Errata
Billmeyer and Saltzman's Principles of Color Technology, 4th edition

Updated August 23, 2023

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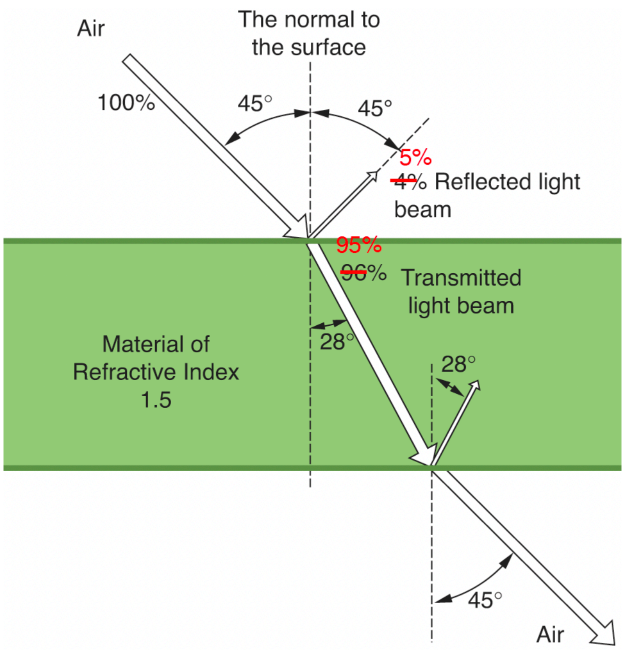

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$$K_1 = \left(\frac{n_{\text{material}} - n_{\text{air}}}{n_{\text{material}} + n_{\text{air}}}\right)^2 \qquad (1.6)$$

Light transmitting through a material as shown in Figure 1.10, that is, at 45° incidence relative to the normal angle of a material with a refractive index of 1.5, results in the following values: $R_{\text{parallel}} = 0.080$, $R_{\text{perpendicular}} = 0.013$, $R_{\text{unpolarized}} = 0.047$, $T_{\text{inside top surface}} = 0.953$, $\theta_{\text{transmitted}} = 28.1$, and $T_{\text{measured}} = 0.092$.

I calculated these values incorrectly by using sin(sin(theta)) instead of the correct (sin(theta))^2

The correct values are
Rparallel = 0.092
Rperpendicular = 0.0085
Runpolarized = 0.0502
Tinside top surface = 0.950
Tmeasured = 0.923

Light transmitting through a material as shown in Figure 1.10, that is, at 45° incidence relative to the normal angle of a material with a refractive index of 1.5, results in the following values: $R_{\text{parallel}} =$ **0.092**, $R_{\text{perpendicular}} =$ **0.0085**, $R_{\text{unpolarized}} =$ **0.0502**, $T_{\text{inside top surface}} =$ **0.950**, $\theta_{\text{transmitted}} = 28.1$, and $T_{\text{measured}} =$ **0.923**.

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$$\begin{pmatrix} \text{white} \Longleftrightarrow \text{black} \\ \text{red} \Longleftrightarrow \text{green} \\ \text{yellow} \Longleftrightarrow \text{blue} \end{pmatrix} = \begin{pmatrix} 0.64 & 1.12 & 0.35 \\ 0.39 & -1.50 & 0.15 \\ -0.01 & 0.34 & -0.53 \end{pmatrix}_{\text{opponency}} \begin{pmatrix} L \\ M \\ S \end{pmatrix} \quad (2.26)$$

The transformation matrix should be transposed and reduced in the number of significant figures:

0.64	0.36	0
1.16	-1.5	0.34
0.38	0.15	-0.53

The row sums are 1, 0, 0.

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This matrix assumes a relative luminance factor of 1:

$$\begin{pmatrix} L_{r\,\max} \\ L_{g\,\max} \\ L_{b\,\max} \end{pmatrix} = \begin{pmatrix} (x_r/y_r) & (x_g/y_g) & (x_b/y_b) \\ 1 & 1 & 1 \\ (z_r/y_r) & (z_g/y_g) & (z_b/y_b) \end{pmatrix}^{-1} \begin{pmatrix} (x_n/y_n) \\ 1 \\ (z_n/y_n) \end{pmatrix} \quad (4.41)$$

