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Photo Credit: Mark Fairchild

ISCC Board of Directors Corner

Karen Triedman

Bright Marimekko prints, multicolored shag rugs and yellow walls were the ever-familiar signature of my childhood home. While I majored in American studies at Brown University, my engagement with color and my love of museums and everything art led me to seek a Master of Arts from University at Albany, State University of New York (SUNY) and a Master of Fine Arts in painting at the University of Chicago. On graduation and relocation to New York City, I was able to get a job at Bloomingdales in visual merchandising. This combination led me to color and design consulting work and many years of teaching color classes at Rhode Island School of Design Certificate Programs.

In my writing and teaching, I have always wanted to explore color in context. As artists and designers, we have been exposed to color theory, but we may find it difficult to expand our theoretical understanding into the realm of practical use. My students learn traditional painting techniques and theoretical principles. But my parameters are larger, exposing them to science, culture and psychology. When teaching color and design, we explore M. C. Escher's mathematical color design relationships, we focus on perception and response, and we talk about color culture with respect to history and geography. Although we may understand that a pair of complementary colors will create harmony, we may not

understand which pair will increase the communicative power of design. Standard theory suggests that all colors mixed together become gray, but it takes a more expansive sophisticated view of color to see that the combination could be used to represent the blending of corporate cultures in different parts of the world. When designing a spa, why not use color palettes and lighting that realize and utilize expressive powers of color to create a physiological shift, such as slowing the heart rate.

This integrative approach, backed by research, led me to the ISCC Munsell Centennial Color Symposium and to ISCC. Since I joined the board, my focus has been to participate on the steering committee for Color Impact 2023: Color and Human Experience. In this role, I'm helping to create an art exhibit that will be combined with the poster presentation. I am looking forward to calling for creative expression from color scientists, artists and designers in an "integrated" digital art exhibit, juried by a variety of color professionals.



Karen Triedman

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This issue marks a milestone in the ISCC organization. It is the 500th newsletter. You can take a look at Issue 1 on our website for a look at the color issues the ISCC was addressing in 1933. <http://www.iscc-archive.org/Newsletters/ISCCNews001.pdf>

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Remembering Danny C. Rich

Paula J. Alessi and Roy S. Burns



Danny Clark Rich was taken from us too soon (April 23, 1951 – July 3, 2022). Tragically, he could not recover from his injuries sustained in a three-car accident on July 1, 2022. Danny joined the ISCC during the mid-1970's while he was a graduate student at The Rensselaer Color Measurement Laboratory, directed by Professor Fred W. Billmeyer, Jr. At that time, the ISCC had technical committees on various aspects of color technology and Danny participated in many of them. This was the beginning of a career focused on the practical problems of color science. Danny chaired and served on technical committees in the ISO, CIE and ASTM, among others, following in the footsteps of his mentor, Professor Billmeyer. We have asked colleagues to write about their relationship with Danny to give life beyond what we can read in a resume. The contributions are not exhaustive, but representative.

The ISCC has created the Danny C. Rich Memorial Lecture to honor him in perpetuity. The first lecture will be a retrospective of his contributions to color science and technology. This will occur at the 2023 ISCC Annual Meeting.

Paula J. Alessi and Roy S. Burns

P.S. We selected the spectrum because Danny's passion was spectrophotometry. The spectrum ranges from 380 – 730 nm, calculated from the 1931 standard observer and rendered for sRGB.




I first met Danny at The Rensselaer Color Measurement Laboratory (TRCML) in 1977 where I pursued a master's degree in Color Science as he was working on his doctoral degree. Danny and his lovely wife Phyllis took me under their wings because moving to Troy, New York was the first time I had ever been away from home! I enjoyed dinner at their home, especially their homemade macaroni and cheese! Danny was my mentor. I was impressed and amazed at how he knew the answer to all questions that were posed to him, whether they came from our fellow lab members or our summer industry students who came in to learn a bit of color science to enhance their job performance. Danny had a rare sense of humility that allowed him to answer questions in a way that would inform you while making you feel like his intellectual equal. I left TRCML in 1979 followed by Danny in 1980. Thankfully, we stayed in touch over the years as we both pursued active careers in color science. I always enjoyed meeting Danny again at many national (ISCC) and international (CIE and AIC) color meetings. You could never miss his infectious laugh in the audience! He remained a very gallant gentleman always checking on me as I traveled alone to make sure I found my way back to my hotel, especially if we were outside the United States. Danny always shared family photos of his wife, daughter and twin sons. It was a pleasure to see how their children had grown

over the years and Danny was so proud of them as he shared their many accomplishments!

Danny's very successful color career propelled him into management positions, but he always performed very important color research to advance state-of-the-art. Yet the role he embraced the most was the role of teacher. He was a natural at it and remained a perpetual mentor as colleagues continued to seek knowledge from him via phone, email, social media groups or casual fireside conversations during meetings. Danny was a man of deep faith and it showed as he interacted with all as a humble advisor and friend.

The loss of Danny has left a void in my heart that no one else can fill. I have been trying to fill that void with memories of him and thoughts of his significant color science contributions. The color science world will never be the same without you, Danny! We will miss you! We will try to carry on in your memory. Rest in peace!


Paula J. Alessi, Retired Senior Color Scientist, Past President AIC, President ISCC (1992-93)



When I began a doctoral program in Color Science at Rensselaer Polytechnic Institute, Danny loomed larger than life. Almost every answer to my many questions included "Danny." I met him at his dissertation defense. I assumed it would be a walk in the park for him. After all, he IS Danny. To this day, I have never seen a defense as brutal as his. One of the committee members had an epiphany the night before that the statistics were wrong. It didn't matter that the statistics were recommended by this member. Somehow, Danny kept his composure and professionalism. This was the beginning of a 40-year friendship. Looking back, "generous" comes to mind. I would write Danny emails where I would ask and answer a question, looking for confirmation. One-word emails, "Yes," were treasured. During the mid-1980s, I wanted to use computer-controlled CRT displays for visual experiments. The systems I knew were very complex and too expensive. Danny told me about a Number Nine full-color video card that worked with an IBM PC-AT. We were off and running. I cannot overstate how important this advice was to our research program at the RIT Munsell Color Science Laboratory. I have many examples of his intellectual generosity. I have very strong memories of Danny as an ISCC President. He was at ease and confident, and most importantly, he had this amazing smile. During his funeral when I heard about his involvement with the Church of Christ, it reinforced what I knew about Danny. His spirit lives on in so many of us.


Roy S. Berns, Professor Emeritus Rochester Institute of Technology

*"Most of all, he always
patiently explained
complex topics in
understandable ways"*




Danny Rich was many things to me. Professionally, he was a mentor throughout our 20+ year relationship. He always answered the phone. He always answered my emails. Most of all, he always patiently explained complex topics in understandable ways. Often starting with "as you might recall..." which almost always turned out to be the case. Often citing a standard or paper, sometimes one that I myself wrote. Always firm but not unkind, always gentle but not yielding to emotion over truth. If you did not want a straight answer, you should have asked someone else. Personally, Danny was a kind of guardian angel. I knew he was always there when I needed him, as I progressed through my career in academia and then into self-employment. It didn't matter if he was to be listed as an author, or stand to gain in any way. He let me know that I mattered, and that I could make a difference. He helped simply because it was the right thing to do. Finally, Danny was practical, as witnessed by this conversation in Minneapolis at the 2019 TAGA/ISCC Conference (my last in-person meeting with him): After being invited to sit down with Danny at dinner in the hotel restaurant, we ate, chatted, and eventually received the check. As he had already paid for several dinners, I offered to cover the bill. And he said this: "You know Dave, if I eat alone, and order a \$45 steak, I will get all kinds of grief when I submit the expense report. But if I say I was eating with a colleague, and we both order \$45 steaks, my expenses are paid without question." Funny. Brilliant. Kind. Helpful. Missed. Danny.

Dave Wyble, President Avian Rochester LLC, President ISCC (2021-22).



I had a video meeting with Danny one week before his death. He was showing me his sun room—the working place in his new house. Danny was a colleague, friend, and my guardian angel whom I could consult on all colour science questions. He was always there to help and advise me. A quick search of an exemplary email in my saved correspondences begins as follows: "I am afraid that you have not looked far enough into the history of colour technology to see the real reason for the development of hemispherical diffuse spectrophotometers." On his last visit to Munich, he insisted on inviting not only me but also my wife to dinner. I am very grateful to have known him for over 20 years, mostly within ISO standardization matters. Having a moment of silence during the recent Fogra Colour Management Symposium and a dedicated obituary in the current German Colour Council report was the minimum I could do to express my deepest respect and thanks.

