COLOR

Pixels
Palettes &
Perception

MARCH 2-3, 2018

HF DeLuca Forum, Discovery Building, University of Wisconsin – Madison

SCHEDULE

Friday Morning, March 2nd , 2018

8:15 – 8:30 **Check-in and Coffee**

8:30 – 8:45 **Opening Remarks**
Theresa Kelley, Department of English, UW–Madison
Ullrich Langer, Director, UW Institute for Research in the Humanities, UW–Madison

8:45 – 9:25 **Keynote I. Communicating through Color**
Karen B. Schloss
Department of Psychology, Wisconsin Institute for Discovery, and McPherson Eye Research Institute, UW–Madison

9:25 – 9:30 **Brief Break**

9:30 – 10:45 **Session 1: Aesthetics and narrative**
Moderator: Theresa Kelley, Department of English, UW–Madison

9:30 **Modern Enchantment and the Advent of Color in Children's Picture Books**
Erica Kanesaka Kalnay
English, Literary Studies, UW–Madison

9:45 **Neural Processing Underlying Color Preference Judgments**
Chris Racey[1], Ruyuan Zhang[2], Kendrick Kay[2], Karen B. Schloss[1]
[1]Department of Psychology and Wisconsin Institute for Discovery, UW–Madison, [2]Department of Radiology, University of Minnesota

10:00 **Color in Metaphor**
Brooke A. Alexander[1], Bret R. Shaw[1], and Timothy B. Campbell[2]
[1]Life Sciences Communication, UW–Madison, [2]Environmental Resources Center, UW–Madison

10:15 **Pylades and the Amazing Technicolor Dreamcloak: Seeing the Ancient Greek Theater in Color**
Mali Annika Skotheim
Institute for Research in the Humanities, UW–Madison

10:30 **Color Commands Commitment: Capturing the Attention of New Audiences to Initiate Action on Environmental Issues**
Judith L Waller[1] and James A. Brey[2,3]
[1]Art Department, UW–Fox Valley, [2]Geography and Geology, UW–Fox Valley, [3]Education Division, American Meteorological Society, Washington D.C.

11:00 – 2:00 **Lunch and Afternoon Break**
Print in Color, Color in Print -- Exhibit in Special Collections, UW Memorial Library
Created for this Symposium, this exhibit displays books and documents on the history of color making and printing. See back of program for directions/map for UW Memorial Library and for lunch options nearby.

Friday Afternoon, March 2nd, 2018

2:00 – 2:40 **Keynote II. A Painter's Color: Seen, Sampled, Suspended**
Christopher Campbell
Independent artist, basICColor Ambassador

2:40 – 2:45 **Brief Break**

2:45 – 3:45 **Session 2: Visual Communication**
Moderator: Marisa Otegui, Botany and Laboratory of Cell & Molecular Biology

2:45 **Color under the Microscope: From Chromosomes to Brainbows**
Steve W Paddock
HHMI, Laboratory of Cell and Molecular Biology, UW–Madison

3:00 **Modeling Color Inference: A Study of Color-coding Systems in Recycling**
Laurent Lessard[1,2], Kathleen Foley[2,3], Charlotte S. Walmsley[4], and Karen B. Schloss[2,3]
[1]Department of Electrical and Computer Engineering, UW–Madison, [2]Wisconsin Institute for Discovery, UW–Madison, [3]Department of Psychology, UW–Madison, [4]Termeer Center for Targeted Therapies, Massachusetts General Hospital Cancer Center

3:15 **Imaging the Color of Cancer**
Joseph Szulczewski, Dave Inman, Kevin Eliceiri, and Suzanne Ponik
Cell and Regenerative Biology, Laboratory for Optical and Computational Instrumentation, UW–Madison

3:30 **Data Visualization: Applying Perception to Design**
Michael Gleicher
Department of Computer Science, UW–Madison

3:45 – 4:00 **Coffee Break**

4:00 – 5:00 **Session 3: Color Substrates: Colored Threads**
Moderator: Gail M. Stirr, McPherson Eye Research Institute and Wisconsin Institutes for Medical Research, UW–Madison

4:00 **Color in Print in Word and Deed**
Robin E. Rider
General Library System and History Department, UW–Madison

4:15 **Coloring the World in Wonder: The Poetic Pigments of Master Dyers in Early Modern India**
Sylvia W. Houghteling
Department of Art History, Bryn Mawr College

4:30 **Spectrophotometric Color Measurement for Textile Industry & the New Fluorescent Pink Hunting Clothing**
Majid Sarmadi
Department of Design Studies and Materials Science, School of Human Ecology, UW–Madison

4:45 **The Power of Light**
Marianne Fairbanks
Department of Design Studies, School of Human Ecology, UW–Madison

5:00 – 5:05 **Brief Break**

5:05 – 5:50 **Session 4: Nature’s Secrets**
Moderator: Andreas Velten, Dept. of Electrical and Computer Engineering, Biostatistics and Medical Informatics, UW–Madison

5:05 **Spot the Imposter: Beyond the Surface of insect Mimicry**
Jacki Whisenant
Department of Integrative Biology, UW–Madison

