. Berns, Spectral Imaging Using a Liquid Crystal Tunable Filter – Part II, Studio for Scientific Imaging and Archiving of Cultural Heritage Technical Report, August 2014.

R.S. Berns, A New Encoding System for Image Archiving of Cultural Heritage: ETRGB, Studio for Scientific Imaging and Archiving of Cultural Heritage Technical Report, May 2014.

R.S. Berns, Artist Paint Target (APT): A Tool for Verifying Camera Performance, Studio for Scientific Imaging and Archiving of Cultural Heritage Technical Report, June 2014.

R.S. Berns, Camera Encoding Evaluation for Image Archiving of Cultural Heritage, Studio for Scientific Imaging and Archiving of Cultural Heritage Technical Report, May 2014.

R.S. Berns, Evaluating Solid State and Tungsten-Halogen Lighting for Imaging Artwork, Computer Simulation, Studio for Scientific Imaging and Archiving of Cultural Heritage Technical Report, January 2014.

R.S. Berns, Spectral and Color Characteristics of Broncolor Pulso F4 Strobe with UVE Protection Dome, Studio for Scientific Imaging and Archiving of Cultural Heritage Technical Report, May 2014.

R.S. Berns and Y. Wang, Spectral Sensitivity and Transmittance Measurements of a Sinar 86H CTM Dual-RGB Digital Camera, Studio for Scientific Imaging and Archiving of Cultural Heritage Technical Report, April 2014.

FACULTY & STAFF

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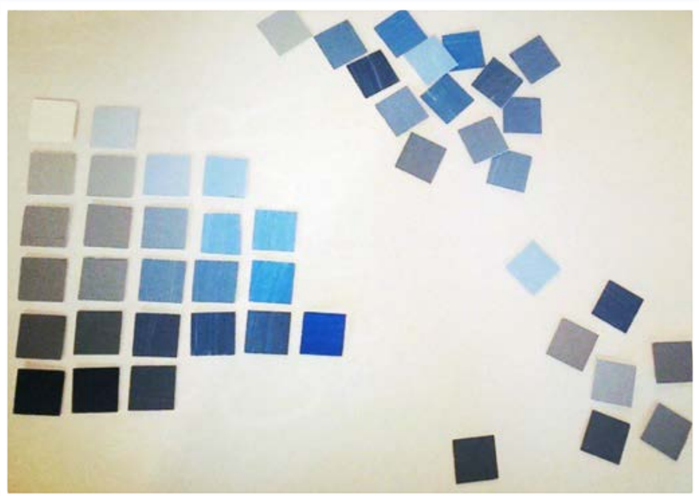

