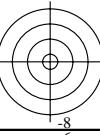
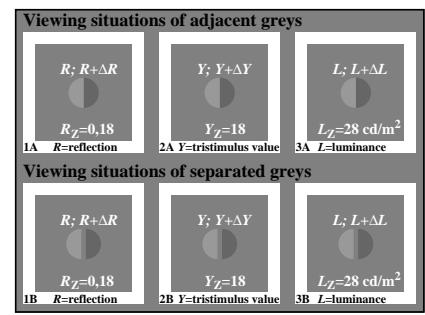
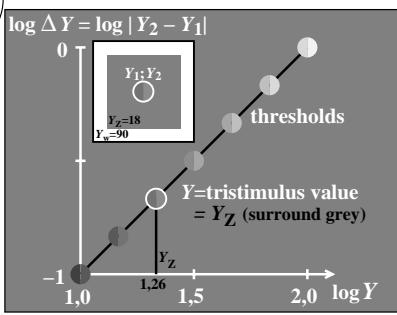


see similar files: <http://farbe.li.tu-berlin.de/CEA1/CEA1L0NA.TXT/.PS>
technical information: <http://farbe.li.tu-berlin.de/CEA1/CEA1.HTML> or <http://color.li.tu-berlin.de>



<http://farbe.li.tu-berlin.de/CEA1/CEA1L0NA.TXT/.PS>; only vector graphic VG; start output
N: no 3D-linearization (OL) in file (F) or PS-startup (S)



Lightness L^*Z for surround mean grey Z (sRGB)
For separated surface colours in the range 0,0036< R <0,90 or the digital range 1/255=0,0039< R <1,00 it is valid:
$$L^*Z = a(R/R_n)^k$$
 [1] $a=100$; $R_n=1,00$; $k=0,42=1/2,4$
$$= b(R/R_u)^k$$
 [2] $b=(R_u/R_n)^k=50$; $R_u=0,18$
For $R=R_u$ it is valid: $L^*Z_u=50$.

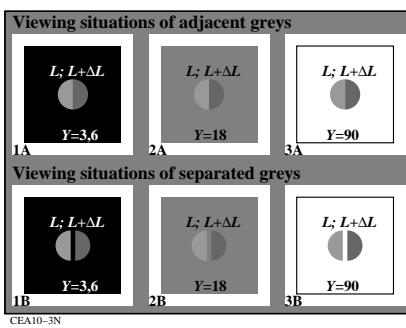
Derivation of equation [2] gives with $1-k=0,58$:
$$\delta(L^*Z)/\delta R = c(R/R_u)^{1-k}$$
 [3] $c=(b/k)/R_u=21/18=1,17$
or for the threshold $\delta(L^*Z)=1$
$$\delta R = d(R/R_u)^{1-k}$$
 [4] $d=R_u/(b/k)=18/21=0,86$

For the surround lightness $L^*Z_u=50$ with $R=R_u$ the threshold is: $\delta R_u=0,86$. This threshold is *independent of k*.
CEA11-IN

Lightness L^*_{JND} for the Just Noticeable Difference (JND)
For adjacent surface colours in the range 0,0036< R <0,90 or the digital range 1/255=0,0039< R <1,00 it is valid:
$$L^*_{JND} = a(R/R_n)^k$$
 [1] $a=572$; $R_n=1,00$; $k=0,14=1/7,2$
$$= b(R/R_u)^k$$
 [2] $b=(R_u/R_n)^k=450$; $R_u=0,18$
For $R=R_u$ it is valid: $L^*_{JNDu}=450$.

Derivation of equation [2] gives with $1-k=0,86$:
$$\delta(L^*_{JND})/\delta R = c(R/R_u)^{1-k}$$
 [3] $c=(b/k)/R_u=63/18=3,5$
or for the threshold $\delta(L^*_{JND})=1$
$$\delta R = d(R/R_u)^{1-k}$$
 [4] $d=R_u/(b/k)=18/63=0,29$

For the surround lightness $L^*_{JNDu}=450$ with $R=R_u$ the threshold is: $\delta R_{JNDu}=0,29$. This threshold is *independent of k*.
CEA11-2N



sensation scaling functions
lightness L^* and tristimulus value Y
adaptation on surround white W
 $L^*W = 100 (Y/100)^{1/2,0}$
adaptation on surround grey Z
 $L^*Z = 100 (Y/100)^{1/2,4}$
description with CIELAB 1976
 $L^*CIELAB = 116 (Y/100)^{1/3,0} - 16$
adaptation on surround black N
 $L^*N = 100 (Y/100)^{1/3,0}$
CEA10-4N

Lightness L^*Z for surround mean grey Z (sRGB)
For separated surface colours in the range 3,6< Y <90 or the digital range 100/255=0,39< Y <100 it is valid:
$$L^*Z = a(Y/Y_u)^k$$
 [1] $a=100$; $Y_u=100$; $k=0,42=1/2,4$
$$= b(Y/Y_n)^k$$
 [2] $b=a(Y_u/Y_n)^k=50$; $Y_u=18$
For $Y=Y_u$ it is valid: $L^*Z_u=50$.