5:20 **A Molecular Secret of Beet Red**
Hiroshi Maeda
Department of Botany, UW–Madison

5:35 **Rapid Adaptive Camouflage in Cephalopods : Linking Science and Art to Bio-inspired Materials and Engineering**
Roger Hanlon
Marine Biological Laboratory

5:50 – 6:15 **Break**
Coffee/tea option: *Prairie Fire, Union South (across from Discovery Building)*
Bar options: *The Sett, Union South (across from Discovery Building), Steenbocks (Discovery Building)*

6:15 – 7:15 **Public Plenary Lecture: Color: In the Brain of the Beholder**
Bevil Conway, National Institutes of Health
Moderator: Karen Schloss, Psychology, Wisconsin Institute for Discovery, McPherson Eye Research Institute, UW–Madison

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Saturday March 3rd, 2018

10:00 – 12:00 **Saturday Science: The Science of Color**
This event is open to the public, featuring interactive exploration stations for kids and families.
Exhibits will focus on how light colors our world and is essential to science. Discover how to use color to study stars, learn how colors are mixed to make new shades, explore how fluorescence is used in research, mix light to create your own colors and more.

12:00 – 12:40 **Saturday Science Color Keynote: The Ocean's Most Spectacular Color Change Artists**
Roger Hanlon
Marine Biological Laboratory
Moderator: Kevin Eliceiri, LOCI, Morgridge Institute for Research, McPherson Eye Research Institute, UW–Madison

12:40 – 12:45 **Brief Break**

12:45 – 1:45 **Session 5: Color Perception**
Moderator: Adam Steinberg, ArtForScience, Wisconsin Institute for Discovery and McPherson Eye Research Institute, UW–Madison

12:45 **How Language Changes Color Perception**
Gary Lupyan[1] and Lewis Forder[2]
[1]Department of Psychology, UW–Madison, [2]Department of Psychology, University of Sussex

1:00 **Enhancing Human Color Vision by Breaking Binocular Redundancy**
Bradley S Gundlach[1], Michel Frising[1,2], Alireza Shahsafi[1], Gregory Vershbow[3], Chenghao Wan[1,4], Jad Salman[1], Bas Rokers[5,6], Laurent Lessard[1,7], and Mikhail A. Kats[1,4,6]
[1]Department of Electrical and Computer Engineering, UW–Madison, [2]Department of Mechanical and Process Engineering, ETH Zurich, [3]Department of Art, UW–Madison, [4]Department of Materials Science and Engineering, UW–Madison, [5]Department of Psychology, UW–Madison, [6]McPherson Eye Research Institute, UW–Madison, [7]Wisconsin Institute for Discovery, UW–Madison

1:15 **Ephemeral Process (EP) Photography—A New Way to Make Color Pictures from Old Black and White Emulsions**
John Beaver
Department of Computer Science, Engineering, Physics and Astronomy, UW–Fox Valley

1:30 **Fifty Shades of Blue**
Thomas Littrell
ETC, Inc. Stage Lighting company using LED fixtures, Middleton, WI

1:45 – 2:00 **Coffee Break**

2:00 – 3:00 **Session 6: Physical Properties of Color**
Moderator: Susan Barribeau, Memorial Library, UW—Madison

2:00 **Optical Paleothermometry Using Nacre**
Jad Salman[1], Chang-Yu Sun[2], Alireza Shahsafi[1], Bradley S. Gundlach[1], Michel Frising[3], Chris Draves[4], Steve Weibel[4], Yuzhe Xiao[1], Gabor Kemeny[4], Pupa Gilbert[2], Mikhail A. Kats[1,2]
[1]Department of Electrical and Computer Engineering, UW–Madison, [2]Department of Physics, UW–Madison, [3]Department of Mechanical and Process Engineering, ETH Zurich, [4]Middleton Spectral Vision, Middleton, WI

2:15 **Color: Physics and Perception**
Pupa Gilbert
Department of Physics, UW–Madison

2:30 **Color, Clocks, and Gravity**
Shimon J Kolkowitz
Department of Physics, UW–Madison

2:45 **Flesh and Blood: The Vibrant Matter of Medieval Color**
Lisa Cooper
Department of English, UW–Madison

3:00 – 3:10 **Brief Break**

3:10 – 3:50 **Keynote III. Studio Notations: Color in Play**
Derrick Buisch
Department of Art, UW–Madison

3:50 – 3:55 **Closing Remarks**
Kevin Eliceiri, LOCI, Morgridge Institute for Research, McPherson Eye Research Institute, UW–Madison

SPONSORS

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Center for Visual Cultures, the Departments of Art, Art History, Psychology, and English, and the School of Human Ecology

ABSTRACTS

PUBLIC PLENARY LECTURE

Color: In the Brain of the Beholder

Bevil Conway
National Institutes of Health

What is color for and how do we see it? Color is a fundamental determinant of visual experience, playing a role in seemingly simple behaviors such as object grouping, as well as high-level behaviors such as social cognition. I will describe what we have learned about the brain mechanisms responsible for color, and how this knowledge is shaping the on-going debate about what color is for.