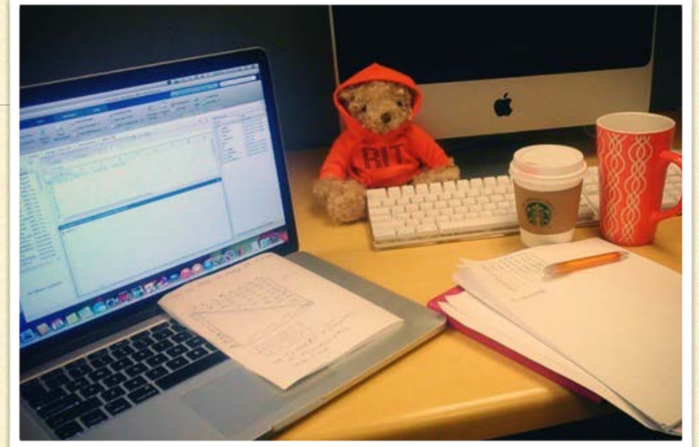

PoCS/MCSL Faculty & Staff

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Professor & Director, Program of Color Science/Munsell Color Science Laboratory
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Dave Wyble, Ph.D.
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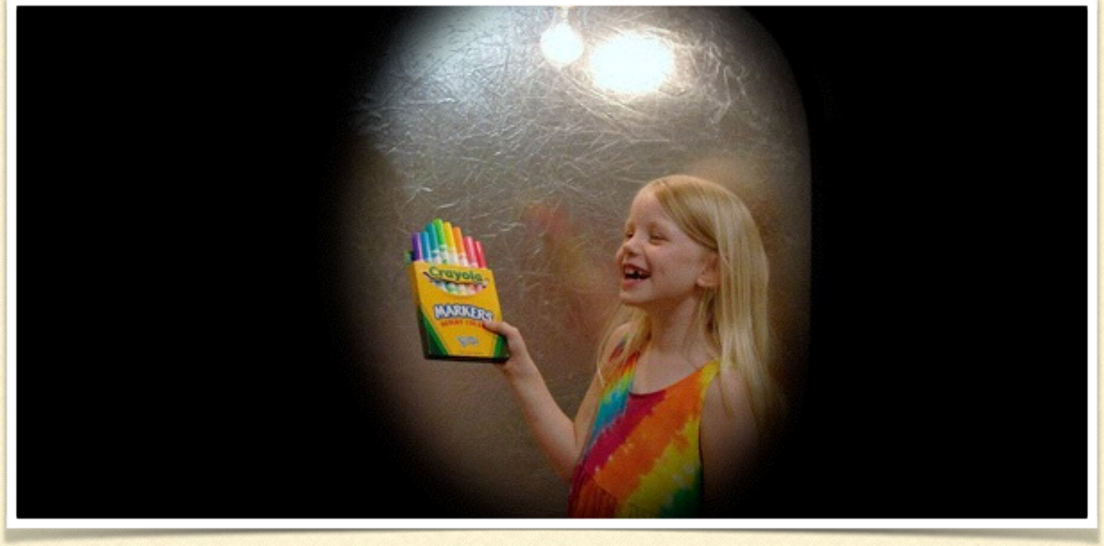
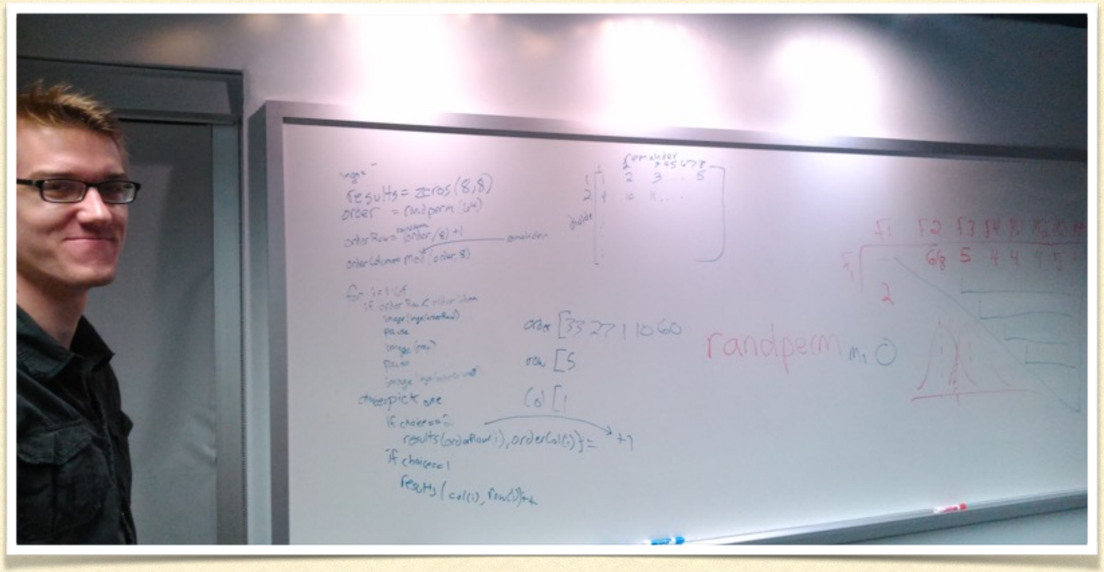
Ellen Carter, Color Research & Application
Scot Fernandez, Hallmark
Francisco Imai, Canon USA
Tom Lianza, Sequel Color Science
M. Ronner Luo, U. Leeds *et al.*
Ricardo Motta, Apple