Dr.-Ing. Andreas Kraushaar, Abt. Vorstufentechnik, Fogra



I met Danny in February 1977 when he was working towards a doctoral degree in Professor Billmeyer's Rensselaer Color Measurement Laboratory. I had joined the laboratory for six months as a Visiting Scientist. When I first saw Danny, he was sitting at his desk working on the finishing touches of a digital clock he had put together from some electronic parts. Needless to say, I was duly impressed—it was in 1977! We became good friends, and I even had the privilege to be invited for dinner in their home. I still cherish the handwritten recipe (by Phyllis) for the Beef Stroganoff, which, upon my return to Hungary, has become one of our favorite dishes. Since then, I participated with Danny at countless AIC and CIE events, we served on each other's CIE technical committees, and I often turned to him for professional advice—never in vain. For me he was the model scientist, thorough and reliable, with an incredible, solid knowledge of colour science. I miss him dearly.

Robert Hirschler, Colour Consultant, Budapest, Hungary



Danny hired me in 2019 as a color scientist in Sun Chemical's Color Research Lab. I worked under him until his retirement in the summer of 2021.

Danny was a particularly valuable resource because my background was largely theoretical. For example, he served on many standards bodies and their committees: ISO, ASTM, CIE, ICC, and many more. After attending some meetings alongside him (where he was regularly greeted as an old friend, having known everybody for decades), the many compromises and inevitable approximations that go into standards, and the practical considerations that make changing them so difficult, made more sense. Danny's views, sometimes sharply worded, on the wisdom—or otherwise—of the bodies' previous decisions, were often more enlightening than the standards' text, not only because he'd participated in a lot of the decision making, but also because he talked in terms of the motivations rather than the final results.

As a supervisor at Sun Chemical, Danny's demanding rigor served both him and his subordinates well. While at times he could be very critical (even a bit sarcastic), he was always receptive and gave a fair hearing to any ideas about how to solve the myriad practical problems that arose. With his long experience and encyclopedic knowledge, he usually suggested a helpful technique or identified relevant previous work. On a few occasions I managed to come up with novel solutions that differed from established procedures. He took a few days to look carefully and thoroughly, and perhaps a bit skeptically, at the new offering. His verdict was usually curt approval. On rare occasions he came back with a compliment that was to the point and never effusive.

***“Whatever the situation,
Danny was available as a
guide and mentor”***

Whatever the situation, Danny was available as a guide and mentor, and I remember him fondly, humming to himself as he worked in his office across the hall.

Paul Centore, Color Scientist, Sun Chemical Corporation



I knew and was friends with Dan for forty years. He was always kind and considerate and would go out of his way to be helpful to everyone. The whole of the color community sought his advice and were never disappointed. I remember one time he had presented a paper on inter-instrument agreement. I told him I enjoyed the paper but could not use it as the color-difference data were not in FMC-2. He raised an eyebrow and laughed. He knew I worked for Sherwin-Williams and he had worked there years previously and understood they used FMC-2 for internal work. A few days later he sent me the paper reworked in FMC-2. That was just how he was. We have all lost a great mentor and friend.

Frank O'Donnell, Retired Research Fellow Sherwin-Williams, President ISCC (2010-11)



Danny was my friend, mentor, colleague, and fellow Christian. We met in the 1980s. We shared passionate, lifetime interests in color, color science, and God. He will never be forgotten because my life is enriched by his.


Jack Ladson, President ISCC (2000-01)



I interacted with Danny over three decades—as a colleague, friend and devil's advocate. This occurred in the venues of color professional societies (e.g., ISCC) and standards bodies (e.g., ASTM). An iconic image I have of Danny was at the 1992 ISCC/AIC conference in Princeton, New Jersey, where he held open the door of Datacolor's new Lawrenceville facility to welcome the attendees for a visit. At the time, Danny was Datacolor's Principal Color Scientist, a position I was to take a decade later. He was a hard act to follow. On a personal level, Danny was always patient, articulate and confident. I learned a lot during our discussions and prized his occasional deference. His deep knowledge covered all fields concerned with color, and also extended into other unexpected places. For example, he once gave me very practical advice (not to eat green peanuts) based on his experience as a Civil War buff (soldiers got very sick when forced to survive on green peanuts). After I failed to heed his advice, I resolved always to listen to Danny—a resolution I happily was able to follow. Also, Danny was informed enough about theological debate


and theoretical physics to publish a 3,000-word book review of Frank Tipler's book, *The Physics of Immortality* [1]. That essay is both engaging and logically compelling. I recommend it even if you haven't read the book! After Danny retired and moved to Memphis (cutting off opportunities to interact with him in ASTM and ISCC), I still found myself phoning him occasionally about some technical matter or another. Sadly, that is no longer possible.

[1] <https://www.doesgodexist.org/JanFeb96/PhysicsOfImmortality.html>
Michael H. Brill, Director of Research Datacolor, President ISCC (1998-99)



My acquaintance with Danny Rich involved various color-standards organizations including the International Color Consortium (ICC), CIE Division 8, ISO TC 130, and the CGATS/USTAG. Danny's insight and extensive practical knowledge in color science, instrumentation, and metrology as well as inks and printing were always welcome in the discussions during these standards meetings. His boisterous laugh was contagious bringing joy to all in the room. Mostly, I'm extremely appreciative of Danny's belief and support of me and my work. For whatever reason, Danny strongly believed in what we were doing in the ICC to advance color management with iccMAX as well as being a strong advocate and mentor for standardizing the work related to my Ph.D. in the CIE. He understood the vision and whole-heartedly embraced it. In some ways, I have been asked to fill in his footsteps in some of these organizations, and believe me, Danny's shoes are really big to try to step in to. Danny will truly be missed by many others including me with a big hole in my heart left by his passing. If possible (at some future cosmic day), I look forward to meeting with him again.

Max Derhak, Principal Color Scientist Onyx Graphics Inc.



As I think back on my time and interactions with Danny, I can only say that I'm thankful for the various roles and influences he's had on me over the years. As my manager he gave me my first opportunity in the real world following graduate school; while it was only a few short years working together he gave me every opportunity to learn and grow, even when it was time for me to move on. As a mentor he epitomized knowledge sharing—always willing to point out what I “must have forgotten” or remind me “as we all know” before expertly referencing some obscure text or study I had no idea existed. As a friend, he always answered the phone; while many of our discussions contained some elements of shop-talk, he was always willing to lend an ear no matter the topic. Thinking through these interactions, it amazes me that it's still one of our earliest that stands out, and is a story I've told too many times to count. It was summer 2002 and I was finishing my M.S. in Color Science at RIT.

“Besides discussing various color-related issues at the lab, Danny had a fun side to him”

I was interviewing with Danny for a position at Sun Chemical in Carlstadt, NJ and I flew in from Rochester, NY that morning. For some reason, I agreed sushi was a good lunch choice with Danny and his manager, even though I'd never eaten sushi before! My goal was not to embarrass myself and, fortunately, the food was great, the conversation was great, and I'm thinking I have this job all wrapped up. As I get to the end of my plate, I see a flowery-looking vegetable thing and figure it's time to try this out too. I pick it up in my chopsticks, dip it in the soy sauce, and throw the whole thing in my mouth. The heat hit me instantly, my eyes immediately watered, and I can't imagine how I looked as I chewed away at this ball of fire! After I swallow and compose myself, I look up to see Danny giving me a terribly confused look. He said, "did you eat that all in one bite?" I respond "yes." He said, "that was ginger; you're supposed to take a little piece at a time." Unsure how to respond I mutter "but you saw me pick it up, you saw me dip it in the soy sauce, you saw me pop this in my mouth and didn't bother to warn me?" With a smile Danny responded "Anthony, I can't teach you everything. Certain things you'll have to learn for yourself."

I'm immensely grateful for all that Danny Rich has taught me over the years, and the lessons I had to learn for myself. I can only aspire to be as positive an influence on others as he was to me.


Anthony Calabria, Sr Manager Color Technology and Automation Axalta Coating Systems



Among all of us, I believe that I was with Danny for the longest time at The Rennselaer Color Measurement Laboratory (TRCML). Besides discussing various color-related issues at the lab, Danny had a fun side to him. After school hours, he would go to the student union building and play pin ball machines. He was serious about it, and being big, he would shake the machines to direct the pin ball to specific slots and win the game. He really had fun and I bet he became a serious video gamer.