KEYNOTE LECTURES

Communicating Through Color

Karen B. Schloss
Department of Psychology, Wisconsin Institute for Discovery, and McPherson Eye Research Institute, UW–Madison

Experiences of colors are typically described in terms of perceptual dimensions. A particular color, say, UW–Madison Badger Red, has a certain amount of redness, lightness, and saturation. Yet, the experience of a color is so much more. It activates a rich network of associated concepts (e.g., UW-Madison, ripe strawberries, fire, the US Republican Party, and Target stores), which makes it a powerful tool for visual communication. I will discuss how people form inferences about the meanings of the colors, and how those inferences influence the way people evaluate and interpret the world.

A Painter's Color: Seen, Sampled, Suspended

Christopher Campbell
Independent artist, basICColor Ambassador

Since at least the 1860s, some of the most compelling moments of modernist painting have turned on artists' relationships to color: Monet in a particular bend of the Seine at a precise moment of the sun's elevation, Cézanne pausing for long moments, brush in hand, studying the motif of Mont Sainte-Victoire before marking out a single patch of paint. Using high-resolution details of their canvases, I will speak about my understanding of several aspects of their practice in processing vision into painting. I now use digital photography to "draw" slowly with a camera, trading away the registration of surface texture in order to capture the average unit color of objects and space, thereby harvesting sensation, something analogous to musical "sampling." This positivist immersion in nature thus acts as a supplement to imagination, as it yields endlessly surprising structural configurations and undreamed of chords of color; photographs pressed towards the painterly in advance of being painted. Over the years, the evolution in materials, tools, and technique that I have used to translate aspects of this phenomenal richness into form have led me to a practice in which I often work in the studio on large aluminum panels, suspending and dispersing pigment in micro-thin dispersions of alkyd resin, or out in the elements, working on large sheets of specially sized paper with oil paint and powdered pigments. In these ways I have sought to cultivate a new chromatic vocabulary, one which at times realizes some of the un-imaginable colors in Wittgenstein's Remarks on Color: an orange that is actually pale (not pink), or a "translucent" white.

The Ocean’s Most Spectacular Color Change Artists

Roger Hanlon
Marine Biological Laboratory

Nature has evolved elegant solutions for manipulating ambient light to produce dramatic and colorful animal behavior. Octopus, cuttlefish and squids are marvelous animals that use rapid adaptive coloration to fight, attract mates, confuse prey and avoid predators. They are among the most cognitively advanced animals in the ocean. Dr. Hanlon will present exciting new discoveries and illustrate them with extraordinary underwater video. He is a diving biologist who has published extensively on color change in cephalopods and fishes, and his work has appeared in many TV programs and print/internet media. This research is broad-based and includes fields as diverse as ecology, art and bio-inspired engineering.

Studio Notations: Color in Play

Derrick Buisch
Department of Art, UW–Madison

I will present my studio work, focusing on the ways color is employed. The talk will describe a few projects and the development of my color thinking and improvisation in the studio. The processes of choosing and orchestrating color palettes for individual series of paintings will be revealed with an archive of personal studio photographs and documentation of artworks/paintings from the last twenty years.

SESSION 1: AESTHETICS AND NARRATIVE

Modern Enchantment and the Advent of Color in Children's Picture Books

Erica Kanesaka Kalnay
English, Literary Studies, UW–Madison

Color has been thought to have enchanting qualities, yet the rise of color in children's picture books has rarely been compared to the rise of color in photography, cinema, or television—to the way new color technologies amplified the mesmerizing spectacle of the entertainment industry, what Theodor Adorno deems "a schematically produced fantasy." This paper begins to fill in this oversight by arguing that the shift from black-and-white to color illustrations represented a significant restructuring of children's aesthetic experiences. The color printing technologies that first became possible at the turn of the century not only rendered the children's book an art object, but reconfigured understandings of how children interact with images and texts. The emergent picture book format—with its double-page illustrated spreads—invited children to imaginatively enter into the vibrantly colored worlds that unfolded before them. Designed to evoke intense emotional attachments, picture books moreover performed political work, presenting immersive "new worlds" and soliciting identification with and desire for colonialist images in a time of rapid globalization. Drawing from book history and Walter Benjamin's essays on children's literature, this paper shows how, with the advent of color, the picture book became an everyday object of modern enchantment.

Neural Processing Underlying Color Preference Judgments

Chris Racey[1], Ruyuan Zhang[2], Kendrick Kay[2], Karen B. Schloss[1]
[1]Department of Psychology and Wisconsin Institute for Discovery, UW–Madison, [2]Department of Radiology, University of Minnesota

People form semantic associations with colors, which influence the way they evaluate and interpret the world. Behavioral evidence indicates that evaluations of colors are determined by the combined valence of all entities associated with those colors (Ecological Valence Theory; Palmer & Schloss, 2010). This implies that when people judge preference for a color, semantic associates of that color are activated, and the valences of those associates pooled to produce the preference response. Therefore, we predicted that brain areas involved in visual semantic processing (perirhinal cortex; PrC) would be recruited during color preference judgments and object association judgments, but not during perceptual judgments. We tested this using fMRI. Participants viewed calibrated color patches while performing four different tasks. We found that the BOLD signal in PrC remained at baseline when participants made perceptual judgments about the colors. However, the signal in PrC increased when participants judged their preference for the colors and when participants explicitly associated objects with the colors. These results provide the first evidence of a neural instantiation of the Ecological Valence Theory for color preferences, and highlight the rich diversity of neural responses elicited by cognitive judgments made on simple stimuli.

