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COLOR AND APPEARANCE

And it's importance in the Cosmetics Industry

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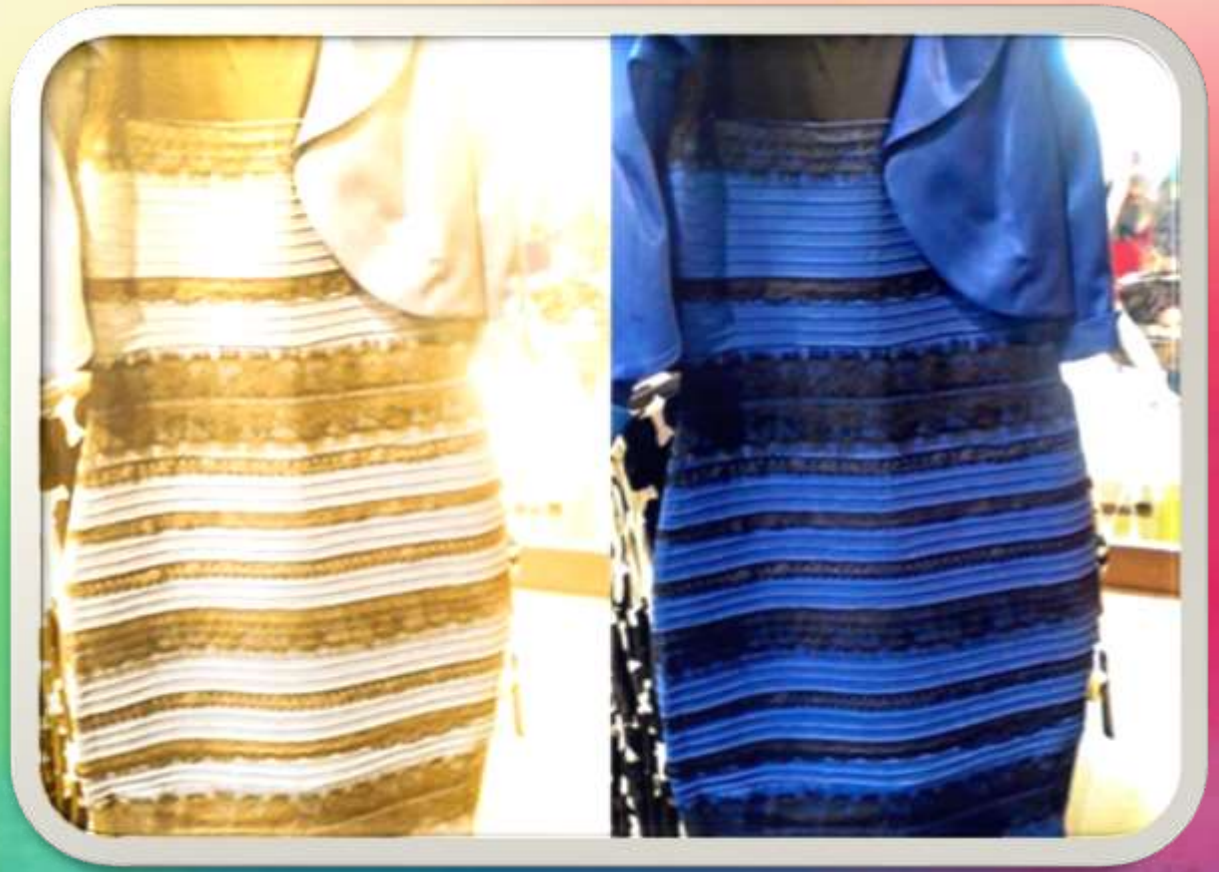

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WE MEASURE, QUANTIFY AND HELP YOU CONTROL THE COLOR OF YOUR PRODUCTS

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DEFINITION OF COLOR

Color is the quality of an object with respect to the amount of light transmitted through or reflected from it.

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PSYCHOLOGY OF COLOR

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PSYCHOLOGY OF COLOR

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PSYCHOLOGY OF COLOR

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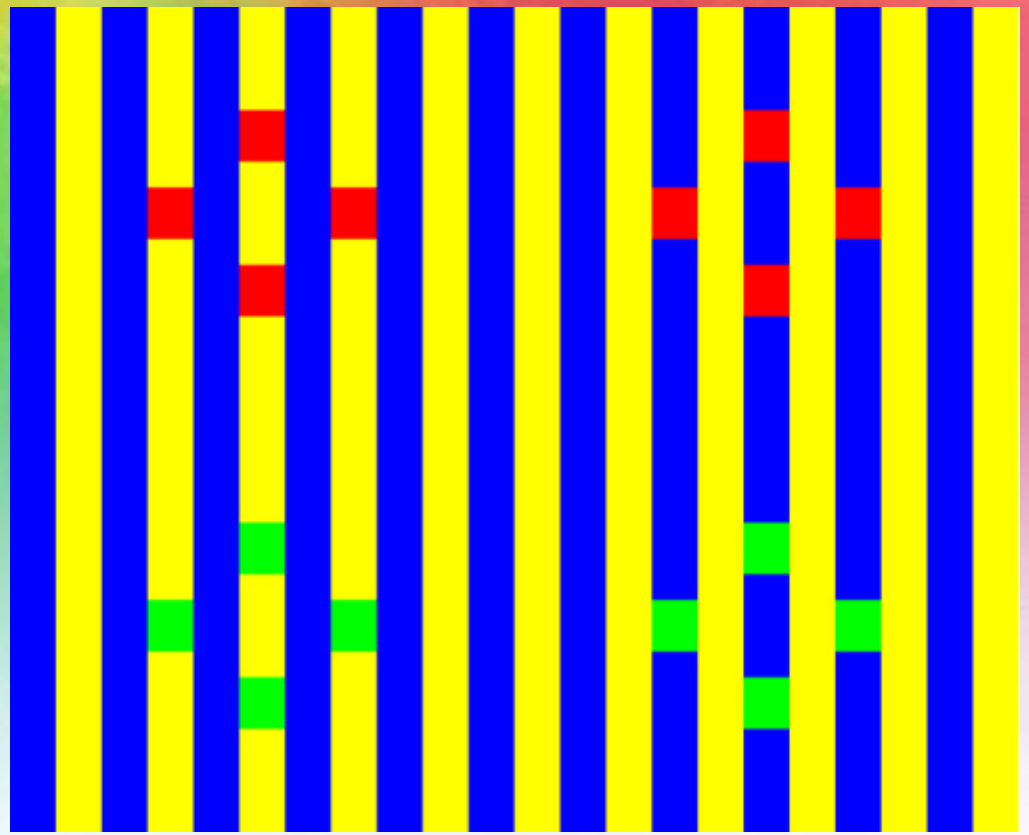
CHAMELEON EFFECT



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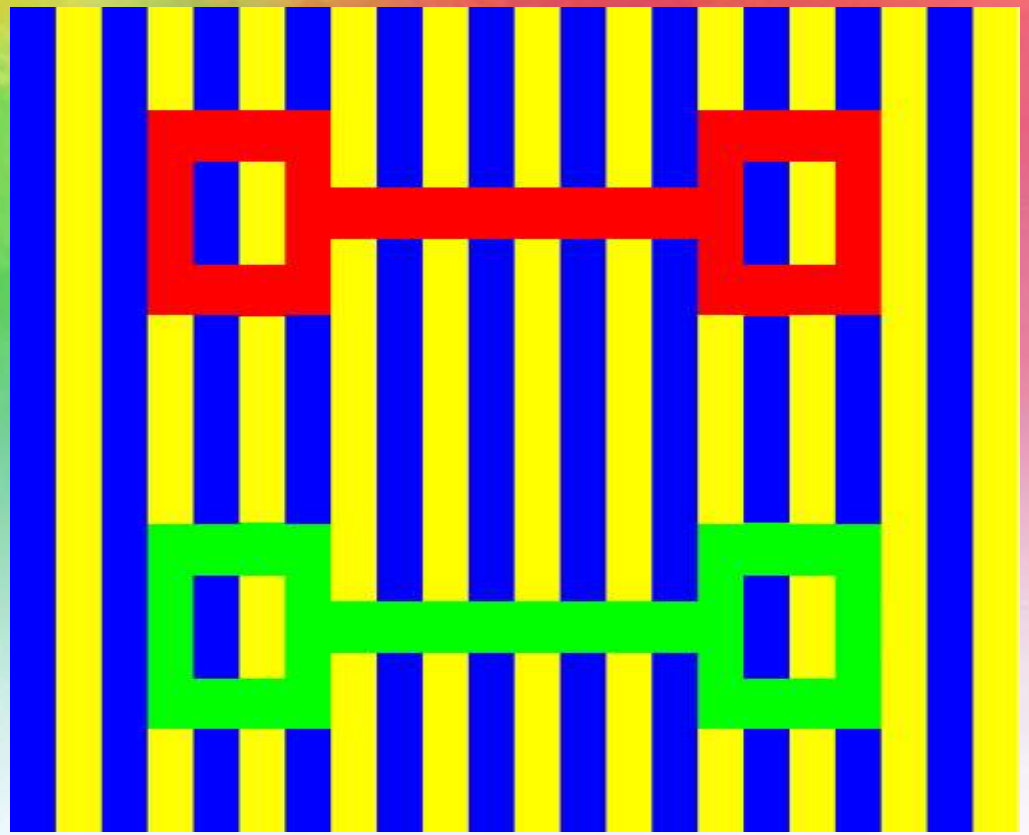
CHAMELEON EFFECT



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WHAT IS “DE*” ?