While pursuing our graduate degrees, all of the students would pile into Danny's Dodge Dart and we would visit instrument manufacturers including IBM, ACS and Diano-Hardy. They were interested in our opinions as this was the time when spectrophotometers became viable alternatives to colorimeters. These trips sometimes resulted in companies sending us instruments to test out. I remember the trip to Diano-Hardy, located near Boston. We had dinner at a clam shack followed by a Red Sox baseball game at Fenway Park. Thankfully, Danny didn't drink and was our permanent designated driver. After leaving RPI, Danny and I stayed in contact discussing color and pigments projects. As always, he was helpful, delightful, a gentleman and scholar.

Romesh Kumar, Technical Consultant Heubach Color




Danny was very active in CIE for many years as I have been myself. He was certainly one of the key persons in CIE colorimetry and his passing is a big loss for the CIE. He was active over multiple Divisions in CIE. In Division 2, he chaired TC 2-39 (Technical Committee) for geometric tolerances for color measurements that produced CIE 176-2006, a key publication in colorimetry. He also chaired TC 2-70 and was active in many other TCs related to optical properties of materials. He contributed much to Division 1, for CIE 15 (2004 and 2018) and other colorimetry publications. He was also active in CIE Division 8 and was also a liaison officer between CIE and ISO for reflectance and transmittance issues. I remember in 2015 Danny invited me to ACA Coatings Tech conference in Louisville, KY and we had a great time. He was always prompt in responding to requests, was thorough in his responses and was a pleasure to work with. We appreciate Danny's great contributions in CIE over the years and we miss him. May he rest in peace.

Yoshi Ohno, National Institute of Standards and Technology NIST Fellow, Past President CIE



It is not easy to write about someone with as much knowledge and a willingness to help others as much as Danny. My first introduction to Danny was through his messages on Usenet groups in the 1990s. His knowledge was so wide and his responses so helpful that I still have some of them in my archives. We finally met at an early CIC conference where I had a chance to get to know him over lunch. Through the years Danny was my "go to" person for questions about standards, instruments and measurement. Whenever I contacted him, his information was so good that thanking him seemed insufficient, so I occasionally offered to buy him a round of his favorite adult beverage the next time we met. I think my debt is now up to a barrel. There is hardly an area of color science that will not be affected by his absence.

Robin Myers, Robin Myers Imaging



In the 1970s, there was a commercial for a brokerage firm. The scene was a busy restaurant (or a plane or a ball game). One person is asking another about stocks. The other says "Well, my broker is E.F. Hutton..." The room suddenly goes quiet. Everyone leans in closer to be able to hear what E. F. Hutton has to say. I was reminded of that commercial many times in standards committee meetings. It wasn't E.F. Hutton who was talking, of course. It was Danny Rich. He would be sitting quietly, perhaps playing solitaire, and a color question would come up. Whatever argument or discussion was going on, Danny would

be given deference by all in the room, and whatever he said would be the answer.

When I was cutting my teeth in the mid-1990s, I was a brash newcomer who would ask him questions. I would use technical terms in a sloppy way, and he would chastise me. But he would always take the time to explain to me why I was wrong. Yes. It was frustrating. Yes, he was usually right. Yes. I always learned something.

I recall one instance when I had a brilliant idea that I wanted to get his take on. It had taken me weeks to work through the math. I described it. He understood it – far quicker than anyone else could have. And then he said “John, that idea was described in a paper by Hemmendinger in 1951...”

One of my proudest moments was after I had presented a paper, probably at TAGA. Danny got up to respond during the Q&A period. I smiled, not betraying the fact that I was inwardly scared at how he might off-handedly dismiss everything I said. But he started out saying “This is good work...” Naturally, he found things to poke holes in, but I had snatched the pebble from the master’s hand!

Danny was a mentor of mine. I cannot begin to list what he taught me. I recognize that he likely spent hours responding to emails of mine, and I am grateful for his generosity. From what I hear from others, I was not the only person that he mentored.

I will miss him. The graphic arts community will miss him. The color science community, which owes so much to him, will miss him.

John Seymour, John the Math Guy and Professor Clemson University



And finally, The Rennselaer Color Measurement Laboratory team, taken in 1977 on Lake George during the International Colour Association 3rd Congress in Troy, New York.



From left to right: Jean François Dubois, Paula Alessi, Danny Rich, Romesh Kumar, Robert Hirschler, Patrick Chong, Professor Fred Billmeyer, and Patrick Chassaigne.

Visual Identity Project (VIP)

Ellen Divers

After a year that included hosting a student competition and working with a professional design firm, the ISCC membership was introduced to two versions of our new logo at the 2022 annual meeting. As this meeting, the principals of the design firm YELLOW, Marcus Hewitt and Susan Hopper, were recognized and thanked for developing the final versions of the logo for us as a pro bono project of their company.

In the first version of the logo, the acronym ISCC is the focus. In the second, Color Council takes precedence. The second logo is the identity the VIP team is recommending for the ISCC brand going forward. The re-branding of ISCC as the Color Council will reflect our role as the principal interdisciplinary professional organization on the color scene.

In addition to a new logo, the updating of the ISCC website continues to evolve. As of this issue, we have version one - V.1 - of the navigation menu and the logo in place so that visitors interested in presenting at **Color Impact 2023** can get to the right page to do so. A shout-out to board member Amy Woolf for the time she put in setting this up!

The aesthetic design for the website is still ahead of us and, as you may already be aware, this is a complicated task when dealing with template constraints. We will require the help of professionals to sort it all out and produce V.2 over the next year, but for now, we have taken the first plunge with our new identity and it feels good to have reached this milestone!

We invite you to take a little bit of time and check out V.1 of the ISCC website at www.iscc.org. As we continue with the Visual Identity Project, we welcome your comments about the changes and are especially interested in your input on the Members-Only portion of the website. It is, after all, there for you.



Hue Angles

Erwin Schrödinger's Math Error

Michael H. Brill

In mid-August, an article from Los Alamos National Laboratory (LANL) News was brought to my attention¹. The title was provocative: "Math error: A new study overturns 100-year-old understanding of color perception." The error—made by Erwin Schrödinger in 1920 but actually going back to Bernhard Riemann in 1854—was to model color perception as a 3D curved space (called a Riemannian space) in which distance along special curves, called geodesics, represents perceived color difference. The article from LANL News called it a math error—exhilarating to discover among the works of the greats after more than a century. The article cited a research paper in the Proceedings of the National Academy of Sciences (PNAS) and was based on work at LANL². The LANL authors were declaring that their work should inspire a paradigm shift in color science.

I was curious enough to get the PNAS paper. Unsurprisingly, what they called the "math error" was a counterfactual assumption and not a mistake in the algebra. Further, LANL had not proposed an alternative model, and a paradigm shift requires a new as well as an old paradigm. So there's no paradigm shift yet.

To understand more requires a bit more about Riemannian space. Picture the surface of a sphere. Draw a point on the sphere, and a little circle around the point. On a Euclidean plane the ratio of the circumference to the diameter of that circle would be π , but on the sphere it is less than π (Figure 1), because

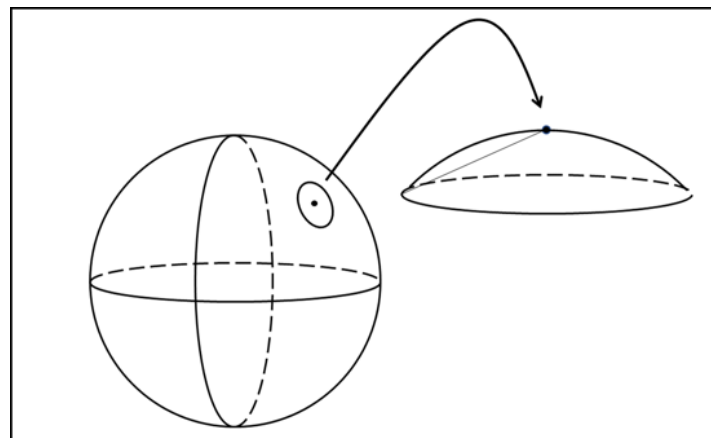


Figure 1 – The distance from a point to the circle, if constrained to be on the sphere, is always greater than the straight-line distance through the interior of the sphere.