Color in Metaphor

Brooke A. Alexander[1], Bret R. Shaw[1], and Timothy B. Campbell[2]
[1]Life Sciences Communication, UW–Madison, [2]Environmental Resources Center, UW–Madison

Color is a powerful tool used to inform society. Color can dictate instructions (red mandatory actions), information (bright yellow caution tape), and moods (blue-walled hospitals, dreary grey days). In the following study in the UW Madison Life Sciences Communication Department, I was hired to illustrate different metaphors regarding the aquatic invasive species, zebra mussel. My job was to use the chromatic scale to evoke the same feelings in color that you would otherwise in text. The illustrations were to be used comparatively - the goal of the study was to isolate any variability among the illustrations that was not directly related to the predictive variable itself, the metaphors. The metaphorical campaigns included: a) a militaristic campaign, evoking verbiage such as, "Stop the invading species", b) a nurturing campaign, evoking verbiage such as, "You can help protect the lakes", c) an ironic campaign about aquatic hitchhikers, d) a species-phobic campaign, evoking the mood, "Non-native. Keep them out", and e) a strictly scientific campaign, evoking stringent verbiage such as, "Zebra mussels affect lake recreation". Here I present the five illustrations and compare and contrast the use of color in each.

Pylades and the Amazing Technicolor Dreamcloak: Seeing the Ancient Greek Theater in Color

Mali Annika Skotheim
Institute for Research in the Humanities, UW–Madison

The ephemeral performances of Greco-Roman antiquity were greatly enlivened by the colors used in the performance space. In this paper, I reconstruct the ancient theater as a colorful spectacle, with the theater buildings adorned with scene paintings and multi-colored curtains, and the performers wearing costumes and masks of many colors, often further accentuated by wreaths and garlands, and argue that color was a central part of the spectacle of ancient pantomime, a solo, masked, silent dance. The pantomime dancer wore a silk, saffron-colored cloak, trimmed with golden fringe, and a scarf, with which he imitated every character in the myth. Due to these rapid transformations of character, the pantomime dancer was compared to Proteus, the shape-shifting water deity. The color of his cloak, which would have caught the sunlight in an open-air, daytime performance, and shone in lamplight as darkness fell, must have contributed to the intense focus of the spectators on the solo dancer, often commented upon in ancient literary texts and inscriptions, and highlighted his movements as he flashed across the stage.

Color Commands Commitment: Capturing the Attention of New Audiences to Initiate Action on Environmental Issues

Judith L Waller[1] and James A. Brey[2,3]
[1]Art Department, UW–Fox Valley, [2]Geography and Geology, UW–Fox Valley, [3]Education Division, American Meteorological Society, Washington D.C.

In our collaborative art and science exhibitions, we use color as a language descriptive of historical events and objects, natural and human action, loss, change, hope and as a bridge between the observed and the poetic. In our three large-scale projects, some in collaboration with twenty other scientists, we strategically incorporate color choices to attract, inform and influence. Exhibits of paintings and accompanying science essays include treasured world places confronting catastrophe ("Layers: Places in Peril"), small scale objects leading to large-scale threats ("small problems, BIG TROUBLE") and the epic narratives inspired by select world rivers, ("River Bookends: Headwaters, Delta and the Volumes of Stories in Between"). All showcase color as descriptive yet intuitive, sincere yet ironic and reference historical and contemporary art ideas. Specific pigment choices include powdered graphite mixed with lamp black in a painting on Carbon, cobalt blue recalls Portuguese azulejos on a Tagus River painting, a Titian influenced palette for a painting on Venice, flake white in a work on Lead and the use of metal leafing, interference and other reflective pigments in several 'small problems" works to suggest the notion of mirrors and suggest that the problems and issues reflect us.

SESSION 2: VISUAL COMMUNICATION

Color under the Microscope: From Chromosomes to Brainbows

Steve W Paddock
HHMI, Laboratory of Cell and Molecular Biology, UW–Madison

Most living cells and tissues are colorless, almost transparent, and lack contrast when viewed with a light microscope. Therefore, to visualize any details of cellular components, it is necessary to introduce contrast into the specimen. This can be achieved either by optical means using a specific configuration of microscope components, or more usually by staining the specimen with one or more colorful dyes. Different regions of cells, for example the chromosome, or different cells in tissues, for example cell types in the brain, can be stained selectively with differently colored dyes. Color has become an important tool for understanding cellular functions in health and disease.

