

Best Practices For Performing Visual Color Evaluation

Overview

Attempting a visual color evaluation is to determine the degree of difference between a sample's color and the standard color. The method for establishing the procedure is usually straight-forward and simple depending on the industry or the company's requirements. Today, many leading companies invest time and money to ensure the color of their products matched all the time.



Color can be measured instrumentally or viewed under controlled lightings to provide an objective color evaluation. [Chroma Meters and spectrophotometers](#) are used to measure color and light booths or cabinets are often used as visual grader. A light booth is a lighting cabinet with standard light sources such as D65 (Daylight 6500K), F2 (Cool White Fluorescent), Illuminant A (Tungsten) or industry specified light source. These light sources are useful in the evaluation of color and metamerism.

There may be problems experienced when performing visual color evaluation. They could result from the incorrect choice or use of a light source, improper viewing conditions and observer difference. Listed below are some of the best practices for accomplishing accurate results for visual assessments.

Observer Conditions

All humans perceive color differently because the sensitivity of the human eye varies from person to person which often cause the perception of color to appear differently to each individual.

In order to ensure the accuracy of results, the observer requirements must be defined and adhered.

- The observer must not be color blind. People involved with color evaluation must be tested for color deficiencies.
- Observer's attire must be achromatic. Neutral colors such as grey or white should be worn, to minimize influencing the appearance of samples. This is the reason color viewing light booths are painted in neutral grey.
- No tinted glasses or contact lens are allowed during visual assessment. This will affect the judgement of the observer significantly.
- When conducting color inspection of a sample, do not assess it for more than 10 seconds before making a pass/fail judgement, because the human eye's sensitivity decreases with time.

Viewing Conditions

Samples being evaluated must be prepared and presented correctly with consistency as the viewing orientation can affect the appearance. An object that is viewed from a slightly different angle, for example, may make the object appear brighter or darker.

- Position samples flat in the light booth or at 45 degree angle and swap their positions left to right, top to bottom to observe any color changes.
- When making comparisons between a sample and the standard, position them side by side so that they are parallel with each other for better color judgement.
- Other colors will affect the color perception. Always perform the evaluation with a common background and keep the light booth clean. Do not place any other foreign objects in the light booth other than the samples that are being assessed so as not to affect the appearance for their color.

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Lighting Conditions

Light sources can be specified by an industry, company or an individual when establishing a procedure for visual assessment. A conventional light bulb can be considered an actual emitting device, although it might not be a commonly used source for color evaluation. A light source can be considered characterized when its spectral output has been documented. Most of the light sources in the market are characterized by the developer or the manufacturer. Common standardized sources include:

Standardized Source	Description	Details
Illuminant A	A tungsten source at a color temperature of 2856K.	Emits high amount of red and yellow energy with very little blue and no UV.
Illuminant C	Daylight source at 6770K with no UV component.	Specifically used by the paper industry.
D50 (Daylight 5000K)	Daylight with equal amount of daylight (red, green and blue). Includes UV energy.	Commonly used in the imaging industries where the sample has many colors to match (eg. photograph).
D65 (Daylight 6500K)	Characterized by having lesser red than blue energy. Spectrally complete with all colors and energy down through the UV region of the spectrum.	Extensively used for color matches and the detection of metamerism. It is the source of choice for instrumentation applications.
D75 (Daylight 7500K)	Characterized by having higher amount of blue energy than D65, otherwise similar.	Originally specified by the imaging industries to help viewers identify the yellow ink and for color matches in the USA. Now has been taken over by D65 for general industrial use.
F2	Cool White Fluorescent (CWF) with single phosphor, broad halo fluorescent source at 4100K.	Low CRI (below 70), commonly used in the USA for facility lighting applications.
F4	Warm White Fluorescent source with higher red energy than F2 (2940K).	Used in general lighting applications where a warmer lighting atmosphere is required without the use of tungsten.
F11	Tri-phosphor fluorescent source at 4100K.	Commonly used source in Europe for general lighting applications. CRI is below 85.

Standardizing lighting conditions are required to maintain consistency as different light sources often lead to different judgement. Hence it is important to:

- Evaluate within a controlled environment of a light booth to maintain standardized lighting conditions.
- Switch off all room lighting except the light source of the light booth. This is to minimize the influence of ambient light interference.

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Test for Metamerism

Metamerism is a very common problem, though most people do not realize this. It occurs when a pair of sample is deemed to match under one light source but not under another. This happens when the color batch or recipe for dyes, paints, inks or other pigments is changed during production, leading to a mismatch of colors.

Metameric effects are best observed under two or more different light sources and illuminants such as daylight (D65) and incandescent light (illuminant A). Visual test can be conducted using the following steps:

- Visually compare a pair of metameric sample under one light source within the light booth.
- Change the light source, for example D65 to illuminant A, and observe the samples for any color mismatch.
- Samples are considered metameric if they match under one light source but not under another.

- For best results in a visual test, always compare the samples using three light sources. Incandescent for its high red energy content, D65 for its high blue energy and CWF for its high green energy.
- It is important that metamerism is identified and kept to a minimum using a light booth. In some cases, an instrument test is performed using a spectrophotometer to confirm the presence of this phenomenon.

You may be doing visual evaluation correctly but is the person you communicate with doing it right? Are they using the same light sources and evaluation methods? Make sure that good practices and procedures are in place within the organization as these will save you countless hours and money.

To know more information on the proper tools and evaluation procedures, you can contact Konica Minolta Sensing Singapore Pte Ltd at 6563 5533 or email us at ssg@konicaminolta.sg.