¹ <https://discover.lanl.gov/news/0810-color-perception>

² Bujack R, Teti E, Miller J, Caffrey EJ, and Turton TL, The non-Riemannian nature of perceptual color space. Proc Nat Acad Sci, vol 119, No. 18 (2022).

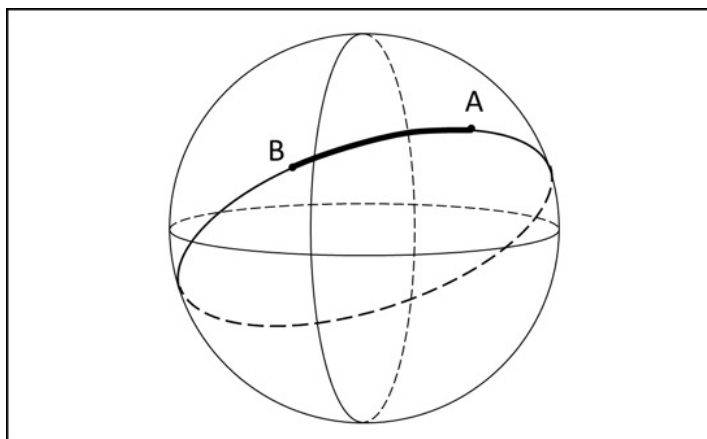


Figure 2 – The black arc shows the shortest path between two points.

the surface of the sphere is a Riemannian space of 2 dimensions. A geodesic between two points A and B on a sphere is the big circle on the sphere that is in the plane containing the sphere's center. The arc of shortest distance $d(AB)$ between A and B on the sphere is on that big circle (Figure 2).

Given this background, here is the logic of the paper: In a Riemannian space, if 3 points A, B, C are on a geodesic with B between A and C, then their distances d have additivity: $d(AB) + d(BC) = d(AC)$. To test this additivity, the authors first assumed that the neutral colors comprise a geodesic in Riemannian color space. Then they showed experimentally that, for widely separated neutral colors, $d(AB) + d(BC)$ is greater than $d(AC)$. Therefore, colors can't form a Riemannian space.

The person who brought the LANL News article to my attention wanted to know if the PNAS research paper would lead to a paradigm shift with industrial color implications. A glance at the history of such errors is enough to make a fair prediction.

Consider the basic laws of color matching—Grassmann's laws. The error there is in the assumption that matches are transitive: If A matches B and B matches C, then A must match C. But in the real world, "A matches B" means "A is within a just-noticeable color difference of B." So Grassmann was wrong. Yet the New York Stock Exchange was unaffected. In fact, I am not aware of any effect on color-matching protocols.

Next, consider the Euclidean color space (a special case of Riemannian in which the geodesics are straight lines and distance is the square root of the sum of squares of coordinate differences). Euclidean color spaces have existed

for more than 150 years. The earliest may be Helmholtz's color space (which was Euclidean in log RGB coordinates). A typical one is CIELAB (in nonlinear coordinates relative to XYZ). The latest may be DIN99o, the current version of the German standard DIN99, which was published in 2018. Euclidean spaces persist even though their incorrectness was noted by Ludwig Silberstein in 1943³.

For CIELAB, the lack of perceptual uniformity was not totally ignored. In response to the long-obvious fact that CIELAB's Euclidean distance doesn't track color differences, the standards bodies detoured around the impressive and difficult Riemannian alternative and took a new approach: they built color-difference models using the underlying CIELAB coordinates, but wrote color differences using creative combinations of CIELAB quantities. Examples are CMC, CIE94, and CIE2000—all applicable for small color differences. (Large color differences were left to a few adventurers.) But none of this activity could be called a paradigm shift.

In view of these examples, let's look at the history of Riemannian color spaces that are not Euclidean. The earliest may be Schroedinger's in 1920 (missed being Euclidean by "*tha...at* much"), and the latest may be a September paper⁴, that describes the post-CIELAB Riemannian choice as the road rarely taken. That observation in itself denies Riemannian color space the status of "the current scientific paradigm" as asserted in the PNAS paper. The vaunted paradigm shift, then, has neither a "before" nor an "after" paradigm.

And the LANL result has an ironic twist: Its principle of diminishing returns teaches us that we should care less rather than more about evaluating very large color differences, because large color differences matter less than we had assumed. "Relax...it's no big deal," it says.

So a paradigm shift is not imminent. But the buzz generated by the LANL article might give The Dress a run for its money!

Send contributions to mbrill@datacolor.com

Thank you to John Seymour for creating the illustrations for this article.

³ Silberstein L, Investigations on the intrinsic properties of the color domain. J Opt Soc Am 33 (1943), 385-418.

⁴ Candry P, De Visschere P, Neyts K. Line element for the perception of color. Optics Express 30 (20) 36307-36331 (2022)

Twenty-first Century Color Education for Design: Challenges and Opportunities

Ingrid Calvo Ivanovic

During the last 30 years, studies about the inclusion of color in design, architecture and art education have evidenced a critical panorama: there is a lack of proper training in this subject at all educational levels—primary, secondary and higher education¹. Color courses are under-considered at the university level as less than 40% of design schools include color education in their curricula (Bantom, 2006; Minah, 2008). Within those schools, color is sometimes offered as an elective or short course in the form of continuing education (with a duration of one semester or less), the choice of which is left to the student's discretion. Other times, the subject of color is taught even less, in a few lessons inside another course, usually basic design courses. However, technical or advanced color knowledge is rarely meaningfully integrated. In both cases, the dedication of hours to color training is insufficient. The issue becomes critical when we consider that those lessons are probably the only instances that students will have to learn color within their degree. The remaining 60% of schools leave color completely out of their curricular planning.

Some color theorists have defined this lack of consideration of color in design programs as “the contemporary bias against color” (Willard, 1998), “the marginalization or exclusion of color from higher education” (O'Connor, 2010), or more recently, “a programmed ignorance of color” (Anna Marotta in Calvo Ivanovic, 2022). All these definitions refer to the invisibility or inattention of the design schools toward color, which reveals that it is often minimally considered compared to other visual perception elements. To name a few—shape, drawing and perspective are often taught in depth, confirming that visual education is fundamental and, at the same time, supporting the thesis that color is unequally treated.

When trying to understand the causes that created this situation, it is possible to define two main parallel, and in a certain way opposing, motivations that have been highlighted by scholars:

The first refers to *the complex interdisciplinary nature of color knowledge*. Even if color can be perceived as “the ideal subject for interdisciplinary education” (Hirschler, 2018) and “could find a natural place in virtually every subject in

¹See the studies of Smedal & Svedmyr, 1989; Janssens & Mikellides, 1998; Durão, 2002; Bantom, 2006; Gamito & Moreira, 2008; Minah, 2008; O'Connor, 2010; Jung, 2015; Motamed & Tucker, 2016; Witcher, 2016; Weber & Kanthak, 2017; Arnhil & Pyykkö, 2018; Csillag et al., 2018; Hirschler et al., 2018; Mottram, 2018; Calvo Ivanovic, 2022.

the curriculum" (Green-Armytage, 1981), its vastness seems to hinder its complete understanding and the delimitation of a focused body of study for the creative disciplines. According to O'Connor (2010), a significant part of design institutions does not offer color training because it would need a comprehensive review of embedded theoretical paradigms, ontological assumptions and constructs. Other researchers (Kwallek and Stovall, 2010) have related the poor consideration of color education to "communication problems" as teachers lack color knowledge, which in turn would be based on the fact that they have not received the necessary training, like the chicken and the egg paradox. Similarly, Verity (1977) complements this by saying, "the quality and quantity of information is so uneven, it is difficult for the student who wants to learn about color in a broad way to find, comprehend and collate the specialist information that exists. Surely in no other field of study are the arts and sciences so interdependent and yet so divided by lack of adequate communication." These communication problems may be due to the development of color knowledge from several disciplines (sciences, arts, philosophy and chemistry, among others), each with their professional terminology. Back in 1942, Farnum had stated that "probably a few teachers are competent to determine fundamental colour facts or essential prerequisites which are basic to all the numerous art professions" (Farnum, 1942).

