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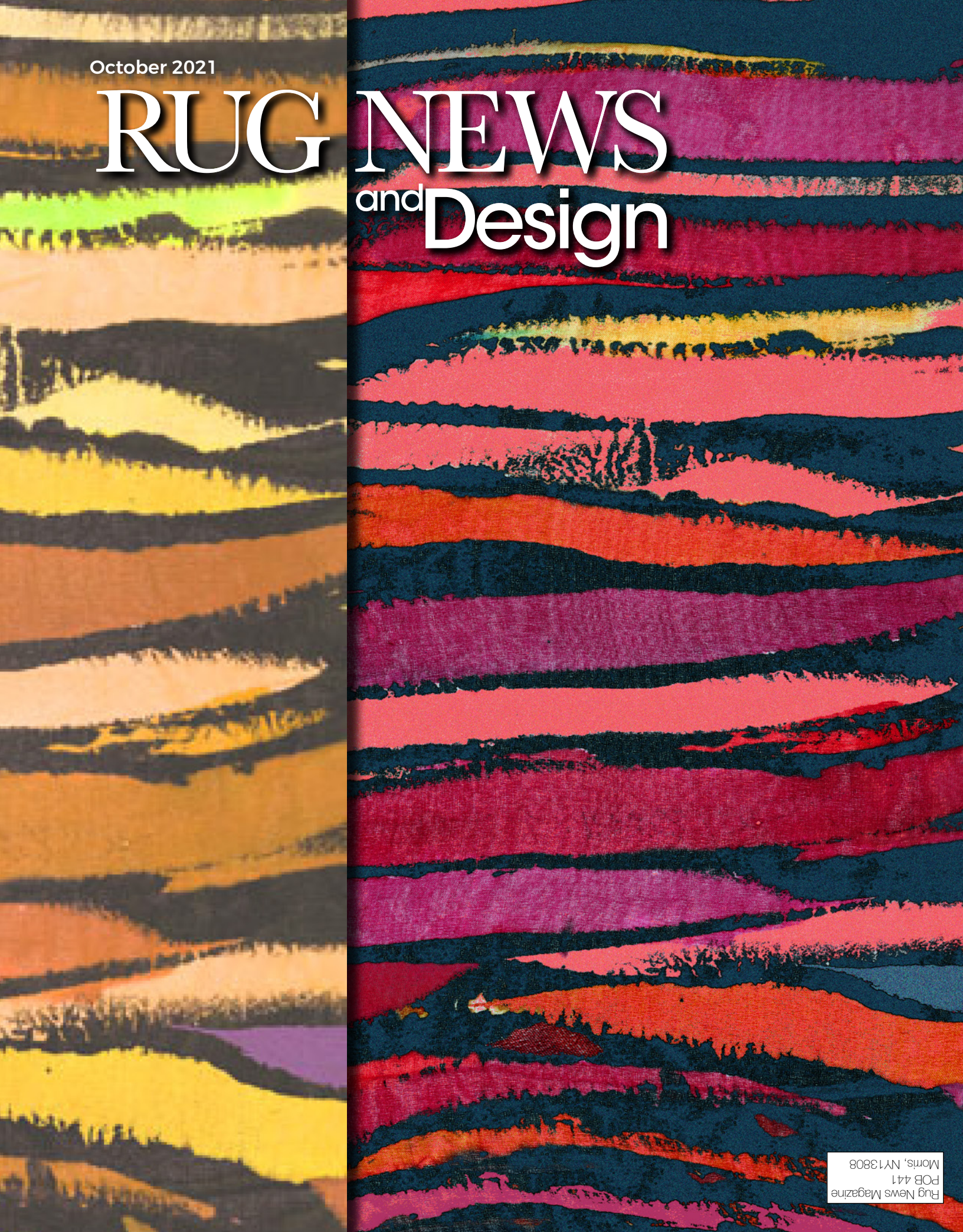
RUG NEWS and Design