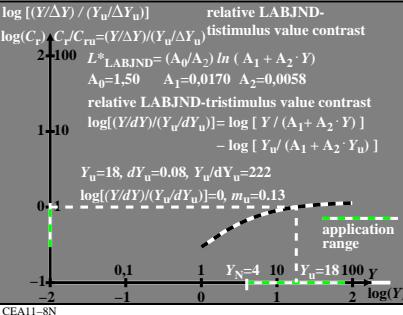
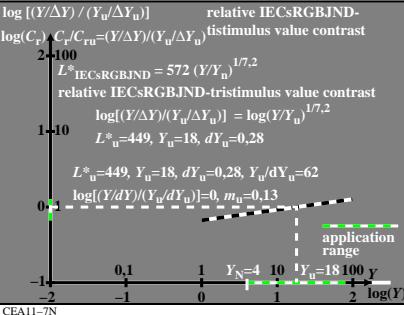
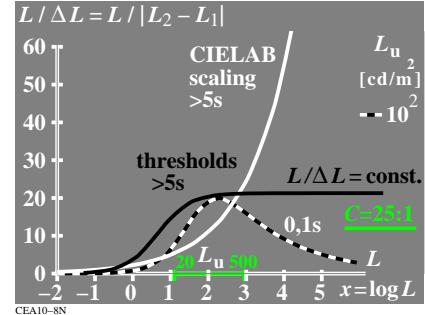
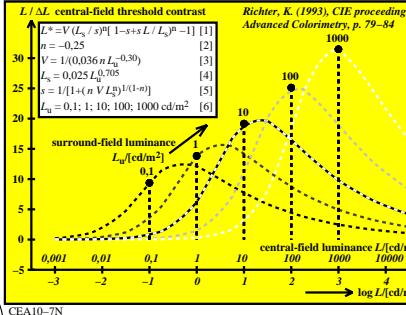
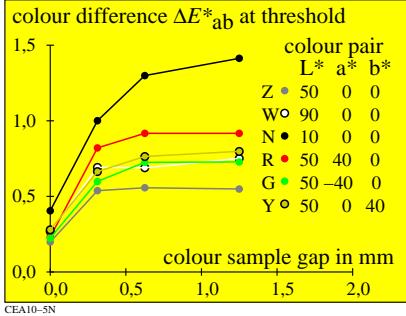
Derivation of equation [2] gives with $1-k=0,58$:
$$\delta(L^*Z)/\delta Y = c(Y/Y_u)^{1-k}$$
 [3] $c=(b/k)/Y_u=21/18=1,17$
or for the threshold $\delta(L^*Z)=1$
$$\delta Y = d(Y/Y_u)^{1-k}$$
 [4] $d=Y_u/(b/k)=18/21=0,86$

For the surround lightness $L^*Z_u=50$ with $Y=Y_u$ the threshold is: $\delta Y_u=0,86$. This threshold is *independent of k*.
CEA11-3N

Lightness L^*_{JND} for the Just Noticeable Difference (JND)
For adjacent surface colours in the range 3,6< Y <90 or the digital range 100/255=0,39< Y <100 it is valid:
$$L^*_{JND} = a(Y/Y_u)^k$$
 [1] $a=572$; $Y_u=100$; $k=0,14=1/7,2$
$$= b(Y/Y_n)^k$$
 [2] $b=a(Y_u/Y_n)^k=450$; $Y_u=18$
For $Y=Y_u$ it is valid: $L^*_{JNDu}=450$.

Derivation of equation [2] gives with $1-k=0,86$:
$$\delta(L^*_{JND})/\delta Y = c(Y/Y_u)^{1-k}$$
 [3] $c=(b/k)/Y_u=63/18=3,5$
or for the threshold $\delta(L^*_{JND})=1$
$$\delta Y = d(Y/Y_u)^{1-k}$$
 [4] $d=Y_u/(b/k)=18/63=0,29$

For the surround lightness $L^*_{JNDu}=450$ with $Y=Y_u$ the threshold is: $\delta Y_{JNDu}=0,29$. This threshold is *independent of k*.
CEA11-4N



TUB-test chart CEA1; Colour thresholds and colour spaces
Comparison of scaling, threshold, and contrast functions for different applications

input: $rgb/cm^2/0/0/0/k/n$