The other motivation refers to *the debate of color versus form*, where form is considered a fundamental element of design, *giving shape to things*, and color is seen as a mere aesthetic characteristic of form, hence, a secondary element of design. This low status of color in design and design education can be explained by a tradition inherited from a mixture of historical "chromophobia" (i.e., the prejudice or fear of color, Batchelor, 2000) and that design teaching, in many cases, was generated from architecture schools or faculties, a discipline that carries a much more formalist tradition from classical architecture through the work of the Renaissance and Neo-classical periods. Durão (2002) goes further and says that "the lack of concern with color at an educational level may be justified by the influence of the Modern Movement and its belief that color distorts form and therefore reduces the objectivity in the act of seeing." In this debate, designers (and design teachers) inspired by the whiteness of modernism reinforce the supremacy of form over color. Within this motivation, color is wrongly considered as a mere aesthetic factor linked to personal taste and individual expression.

In the first motivation, color is too complex and interdisciplinary to be addressed appropriately. In the second, it is a matter of secondary or minor importance. Both approaches leave color outside the designers' professional formation. However, there are design and architecture schools that do consider color training, although with some difficulties that researchers have also discussed:

One of the problems of current color teaching is that courses *mainly focus only on color theory*, leaving aside content concerning color application in design fields. According to Bantom (2006), in many cases, the lectures and assignments do not go beyond theoretical knowledge, such as the color wheel, color harmony and color systems. This fact is confirmed by other scholars (Wang et al., 2010; Ural et al., 2017; Hirschler, 2018). Additionally, this knowledge of color theory, undoubtedly essential, in many cases has not been brought up to date with the current needs of the design discipline (O'Connor, 2010), with concepts being outdated for more than a century. Getting acquainted with color theory is only a starting point for color education. Design educators, therefore, need to teach more about the use of color in practice in commercial, industry and technological applications (Witcher, 2016).

Another issue of color teaching pertains to *shortage of time and resources*: the dedication of hours to such a complex interdisciplinary subject is often insufficient (Weber & Kanthak, 2017). Teachers usually have a few hours to devote to the teaching of color, for example, dedicating one week to color theory in a full semester course (Csillag et al., 2018). Color is frequently relegated to brief, disjointed units taught in several courses. Additionally, the didactic materials that could support teaching have high costs and usually, schools work on a limited budget. In addition, materials are often short-lived and must be replaced constantly due to discoloration or handling.

The consequence of this situation is that students may lack confidence in using color conspicuously in design practice (Motamed & Tucker, 2016), as they may not reach the basic academic skills for a good use of color (Cares & Calvo Ivanovic, 2016). Designers often graduate without proper training about color and, hence, almost exclusively rely on intuition or self-learned knowledge when choosing colors, espousing the idea that successful color applications depend on the designer's natural gifts and experience. In addition, color decisions often appear in the final phase of the project, not as an integrated part of the design process, and the reasoning for color choices is seldom questioned (Minah, 2008). Proserpio et al. (2009) go further, pointing out that the lack of a culture of color in design and the scarcity of training instances related to it in terms of specialized courses at the university level, contribute to the lack of qualified professionals who know

how to tackle color design with the necessary skills. Additionally, scholars have shown that if students do not receive motivation or awareness-raising on color's value during their design formation, they are unlikely to seek further color training afterwards. They will probably not explore color as practicing designers. The latter will continue contributing to the vicious circle of disregard for color in design practice and education.

OPPORTUNITIES FOR COLOR EDUCATION IN DESIGN

A first reflection regarding *a more significant inclusion of color matters* in design education. As emerged during a workshop with design teachers (Calvo Ivanovic, 2022), some of them consider it their responsibility to encourage greater inclusion of color within schools, even providing practical ideas on how to do so, understanding that they are the ones called upon to raise awareness among curriculum planners and managers; otherwise, no one else will do it. About this, teachers propose *a greater consideration of contents focused on applying color* (and not only theory), associating it with the productive or commercial design environment. From their perspective, professionals and companies that work with color daily could constitute an ally in creating awareness of how important color is in the disciplinary exercise and with this, promote greater inclusion of this subject in schools. However, it is valid to reflect on the question: *Who is responsible for implementing more color training within design schools?* The answer could be related more to institutional culture and willingness than to the personal effort of the instructors: teachers highlighted the feeling of isolation concerning difficulties in convincing curricula planners and schools' directives that color should be more seriously considered within design schools. This issue directly impacts the availability of teaching hours or space for color within the programs. There is still much to be done to negotiate and broaden the will of people who may have the power and real opportunity to implement a didactic innovation in schools.

From the didactic point of view, another opportunity concerns the need to move from a color education based "only" in the transmission of theory (or contents) to a student-centered focus or *human-centered color education*. This focus shift starts by acknowledging that color is above all human experience and that, according to Krippendorf (2006), "humans do not respond to the physical properties of things — to their form, structure and function — but to their individual and cultural meanings." Regarding the current teaching strategies implemented, basic design and color teachers highlighted the importance of observation and reflection when learning color (Calvo Ivanovic, 2022). However, the teaching of color phenomena through direct observation and experiential learning is not widely addressed at the university level. Experiential and active learning strategies may encompass

the subjectivity inherent to students when learning color and its application, and be key to fostering their engagement with the subject, understanding its relevance for the design discipline, and creating a life-long learning experience.

Still, on the teaching and learning strategies, an analysis of 103 color courses for design education implemented from 2010 to 2020 (Calvo Ivanovic, 2022) highlighted a *low consideration of Educational Technologies (ET)*. However, the inclusion of ET within color teaching may be a different scenario today, as teachers were probably forced to implement synchronous and asynchronous distance learning from 2020 to continue teaching remotely. The low inclusion of ET before 2020 may be highly related to the challenges of color relativity when teaching color mediated through a screen. Teachers may naturally be divided between those who do not know how to deal with the problem and those who have tried to adapt, proposing solutions and new ways of teaching color remotely. The implementation of ET supports learning and teaching could dissolve the boundaries of time and space, allowing different kinds of interaction between people (Biggs & Tang, 2007), and providing several benefits for students. To open up to the use of educational technologies when teaching color may mean getting closer to the natural way the younger generations communicate, interact and learn today. At the same time, this new context could bring about a revolution in the traditional teaching of color and despite presenting significant challenges, could be transformed into a considerable opportunity for updating and renewing educational practices that have been in place for decades.

Also, updating color education, in parallel to the further consideration of more applied content and educational technologies, it is becoming imperative *to reflect on the social perspective*, as defined by Rampino (2008) "in parallel with the proliferation of digital technologies, we are witnessing a growing dissemination of social and ethical concerns. [...] The potential for fostering more sustainable user behaviour is a growing field of interest, together with a need for a careful evaluation of the ethical issues." These social and ethical concerns are also growing inside the color research community through the emergence of topics and keywords regarding "human comfort," "wellbeing" and "behavioral change." To train students for the current design discipline needs, color education should embrace the fostering of more sustainable user behavior and a careful evaluation of color application involving ethical issues. Being sustainable with color can refer to a reflection on how the chemical and technological processes of color production and reproduction impact the environment. A reflection on color related to the 21st century ethical and social concerns should be

fostered in design schools, so that it could be appreciated and understood as the complex, current and relevant topic for design discipline and human experience.

COLOR EDUCATION AS AN INTERNATIONAL PRIORITY

The good news is that the issue of color education has become increasingly evident, and has begun to receive greater attention from the scientific community of reference (Wang et al., 2010; Hirschler 2018). The International Color Association (AIC) and the Inter-Society Color Council (ISCC) have acknowledged this problematic situation and have implemented some actions. In the case of the AIC, a specialized group of researchers on the matter, the *Study Group on Color Education* (SGCE) created in 1978, continually organizes specialized meetings for its members, contributing to the creation of a community, a first-person experience of the debates and discussions that have taken place in recent years around the issues described above.

On the other hand, in 2018, the ISCC proposed the creation of a *Color Literacy Problems Committee*, in response to challenges concerning color education raised during the Munsell Centennial Color Symposium in Boston, held that same year. The original committee was composed of seven color researchers, some of whom were also members of the SGCE. With the aim of pooling efforts, during 2019, the ISCC Problems Committee made the proposal for a joint educational initiative regarding color literacy to the ISCC and AIC boards. The proposal was accepted, giving birth to the *AIC | ISCC Color Literacy Project* (CLP). From then on, the CLP has been implemented as a four-year project, with the goal of “the design, production and promotion of an introductory color education website for educators in all disciplines and at all levels”² —this is, from kindergarten to the Ph.D. Color education will be built on a transdisciplinary foundation of basic color concepts and based on a constructivist approach. Additionally, the idea of the CLP is to provide easily accessible color resources for hands-on exercises and experiments, at the same time that it promotes color as an ideal STEAM (Science, Technology, Engineering, Art and Math) topic.³ This current *momentum* of the discussion on color education, may be crucial to raising awareness both in the educational community and in the professional environment of the discipline.