For generalization, change to:

$$\begin{pmatrix} L_{r\,\max} \\ L_{g\,\max} \\ L_{b\,\max} \end{pmatrix} = \begin{pmatrix} (x_r/y_r) & (x_g/y_g) & (x_b/y_b) \\ 1 & 1 & 1 \\ (z_r/y_r) & (z_g/y_g) & (z_b/y_b) \end{pmatrix}^{-1} \begin{pmatrix} (x_n/y_n)L_n \\ L_n \\ (z_n/y_n)L_n \end{pmatrix} \quad (4.41)$$

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$$\mathbf{S} = \begin{pmatrix} {\sigma_{\Delta L^*}}^2 & \sigma_{\Delta L^*}\sigma_{\Delta a^*} & \sigma_{\Delta L^*}\sigma_{\Delta b^*} \\ \sigma_{\Delta a^*}\sigma_{\Delta L^*} & {\sigma_{\Delta a^*}}^2 & \sigma_{\Delta a^*}\sigma_{\Delta b^*} \\ \sigma_{\Delta b^*}\sigma_{\Delta L^*} & \sigma_{\Delta b^*}\sigma_{\Delta a^*} & {\sigma_{\Delta b^*}}^2 \end{pmatrix} \quad (5.12)$$

$$\mathbf{S} = \begin{pmatrix} \sigma^2_{L^*} & \sigma_{L^*}\sigma_{a^*} & \sigma_{L^*}\sigma_{b^*} \\ \sigma_{a^*}\sigma_{L^*} & \sigma^2_{a^*} & \sigma_{a^*}\sigma_{b^*} \\ \sigma_{b^*}\sigma_{L^*} & \sigma_{b^*}\sigma_{a^*} & \sigma^2_{b^*} \end{pmatrix} \quad (6.7)$$

Somehow, I wrote the variance-covariance matrix in terms of standard deviations. This is not correct. Here are the correct formulas:

$$cov_{x,y} = \frac{\sum(x_i - \bar{x})(y_i - \bar{y})}{N-1}$$

$cov_{x,y}$ = covariance between variable x and y

x_i = data value of x

y_i = data value of y

$\bar{x}$ = mean of x

$\bar{y}$ = mean of y

N = number of data values

$$S^2 = \frac{\sum(x_i - \bar{x})^2}{n-1}$$

S^2 = sample variance

x_i = the value of the one observation

$\bar{x}$ = the mean value of all observations

n = the number of observations

$$\begin{bmatrix} var(x) & cov(x,y) & cov(x,z) \\ cov(x,y) & var(y) & cov(y,z) \\ cov(x,z) & cov(y,z) & var(z) \end{bmatrix}$$

I also compared Excel and Matlab. The Excel function is not accurate.

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$$C^*_{ab} = \left\{ \begin{matrix} C^*_{ab,\mathrm{Std}} \\ \sqrt{C^*_{ab,1} C^*_{ab,2}} \end{matrix} \right\} \qquad (5.34)$$

Eq. 5.34 indicates a choice between the two options, but it does not explain how to select between the options. The upper equation simply uses the C^*_{ab} of the standard, while the lower equation computes the geometric mean of the C^*_{ab} of the standard and batch. This choice was apparently left to the user because of a disagreement in the committee. The upper equation means that the color difference is asymmetric (it matters which sample is called "standard" and which is "batch," while the lower equation is symmetric. Note that the equations approach equivalence as the C^*_{ab} of the standard and batch are closer together, thus the only time it has a meaningful effect is if the C^*_{ab} difference is large. Note that the CIEDE2000 formula removed this choice and used the arithmetic average.

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$$\frac{\partial b^*}{\partial R_\lambda} = 200\left[a_{\lambda,\bar{y}}\frac{1}{3Y}\left(\frac{Y}{Y_n}\right)^{\frac{1}{3}} - a_{\lambda,\bar{z}}\frac{1}{3\cancel{Y}\,\underset{Z}{}}\left(\frac{Z}{Z_n}\right)^{\frac{1}{3}}\right] \qquad (8.24)$$

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$$K_1 = \left(\frac{n_{\mathrm{material}} - n_{\mathrm{air}}}{n_{\mathrm{material}} + n_{\mathrm{air}}}\right)^{2} \qquad (9.6)$$

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$$s_{\lambda,0} = \frac{s_{\lambda,\text{white}} \left(\frac{K}{S}\right)_{\lambda,\sout{\text{masstone}}\ \text{tint}} - k_{\lambda,\text{white}}}{\left(\frac{K}{S}\right)_{\lambda,\text{masstone}} - \left(\frac{K}{S}\right)_{\lambda,\text{tint}}} \tag{9.27}$$