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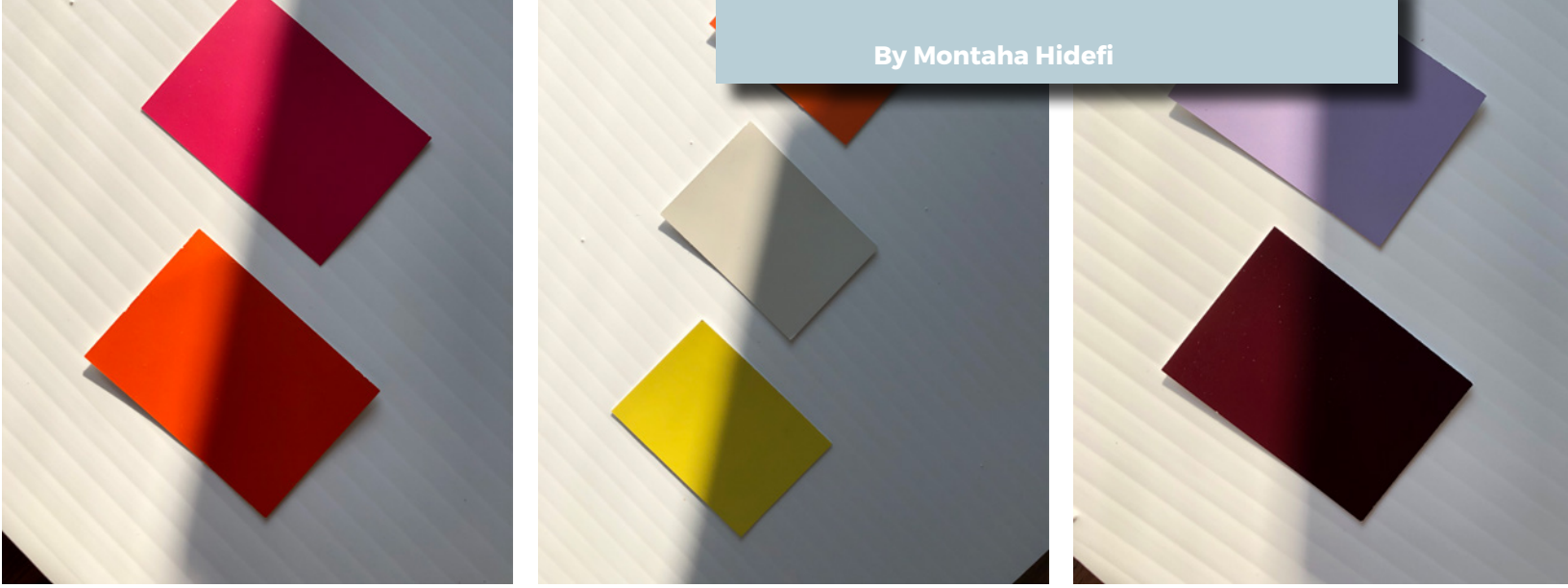


By Montaha Hidefi

Whether direct sunlight or artificial illuminant, light changes our perception of color.

The Effect of Light on Color

We have all been through it at one time or another! The velvet, purple curtains, the satin, lavender bed covers, the crimson red of the carpet festooned with sky blue blooms, the white lamp stands, the green vase resting on the table, they all look so colorful and lively. But the moment we turn the lights off to end our day and retreat to bed, everything turns black or dark gray. The vivid items fitting the room dramatically disappear in the obscurity of the space.

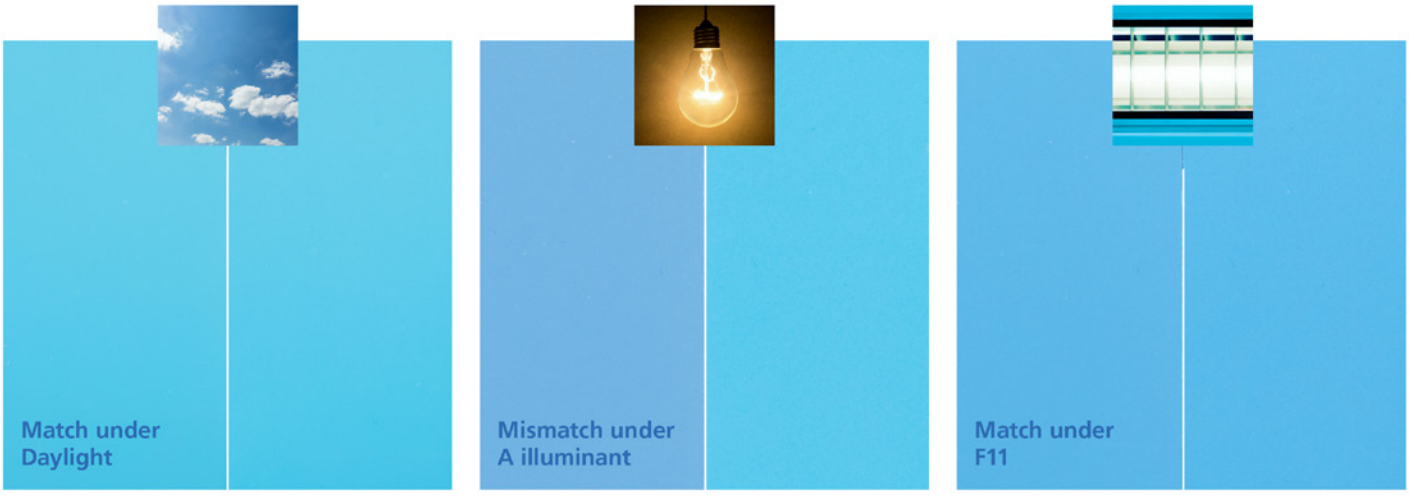
Before the first ray of sunlight started illuminating our globe, millions of years ago, everything on earth was devoid of color. Color revealed itself only with the grace of light that touched the surface of the planet. In the absence of light our world will be nothing but an ocean of dark matter.

We have all been through it! The process of alternating between daylight and nightlight, but how does this lighting activity affect our color perception of the world around us?

Light Sources and Color

There are various types of illuminants or light sources. The most known and used are daylight, halogen, neon, fluorescent, and to a lesser extent nowadays, incandescent. Our perception of our surroundings depends not only on how much daylight we receive daily, but also on the type of illuminant that we use indoors.

