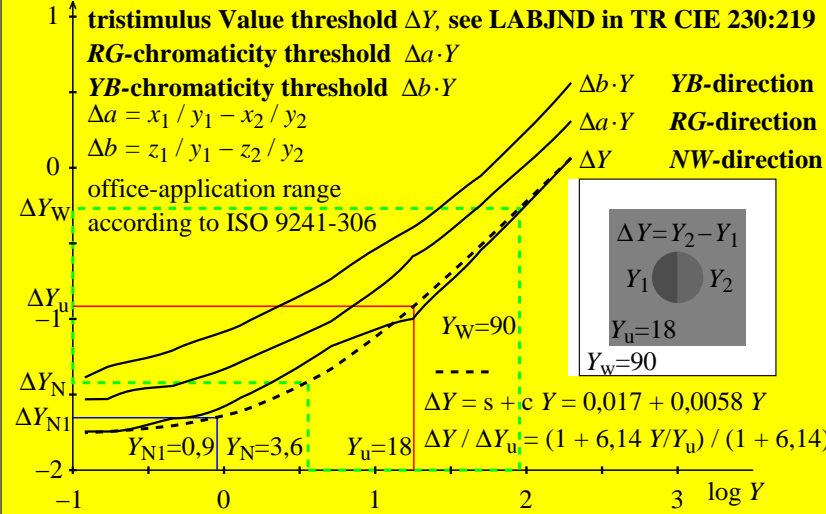


NW-achromatic, and RG- and YB-chromatic thresholds as function of Y

experiments and data: BAM-research report no. 115 (1985), page 72, see
log[$\Delta Y, \Delta a \cdot Y, \Delta b \cdot Y$] <https://nbn-resolving.org/urn:nbn:de:kobv:b43-3350>



eeg10-3n eeg10-7n

Colour-difference formula LABJND 1985 for near achromatic colours

$$\Delta E_{JND}^* = \Delta E_{85}^* = A_0 [(\Delta Y)^2 + (A_3 \Delta a \cdot Y)^2 + (A_4 \Delta b \cdot Y)^2]^{1/2} / (A_1 + A_2 \cdot Y) \quad [1]$$

$$a = x / y \quad b = -0,4 z / y \quad [2]$$

$$Y = (Y_1 + Y_2) / 2 \quad \Delta Y = Y_1 - Y_2 \quad \Delta a = a_1 - a_2 \quad \Delta b = b_1 - b_2 \quad [3]$$

$$A_1 = 0,0170 \quad A_2 = 0,0058 \quad [4]$$

$$A_3 = 1,0 \quad A_4 = 1,8 \quad A_0 = 1,5 \quad \text{background D65} \quad [5]$$

$$A_3 = 1,0 \quad A_4 = 1,7 \quad A_0 = 1,0 \quad \text{background A} \quad [6]$$

Just noticeable difference (JND) in three colour directions and line elements

$$A_0 \cdot \Delta Y = (A_1 + A_2 \cdot Y) \quad \text{in luminance direction WN} \quad [1a]$$

$$A_0 \cdot \Delta a \cdot A_3 \cdot Y = (A_1 + A_2 \cdot Y) \quad \text{in chromaticity direction RG} \quad [2a]$$

$$A_0 \cdot \Delta b \cdot A_4 \cdot Y = (A_1 + A_2 \cdot Y) \quad \text{in chromaticity direction YB} \quad [3a]$$

$$dE_{85,L}^* = \frac{\delta}{\delta Y} L_{85}^* = \frac{\delta}{\delta Y} [(A_0 / A_2) \cdot \ln(A_1 + A_2 \cdot Y)] = A_0 \cdot dY / (A_1 + A_2 \cdot Y) \quad [4a]$$

$$dE_{85,a}^* = \frac{\delta}{\delta a} a_{85}^* = \frac{\delta}{\delta a} [(A_0 \cdot A_3 \cdot Y \cdot a) / (A_1 + A_2 \cdot Y)] = A_0 \cdot da \cdot A_3 \cdot Y / (A_1 + A_2 \cdot Y) \quad [5a]$$

$$dE_{85,b}^* = \frac{\delta}{\delta b} b_{85}^* = \frac{\delta}{\delta b} [(A_0 \cdot A_4 \cdot Y \cdot b) / (A_1 + A_2 \cdot Y)] = A_0 \cdot db \cdot A_4 \cdot Y / (A_1 + A_2 \cdot Y) \quad [6a]$$

eeg10-7n CEA21-7n

Test chart eeg1; Colour thresholds and colour spaces with *Ostwald* optimal colours as reference
Line elements for achromatic and chromatic colours for different applications, new TUBJND 2023

