Color threshold formula LABJNDS 1985 (JND=just noticeable difference)

$$\Delta E^{*}_{JND} = Y_0 \left[(\Delta Y)^2 + (a_0 \Delta a'' \cdot Y)^2 + (b_0 \Delta b'' \cdot Y)^2 \right]^{1/2} / \ (s + q \cdot Y^g)$$

$a = x / y$ $\quad a_n = x_n / y_n$ $\quad b = -0{,}4\, z / y$ $\quad b_n = -0{,}4\, z_n / y_n$

$a'' = a_n + (a - a_n) / (1 + 0{,}5 \left| a - a_n \right|)$

$b'' = b_n + (b - b_n) / (1 + 0{,}5 \left| b - b_n \right|)$

n = D65 or A (surround)

$Y = (Y_1 + Y_2) / 2$ $\quad \Delta Y = Y_1 - Y_2$ $\quad \Delta a'' = a''_1 - a''_2$ $\quad \Delta b'' = b''_1 - b''_2$

$s = 0{,}0170$ $\quad q = 0{,}0058$ $\quad g = 1{,}0$

$a_0 = 1{,}0$ $\quad b_0 = 1{,}8$ $\quad Y_0 = 1{,}5$ $\quad$ surround D65

$a_0 = 1{,}0$ $\quad b_0 = 1{,}7$ $\quad Y_0 = 1{,}0$ $\quad$ surround A

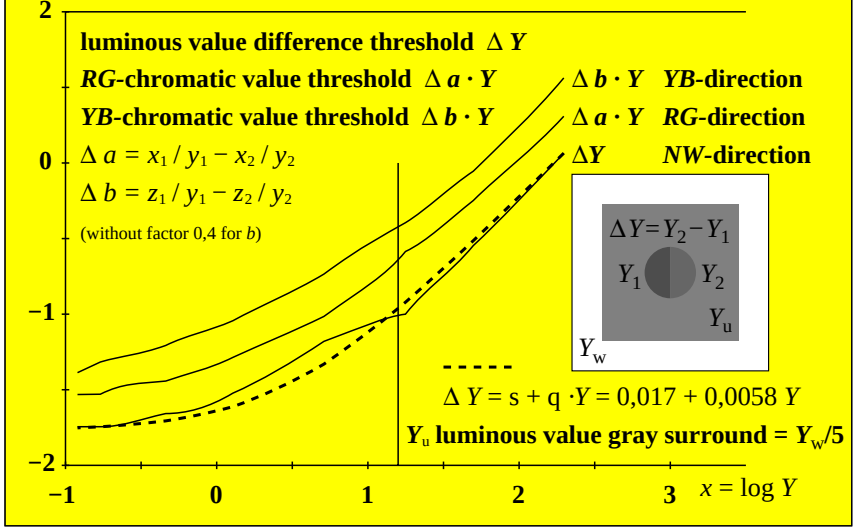
Just noticeable difference (JND) in four colour directions

$\Delta Y = \text{const} (s + q \cdot Y^g) / Y_0$	in luminance direction *WN*
$\Delta a'' \cdot Y = \text{const} (s + q \cdot Y^g) / (Y_0 \cdot a_0)$	in chromaticity direction *RG*
$\Delta b'' \cdot Y = \text{const} (s + q \cdot Y^g) / (Y_0 \cdot b_0)$	in chromaticity direction *YB*
$\Delta c_{ab}'' \cdot Y = \text{const} (s + q \cdot Y^g) / (Y_0 \cdot [a_0^2 + b_0^2]^{1/2})$	in any chromaticity direction c_{ab}

1−000030−L0 UE080−3N

NW-achromatic- as well as *RG*- and *JB*-chrom. thresholds as function of *Y*

experiments and data: BAM-research report no. 115 (1985), page 72 for colours near the achromatic axis



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Colour space LINYAB 1985 (color data: linear relation to CIE 1931 data)

linear color terms	name and relationship to CIE tristimulus or chromaticity values	notes
tristimulus values	*X, Y, Z*	
chromatic value	*linear chromatic value diagram (A, B)*	*n=D65*
red−green	$A = [X / Y - X_n / Y_n] Y = [a - a_n] Y$ $= [x / y - x_n / y_n] Y$	*(background)*
yellow−blue	$B = -0{,}4 [Z/Y - Z_n/Y_n] Y = [b - b_n] Y$ $= -0{,}4 [z / y - z_n / y_n] Y$	
radial	$C_{AB} = [A^2 + B^2]^{1/2}$	
chromaticity	*linear chromaticity diagram (a, b)*	***compare to linear cone excitation***
red−green	$a = X / Y = x / y$	$L/(L+M)=P/(P+D)$
yellow−blue	$b = -0{,}4 [Z / Y] = -0{,}4 [z / y]$	$S/(L+M)=T/(P+D)$
radial	$c_{ab} = [(a - a_n)^2 + (b - b_n)^2]^{1/2}$	

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Colour space CIELAB 1976 (color data: nonlinear relation to CIE 1931)

nonlinear color terms	name and relationship with tristimulues or chromaticity values	notes
lightness	$L^* = 116 (Y / 100)^{1/3} - 16 \quad (Y > 0{,}8)$ approximation: $L^* = 100 (Y/100)^{1/2{,}4} \quad (Y > 0)$	CIELAB 1976
chroma	*nonlinear transform of chromatic values A, B*	
red−green	$a^* = 500 [(X / X_n)^{1/3} - (Y / Y_n)^{1/3}]$ $= 500 (a' - a'_n) Y^{1/3}$	CIELAB 1976
yellow−blue	$b^* = 200 [(Y / Y_n)^{1/3} - (Z / Z_n)^{1/3}]$ $= 500 (b' - b'_n) Y^{1/3}$	**CIELAB 1976** *n=D65*
radial	$C^*_{ab} = [a^{*2} + b^{*2}]^{1/2}$	*(background)*
chromaticity	*nonlinear transform of chromaticities x/y, z/y*	*compare to log cone excitation*
red−green	$a' = (1 / X_n)^{1/3} (x / y)^{1/3}$ $= 0{,}2191 (x / y)^{1/3}$ for D65	log[L / (L+M)]
yellow−blue	$b' = -0{,}4 (1 / Z_n)^{1/3} (z / y)^{1/3}$ $= -0{,}08376 (z / y)^{1/3}$ for D65	= log[P / (P+D)] log[S / (L+M)]
radial	$c'_{ab} = [(a' - a'_n)^2 + (b' - b'_n)^2]^{1/2}$	= log[T / (P+D)]

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