DE* is a total color difference

Anything under 1.0 DE* is acceptable

Anything over 1.0 DE* is unacceptable

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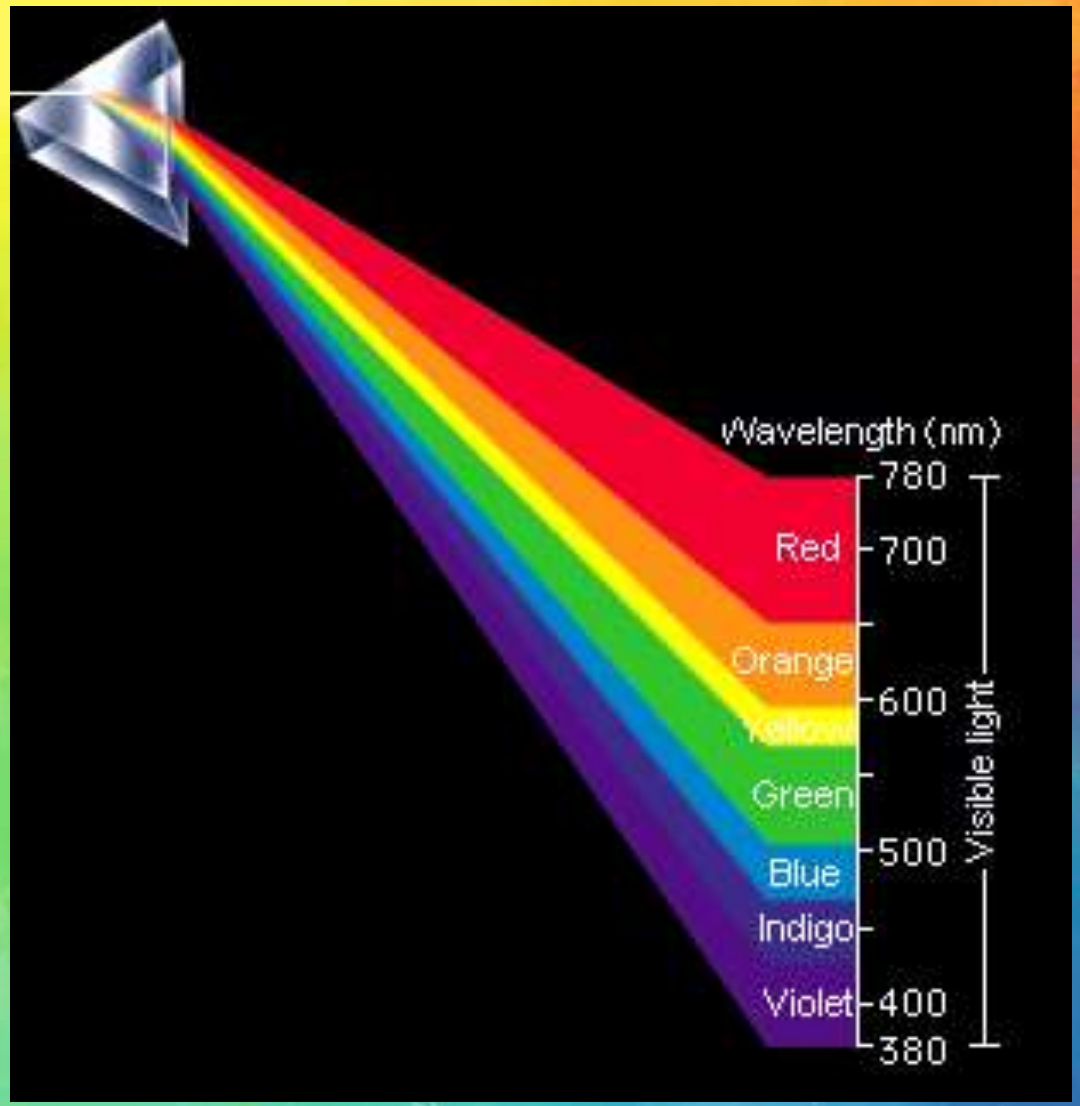

COLOR STARTS WITH THE VISIBLE SPECTRUM (RAINBOW)

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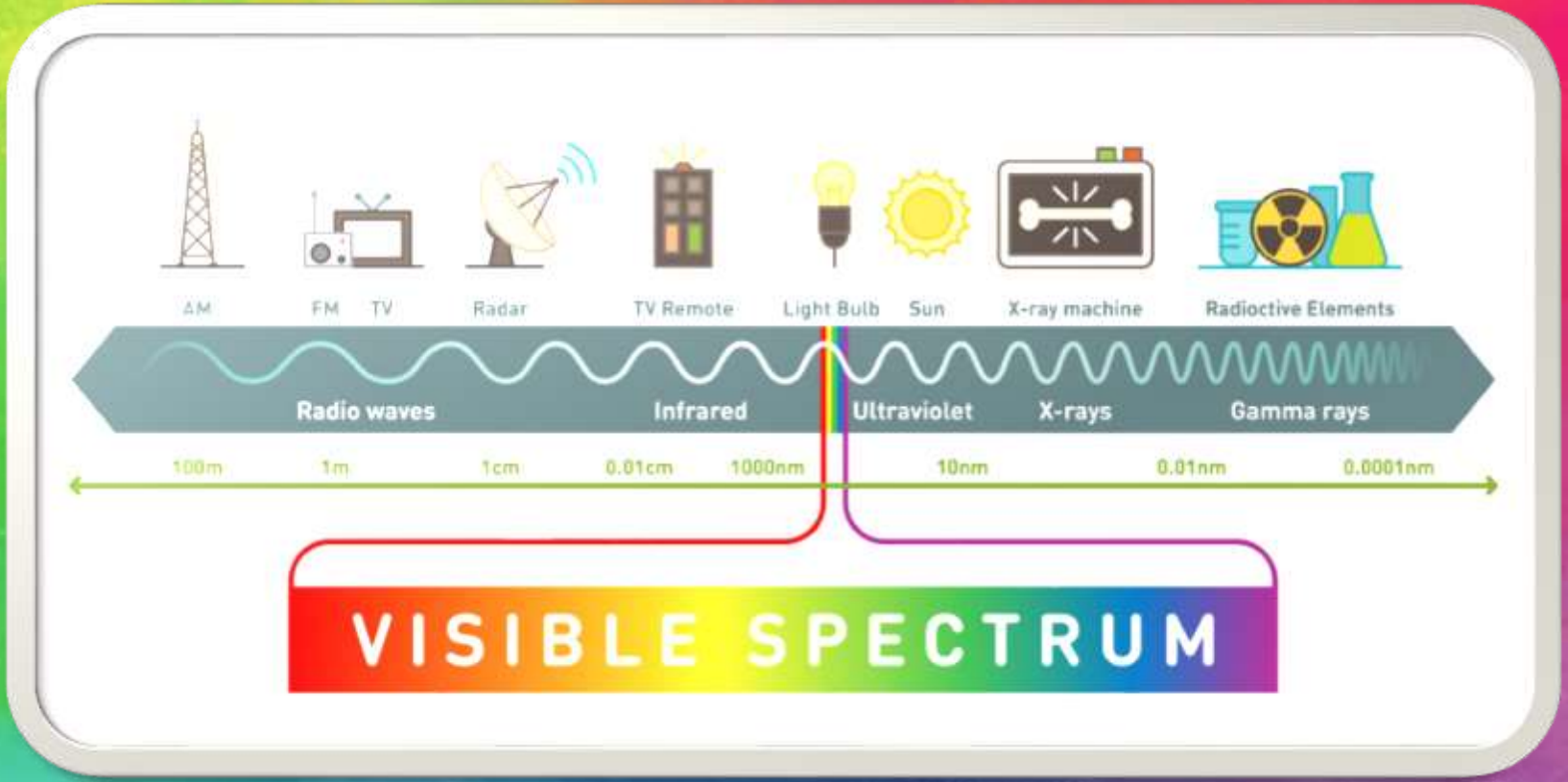
THE ELECTROMAGNETIC SPECTRUM



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THE PERCEPTION OF COLOR

Light Source

Observer

Object

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SUBJECTIVE VS. OBJECTIVE

Subjective (Visual)

