line element of light technology (luminance L) and color metrics with „color values" P, D, T

luminance signal function $F(L)$
color signal functions $F(P, D, T)$

Taylor-derivations:

$\Delta F(L) = \frac{dF}{dL}\Delta L$

$\Delta F(P, D, T) = \frac{dF}{dP}\Delta P + \frac{dF}{dD}\Delta D + \frac{dF}{dT}\Delta T$

JE690−1

line element of *Helmholtz* (1896) with „color values" P, D, T

three separate color signal functions

$F(P) = i \ln P$
$F(D) = j \ln D$
$F(T) = k \ln T$

Taylor-derivations:

$\Delta F(P, D, T) = \frac{dF}{dP}\Delta P + \frac{dF}{dD}\Delta D + \frac{dF}{dT}\Delta T$

$\Delta F(P, D, T) = \frac{i}{P}\Delta P + \frac{j}{D}\Delta D + \frac{k}{T}\Delta T$

JE690−2

double line element of *Richter* (1987) for the lighting technic with luminance $L = F(P, D, T)$

luminance signal function $F(L)$

$F(L) = iQ(H) = \begin{cases} i\,Q(\underline{H}) & (x<u) \\ \bar{i}\,Q(\bar{H}) & (x \geq u) \end{cases}$

with: $\underline{k}=1{,}4$ $\bar{k}=1$ $\underline{i}=1$ $\bar{i}=-2$
$x = \log L$ $u = \log L_u$
$H = e^{k(x-u)}$, $\underline{H} = e^{\underline{k}(x-u)}$, $\bar{H} = e^{\bar{k}(x-u)}$

JE691−1

double line element of *Richter* (1987) for the lighting technic with luminance $L = F(P, D, T)$

luminance signal function $F(L)$

$F(L) = iQ(H)$ $H = e^{k(x-u)}$
$Q[\ln\{1+1/(1+\sqrt{2}H)\}]/\ln\sqrt{2} - 1$

Taylor-derivations:

$\Delta F(L) = \frac{dF}{dL}\Delta L = i\,\frac{dQ}{dH}\Delta H$
$= -i\sqrt{2}\Delta H/[\ln\sqrt{2}(1+\sqrt{2}H)(2+\sqrt{2}H)]$

JE690−8

line element of *Stiles* (1946) with „color values" P, D, T

three separate color signal functions

$F(P) = i \ln(1+9P)$
$F(D) = j \ln(1+9D)$
$F(T) = k \ln(1+9T)$

Taylor-derivations:

$\Delta F(P, D, T) = \frac{dF}{dP}\Delta P + \frac{dF}{dD}\Delta D + \frac{dF}{dT}\Delta T$

$= \frac{9i}{1+9P}\Delta P + \frac{9j}{1+9D}\Delta D + \frac{9k}{1+9T}\Delta T$

JE690−1

line element of *Vos&Walraven* (1972) with „color values" P, D, T

three separate color signal functions

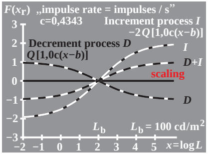
$F(P) = -2i\sqrt{P}$
$F(D) = -2j\sqrt{D}$
$F(T) = -2k\sqrt{T}$

Taylor-derivations:

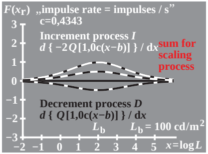
$\Delta F(P, D, T) = \frac{dF}{dP}\Delta P + \frac{dF}{dD}\Delta D + \frac{dF}{dT}\Delta T$

$\Delta F(P, D, T) = \frac{i}{\sqrt{P}}\Delta P + \frac{j}{\sqrt{D}}\Delta D + \frac{k}{\sqrt{T}}\Delta T$

JE690−4



JE691−3



JE691−4

functions $q[k(x-u)]$ „achromatic signal"-description

with $x = \log L$ (L = luminance)
$u = \log L_u$ (L_u = surround luminan.)

$q[k(x-u)] = 1 + 1/[1 + \sqrt{2}e^{k(x-u)}]$

function values:

$q[k(x-u) \to +\infty] = 1$
$q[k(x-u) = 0] = \sqrt{2}$
$q[k(x-u) \to -\infty] = 2$

JE690−5

„achromatic signal"-description functions $Q_{1m}[k(x-u)]$

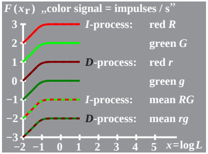
with $x = \log L$ (L = luminance)
$u = \log L_u$ (L_u = surround luminan.)

$Q_{lm}[k(x-u)] = -\frac{l}{\ln\sqrt{2}} \ln q[k(x-u)] - m$

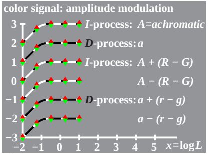
function values with $l = m = 1$:

$Q[k(x-u) \to +\infty] = 1$
$Q[k(x-u) = 0] = 0$
$Q[k(x-u) \to -\infty] = -1$

JE690−6



JE691−5



JE691−6

„achromatic signal" discrimination as function of relative light density $h = \ln H = k(x-u)$ ln = natural log.

$Q' = \frac{d}{dH}[\ln\{1+1/(1+\sqrt{2}H)\}]/\ln\sqrt{2}$
$= -\sqrt{2}/[\ln\sqrt{2}(1+\sqrt{2}H)(2+\sqrt{2}H)]$

function values:

$Q'[k(x-u) \to +\infty] = 0$
$Q'[k(x-u) = 0] = -0{,}5$
$Q'[k(x-u) \to -\infty] = 0$

JE690−7

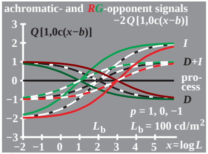
luminance discrimination possibility $L/\Delta L$ as function of H

with: $L = 10^x$ $H = e^h = 10^{\log e\, k(x-u)}$
$dL/dx = \ln 10\, L$ $dH/dx = k\,H$

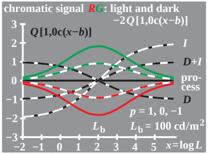
it follows: $L/\Delta L = [kH/(dH \ln 10)]$
$\frac{L}{dL}$ = const $H/[(1+\sqrt{2}H)(2+\sqrt{2}H)]$

$Q'[k(x-u) \to +\infty] = 0$
$Q'[k(x-u) = 0]$ = maximum
$Q'[k(x-u) \to -\infty] = 0$

JE690−8



JE691−7



JE691−6, B8931_2, E8241−6, B4_54_2, N=4_54_2

See original or copy: http://web.me.com/klaus.richter/JE69/JE69L0N1.TXT /.PS
Technical information: http://www.ps.bam.de or http://130.149.60.45/~farbmetrik

TUB registration: 20100301-JE69/JE69L0N1.TXT /.PS
application for evaluation and measurement of printer or monitor systems

TUB material: code=rha4ta