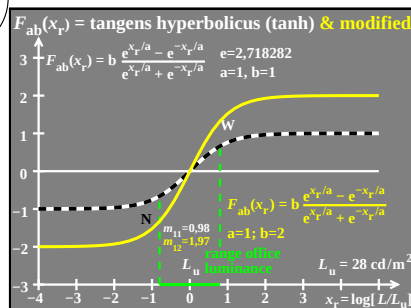


see similar files: <http://farbe.li.tu-berlin.de/DEB0/DEB0.HTM>
technical information: <http://farbe.li.tu-berlin.de> or <http://color.li.tu-berlin.de>

TUB registration: 20210901-DEB0/DEB0L0NP.PDF /.PS TUE
application for evaluation and measurement of display or print output

TUB material: code=rha4ta



Achromatic receptor response function
 $F_{bu}[x_r/a]; x_r = \log(\text{relative luminance})$
 with $x_r = \log [L/L_u]$ (L = test luminance)
 L_u = surround luminance

$$F_{bu}[x_r/a] = b \frac{e^{x_r/a} - e^{-x_r/a}}{e^{x_r/a} + e^{-x_r/a}} = b \tanh [x_r/a]$$

function values for $b=1$ and $a>0$:

$$F_{1u}[(x-u)/a \rightarrow -\infty] = -1 \quad x = \log L$$

$$F_{1u}[(x-u)/a = 0] = 0 \quad u = \log L_u$$

$$F_{1u}[(x-u)/a \rightarrow +\infty] = +1$$

Achromatic receptor response function
 $Q_{1m}[k(u-u_0)] = Q_{1m}[(u-u_0)/a]$; $k=1/a$
 with $u = \log L$ (L = test luminance)
 $u_0 = \log L_u$ (L_u = surround luminance)
 $Q_{1m}[k(u-u_0)] = \frac{1}{\ln \sqrt{2}} \ln q[k(u-u_0)] - m$
 $q[k(u-u_0)] = 1 + 1/[1 + \sqrt{2} e^{k(u-u_0)}]$
 $Q_{11}[k(u-u_0) \rightarrow +\infty] = -1$ $u = \log L$
 $Q_{11}[k(u-u_0) = 0] = 0$ $u_0 = \log L_u$
 $Q_{11}[k(u-u_0) \rightarrow -\infty] = +1$ for $m=1=1$

Achromatic receptor response function
 $Q_{ab}[x_r/a]$
 with $x_r = \log [L/L_u]$ (L =test luminance)
 L_u =surround luminance
 $Q_{ab}[x_r/a] = \frac{b}{\ln \sqrt{2}} \ln q[x_r/a] - b$
 $q[x_r/a] = 1 + 1/[1 + \sqrt{2}e^{(x_r/a)}]$
 $Q_{a1}[x_r/a \rightarrow -\infty] = -1 \quad x = \log L$
 $Q_{a1}[x_r/a = 0] = 0 \quad \text{for } b = 1$
 $Q_{a1}[x_r/a \rightarrow +\infty] = +1$

Achromatic receptor response function
 $F_{bu}[x_r/a]; x_r = \log(\text{relative luminance})$
 with $x_r = \log [L/L_u]$ (L = test luminance)
 L_u = surround luminance
 $F_{bu}[x_r/a] = b \frac{e^{x_r/a} - e^{-x_r/a}}{e^{x_r/a} + e^{-x_r/a}} = b \tanh [x_r/a]$
function values for $b=1$ and $a>0$:
 $F_{1u}[x_r/a \rightarrow -\infty] = -1$
 $F_{1u}[x_r/a = 0] = 0$
 $F_{1u}[x_r/a \rightarrow +\infty] = +1$

Achromatic receptor response function
 $F_{bv}[x_v/a]; x_v = \log(\text{relative } v\text{-luminance})$
 with $x_v = \log [L/L_v]$ (L = test luminance)
 $L_v = L_u + \Delta L_u$ = effective surround luminance

$$F_{bv}[x_v/a] = b \frac{e^{x_v/a} - e^{-x_v/a}}{e^{x_v/a} + e^{-x_v/a}} = b \tanh [x_v/a]$$

function values for $b=1$ and $a>0$:

$$F_{1v}[(x-v)/a \rightarrow -\infty] = -1 \quad x = \log L$$

$$F_{1v}[(x-v)/a = 0] = 0 \quad v = \log(L_u + \Delta L_u)$$

$$F_{1v}[(x-v)/a \rightarrow +\infty] = +1$$

Achromatic receptor response function
 $Q_{lm}[(x-u)/a]$
 with $x = \log L$ (L = test luminance)
 $u = \log L_u$ (L_u = surround luminance)
 $Q_{lm}[(x-u)/a] = \frac{1}{\ln \sqrt{2}} \ln q[(x-u)/a] - m$
 $q[(x-u)/a] = 1 + 1/[1 + \sqrt{2}e^{(x-u)/a}]$
 $Q_{11}[(x-u)/a \rightarrow -\infty] = -1 \quad x = \log L$
 $Q_{11}[(x-u)/a = 0] = 0 \quad u = \log L_u$
 $Q_{11}[(x-u)/a \rightarrow +\infty] = +1 \quad \text{for } m=1$

