

Colour thresholds and potential functions with four constants A_i

nonlinear color terms	name and relationship with tristimulus values XYZ , and the chromatic values (A, B)	notes
Threshold space <i>ABY-JND6</i> equation (6)	$T^* = A_1 \cdot [(A_3 + A_4 \cdot Y)^g - 1] \quad (g = A_2)$ $dT^* / dY = g \cdot A_1 \cdot A_4 \cdot (A_3 + A_4 \cdot Y)^{g-1}$ $dY = 1 / [g \cdot A_1 \cdot A_4 \cdot (A_3 + A_4 \cdot Y)^{g-1}]$ $Y / dY = Y / [g \cdot A_1 \cdot A_4 \cdot (A_3 + A_4 \cdot Y)^{g-1}]$ necessary for least square fit of data: $dT^* / dA_1 = (A_3 + A_4 \cdot Y)^g - 1 \quad (g = A_2)$ $dT^* / dg = A_1 \cdot (A_3 + A_4 \cdot Y)^g \cdot \ln(A_3 + A_4 \cdot Y)$ $dT^* / dA_3 = g \cdot A_1 \cdot (A_3 + A_4 \cdot Y)^{g-1}$ $dT^* / dA_4 = g \cdot A_1 \cdot (A_3 + A_4 \cdot Y)^{g-1} \cdot Y$	$L/dL = (x/y - x_n/y_n) \cdot Y$ Normalization similar to CIELAB: $X_{01} = X/X_n; Y_{01} = Y/Y_n; Z_{01} = Z/Z_n$ Relation for complementary (c) colours: $X_{01c} = 1 - X_{01}; Y_{01c} = 1 - Y_{01}; Z_{01c} = 1 - Z_{01}$ Chromatic values: $A_{01} = (a_{01} - a_{01n}) \cdot Y_{01}$ $= (x_{01} / y_{01} - 1) \cdot Y_{01}$ $= (X_{01} / Y_{01} - 1) \cdot Y_{01}$ $= X_{01} - Y_{01} = -A_{01c}$
Properties complementary colours	$A_{01c} = -A_{01}; B_{01c} = -B_{01}; C_{ab,01c} = C_{ab,01};$ $\Delta A_{01c} = \Delta A_{01}; \Delta B_{01c} = \Delta B_{01}; \Delta C_{ab,01c} = \Delta C_{ab,01}; \Delta Y/Y = \text{const}$	

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Colour thresholds and potential functions with three constants A_i

nonlinear color terms	name and relationship of tristimulus value difference threshold dY and tristimulus value Y	notes
Threshold space <i>ABY-JND7</i> equation (7)	$x = A_3 + A_1 \cdot Y^g \quad (g = A_2)$ $F = \log(x)$ $dF / dx = 1. / [x \cdot \log(10.)]$ necessary for least square fit of data: $dx / dA_1 = Y^g$ $dx / dg = A_1 \cdot Y^g \cdot \ln(Y) \quad (g = A_2)$ $dx / dA_3 = 1$ $dx / dY = A_1 \cdot g \cdot Y^{g-1}$..
logarithmic approximation $F = \log(dY)$		
	$dF / dY = dF / dx \cdot [dx / dY]$ $= [A_1 \cdot g \cdot Y^{g-1}] / [x \cdot \log(10.)]$ for $dF = 1$: $dY = [x \cdot \log(10.)] / [A_1 \cdot g \cdot Y^{g-1}]$ $Y / dY = [A_1 \cdot g \cdot Y^g] / [x \cdot \log(10.)]$	

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Colour thresholds and potential functions with three constants A_i

nonlinear color terms	name and relationship of tristimulus value difference threshold dY and tristimulus value Y	notes
Threshold space <i>ABY-JND7</i> equation (7)	$x = A_3 + A_1 \cdot Y^g \quad (g = A_2)$ $F = \log(x)$ $dF / dx = 1. / [x \cdot \log(10.)]$ necessary for least square fit of data: $dx / dA_1 = Y^g$ $dx / dg = A_1 \cdot Y^g \cdot \ln(Y) \quad (g = A_2)$ $dx / dA_3 = 1$ $dx / dY = A_1 \cdot g \cdot Y^{g-1}$	$L/dL = (x/y - x_n/y_n) \cdot Y$ Normalization similar to CIELAB: $X_{01} = X/X_n; Y_{01} = Y/Y_n; Z_{01} = Z/Z_n$ Relation for complementary (c) colours: $X_{01c} = 1 - X_{01}; Y_{01c} = 1 - Y_{01}; Z_{01c} = 1 - Z_{01}$ Chromatic values: $A_{01} = (a_{01} - a_{01n}) \cdot Y_{01}$ $= (x_{01} / y_{01} - 1) \cdot Y_{01}$ $= (X_{01} / Y_{01} - 1) \cdot Y_{01}$ $= X_{01} - Y_{01} = -A_{01c}$
logarithmic approximation $F = \log(dY)$		
	$dF / dY = dF / dx \cdot [dx / dY]$ $= [A_1 \cdot g \cdot Y^{g-1}] / [x \cdot \log(10.)]$ for $dT^* = 1$: $dY = [x \cdot \log(10.)] / [A_1 \cdot g \cdot Y^{g-1}]$ $Y / dY = [A_1 \cdot g \cdot Y^g] / [x \cdot \log(10.)]$	

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Colour thresholds and potential functions with three constants A_i

nonlinear color terms	name and relationship of tristimulus value difference threshold dY and tristimulus value Y	notes
Threshold space <i>ABY-JND9</i> equation (9)	$x = [A_1 + A_3 \cdot Y]^g \quad (g = A_2)$ $F = \log(x)$ $dF / dx = 1. / [x \cdot \log(10)]$ necessary for least square fit of data: $dx / dA_1 = g \cdot [A_1 + A_3 \cdot Y]^{g-1}$ $dx / dg = [A_1 + A_3 \cdot Y]^g \cdot \ln[A_1 + A_3 \cdot Y]$ $dx / dA_3 = g \cdot Y \cdot [A_1 + A_3 \cdot Y]^{g-1}$ $dx / dY = g \cdot A_3 \cdot [A_1 + A_3 \cdot Y]^{g-1}$	$A_1 + A_3 Y = 1 - s + s \cdot Y/Y_s$ this equation defines: $s = 1 - A_1$ $Y_s = (1 - A_1/A_3)$ $g = A_2 = -1,25$ $1/[(1-g)V] [L_s/s]^g = 1$ $V = 1/[0,036(1-g)L_u^{-0,30}]$ $L_s = 0,25 L_u^{0,705}$ $L_u = 0,1 \dots 1000 \text{ cd/m}^2$
logarithmic approximation $F = \log(dY)$		
	$dF / dY = dF / dx \cdot [dx / dY]$ $= \{g \cdot A_3 \cdot [A_1 + A_3 \cdot Y]^{g-1}\} / [x \cdot \log(10)] = g \cdot A_3 \cdot [A_1 + A_3 \cdot Y]^{-1} / \log(10)$ for $dF = 1$ (dY is logarithmic): $dY = [x \cdot \log(10)] / \{g \cdot A_3 \cdot [A_1 + A_3 \cdot Y]^{g-1}\} = \log(10)[A_1 + A_3 \cdot Y] / \{g A_3\}$ $Y/dY = \{g A_3 Y [A_1 + A_3 \cdot Y]^{g-1}\} / [x \log(10)] = \{g A_3 Y\} / \{\log(10)[A_1 + A_3 \cdot Y]\}$	

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