Colour-difference formula LABJND 1985 (JND=just noticeable difference)

$$\Delta E_{JND}^* = \Delta E_{85}^* = A_0 [(\Delta Y)^2 + (A_3 \Delta a'' \cdot Y)^2 + (A_4 \Delta b'' \cdot Y)^2]^{1/2} / (A_1 + A_2 \cdot Y) \quad [1]$$

$$a = x / y \quad a_n = x_n / y_n \quad b = -0,4 z / y \quad b_n = -0,4 z_n / y_n \quad [2]$$

$$a'' = a_n + (a - a_n) / (1 + 0,5 |a - a_n|) \quad n = D65 \text{ or } A \text{ (background)} \quad [3]$$

$$b'' = b_n + (b - b_n) / (1 + 0,5 |b - b_n|) \quad [4]$$

$$Y = (Y_1 + Y_2) / 2 \quad \Delta Y = Y_1 - Y_2 \quad \Delta a'' = a_1'' - a_2'' \quad \Delta b'' = b_1'' - b_2'' \quad [5]$$

$$A_1 = 0,0170 \quad A_2 = 0,0058 \quad [6]$$

$$A_3 = 1,0 \quad A_4 = 1,8 \quad A_0 = 1,5 \quad \text{background D65} \quad [7]$$

$$A_3 = 1,0 \quad A_4 = 1,7 \quad A_0 = 1,0 \quad \text{background A} \quad [8]$$

Just noticeable difference (JND) in four colour directions

$$\Delta Y = \text{const} (A_1 + A_2 \cdot Y) / A_0 \quad \text{in luminance direction WN} \quad [1a]$$

$$\Delta a'' \cdot Y = \text{const} (A_1 + A_2 \cdot Y) / (A_0 \cdot A_3) \quad \text{in chromaticity direction RG} \quad [2a]$$

$$\Delta b'' \cdot Y = \text{const} (A_1 + A_2 \cdot Y) / (A_0 \cdot A_4) \quad \text{in chromaticity direction YB} \quad [3a]$$

$$\Delta c_{ab}'' \cdot Y = \text{const} (A_1 + A_2 \cdot Y) / (A_0 \cdot [A_3^2 + A_4^2]^{1/2}) \quad \text{in chromaticity direction } c_{ab} \quad [4a]$$

eeg11-3n CEA21-3n

Colour-difference formula TUBJND 2023 (JND=just noticeable difference)

$$\Delta E_{JND}^* = \Delta E_{22}^* = A_0 [(\Delta Y_r)^2 + (A_3 \Delta a \cdot Y_{rc})^2 + (A_4 \Delta b \cdot Y_{rc})^2]^{1/2} / (A_1 + A_2 \cdot Y_r) \quad [1]$$

$$a = (x - x_c) / y, \quad a_n = (x_n - x_c) / y_n, \quad b = -0,4 B_c z / y, \quad b_n = -0,4 B_c z_n / y_n, \quad x_c = 0,11 \quad [2]$$

$$c_{ab} = [(a - a_n)^2 + (b - b_n)^2]^{1/2}, \quad Y_r = Y / Y_u, \quad Y_u = 18: \text{tristimulus value of grey} \quad [3]$$

$$Y_{rc} = Y_r - (c_{ab} / c_{ab,O}) (Y_r - Y_{r,O}) \quad c_{ab,O}, Y_{r,O}: \text{Ostwald chromaticity and } Y_r \quad [4]$$

$$Y_r = (Y_{r1} + Y_{r2}) / 2 \quad \Delta Y_r = Y_{r1} - Y_{r2} \quad Y_r: \text{relative tristimulus value} \quad [5]$$

$$A_1 = 0,0170 \cdot Y_u \quad A_2 = 0,0058 \cdot Y_u \quad B_c = 0,8 \text{ (D65)}, 1 \text{ (D50)}, 2,5 \text{ (A)} \quad [6]$$

$$A_3 = 1,0 \cdot Y_u \quad A_4 = 1,8 \cdot Y_u \quad A_0 = 1,5 \cdot Y_u \quad \text{background D65} \quad [7]$$

$$A_3 = 1,0 \cdot Y_u \quad A_4 = 1,7 \cdot Y_u \quad A_0 = 1,0 \cdot Y_u \quad \text{background A} \quad [8]$$

Just noticeable difference (JND) in four colour directions

$$\Delta Y_r = \text{const} (A_1 + A_2 \cdot Y_r) / A_0 \quad \text{in luminance direction WN} \quad [1a]$$

$$\Delta a \cdot Y_{rc} = \text{const} (A_1 + A_2 \cdot Y_{rc}) / (A_0 \cdot A_3) \quad \text{in chromaticity direction RG} \quad [2a]$$

$$\Delta b \cdot Y_{rc} = \text{const} (A_1 + A_2 \cdot Y_{rc}) / (A_0 \cdot A_4) \quad \text{in chromaticity direction YB} \quad [3a]$$

$$\Delta c_{ab} Y_{rc} = \text{const} (A_1 + A_2 \cdot Y_{rc}) / (A_0 [A_3^2 + A_4^2]^{1/2}) \quad \text{in chromaticity direction } c_{ab} \quad [4a]$$

eeg11-7n

see similar files of the whole serie: <http://farbe.li.tu-berlin.de/eegs.htm>
technical information: <http://farbe.li.tu-berlin.de> or <http://color.li.tu-berlin.de>

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