- Men vs Women
- Stress
- Age
- Fatigue
- How Much is a Little Redder

Objective (Instrument)

- Quantify
- Assign a Numerical Value
- See's Color The Same Way
- See's Small Color Differences
- Agrees With Our Eye (Usually)

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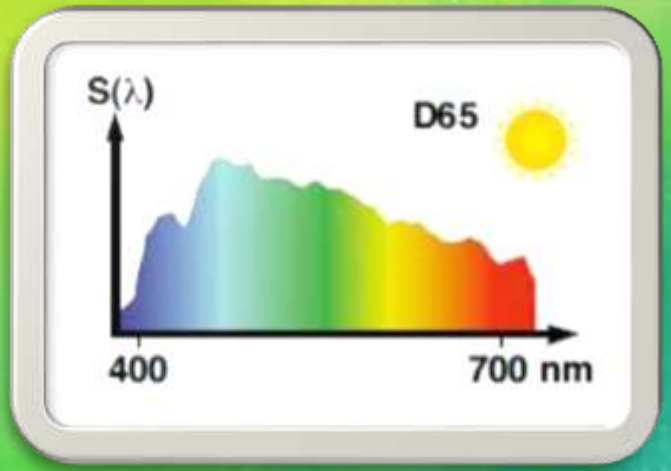
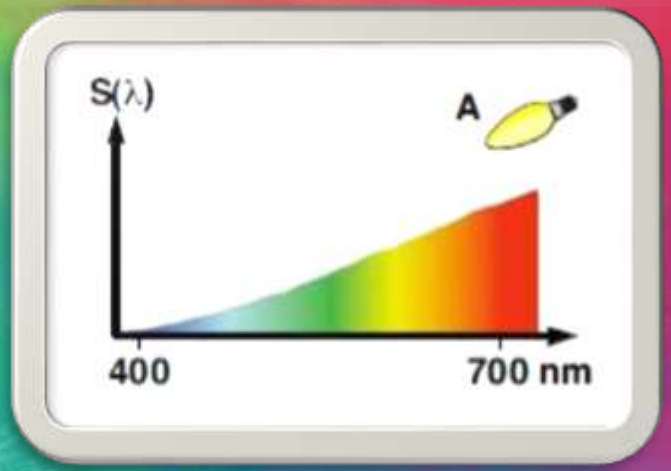
DIFFERENT LIGHT SOURCES

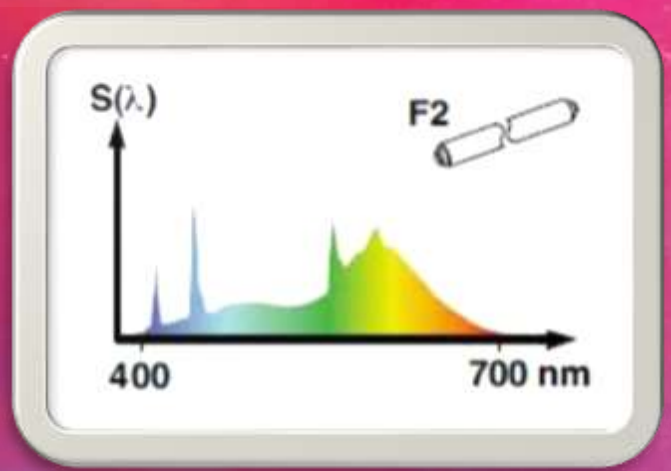
Light sources are defined as standard illuminants.



Daylight



Incandescent



Fluorescent

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THE MYSTERIOUS RODS AND CONES

Visual Receptors:
Rods(Night Vision)
Cones (Red, Green and Blue)

Color Blindness:
1 in 40,000

Color Deficiencies:
1 in 12 males
1 in 250 females

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MOST COMMON LIGHT SOURCES

The three most common light sources are:

Daylight

Incandescent

Fluorescent

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DAYLIGHT IS THE MOST IMPORTANT LIGHT BECAUSE IT IS CHOSEN FOR THE MOST CRITICAL COLOR CHECKING

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MULTIPLE LIGHT SOURCES

D65, CWF, A, U30, and UV - Controlled lighting is the same everywhere and should view samples the same throughout the chain

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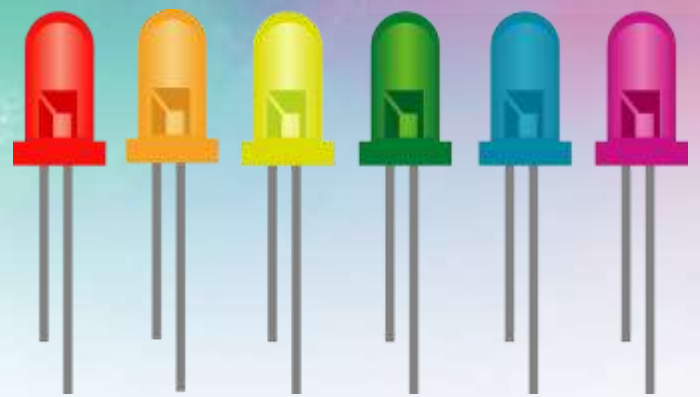
LED

Light Emitting Diode.

- Uses 1/5 of the energy of traditional lighting
- Not hot to the touch like traditional lighting
- Currently, NO standardization from CIE (illuminant)
- Retailers still implementing anyway (Point 1)



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WHEN MAKING CRITICAL VISUAL JUDGEMENT USING A LIGHT BOOTH

- Turn Lights Off
- Wear a Gray smock
- NO tinted eyewear
- Overlap samples
- Look at samples at 45º or flat
- Color Vision Skill Tests

How long should you look at sample?

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VISUAL COLOR MANAGEMENT

What's wrong with this picture?

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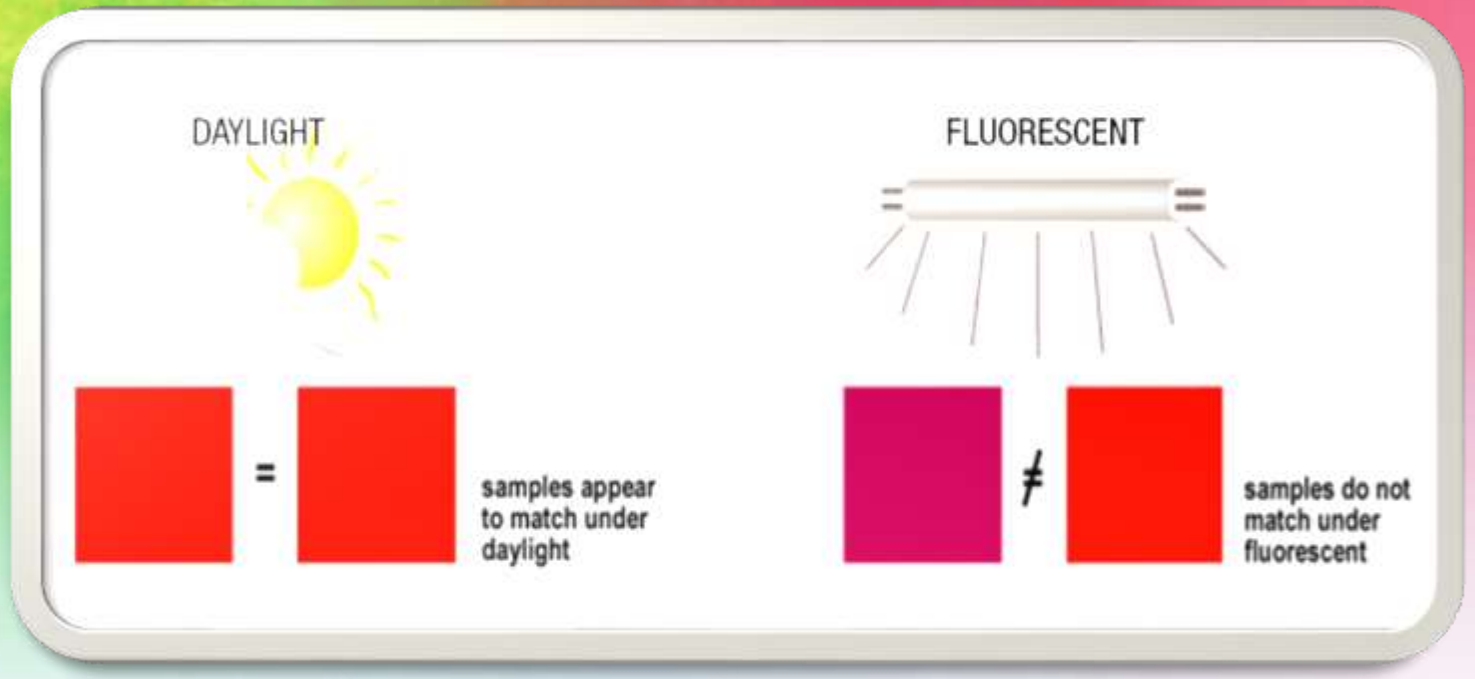
METAMERISM