Modeling Color Inference: A Study of Color-coding Systems in Recycling

Laurent Lessard[1,2], Kathleen Foley[2,3], Charlotte S. Walmsley[4], and Karen B. Schloss[2,3]
[1]Department of Electrical and Computer Engineering, UW–Madison, [2]Wisconsin Institute for Discovery, UW–Madison, [3]Department of Psychology, UW–Madison, [4]Termeer Center for Targeted Therapies, Mass. General Hospital Cancer Center

Color is a useful feature for quickly and visually conveying a message. For example, a red sign can indicate danger or alert while a green sign can mean it's safe to proceed. Ideally, a designer would like to choose the colors they use in such a way that observers consistently and unambiguously infer the intended meaning. However, this task becomes a challenge when the design involves multiple colors and the color choices are not obvious. In this study, we consider color-coding systems in recycling. Specifically, how should bins for the disposal of paper, plastic, glass, metal, compost, and trash be colored? We show how the color inference process can be modeled as finding a maximum weight matching on a bipartite graph (an assignment problem). This allows us to reliably predict people's behavior when the bins are unlabeled and their only distinguishing feature is their color. We also show how our model can be used to select an optimized set of colors that maximizes a user's chance of discarding their item into the intended bin.

Imaging the Color of Cancer

Joseph Szulczewski, Dave Inman, Kevin Eliceiri, and Suzanne Ponik
Cell and Regenerative Biology, Laboratory for Optical and Computational Instrumentation, UW–Madison

Biologists have long sought answers for the basic questions about cancer…How does it start? Where did it come from? How can we stop it? One of the most powerful ways to answer these questions is to observe and measure the tumor environment utilizing light and fluorescence. Using a laser microscope as a flashlight, many groups are able to peer into the dark room of a cancerous tumor and its surrounding tissues, illuminating the small lanterns of green fluorescent proteins that has been genetically expressed inside of the cells. While this can provide great insight, native tumor cells do not contain these GFP lanterns. What they do contain are metabolic lanterns. These lanterns are inside of all of our cells and tissues and contain unique signatures for how well cells are processing nutrients. Through our imaging techniques we now can illuminate this metabolic world in our tissues and observe how normal tissues change into cancerous cells. We believe that through careful observation and diligent testing we can unveil the true color of cancer, and provide further insight on the most basic of our questions.

Data Visualization: Applying Perception to Design

Michael Gleicher
Department of Computer Science, UW–Madison

In this talk we will show examples of how an improved understanding of human perception of color can lead to better information displays. We will examine some recent results that show peoples' ability to perform estimation in images and provide examples of how these abilities suggest new designs for informative visualizations.

SESSON 3: COLOR SUBSTRATES: COLORED THREADS

Color in Print in Word and Deed

Robin E. Rider
General Library System and History Department, UW–Madison

We at the Department of Special Collections, University of Wisconsin-Madison, pride ourselves on our holdings of books with hand-colored illustrations and with illustrations printed in color. In particular, they show how authors, illustrators, printers, and publishers incorporated color into illustrations of science and natural history -- at considerable cost and with mixed success. As they prized "Nature's lively hues," they struggled with defining and reproducing color standards against which to measure animal/vegetable/mineral specimens. Our current exhibit "Print in Color, Color in Print" features the chemistry of color, deploying our deep strengths in history of chemistry alongside examples from the history of print culture. The exhibit highlights the material culture of color samples in printed books and explores the promise and value of uniform color reproduction. Often located at considerable remove from either color printing or hand-coloring is a lively discourse on and of color in early modern science. Textual gestures toward color abound in early work of the Royal Society and the French Academy of Sciences, and this paper builds on our exhibit by situating early modern artifacts of color in print against lexicons of color found in publications of two leading scientific institutions of the period.

Coloring the World in Wonder: The Poetic Pigments of Master Dyers in Early Modern India

Sylvia W. Houghteling
Department of Art History, Bryn Mawr College

Recent scholarship on European crafts has illuminated important connections between the work of master artisans, such as goldsmiths, glass-blowers and cloth dyers, and early modern methods of scientific inquiry. With their deep knowledge of local ecology and their sensitivity to the chemistry of water and fibers, master dyers can certainly be seen as engaged in scientific practices. In their ability to conjure otherworldly colors, dyers also transcended into the realms of wonder and poetry that European art history reserves for the figurative arts of painting and sculpture. Examining the role of the South Asian master dyer can expand our understanding of the possibilities for the craft of dyeing. Drawing upon a rare, early eighteenth-century Indian dyer's recipe book and the findings of a recent collaborative dye analysis project, this paper demonstrates that South Asian dyers retained a high degree of flexibility and individuality in their production of cloth, as well as a deep relationship to local ecology. During the period of European intervention in South Asian cloth, the art of the dyer adds a strand of resistance and autonomy. The inscrutability of the South Asian dyer's craft to European witnesses became an advantage in the seventeenth century when the British, Dutch, Danish and French came to India and began to purchase huge quantities of dyed cotton textiles. While textile painters in India were restricted in their creativity to patterns sent from patrons, a dyer retained control over what one Dutch traveler called "his science."