R·I·T


Crayola
MARKERS


Mark D. Fairchild
COLOR APPEARANCE MODELS
BILLMEYER AND SALTZMAN'S
PRINCIPLES OF
COLOR
TECHNOLOGY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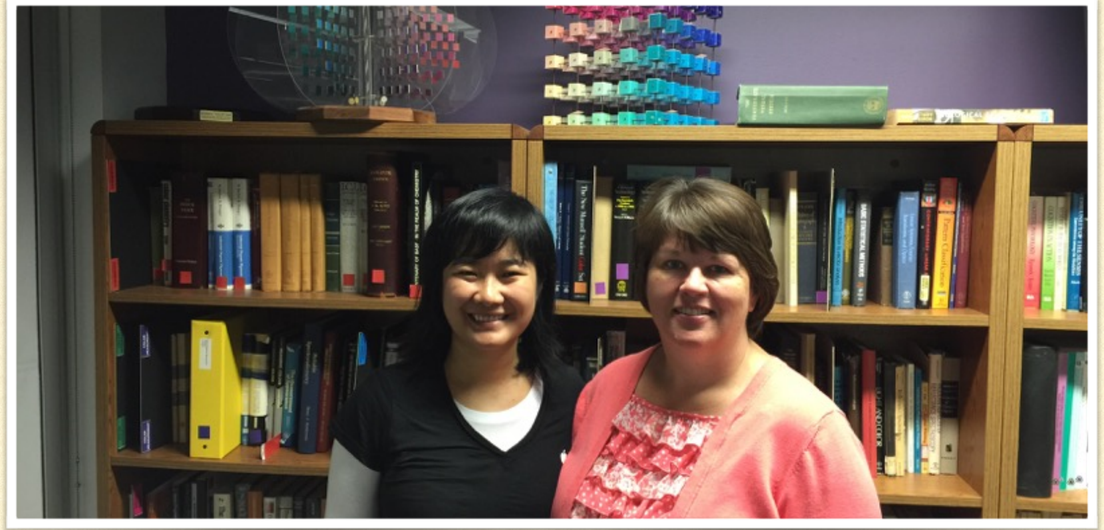


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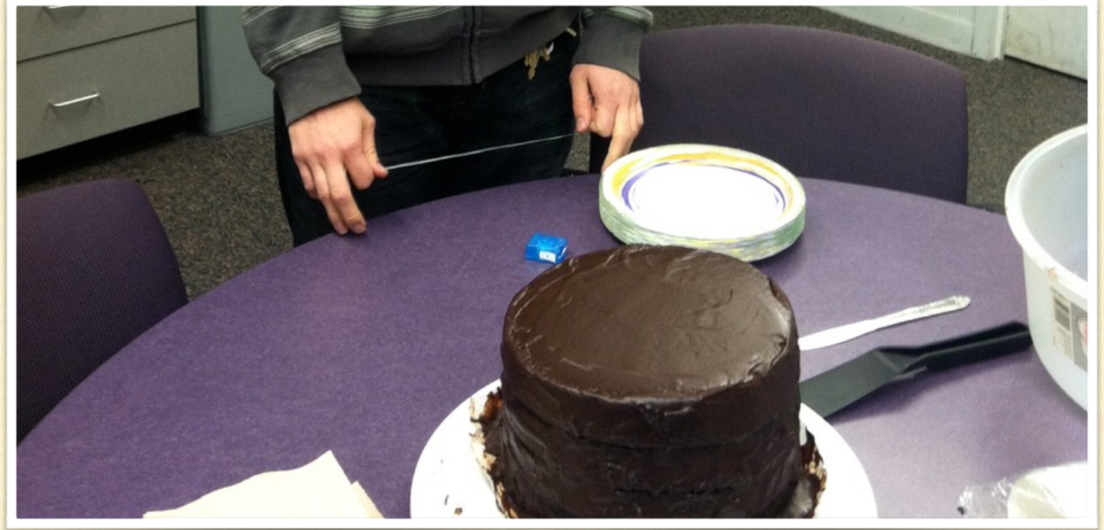

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