



# THE CHROMAZONE

## tangiBook Author Gets MERL Award



**Benjamin Darling, a doctoral student at MCSL,**

received the 2009 MERL award for the best student paper at the IS&T 17th Color Imaging Conference held November 9-13, 2009 in Albuquerque, NM. The paper, "The tangiBook: A tangible display system for direction interaction with

virtual surfaces," was coauthored with advisor James Ferwerda, and was presented as one of the conference's focal presentations. The tangiBook project uses real-time computer graphics rendering to create realistic depictions of virtual surfaces with complex texture and reflectance properties. By incorporating head-tracking of the user and orientation tracking of the screen, it can simulate the user experience of interacting with a real physical object for a variety of material perception and color reproduction applications.

The best student paper award, sponsored by the Mitsubishi Electric Research Laboratories (MERL), was first given at the IS&T 16th Color Imaging Conference in 2008. The best paper award recipient is selected from all eligible papers by a vote of the conference attendees. To be eligible for the award, the paper's first author has to be a student at the time the research was performed and the work has to be presented at the conference by the student.

The project also received recognition at the First Annual RIT Graduate Student Research symposium held on July 29, 2009. Over 70 master's and PhD students from a range of RIT departments presented their research in oral or poster presentations. A poster presentation on the tangiBook was selected for the Best Poster Award by the symposium's attendees. Along with the other symposium award winners, Ben was invited to present his work on the tangiBook at the headquarters of GE Global Research in Niskayuna, NY on November 18, 2009.

fall 2009

Rochester Institute of Technology  
Chester F. Carlson Center  
for Imaging Science  
Munsell Color Science Laboratory  
54 Lomb Memorial Drive  
Rochester, New York  
14623-5604  
(585) 475-7189



**Roy Berns** is on sabbatical at the Getty Museum. Here he is on his first day already out enjoying the California sunshine. Look for details in a future Chromazone.

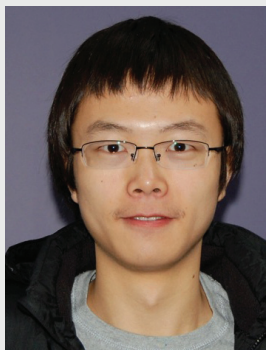
## What's Happening? In & Around MCSL

- We are assembling our 2009 annual report now. Watch your mailbox!
- Our annual summer short course "Essentials of Color Science" will be June 22-23, 2010. Early registration ends June 1. This course is for anyone interested in color or whose job involves color measurement, specification, control, reproduction or use. The lectures are presented at a level assuming that participants have a bachelor's degree, or equivalent experience, in a technical field. See [www.mcsl.rit.edu/outreach/courses.php](http://www.mcsl.rit.edu/outreach/courses.php)



# Introductions

## Are In Order..



### Hao Li

"Before I joined the color science family, I earned my B.S. Degree in Optical Engineering from Wuhan University, China in 2009. There, I was introduced to many interdisciplinary subjects covering math, physics and optics, and

did some research about spectral imaging. My interest in color science started in my third year in Wuhan University when a visiting scientist from MCSL brought a colorful world to me. Since then, my interest in color science has been getting stronger. During the last year in Wuhan University, I did a project in NCS (Beijing) and completed my thesis concentrating on image color appearance models. These experiences encouraged me to pursue a graduate program in color science. Fortunately, I have joined this family and am enjoying every day here. Currently I have been taking the fundamental color science courses. I am determined to broaden what I have learned here to create a more colorful world in the future."



### Brian Gamm

"I received my BS in Imaging and Photographic Technology at RIT with minors in Math, Stats and Psychology. I was given an opportunity after my sophomore year to do an internship with Fogra, in Munich, where I was first

exposed to the world of printing, color management and color science. I was hooked from that point onward. I spent the next two years taking courses in perceptual psychology and statistics, and working as a student researcher for the School of Print Media. I was fortunate to be accepted into the Master's program at Munsell and began studying here in the Fall of 2009. Munsell has so much to offer and every day is filled with new opportunities and experiences. The courses are challenging yet intellectually rewarding, and I am very happy to be studying here."

## Jones and Condit Redux in High Dynamic Range and Color

Rodney L. Heckaman and Mark D. Fairchild, excerpted from their paper presented at IS&T's 2009 Color Imaging Conference.

In a classic 1931 paper, Jones and Condit measured the luminance range in 130 natural scene "... to determine the perfection with which the tonal characteristics of a given scene can be reproduced by the photographic process". And while their data served photography well

over 70 years, their results in no way represent what we see every day in both dynamic range and color. Yet, today's media are approaching such a standard, and it seems as important as it was then to revisit the Jones and Condit study in this larger context through the auspices of Fairchild's HDR photographic survey that captured and documented over a hundred natural scenes in their fullest range of luminance and color. Analysis of these scenes found contrast ratios or within scene dynamic ranges averaging 3 orders of magnitude approaching 6 orders at the 3 sigma limits of their distribution. By contrast, Jones and Condit found an average of 160:1 with a maximum value of 750:1, certainly less than 3 orders of magnitude in total. Perhaps not surprising, a large proportion of the distribution of color in these scenes were largely confined to in and around the neutral axis. However, a small, but significant portion was found that almost fill the gamut of all possible colors in CIE chromaticity space, certainly well outside the current digital cinema and video standards for color. This study only falls short in that the 100 or so natural scenes consisting Fairchild's HDR photographic survey cannot possibly represent all we have seen. Still, scene dynamic ranges approaching six (6) orders of magnitude and CIE chromaticity that come close to filling the entire space in xy at virtually all comprehensible levels of relative luminance are demonstrated. Ultimately, it will be possible for a media to fulfill the promise of the full extent of color and dynamic range documented in this work to, quoting Jones & Condit again, "... determine the perfection with which the tonal [and color characteristics] of a given scene can be reproduced [not by any specific process, but in total]".

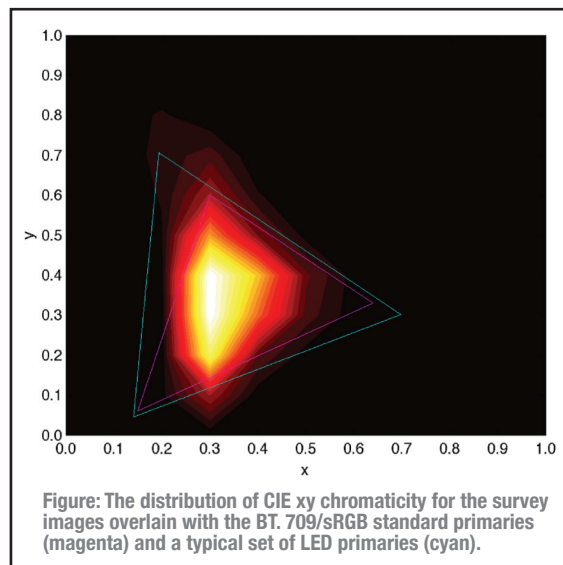


Figure: The distribution of CIE xy chromaticity for the survey images overlain with the BT. 709/sRGB standard primaries (magenta) and a typical set of LED primaries (cyan).

For previous issues of

THE CHROMAZONE

Check out: [www.mcs.l.rit.edu](http://www.mcs.l.rit.edu)