Spectrophotometric Color Measurement for Textile Industry & the New Fluorescent Pink Hunting Clothing

Majid Sarmadi
Department of Design Studies and Materials Science, School of Human Ecology, UW–Madison

It is well established that the visibility of objects (i.e. hunting clothing), depends on many factors including the amount of light that scatters from the objects and their color contrast with the surroundings. This study has used spectrophotometer to measure and analyze the amount of light scattered (reflected) from several blaze orange hunting hats and compared them with blaze pink colors. It has also investigated the color contrasts with green and orange (the colors most found in the woods) under different light sources. It is well known that blaze orange provides a very good contrast in the wooded areas in the spring and summer. However, when visually compared to the orange colors found in the fall leaves, blaze orange was harder to detect than the pink colors that were tested. The pink colors provided a better color contrast. Our spectrometric analysis indicated that the blaze pink that was tested had similar visibility to most blaze orange hats and was even better than a couple of them. Therefore, based on this small study, it can be concluded that the blaze pink we tested were as safe as the "Orange Blaze" hunting hats.

The Power of Light

Marianne Fairbanks
Department of Design Studies, School of Human Ecology, UW–Madison

Color is a trick of light. Which wavelengths are reflected and which are absorbed determine the spectrum we perceive. I present three very different examples of how I use color in my art practice and in my textile research. In my solar textile research, using dyes to create an electronic device on a textile is at the forefront of making multifunctional fabrics, and the color functions with a purpose—to collect energy from sunlight. In my artwork, I've employed the extremes of color—one natural, soft and muted, the other fluorescent, exuberant and loud. In both cases, the color functions to convey meanings. Disparate though each of these approaches may seem, in each case that trick of the light we call color is central, and my job as an artist and designer is to harness the power of that light.

SESSION 4: NATURE'S SECRETS

Spot the Imposter: Beyond the Surface of insect Mimicry

Jacki Whisenant
Department of Integrative Biology, UW–Madison

Color mimicry in insects is a well-documented strategy in the insect world, where one species imitates the shape and coloration of another in order to benefit from those protective qualities. What you see isn't always what you get... To our eyes two species may look completely identical, but how does the mimic tell the difference? In addition to non-visual chemical cues, many insect mimics also display different patterns in the ultraviolet range, which come blazing to life when viewed with UV photography. The range of human vision is only one way of experiencing the world, and many plants and animals (especially insects) communicate one step beyond the visible spectrum.

A Molecular Secret of Beet Red

Hiroshi Maeda
Department of Botany, UW–Madison

Red tulip in spring, red raspberry in early summer, and red maple in fall; Red color is everywhere in nature and on our table. Chemically speaking, red pigments found in a wide variety of plants, like berries and roses, are anthocyanins. Beets and closely related plants, such as spinach, quinoa, and cactus, make different kinds of red, betalain pigments. Why this unique red evolved only in this group of plants has been a mystery. Utilizing beet genome sequence combined with enzyme biochemistry, we recently discovered a key piece to this puzzle. One of over twenty thousand genes in the beet ancestor genome was accidentally altered by a single mutation. This made the encoded enzyme and the plant very efficient in making one particular amino acid—tyrosine—the essential ingredient of making betalain pigments. These plants later found a way to make use of this excess tyrosine and produced betalains that attract animals from pollinators to humans. The finding also has exciting implications beyond beet red pigments. The unique enzyme and mutation found in beets can now be used to boost the production of various plant chemicals derived from tyrosine, such as vitamin E, morphine, and epinephrine, to name a few.

Rapid Adaptive Camouflage in Cephalopods: Linking Science and Art to Bio-inspired Materials and Engineering

Roger Hanlon
Marine Biological Laboratory

Nature has evolved elegant solutions for manipulating ambient light to create patterns and coloration for a wide range of functions such as communication, camouflage and thermoregulation. Nowhere is the diversity and speed of change in body patterning better developed than in the cephalopods (squid, octopus, cuttlefish). First, I will briefly mention visual sensing of the ambient light field and subsequent control of skin patterning. Second, I will illustrate how body patterns are used functionally in the behavioral ecology of various cephalopods. Third, I will describe various details of the biophotonic structures of the skin that produce such remarkable visual diversity: chromatophores, iridophores and leucophores. Emphasis will be placed on the principles involved and how they might provide bio-inspired approaches to materials science and engineering.

SESSON 5: COLOR PERCEPTION

How Language Changes Color Perception

Gary Lupyan[1] and Lewis Forder[2]
[1]Department of Psychology, UW–Madison, [2]Department of Psychology, University of Sussex

As part of learning some languages, people learn to name colors using categorical labels such as "red", "yellow", and "green". Such labeling clearly facilitates communicating about colors, but does it also impact any aspects of color perception? Despite the apparent simplicity of the question, answers have been elusive. Using a standard color-discrimination task, we show that hearing color words affects how accurately people discriminate nearby colors. This improvement took the form of an increase in categorical perception: immediately after hearing a verbal cue, participants were better able to distinguish named category members from non-members, but the cue had no effect on distinguishing two highly typical shades of the named color. In contrast to verbal labels much more informative—a preview of the target color—failed to yield any changes to discrimination accuracy showing that in some cases, color perception is more strongly affected by words than by colors.