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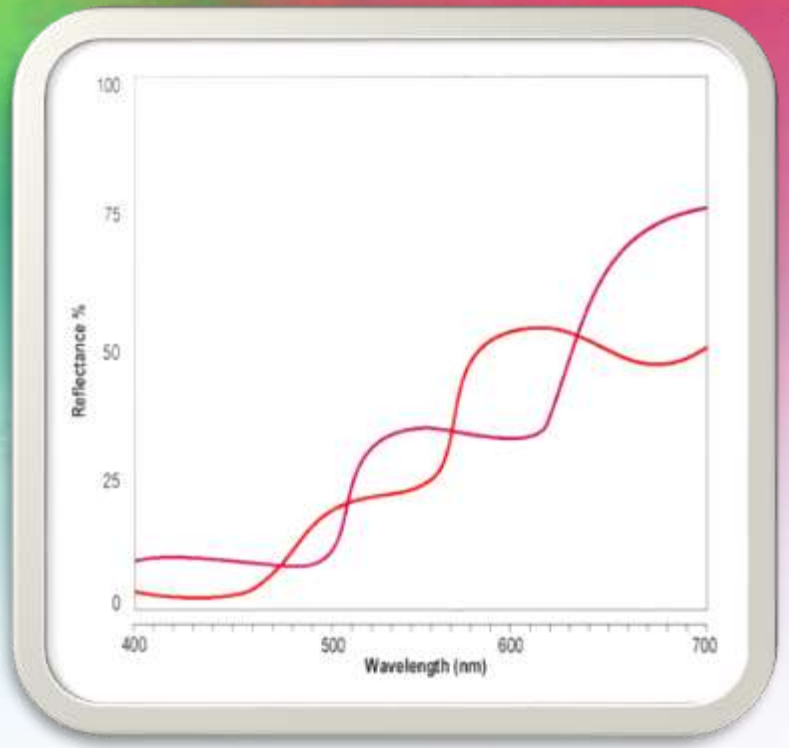
REFLECTIVE CURVES OF A METAMERIC PAIR



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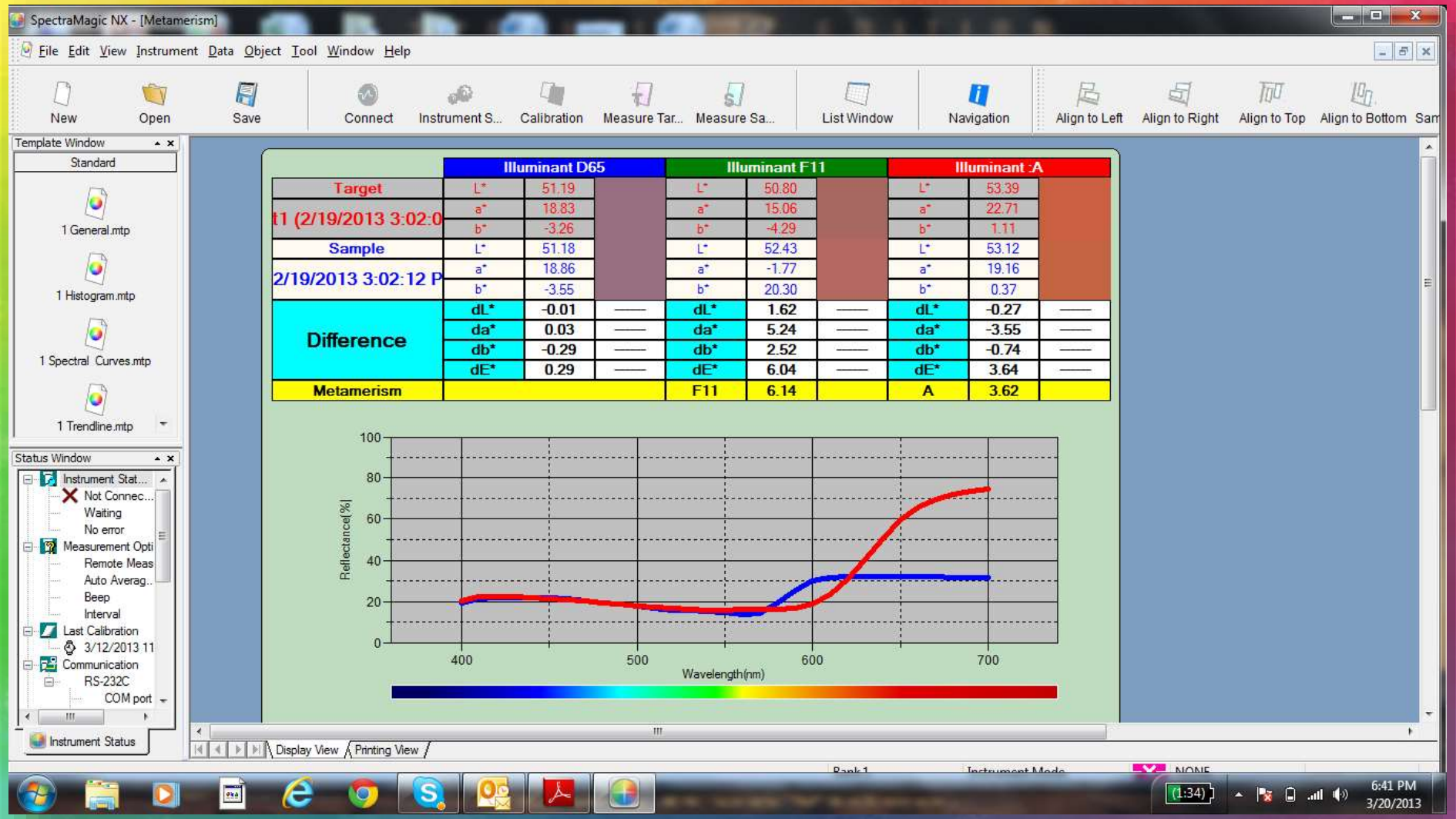

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Visual Analysis Specification

Viewing Conditions

Lighting Product: GTI CMB 2028
Primary light Source: D65
Secondary Light Source: CWF and A
Clothing when viewing: Gray Smock
Viewing Geometry: 0/45
Surround: Munsell N 7

Color Standards and Sample Preparation

Sample Size (standard and trial): 3x5” or larger
Sample Orientation: Side-by-side, always touching
Color Standard Storage: Filed in non-acidic envelope
Sample handling: Lint-free gloves

Color Analysis

Farnsworth-Munsell 100 Hue Test
Color Communication: Based on CIE L*A*B*C*H*

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BUT, HOW MUCH IS “A LITTLE MORE RED?”

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QUANTIFYING COLOR

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WHAT COLOR IS THE APPLE?

Red? Dark Red? Maroon? …Firebrick?

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HOW CAN WE COMMUNICATE COLOR?

With a universal language!

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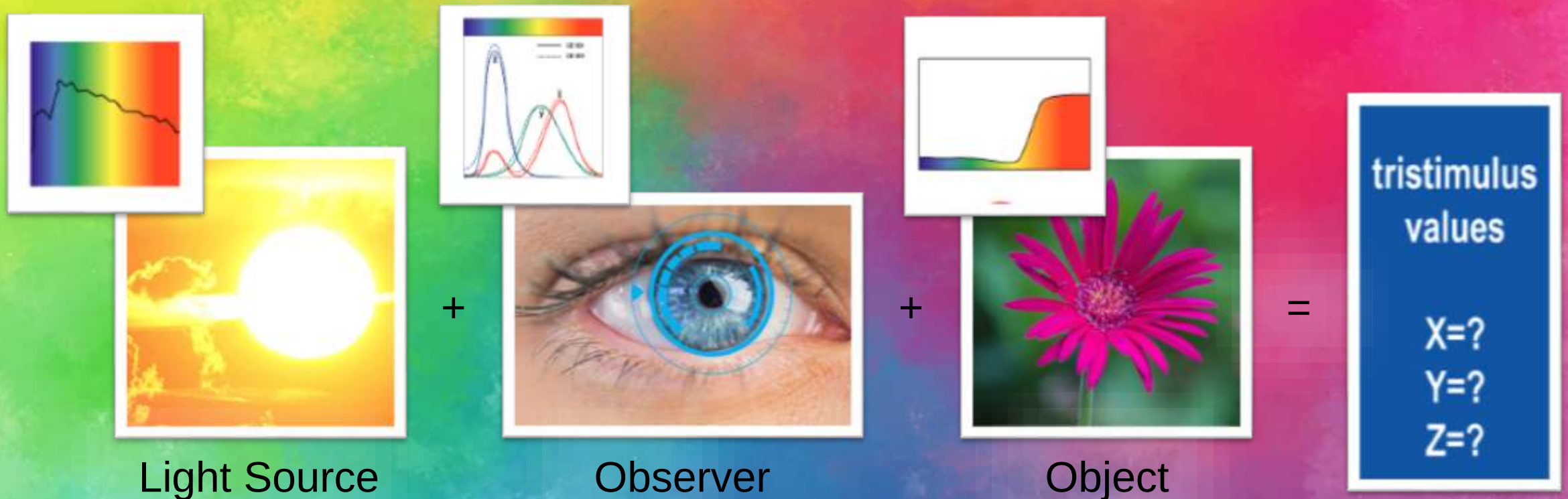
TRISTIMULUS VALUES – X, Y & Z