Depending on their temperature, illuminants are categorized as warm and cold. The temperature describes the appearance provided by the



Graphic courtesy of BYK Gardner - Depending on the application, color needs to match under a variety of illuminants. This is particularly important for multi-component products consisting of different materials or parts with different pigment formulations. In these cases, there is the potential risk the components would be harmonious in one light such as indoors, but very different in another, such as outdoors.

Metamerism is the phenomenon of perceiving a color differently under different light sources.

light source and is determined by Kelvin degrees, having the unit symbol K. This rating is used in honor of the British mathematician, physicist and engineer, William Thomson, First Baron Kelvin (1824-1907). He did important work in mathematical analysis of electricity.

Light Temperature and Color

Illuminants' Kelvin degrees range between 2,700 and 6,500. The lower the K the softer and warmer the light. The warmest light source is a candlelight and measures around 2,000 degrees Kelvin.

Different temperatures have different categories and functions. Incandescent bulbs are soft and provide a feeling of coziness. When their temperature range is between 2,700 and 3,000 K, they are warm and yellow and are said to be suited for living rooms and bedrooms. When their temperature goes between 3,000 and 4,000 K, they are warmer and provide a yellowish ambience. Lighting experts recommend them for kitchens and bathrooms.

As the temperature increases above 4,000 K, the illuminants become cooler and brighter. Between 4,000 and 5,000 K, light bulbs provide a brighter, white bluish tone. They instill a vibrant feeling to a space and are more suitable to areas where more energy is needed, such as workspaces, home offices and even kitchens with chrome fixtures.

Light bulbs with temperatures between 5,000 and 6,500 K have a higher, bluish tone. They emulate daylight and maximize the contrast of colors. They are ideal for working, reading, applying make-up and most importantly for color comparisons and color matching under controlled environments.

It is important to notice that LED lights are available in a range of color temperatures, not only in bright, high Kelvin degrees.

Light Source and Color Perception

Color, the way we perceive it, is the product of the absorption and reflection of the received light. The objects around us will have different color appearance under different light sources. Our perception relies on the number of photons that exist in the light source, but also on how they are seen by different individuals, and by the same individual at different times of day.

In nature color appears to change with the intensity and angle of the light

For example, incandescent bulbs have a high proportion of photons in the red and green range of the color spectrum. When their light strikes an object, a higher charge of red and green will bounce off of its surface and we will perceive a more yellowish color.

Fluorescent bulbs have a higher percentage of blue photons that will bounce off the surface of an object and that's why they produce cooler, brighter colors.

Light Source and Color Differences

For this reason, we might experience color differences of a green floor covering under different types of light sources. Under standard daylight the color that we perceive is balanced. Under an incandescent light, the green will look as if it was injected with a higher dose of yellow, while under a fluorescent light, it will look more blueish, leaning to teal. To avoid this phenomenon, which is called metamerism, companies invest seriously in testing their products under different light sources in controlled environments. The color of an object should not look much different at home from the color on the shelf of a retailer.

In retail applications, good color quality is essential. The color temperature of lighting is critical to the retailer design decision making because consumers need to be able to choose products of the correct color, to reduce the chance of returns once buyers get outside a store to notice a different color under daylight.

To reduce or eliminate color discrepancies under different light sources, I tend to assess colors using a flashlight with a D65 bulb, which is the standard illuminant that emulates daylight. This type of flashlight is not widely available. However, I have found a good alternative with D65 LED bulbs at the dollar store and it works well. Otherwise, I also use the Pantone color evaluation stickers that show metamerism when the illuminant is incorrect. These stickers can be ordered from the Pantone website.

In addition to the physical perception of color, we must be cognizant to color in the digital space. The colors we perceive on our screens rely on the RGB additive color model and are dependent on screens calibration and many other factors. For this reason, the color accuracy of an object must always be tested physically with the naked eye.

Incandescent or Fluorescent?

The differences in light sources and their effect on color perception explain the wide opinion that incandescent light is more pleasing to people than fluorescent light. In fact, shedding a blue and other cool color on a human face will make it look unhealthy. Bringing out the warm colors makes a face look natural and healthier. The same applies to produce, which is why grocery stores may avoid standard fluorescent bulbs near fruits and vegetables.

We have all been through it! The process of alternating between daylight, nightlight, and using different light sources, but hopefully we now have a better understanding of how light sources affect our perception of the world around us.

Montaha Hidefi is an internationally distinguished Color Archeologist who develops color trend concepts and color palettes for organizations around the world. She is Vice President of Color Forecasting at Color Marketing Group® (CMG) and Vice President of the Canadian Freelance Guild (CFG). Born in Venezuela to Syrian immigrant parents, she has lived her life as an expat, building a fascination for traveling and exploring the world. She has been to 59 countries and is fluent in 5 languages: Spanish, English, French, Arabic and Italian. She is now a resident of Canada.

Montaha Hidefi assessing color accuracy using a daylight D65 flashlight

Photographs and Graphics are courtesy of Montaha Hidefi