Enhancing Human Color Vision by Breaking Binocular Redundancy

Bradley S Gundlach[1], Michel Frising[1,2], Alireza Shahsafi[1], Gregory Vershbow[3], Chenghao Wan[1,4], Jad Salman[1], Bas Rokers[5,6], Laurent Lessard[1,7], and Mikhail A. Kats[1,4,6]
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To see color, the human visual system combines the response of three types of cone cells in the retina—a compressive process that discards a significant amount of spectral information. Here, we present an approach to enhance human color vision by breaking its inherent binocular redundancy, providing different spectral content to each eye. In past work, we fabricated and tested a set of optical filters that "splits" the response of the short-wavelength cone between the two eyes in individuals with typical trichromatic vision, simulating the presence of approximately four distinct cone types ("tetrachromacy"). Such an increase in the number of simulated cone types can reduce the prevalence of–pairs of distinct spectra that resolve to the same perceived color. Here, we present our past work, as well as discuss forthcoming work using virtual reality to investigate the underlying principles of this approach and design future devices. With this work, the technique may result in an enhancement of spectral perception, with applications ranging from camouflage detection and anti-counterfeiting to new types of artwork and data visualization.

Ephemeral Process (EP) Photography—A New Way to Make Color Pictures from Old Black and White Emulsions

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What we call ephemeral process (EP) photography uses B&W paper negatives, printed out with neither developer nor fixer, but with a non-developing chemical accelerant applied to greatly increase the speed. The paper negatives, damaged by the light of the scanner used to capture digital images from them, remain light sensitive. We perform only simple digital manipulations of overall levels and color balance. Even though a black and white emulsion is used, the resulting colors are real, and arise from an odd synergy between the spectral response of the different silver salts in the B&W paper, and the scattering colors that appear when one neither develops nor fixes the paper. The physicality of the unusual color palette, and the hand-rendered expressiveness of the process make EP a useful technique for art photography. It is inexpensive, uses no toxic chemicals, and it is highly accessible to beginning students. As such, it has proven useful as a teaching tool for both art photography and physics.

Fifty Shades of Blue

Thomas Littrell
ETC, Inc. Stage Lighting company using LED fixtures, Middleton, WI

Fifty Shades of Blue continues the discussion of how stage lighting is changing with the advent of LED-powered fixtures. Additive color mixing gives designers the power to subtly manipulate color on a real-time basis. This session delves deeper into the nuances of color and presents examples of innovative control features that allow lighting designers to better handle the wonderfully variable—but sometimes non-intuitive—color capabilities of LED-powered stage lighting. Fifty Shades of Blue is a presentation with both PowerPoint and demonstration cues with LED fixtures to clearly illustrate the concepts presented. There are three parts to the presentation: 1. The Array – A color-mixing LED-powered fixture has a printed circuit card with multiple LED emitters of different colors. What is the science behind making the best array for the job? 2. Metamerism – The science of additively mixing colors of light to produce a desired result requires knowledge of the concept of Metamerism. 3. Control – New color-mixing fixtures require new color-mixing tools in the user interface devices. The third part of the presentation shows live examples of new, intuitive control features for dealing with the endless variables of color-mixing fixtures.

SESSION 6: PHYISCAL PROPERTIES OF COLOR

Optical Paleothermometry Using Nacre

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Nacre, or mother of pearl, features a dazzling mix of lustrous colors. These colors emerge due to the microscopic structuring of the materials comprising the nacre. The underlying physical structure is composed of stacks of transparent inorganic thin-film tablets of aragonite, bound by an organic protein. This stacking creates the optical interference effects that we observe as colors, which is strongly dependent on the tablet thicknesses and observation angle. Recently, Gilbert et al. have correlated the average thickness of the individual nacre tablets to the ocean temperatures at the time of formation, thus transforming the nacre into an ancient ocean thermometer. However, the current methods of extracting tablet thicknesses require extensive and destructive microscopic measurements of thousands of individual tablets. In this work, we leverage the dependence of the color of nacre on its structural properties to extract average tablet thickness. We perform optical angle-dependent reflection spectroscopy using hyperspectral imaging of nacre samples, and use a thin-film interference model to extract the average tablet thickness. This technique enables large-area mapping of thicknesses across a sample in a quick and non-destructive manner, and has potential future applications for rapid paleothermometry to be used in the field.

Color: Physics and Perception

Pupa Gilbert
Department of Physics, UW–Madison

The perceived color is more than the simple wavelength of light, because additive neurons in the eye produce it. Imaginative demos show how these neurons work, and how they are fooled by computer and cell phone screens so we see a myriad colors when in fact there are only three. Pupa Gilbert, professor of physics, artist, and author of the "Physics in the Arts" book, clearly and simply explains the complexities of color vision and illusions. Bring your own eyes!

Color, Clocks, and Gravity

Shimon J Kolkowitz
Department of Physics, UW–Madison

One of the remarkable predictions of Einstein's theory of general relativity is that the color of a wave of light will change with height in the presence of gravity. Because the speed of light is constant, the color of light is intrinsically linked to its frequency, and therefore to the passage of time as measured with a clock. Clocks have become so precise that the change in the color of light due to the Earth's gravitational field can now be measured in the laboratory. We will present a brief history of physics experiments that have probed the interplay between color, clocks, and gravity, and will describe plans for related experiments that will take place here at UW-Madison.