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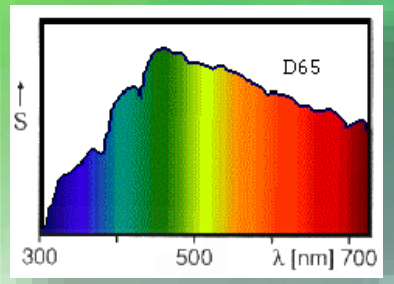
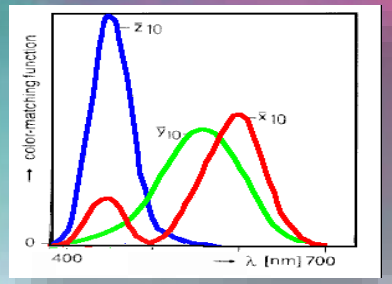
XYZ IS THEN CONVERTED TO L*a*b*

Once we've characterized the Spectral Power Distribution of the light source, the Spectral Reflectance of the object and the standard observer (human eye), then the XYZ's are calculated and converted to L*a*b* or any of the other color spaces.



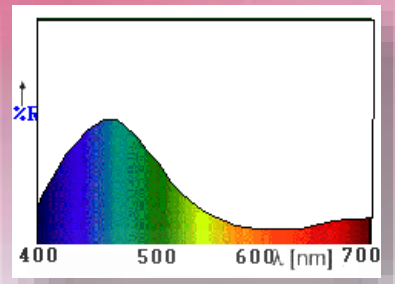
Light Source

X



Observer

X



Object

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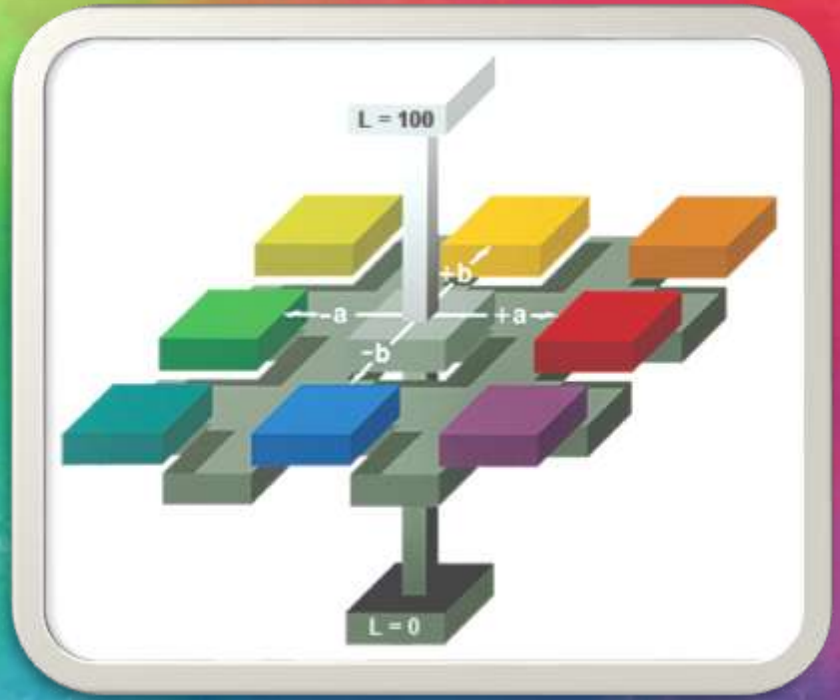
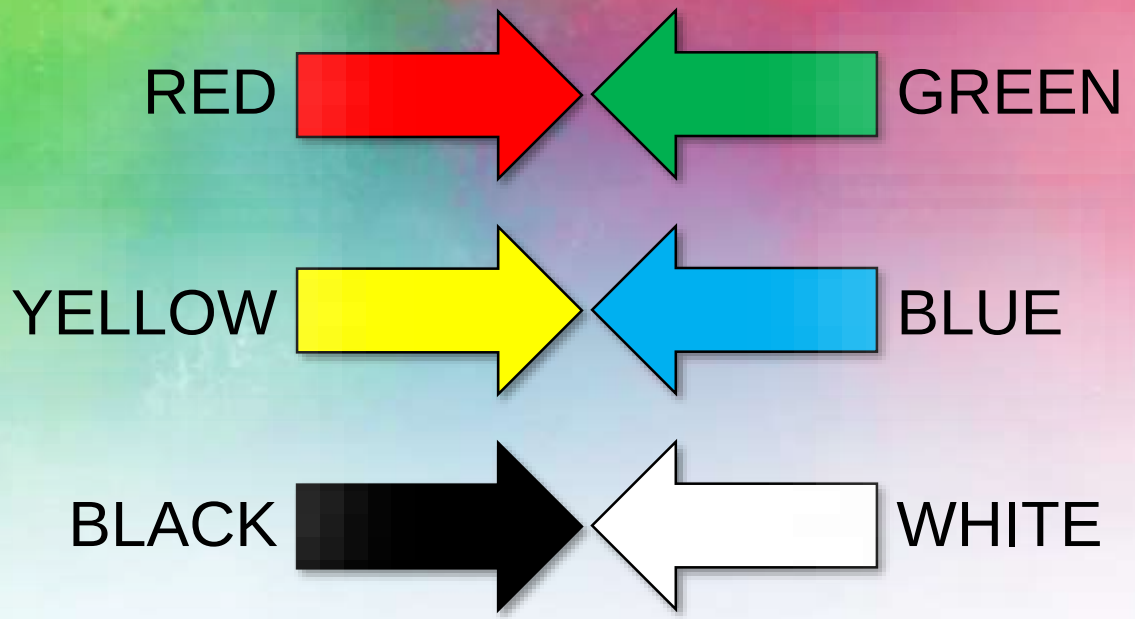
CIE L*a*b*



OPPONENT COLOR THEORY

- Six independent colors (Red, Green, Yellow, Blue, White, and Black).
- Three opponent color systems:



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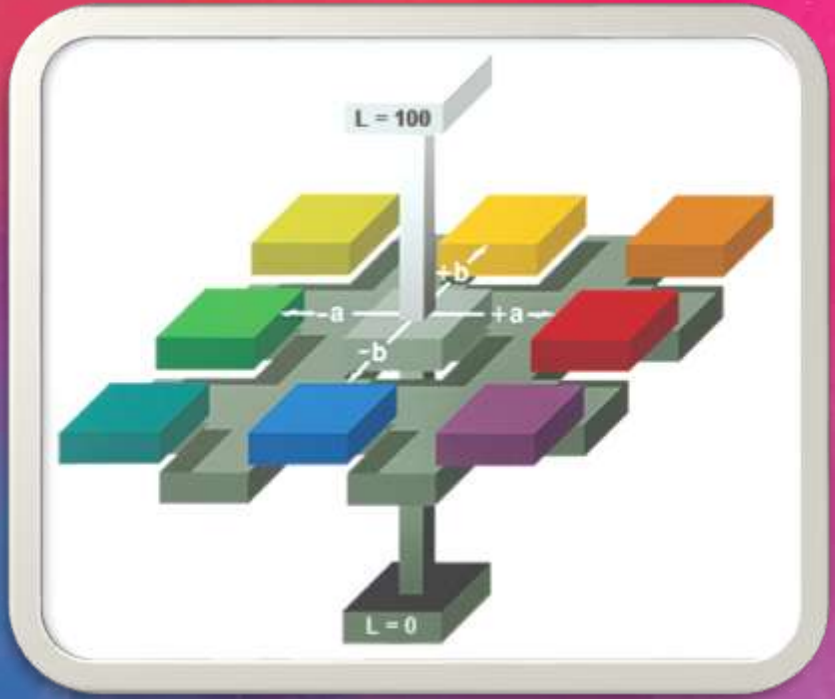
CIE L*a*b*

- Dark/Light scale 0-100 (Positive)
- Red scale has no limits (Positive)
- Green scale has no limits (Negative)
- Yellow scale has no limits (Positive)
- Blue scale has no limits (Negative)



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L*a*b* NUMBERS DESCRIBE THE SAME COLOR IN VISUAL TERMS

X = 21.21
Y = 13.37
Z = 9.32

L* = 43.31 (mid lightness)
a* = 47.63 (very red)
b* = 14.12 (a bit of yellow)

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DOES EVERY COLOR INSTRUMENT MEASURE THE SAME?