² <https://colourliteracy.org/>. Retrieved July, 2020.

³ Ibid.

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2022 Annual Meeting

The 2022 ISCC Annual Meeting will be held 2 p.m. EST Monday October 24, 2022. online. The agenda will consist of three parts:

- The first hour will be the 2021 Godlove Lecture, by RIT faculty and recent Godlove Award recipient, Mark D. Fairchild. The talk is titled Color Dualism and Arboreal Transcendentalism.
- After a short break, the Board will present the formal reports, as required by the By-laws. This will include input from the general audience as time permits. Our goal will be to keep this to one hour. In addition to the traditional reports (finances, membership, etc.), we will also hear about the results of the Visual Identity Project (VIP), describing the recent rebranding of the organization, a report from the Color Literacy Project, and a preview of the 2023 Annual Meeting in June.
- After the official proceedings are completed, we will adjourn and open an informal Colorful Cocktails Zoom meeting for a fun social event to end the day.

Connection links will be sent out to the membership and others approximately one week prior to the meeting. We encourage all ISCC members to attend the annual meeting. It gives you a great way to stay in tune with the happenings of the organization, as well as a forum to share your thoughts directly with the Board of Directors.

Nominating Committee Report

We would like to express our sincere gratitude for the work and service of our colleagues: Outgoing Board of Directors Jen Kruschwitz, Ellen Divers, Michael Murdoch (all with a term of service of 2020- 2022) and Amy Woolf (term of service 2021-2023). We wish them success and hope to have their continued support, counsel and assistance.

The nomination committee consisting of Kate Edwards, Amy Woolf, Rachel Schwen, Maggie Maggio and Renzo Shamey (chair) considered several potential nominees for the Board of Directors elections and recommended the individuals named below. The term of service is two years for officers.

In 30 days, the ballot will be sent as a link via email to all members capable of receiving it. Ballots shall be due on the following January 2. On January 16, the secretary shall report the results of the election to the Board of Directors. Please support the activities of the council by participating in the elections and let us know how best we can serve you. This serves as the report of the Nominating Committee to the membership.

From the By-Laws

The report of the Nominating Committee shall be sent to all voting members at least thirty (30) days before the date on which ballots are provided to the voting members. Additional nominations may be made at the request of five (5) voting members, provided they are forwarded to the Secretary within twenty (20) days after the report of the Nominating Committee is sent out. The Secretary shall give notice of all additional nominations to all voting members at least ten (10) days before the ballot is provided to the membership at large.

Changes for 2023

Dave Wyble becomes Past President
Maggie Maggio becomes President

Outgoing

Renzo Shamey Past president
Jean Hoskin, Secretary

Nominees

Jennifer Kruschwitz, President Elect
Amy Woolf, Secretary
Jerald Dimas, Treasurer

Board of Directors

Karl Tylman
Alicia Keshishian
Christopher Thorstenson

Candidate Biographies

Jennifer Krushwitz

Dr. Jennifer Kruschwitz has been an optical interference coating designer for over 30 years. She earned her B.S. and M.S. in Optics from the University of Rochester's Institute of Optics and worked in optical coatings for companies that included Itek Optical Systems designing coatings for stealth aircraft, the University of Rochester's Laboratory for Laser Energetics working with coatings that withstand high laser fluences, and Bausch and Lomb where she first started designing coatings for lighting. She left industry in 1998 to start her own consulting company, JK Consulting. As an independent consultant, she designed dichroics and heat-reducing coatings for lighting companies, including Electronic Theatre Controls (ETC) and Steris, as well as color-mixing and color-correcting coatings for the IMAX laser cinema projector. She has served as President of the Rochester Local Section of Optica (formally OSA), and on the Board of Directors for Optica. In 2012, she won Digital Rochester's Technology Woman of the Year for her contributions to optics and for mentoring women in her field. She earned her Ph.D. in Color Science from Rochester Institute of Technology in May of 2015 under the guidance of Dr. Roy Berns, where she was a Macbeth-Engel Fellow. She joined the faculty of the University of Rochester's Institute of



Optics in August of 2015 and is now an Associate Professor. She teaches both undergraduates and graduate students in courses involving Wave Optics, Optical Coating Design, and Color Measurement and Modeling. Professor Kruschwitz holds five patents, all of which deal with optical interference coatings and color. She has authored dozens of peer-reviewed papers, and has written the Field Guide to Colorimetry and Fundamental Color Modeling with SPIE, published in 2018. Professor Kruschwitz also holds a 4th degree black belt in Taekwondo through Kukkiwon in South Korea.

Amy Woolf

Amy Woolf is a nationally recognized architectural color designer. She has spent nearly two decades elevating homes and workplaces—selecting colors, materials and finishes from a wide range of building materials including paint, flooring and tile, solid surfaces and soft furnishings. She also assists manufacturers with Color, Materials, Finish (CMF) expertise for product development and marketing strategy. She is a

member of the Color Marketing Group, participating in their global color forecasting process each year since 2018, and co-host of the popular podcast Let's Talk Paint Color. She has served on the ISCC Board for four years and hopes to continue her service in the role of Secretary.

Website: <http://www.awcolor.com/>

Instagram: <https://www.instagram.com/awcolor/?hl=en>

Facebook: <https://www.facebook.com/AmyWoolfColorandDesign/>

Podcast: <https://www.letstalkpaintcolor.com/>



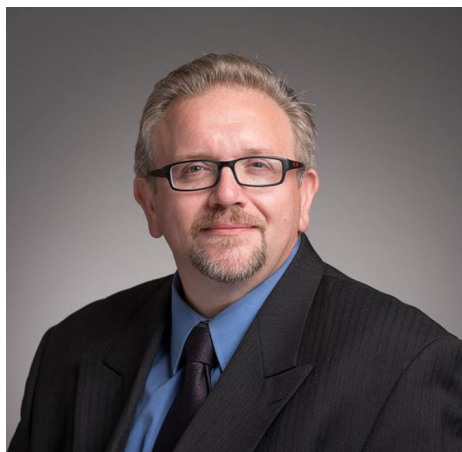
Jerald Dimas

Jerald Dimas is Director of Color Science Applications for Color Communications, LLC Chicago IL. He has spent 43 years in the field of Applied Color Science. Jerald has made substantial color technology contributions to his organization helping to make Color Communications a leader in the production of color collateral and decorative surface products. He's been an active member of the ISCC since 1987 and has served as Director, President, Past-President and currently Treasurer of the ISCC. He has also been a member of the Detroit Colour Council (DCC) since 1994 and is a member of ASTM Committee E12 and ASTM Committee D01.



Karl Tylman

Karl Tylman is the Technical Director for the Duha Group, a fourth-generation family-owned business headquartered in Winnipeg, Canada; primarily focusing on the development and manufacture of color sampling and marketing tools for the architectural and decorative markets. He has over three decades of experience in color related fields. In his current role, Karl oversees all aspects of color technology within the Duha Group where he supports the advancement and deployment of color management and reproduction technologies at the global level. Prior to joining the Duha Group, he held color technology roles in the textile industry with Courtaulds Textiles, and flexible packaging industry with Kromacorp Printing Ink Specialists. Karl has a diploma in Textile Technology from the Derbyshire College of Higher Education (now University of Derby) and a Master of Science in Color Application and Technology from the University of Leeds. Karl resides in the Winnipeg, Canada area with his wife, daughter and two dogs.



Alicia Keshishian

Alicia D. Keshishian is an award-winning designer with more than 40 years of professional experience as an art director, graphic designer, surface designer, illustrator, and color consultant. She has been based in New York City, the San Francisco Bay area, and Asheville, NC. She holds a Bachelor of Fine Arts in Design/Illustration from Community College of Allegheny County (CCAC) and was an artist-in-residence at Penland School of Craft in North Carolina. She currently produces a line of custom, handmade-to-order carpets and is a popular speaker, presenter and teacher on design and color. Alicia has owned and operated her own textile business, Carpets of Imagination. She has also designed for various industries and corporations and operates Chroma-licious, her consulting business. (Clients have included: Papyrus, Bloomingdale's, CBS Publications, New York Magazine, Parenting Magazine, Health/Hippocrates Magazine, Working Woman Magazine, Premiere Magazine, Image Magazine, RCA Records, and American Craft Council).