$Q(x_r)$ = achromatic response function & modified
 see Richter, K. (1996): Computer graphic, Fig. 4. 48
<http://color.liu.uni-berlin.de/BUA4BF.PDF>

$Q(x_r) = \frac{b}{\ln \sqrt{2}} \left[1 - \frac{1}{1 + \sqrt{2} e^{x_r/a}} \right] - b$

$a=0.5$
 $b=2$

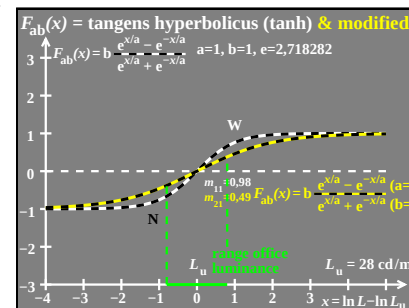
$a=0.5$
 $b=1$

N W

N W

L_u range of office luminance $L = 28 \text{ cd/m}^2$

$x = \log(I/I_0)$



$F_{ab}(x) = \text{tangens hyperbolicus (tanh) \& modified}$

$F_{ab}(x) = b \frac{e^{x/a} - e^{-x/a}}{e^{x/a} + e^{-x/a}}$ $a=1, b=2$

$m_{22} = 1.97$

$F_{ab}(x) = b \frac{e^{x/a} - e^{-x/a}}{e^{x/a} + e^{-x/a}}$ $(a=1, b=2)$

$x = \ln L - \ln L_u$

$L_u = 28 \text{ cd/n}$

range office luminance

$F_{ab}(x) = \text{tangens hyperbolicus (tanh) \& modified}$

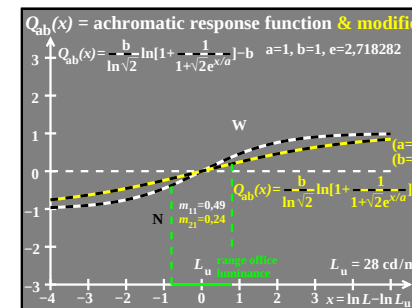
$F_{ab}(x) = b \frac{e^{x/a} - e^{-x/a}}{e^{x/a} + e^{-x/a}} \quad a=1, b=1, c=2, 718282$

$F_{ab}(x) = b \frac{e^{x/a} - e^{-x/a}}{e^{x/a} + e^{-x/a}} \quad a=2, b=1$

$F_{ab}(x) = b \frac{e^{x/a} - e^{-x/a}}{e^{x/a} + e^{-x/a}} \quad a=1, b=1/2$

$m_{11}=0.98$
 $m_{21}=0.49$
 $m_{12}=1.97$
 $m_{22}=0.99$

$L_u = 28 \text{ cd/n}$



$Q_{ah}(x) = \text{achromatic response function \& modification}$

see Richter, K. (1996): Computer graphic, Fig. 4.4

http://color.li.u-berlin.de/BUA48F_PDF

$Q_{ah}(x) = -\frac{b}{\ln 2} \ln \left[1 + \frac{1}{1 + 2e^{x/a}} \right] - b$ $a=1, b=2$

$L_u = 28 \text{ cd/n}$

$x = \ln L_n L_u$

$m_{12} = 0.98$

$m_{12} = 0.93$

L_u range office illuminance

$Q_{ab}(x) = \text{achromatic response function \& modification}$

$Q_{ab}(x) = \frac{b}{\ln \sqrt{2}} \ln[1 + \frac{1}{1 + \sqrt{2}e^{x/a}}] - b$ $a=1, b=1, c=2, 718282$

$Q_{ab}(x) = \frac{b}{\ln \sqrt{2}} \ln[1 + \frac{1}{1 + \sqrt{2}e^{x/a}}] - b$ $a=1, b=2$

$Q_{ab}(x) = \frac{b}{\ln \sqrt{2}} \ln[1 + \frac{1}{1 + \sqrt{2}e^{x/a}}] - b$

$Q_{ab}(x) = \frac{b}{\ln \sqrt{2}} \ln[1 + \frac{1}{1 + \sqrt{2}e^{x/a}}] - b$

$m_1 = 0.49$
 $m_2 = 0.24$
 $m_3 = 0.98$
 $m_4 = 0.49$

$L_0 = \text{range offset in luminance}$ $L_u = 28 \text{ cd/m}^2$

$x = \ln(L - L_0)$

TUB-test chart DEB0; Model of two visual response functions $F_{ab}(x_r)$ and $Q_{ab}(x_r)$ $\tanh(x_r)$ and modified functions with e^{x_r} and 10^{x_r} ; $a^n = a^{1,0}$

input: rgb
output: rqb