Unfortunately no- Due to the setup of the optics, the components and the (Basic-)calibration of different instruments there are differences between device to device, model to model and manufacturer to manufacturer.

For this reason there is the special wording of:

- **Inter-Instrument Agreement-** Comparison between same instruments of the same kind of one manufacturer.
- **Inter-Model Agreement-** Comparison between instruments of one manufacturer with similar optics but different construction.
- **Intra-Instrument Agreement-** Comparison between instruments with similar optics and from different manufacturers.

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COLOR INSTRUMENTS AND INTER-INSTRUMENT AGREEMENT

IIA = .6 DE

IIA = .2 DE

IIA = .2 DE

IIA = .15 DE

IIA = .15 DE

IIA = .08 DE

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INSTRUMENTATION

Colorimeter	**Spectrophotometer**
Filter Based RGB	Grating
OK Inter-Instrument	Tight Inter-Instrument
One Illuminant D65 or C	Multiple Illuminants
2 or 10 Degree Observer	2 & 10 Degree Observer
No Spectral Data	Spectral Data
Can’t Detect Metamerism	Metamerism Detection
QC Only	QC and Formulation

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QUALITY CONTROL

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INCOMING QC, IN-PROCESS QC AND FINAL QC

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COLOR MATCHING (FORMULATION)

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Colibri®: the color management software for the global supply chain.

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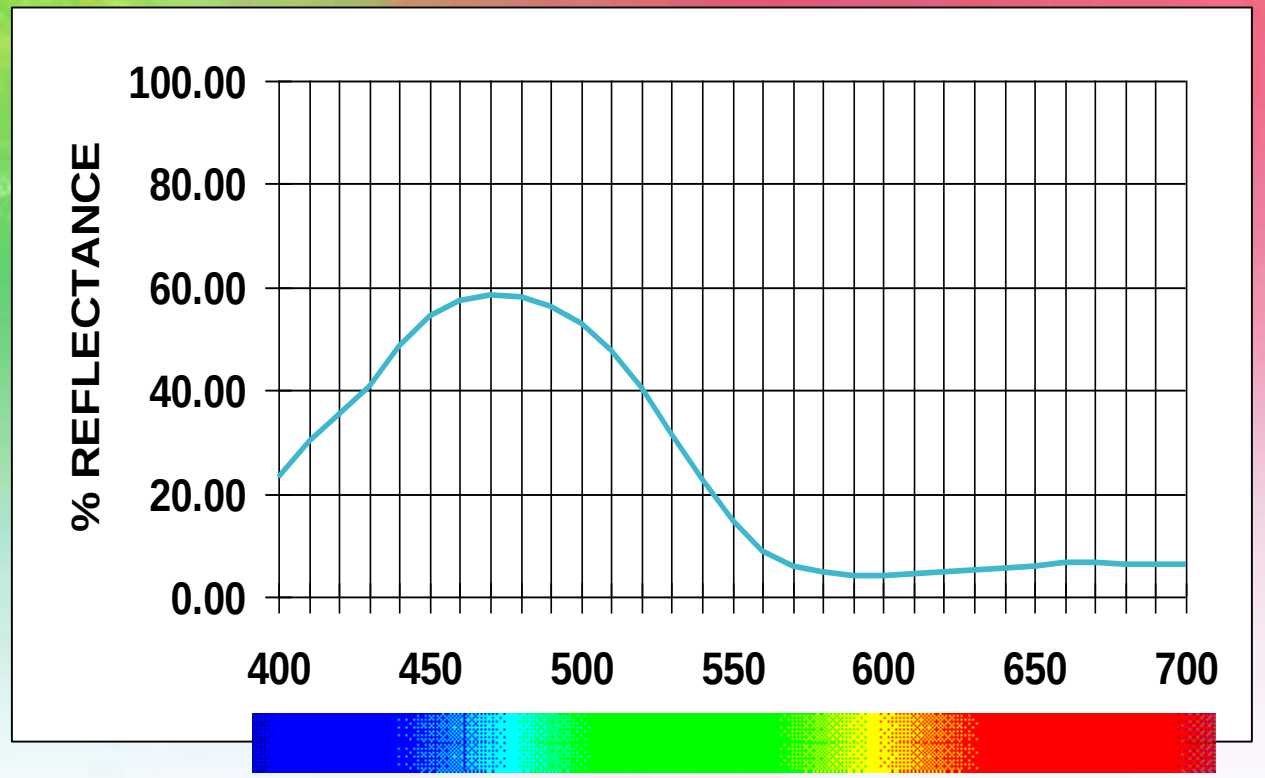
REFLECTANCE CURVE

As unique as a fingerprint.



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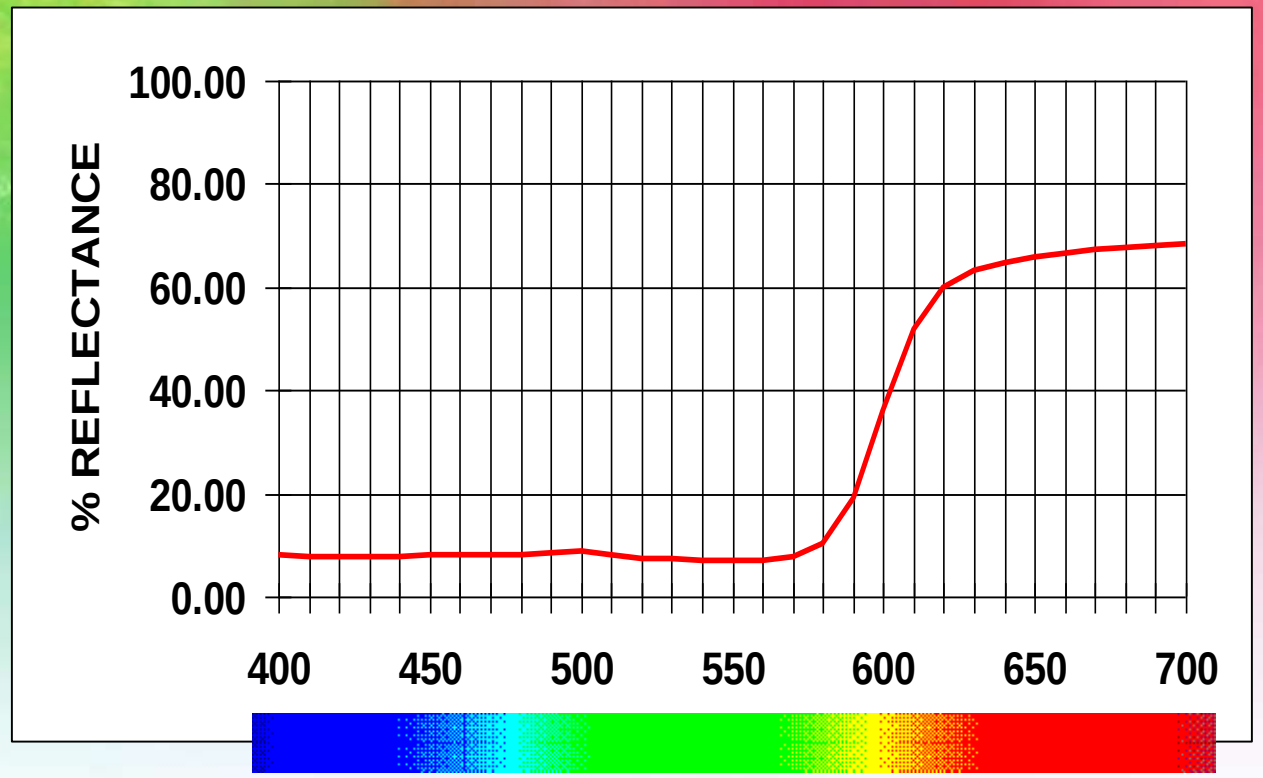
% REFLECTANCE CURVE