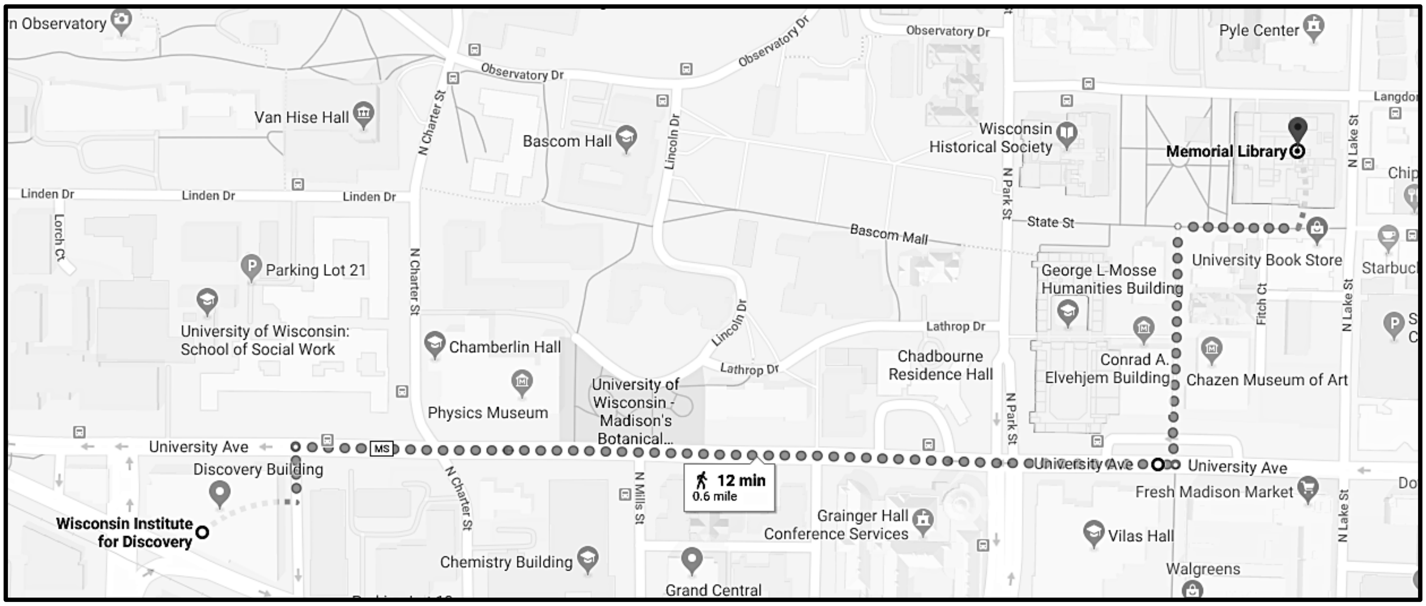
Flesh and Blood: The Vibrant Matter of Medieval Color

Lisa Cooper
Department of English, UW–Madison

It is hard to underestimate the significance of color in Western medieval thought and experience. As a recent exhibit catalog on the topic declares, "[i]n medieval…Europe, colours represented man's place in society and the universe….[they] expressed global beliefs, regional fashions and individual tastes." Thus it should be no surprise that the sources for the study of medieval color-thinking are numerous and varied, ranging from works of visual art and vernacular literature to scientific treatises on optics by (among others) the thirteenth-century thinkers Robert Grosseteste and Roger Bacon. This paper will explore just one small but nonetheless critical set of these sources: recipes for the making of colored pigments for use by scribes, illuminators, and painters. It will focus in particular on color recipes that, in explaining how to mix ingredients and use tools drawn from animal, mineral, and vegetable bodies in order to represent human ones, speak to larger issues regarding the nature of creation—of world-making—both human and divine. I argue that these recipes are productive sites for thinking through, both then and now, what the political philosopher Jane Bennett has called "the vitality of matter and the lively powers of material formation."

Print in Color, Color in Print

Special Collections Exhibit
976 Memorial Library, 728 State St.
9AM-5PM



Special Collections Location and Directions:

The Department of Special Collections is located on the 9th floor of Memorial Library. We welcome members of the University of Wisconsin community as well as visitors from near and far. To enter Memorial Library, you will need either a valid UW ID or a day pass obtained at the entrance. To obtain a day pass you will be asked to present a current form of identification (driver's license, passport, etc.) with current address.

To reach Special Collections on the 9th floor of Memorial Library, take elevator 5 (marked Special Collections and South Stacks) to floor 9R. Alternatively, take one of the bank of 3 elevators in Memorial Library to the 7th floor, take the stairs to the 9th floor, then follow the signs to Special Collections. If you have questions, please call Special Collections at 608-262-3243 or ask at the Circulation Desk on the 1st floor of Memorial Library.

To reach Memorial Library from University Avenue, turn north onto Lake Street. Memorial Library is at the corner of Lake Street and State Street, and faces the University Bookstore building. The closest public parking is the City of Madison State Street Campus Ramp on North Lake Street between State Street and University Avenue.

Where to Eat

Near WID--

Steenbock's (in WID)
UW Union South
Library Café & Bar

Near UW Memorial Library on Library Mall--

University Club
Amazing Food Carts

On lower State Street East of Library Mall--

Mediterranean Cafe
Kabul
Einstein Bros.
…and many more.