Her true loves have always been color and texture. Alicia comes from a long line of accomplished artists and her emergence as a rug maker is thanks to family: her Armenian-born grandfather, uncles and cousin are renowned Oriental rug authorities and collectors. Carpets and color have been part of Alicia's life as long as she can remember: the smell of the wool, the touch of the fibers, the variety of patterns all are in her DNA.

It's clear that people respond to color before anything else. It's truly visceral. Clients are unable to navigate into any new territory, be it pattern or style, if the colors don't resonate. Alicia believes that colors are very personal and transcend any current fashion trends or peer pressure. It's important as a designer and color consultant to extend that confidence to her clients so they can live in the comfort of their own dreams.

Alicia is in her second term as an executive board member of the Color Marketing Group, heading the education team. She has studied with Leatrice

Eiseman, executive director of the Pantone Color Institute, attended two intensive Color Science courses at Rochester Institute of Technology | RIT, as well as a color course with NCS – Natural Colour System in Sweden. She continues to increase her knowledge of color through various educational pursuits while continuing to make art in her California studio (www.adkcarpets.com).

Christopher Thorstenson

Christopher Thorstenson is an Assistant Professor in the Program of Color Science and Munsell Color Science Laboratory at Rochester Institute of Technology. He received his M.S. in Color Science from RIT in 2017, his Ph.D. in Social Psychology from University of Rochester in 2019, and worked as a Post-Doctoral Research Associate at the University of Wisconsin-Madison from 2019-2021. His Research focuses on how the human visual system, with an emphasis on color perception, works to perceive and evaluate people and artificial social agents, including social robots, avatars, and emojis, in real and virtual environments. He currently teaches graduate-level courses at RIT, supervises graduate student research, serves on the organizing committee for the *International Conference on Affective Computing and Intelligent Interaction (ACII)*, and serves on the editorial boards for *Color Research and Application* and *Frontiers in Perception Science*.



A Blast from the Past: ISCC Newsletters 50 Years Ago ISCC Newsletter No. 220 September-October 1972

Paula J. Alessi

The focus of this article will be three topics from the 10-page 1972 September-October Newsletter, No. 220.

SUMMARY OF DOROTHY NICKERSON'S TRIBUTE TO DR. DEANE BREWSTER JUDD

Sadly, Dr. Deane Brewster Judd passed away on October 15, 1972 at the age of 71. Not only was Dr. Judd an international colorimetry and color vision expert, but he was also an organizational leader for the Optical Society of America (past President from 1953 – 1955). Furthermore, he was the only two-term Inter-Society Color Council (ISCC) President from 1940 – 1944.

He received the highest honors from the organizations that he led. Other organizations also recognized his exceptional contributions:

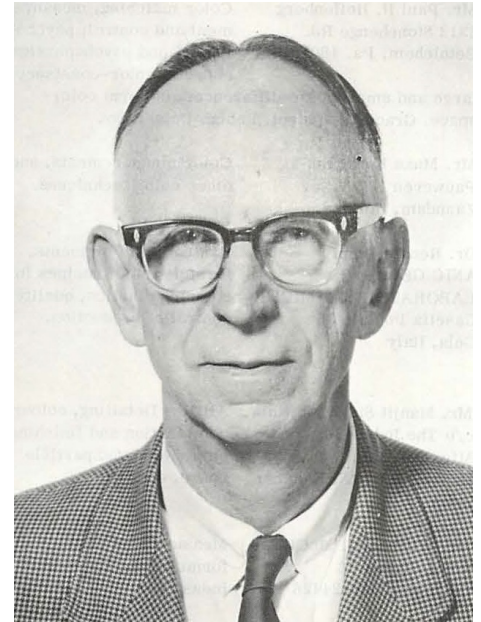
- 1958, Ives Medal recipient from the Optical Society of America
- 1957, ISCC Godlove recipient
- 1950, Exceptional Servant Award from the U.S Department of Commerce
- 1961, Gold Medal recipient from the Illuminating Engineering Society
- 1936, "Journal Award from the Society of Motion Picture Engineers

Dr. Judd's color expertise was very diverse. His research was centered around such topics as:

- Vision
- Color blindness
- Color measurement
- Color standards development
- Uniform color spacing studies

He was a long-term member of the National Research Council Vision Committee from 1942 up until his death. Also, he served as President of the Munsell Color Foundation. In addition to publishing over 100 research papers, Judd published *Color in Business, Science and Industry* with Günther Wyszecki from the National Research Council (1952 for first edition and 1963 for second edition)¹.

¹ This classic book was invaluable to me throughout my career in the Research Labs at Eastman Kodak Company (Paula Alessi).



Dr. Deane Brewster Judd

Dr. Judd's influence was felt on the international stage in many significant ways:

- Chair of CIE (Commission Internationale de l'Eclairage) Colorimetry Committee from 1955 – 1963
- Presented prominent color lectures in such European cities as London, Stockholm, Berlin, Madrid, Lucerne
- Played an active role for ISCC in the AIC (International Colour Association)

Judd was so dedicated to his craft that five days before his death, he recorded a message of acceptance for the Newton Medal to be given to him at the July 1973 AIC meeting in York, England by the British Colour Group for his Newton Lecture. The work of Deane B. Judd was so revered by AIC that they embraced the 1973 proposal by his wife, Betty to establish an award in his honor. The coveted AIC Deane B. Judd Award is the highest honor that can be bestowed by the international color community. The Award is to recognize work of international importance in the fields of color perception, color measurement, and/or color technology. It is fitting that the first recipient of the 1975 AIC Deane B. Judd Award was his dear friend and colleague, Dorothy Nickerson, the author of this 1972 newsletter tribute to him after his death!

SCIENCE BROUGHT TO TRIAL

This title piqued my curiosity! The article, published by David L. MacAdam, contains a reprint with permissions from *J. Opt. Soc. Amer.* 1972, 62, 1244. Vasco Ronchi, an Italian physicist specializing in optics, was the original author of this article. Ronchi's premise was that "science, which gets most of its information by way of sight, should establish, as soon as possible, the way in which the visual apparatus functions and how reliable it can be. Scientists should ask themselves, what does 'to see' mean?" Ronchi points out that we need our eyes to see and we need light on the object that we see, but the exact mechanism for how vision works still needed to be completely understood in 1972. Ronchi then goes on to describe 'closed boxes' that all men (notice there is no reference to women) use without knowledge of what is inside. Thus, "the visual apparatus is a closed box that shows reality, truth". It was well known to those studying geometrical optics that the lens of each eye would project a real-world image onto its retina. What wasn't well known, primarily because scientists weren't asking the question, is "why do we see things outside us, even far away, rather than images on the retina?" Furthermore, physiologists were well-versed in "retinal response to incident light and nerve transmission to the visual cortex," but not in why observers perceive objects differently in their apparent reality. Ronchi goes on to describe the difference between the apparent world and the real world:

the real world is objective and only one; it is what it is -- unknown and possibly unknowable. The apparent world is subjective and different for one observer than for any other.

Ronchi concludes that as long as experimental scientists refuse to address the difference between the apparent and real world, bringing it to trial would be "frivolous." Further evidence is provided by Ronchi using the following examples showing that "seeing is not believing:"

- Galileo asserted that he believed what he saw through his telescope, but he also asserted that he could not prove scientifically that the distant things he saw through his telescope were real.
 - Was his explanation of the "satellites around Jupiter or the mountains on the moon" real?
- Galileo critics knew he did not have an optics background emboldening them as they insisted that images seen through his telescope could not be believed.

In 1610, Kepler, viewed by his colleagues as an optics expert, added credence to Galileo's convictions about the reality of what he saw through the telescope. However, as Ronchi put it, this was a "victory of faith, not a proof that the real world is the seen world! That faith is the cornerstone of modern science."



<https://mymodernmet.com/galileo-galilei-telescope/>

Ronchi ended the article by positing that the only way this dilemma can be proved is if we discover whether or not faith is possible.