RED



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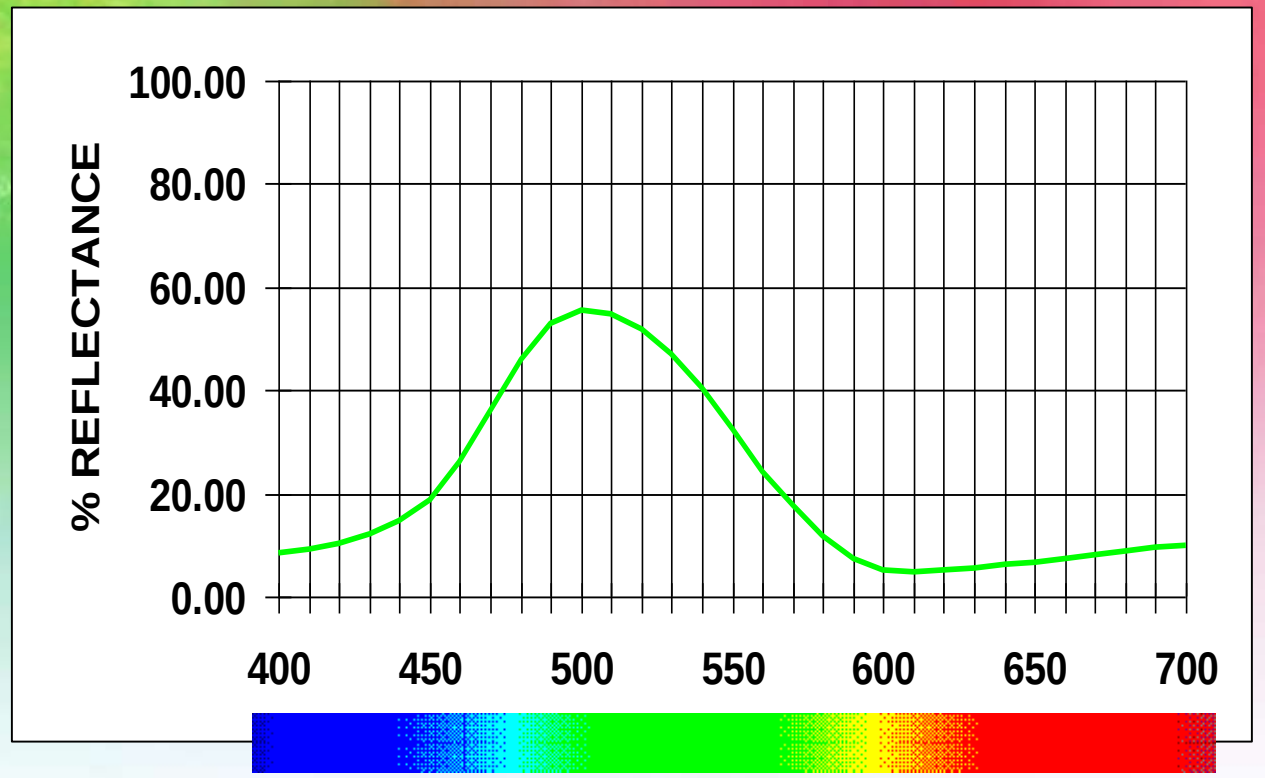
% REFLECTANCE CURVE

GREEN



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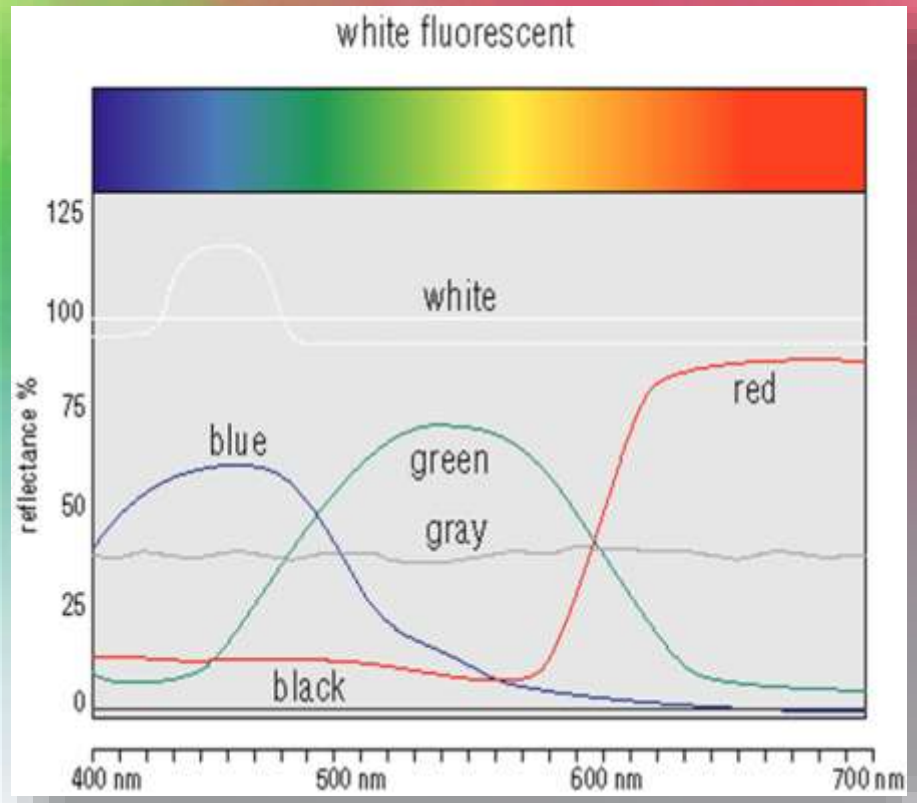
SPECTRAL REFLECTANCE CURVE

As unique as a fingerprint. (FBI)



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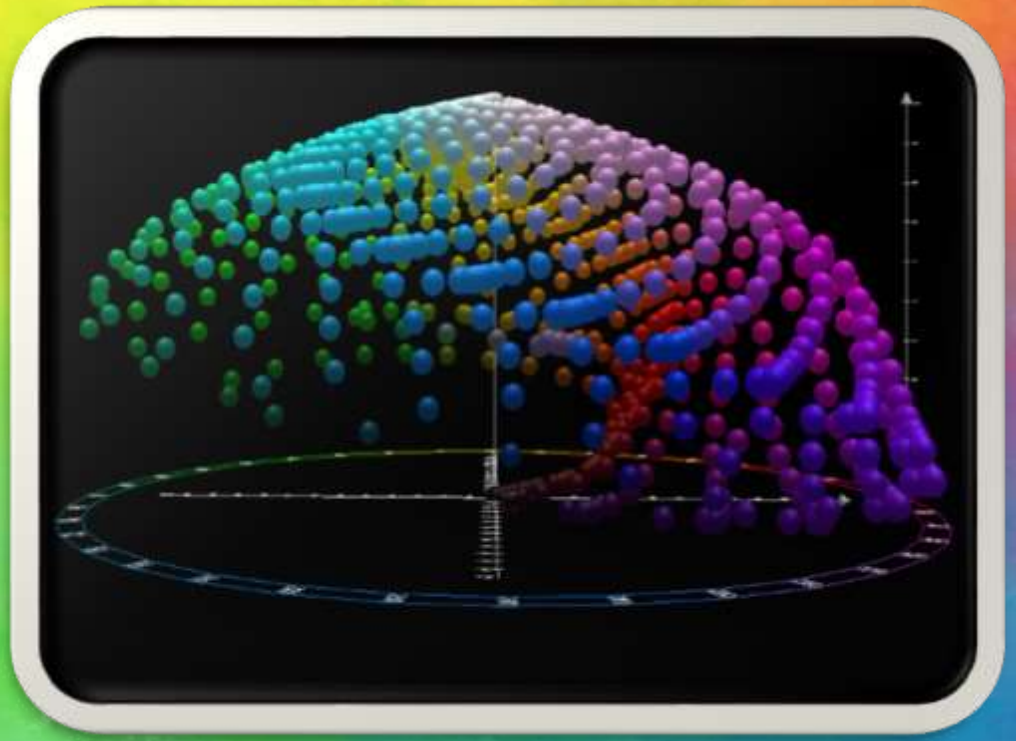

COLOR DIFFERENCE EQUATIONS

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COLOR DIFFERENCE

- Numerical comparison of trials to the standard

- The difference in absolute color coordinates between a trial and a standard

- These differences are called Deltas

- Deltas may be positive or negative (except DE* - always positive)

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CIE L*a*b* DIFFERENCE

- DL* = L*SAM - L*STD Difference between Light/Dark
- Da* = a*SAM - a*STD Difference between Red/Green
- Db* = b*SAM - b*STD Difference between Yellow/Blue

- DE* = ((Da*)2 + (Db*)2 + (DL*)2)1/2

DE* is a total color difference (Anything under 1.0 DE* is acceptable and anything over 1.0 is unacceptable)

