

Transformation between the *Judd* tristimulus and opponent values

Data see K. Richter, PhD thesis, University of Basel (Switzerland), 1969, page 81.

For the antagonistic spectral elementary colours

$\lambda_B = 475 \text{ nm}$, $\lambda_G = 502 \text{ nm}$, $\lambda_Y = 574 \text{ nm}$, $\lambda_R = 494 \text{ nm}$

modern coordinates $\bar{l}$, $\bar{a}$, $\bar{b}$ are used instead of $\bar{x}_i$ ($i=1$ to 3).

Linear model equations between spectral colour values in both directions:

$$\begin{pmatrix} \bar{l}(\lambda) \\ \bar{a}(\lambda) \\ \bar{b}(\lambda) \end{pmatrix} = \begin{pmatrix} b_{11} & b_{12} & b_{13} \\ b_{21} & b_{22} & b_{23} \\ b_{31} & b_{32} & b_{33} \end{pmatrix} \cdot \begin{pmatrix} \bar{x}(\lambda) \\ \bar{y}(\lambda) \\ \bar{z}(\lambda) \end{pmatrix} = \begin{pmatrix} 0,0000 & 1,0000 & 0,0000 \\ 2,9797 & -2,6662 & -0,0960 \\ -0,4139 & 1,4571 & -2,4046 \end{pmatrix} \cdot \begin{pmatrix} \bar{x}(\lambda) \\ \bar{y}(\lambda) \\ \bar{z}(\lambda) \end{pmatrix} \quad (1)$$

$$\begin{pmatrix} \bar{x}(\lambda) \\ \bar{y}(\lambda) \\ \bar{z}(\lambda) \end{pmatrix} = \begin{pmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{pmatrix} \cdot \begin{pmatrix} \bar{l}(\lambda) \\ \bar{a}(\lambda) \\ \bar{b}(\lambda) \end{pmatrix} = \begin{pmatrix} 0,9093 & 0,3338 & -0,0133 \\ 1,0000 & 0,0000 & 0,0000 \\ 0,4494 & -0,0574 & -0,4136 \end{pmatrix} \cdot \begin{pmatrix} \bar{l}(\lambda) \\ \bar{a}(\lambda) \\ \bar{b}(\lambda) \end{pmatrix} \quad (2)$$

The tristimulus values L , A , B and X , Y , Z need the same transformations.

The normalized purity data a_n and b_n are defined in LabMUN 1969 as follows:

$$a_n = n_a a_u = n_a X/Y = n_a x/y; \quad n_a = 2,8 \quad (3) \quad b_n = b_u = X/Y = x/y \quad (4) \quad z = 1 - x - y \quad (5)$$

The normalized purity data a_n and b_n are defined in LabMUN 1969 as follows:

$$\begin{aligned} a_n &= n_a [(b_{21} - b_{23})x + (b_{22} - b_{23})y + b_{23}] / y \\ &= 2,8(3,0757x - 2,5702y - 0,0960) / y \\ &= (8,6119x - 7,1965y - 0,2688) / y \end{aligned} \quad (6)$$

$$\begin{aligned} b_n &= [(b_{31} - b_{33})x + (b_{32} - b_{33})y + b_{33}] / y \\ &= (1,9906x + 3,8617y - 2,4046) / y \end{aligned} \quad (7)$$