Fifty years later in 2022, the same dilemma exists, even though we know more about optics and physiology of vision. So, if we were to put color science on

trial, there would be more evidence, but the difference between the real and apparent world would still exist. The real world can be easily measured and explained objectively, but the apparent world is forever plagued by the fact that perception is subjective and no two people perceive our world in exactly the same way. That is the beauty of color perception! That is what makes the world more exciting and fun! As my mom would say, "That is what makes the world go around!"

FABER BIRREN'S VIEWS ON THE LÜSCHER COLOR TEST

First, a bit of background on the Lüscher Color Test. I, for one, had no idea what the Lüscher Color Test was. So, I went to Wikipedia (https://en.wikipedia.org/wiki/L%C3%BCscher_color_test). A psychological color test developed by Max Lüscher of Switzerland, the Lüscher Color Test, was designed to examine personality traits based on color choices. The premise behind the test design was that color perception is universally objective while color preferences are subjective. Thus, color choices reveal personality traits and not color preferences. Administration of the test involves asking subjects to arrange eight colored cards in order of preference from most liked to least liked. Next, subjects were asked to evaluate the extent to which their personality matched the descriptive statements in Table 1 based on their color preference order.

The Wikipedia page clearly states that "the majority of the scientific community puts this test high on discredited tests lists." This test completely

COLORS	MEANINGS
Blue	"Depth of feeling" passive, concentric, tranquility, calm, tenderness
Green	"Elasticity of will" passive, concentric, defensive, persistence, self-esteem/assertion, pride, control
Red	"Force of will" eccentric, active aggressive, competitive, action, desire, excitement, sexuality
Yellow	"Spontaneity" eccentric, active, projective, aspiring, expectancy, exhilaration
Violet	"Identification" unrealistic/wishful fulfillment, charm, enchantment
Brown	Bodily senses, indicates the body's condition
Black	Nothingness, renunciation, surrender or relinquishment
Grey	Non-involvement and concealment

ignores any link between biological and physiological effects of color and behavior.

When Lüscher Color Test results started to be used to wipe out troves of data represented by “the words that are full of references to the biological and psychological effects of color”, Faber Birren became passionately involved in discouraging people from using this inaccurate and deceiving test! Birren was unwilling to deny biological effects of color based on Lüscher Color Test personality trait results. Birren stated “There may be no emotional effects for those who don’t want them. But to deny biological effects is futile.” Birren cited the following examples to defend his position:

- Treatment of jaundice in newborn infants successfully relies on use of visible blue light color therapy.
- United States Atomic Energy Commission (AEC) has demonstrations of animals exposed to different colored environments resulting in a variety of physiological behaviors.
- Such AEC studies and others have many examples of how important color is in confined environments like space vehicles.
- In 1972, the American Society of Photobiology formed with the specific task of studying physiological behaviors recognizes that color plays an important role in such behaviors.
- The Illuminating Engineering Society and Inter-Society Color Council have both formed committees charged with studying the physiological effects of color and light.

Faber Birren concluded this article with the following quote: “I am sorry, but if games are to be played, let us hope it will not be blind man’s bluff.”

Even in the 21st century, there are mountains of evidence on how important color and our environment is to human life, especially in hospital situations! Thank goodness the Lüscher Color Test disappeared into the sunset, which is probably why I had never heard about it. If anyone wants more information on the evolution of the Lüscher Color Test and what led to its demise, there is a three-page (p. 13-15) detailed article on it in the ISCC News No. 219 from July-August 1972.

Color Research and Application

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AIC 2023 Announcements

SAVE THE DATE FOR AIC CHIANG RAI, THAILAND 2023

November 28-December 2, 2023



CALL FOR PAPERS FOR AIC CHIANG RAI, THAILAND 2023

Short Abstract Submission December 1, 2022 – February 28, 2023

Topic: Color in Nature and Culture

AIC2023 15th Congress of the International Colour Association
November 28th - December 2nd, 2023
 Venue: The Riverie by Katathani, Chiang Rai, Thailand

Call for papers

Short abstract submission 1 st December 2022 – 28 th February 2023	Notification of acceptance 31 st May 2023	Full paper submission deadline 31 st August 2023
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Visit AIC2023 website for more information www.aic2023.org

Calendar 2022

Oct 4 - 6	AATCC 2022 Textile Discovery Summit Hilton University Place Charlotte, NC https://aatcc.org/summit/
Oct 10	Color Association of the United States Blog https://www.colorassociation.com/blog
Oct 10 - 13	IES Street & Area Lighting Conference 2022 Dallas, TX https://www.ies.org/events/street-area-lighting-conference/
Oct 16 - 20	Frontiers in Optics + Laser Science Rochester, NY https://www.frontiersinoptics.com/home/
Oct 18- 20	NAPIM Fall Technical Conference 2022, Oak Brooks Hills Resort and Conference Center, Oak Brooks, IL https://www.napim.org/fall-technical-conference
Oct 24	SCC 2022 Annual Business Meeting 2-4 EDT https://iscc.org/event-5009578
Oct 26-27	AATCC Textile Testing Workshop AATCC Technical Center 1 Davis Dr, RTP, NC 27709 https://www.aatcc.org/aatcc-events/ttw/
Oct 28	Colour and Emotions: A Psychological Perspective 1 PM EDT https://iscc.org/FF-24Oct2022
Nov 2	OPTICA Webinar virtual evento Color from Pixels to Objects 11:00 -0:00 EDT https://www.optica.org/en-us/events/webinar/2022/11_november/color_from_pixels_to_objects/
Nov 2 - 4	Design for Adaption – Cumulus Detroit 2022 https://cumulusdetroit2022.org/about/

Nov 4	1:30 PM Eastern Colour Literacy Forum 3: Color & Light https://cumulusdetroit2022.org/program/
Nov 4	Illuminating Engineering Society IES Light and Justice Symposium 11:00 – 4:00 PM EDT https://www.ies.org/event/light-justice-symposium/
Nov 8	AATCC Reserach Showcase: Part 3(Protective Textiles) 11AM ET Virtual Meeting https://www.aatcc.org/aatcc-events/aatcc-research-showcase-part-3-protective-textiles/
Nov 10	IES Webinar: Tear Down This Wall: The Renaissance Pioneer or the Specialist? 12:00 – 1:00 PM EST https://www.ies.org/event/webinar-tear-down-this-wall-the-renaissance-pioneer-or-the-specialist/
Nov 10-11	CMG International Summit Tucson, AZ https://colormarketing.org/event/2022-international-summit-november/
Nov 13-17	CIC 30 Color & Imaging Conference Scottsdale, AZ https://www.imaging.org/site/IST/Conferences/Color_and_Imaging/IST/Conferences/CIC/CIC_Home.aspx?hkey=d2cf3f19-87b4-4164-8274-c40180e9dfa7
Nov 14-16	Council for Optical Radiation Measurements(CORM) and US National committee of CIE (USNC) anual meeting and conference https://cormusa.org/news-events/
Nov 14 - 16	SOCMA Summit Conference & Annual Meeting New Orleans, LA https://www.socma.org/forms/meeting/Microsite/socma-fall-summit-2022
Nov 14 - 17	AATCC Research Committee Meetings 1 Davis Dr RTP, NC 27709 and Virtual https://www.aatcc.org/aatcc-events/research/
Nov 22	CLEO Conference and Exhibition Call for Papers deadline https://www.optica.org/events/

Dec 1 - Feb 28 2023	Call for papers Short Abstract submission AIC Chiang Raj Tailand 2023 https://aic2023.org/
Dec 6	CPMA Annual Meeting https://www.pigments.org/news-resources/events/#CPMA_Events
Jan 15 - 19	IS & T Electronic Imaging 2023 San Francisco, CA https://www.imaging.org/site/ist
Feb 1 - 2	ASTM E12 on Color and Appearance Location Grand Hyatt San Antonio, Texas United States
Feb 13 - 15	2023 ASPRS Annual onference at Geo Week Denver, Colorado https://my.asprs.org/2023conference
May 21 - 26	SID display Week 2023 Los Angeles, CA https://www.displayweek.org/
June 22 -23	ASTM June Meeting 2023 ASTM headquarters 100 Barr Harbor Drive, West Conshohocken, PA
Nov 10 - 11	SCAD Annual Conference Chicago Marriott Downtown https://scadent.org/events/newportbeach-2023

Sustaining Members

Sustaining members of the ISCC are organizations who support the mission and goals of the ISCC through financial or other support. With our member bodies, Sustaining Members also provide a critical connection to the color community. If you feel your company or organization should support the ISCC in this way, please contact the office for more information about member benefits.



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