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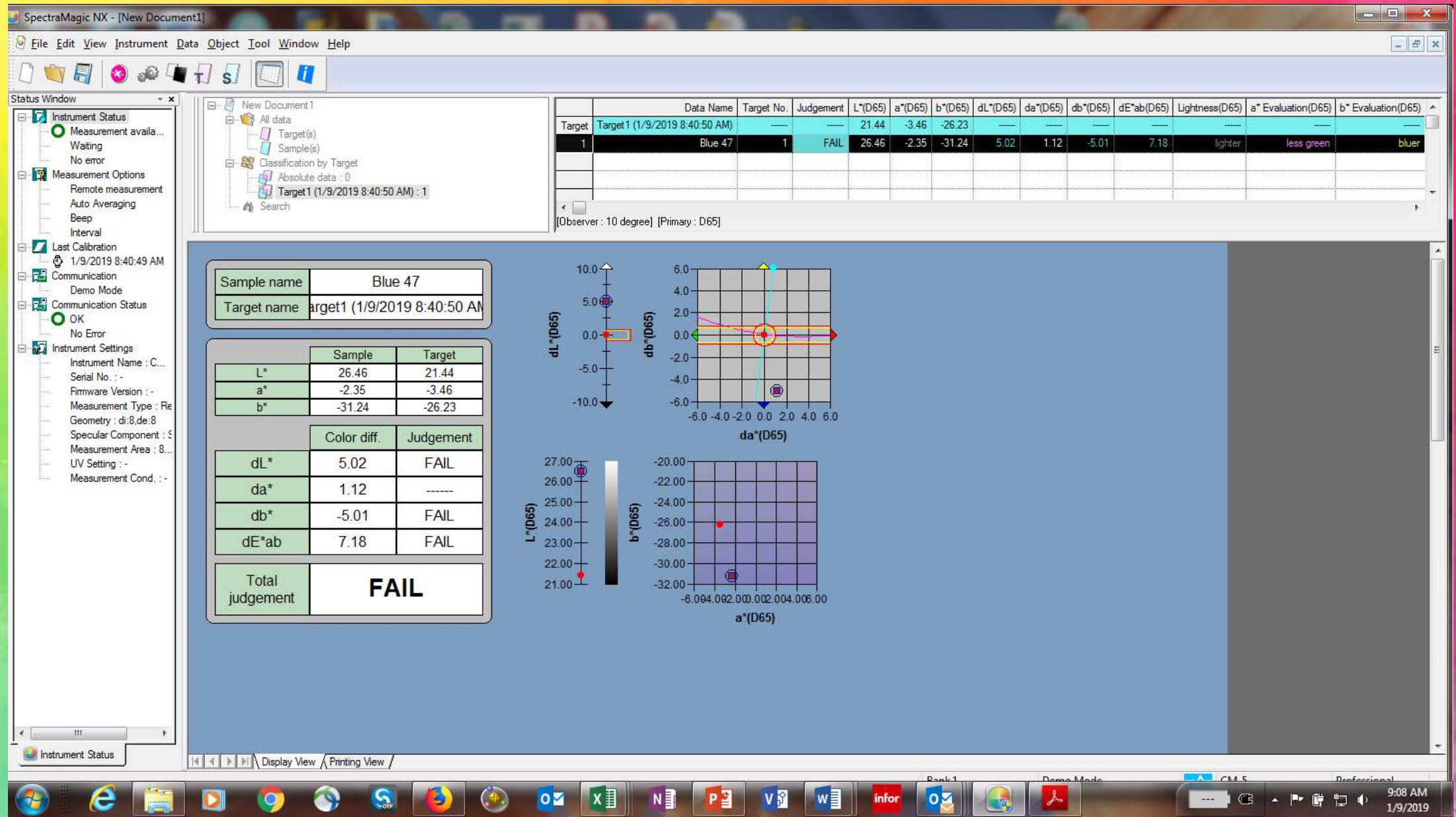

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dL*(D65)	da*(D65)	db*(D65)	dE*ab(D65)	Lightness(D65)	a* Evaluation(D65)	b* Evaluation(D65)
-----	-----	-----	-----	-----	-----	-----
5.02	1.12	-5.01	7.18	lighter	less green	bluer

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MEANINGFUL TOLERANCES

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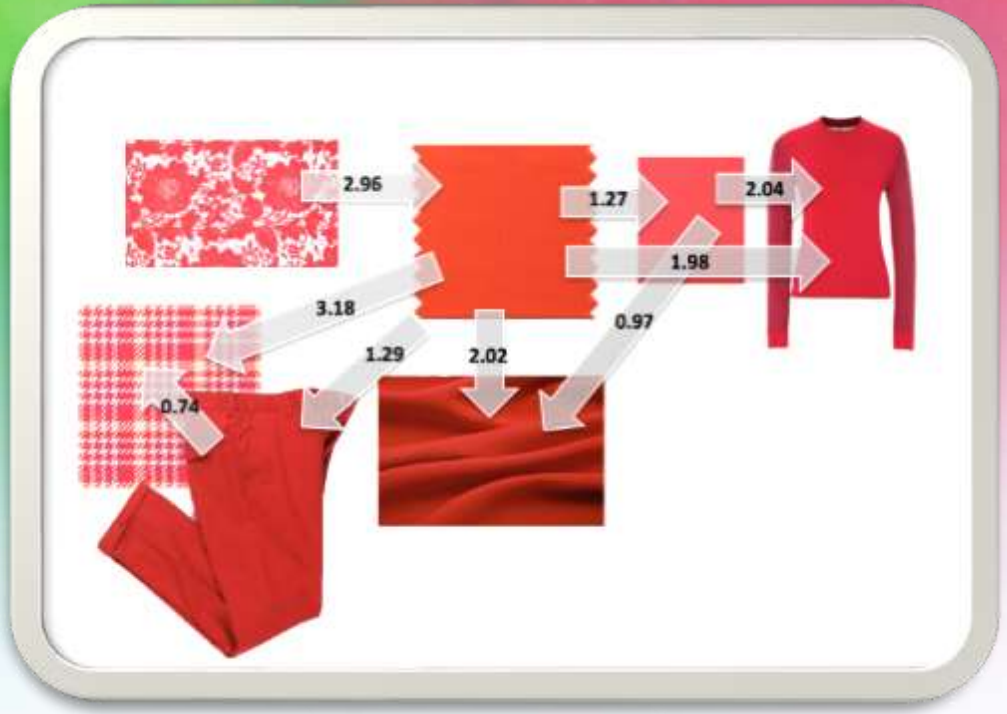
COLOR TOLERANCES

Balance between customer satisfaction

and maximum production



PROBLEMS IN SETTING COLOR TOLERANCES

- It is better to start with a wide tolerance and tighten it to acceptable limits

- Avoid setting a tolerance at the minimum perceptible difference

- Tolerances should be agreed upon by customer and supplier

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CREATING A TOLERANCE

- Consistency is critical
- Specify exact calculation
- Avoid “fudge” factors
- Confirm numbers visually

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HOW DO YOU ESTABLISH THE RIGHT TOLERANCE?

- Tolerances Have To Be Confirmed Visually Using Controlled Lighting And Done By Committee Or By Customer And Supplier
- Tolerances Should Be Set As Wide As Possible To Start And Refined As The Process Continues
- Take A Few Sets Of Panels Using A Few Colors And Visually Choose Which Ones Are Acceptable
- Then Measure Those Panels And You Should Be Able To Come Up With A CMC DE Or Deoo Number (.65) That Applies To All Colors

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CONSISTENCY FOR GOOD CORRELATION BETWEEN INSTRUMENTS

- Instrument Geometry D8 (SCI or SCE) or 0/45
- Observer 2 or 10 Degree
- Illuminant D65, CWF, A
- Color Space L*A*B*, L*C*H*, CMC
- Measurement Area 30MM, 8MM, 3MM

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COLLABORATIVE TESTING

Can Instruments from Different Manufacturer's Correlate to Each Other?

- If the geometries are the same
- If the illuminant, observer and color space are the same
- If the samples are measured the same way

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INSTRUMENTAL COLOR EVALUATION SPECIFICATION

INSTRUMENTAL ANALYSIS

1. Color Measurement
    - Spectrophotometer: Konica Minolta CM-5 Sphere (D8) CIE Observer: 10 degree
    - CIE Illuminant: D65
    - Secondary Illuminants: A and CWF
    - Color Scale: CIE L*A*B*, CMC
    - Measurement Mode: Reflectance, SCI, LAV
    - Number of Measurements: AVERAGE = 3
    - Tolerance: CMC Delta E .8

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SO, HOW MUCH IS “A LITTLE MORE RED”?

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QUESTIONS?

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https://promo.sensing.konicaminolta.us/color-and-appearance-workshops

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THE STANDARD IN MEASURING COLOR

About Our Seminars

Please join us for a seminar on the evaluation and control of product color.

Learn the essentials of color science and the elements to an effective color process within research and manufacturing environments. This engaging seminar is targeted to industry professionals with job functions in controlling the color quality, consistency, and appearance of their products or samples. Hosted by a Konica Minolta Sensing color expert, each attendee will leave with a solid understanding of color and the components required for evaluating, communicating, and controlling color internally

All are encouraged to interact with our experts for technical advice, tips, color and appearance assessments, and networking and to stay connected after the event. If interested in having one of our experts assess the color and appearance of your product or application, please bring in a sample to the seminar or make arrangements for one of our experts to visit your site.

Registration form

First name* — First name

Last name* — Last name

Email* — your.name@email.com

Phone number* — (000) 000-0000

Business name* — Company name

Title — Manager

Street address* — 123 Main Street

City* — Anytown

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NEW YORK Society of Cosmetic CHEMISTS

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The Evolution of Beauty

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...CELEBRATING 40 YEARS

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THANK YOU!

We’re so glad you were able to make it.

☺