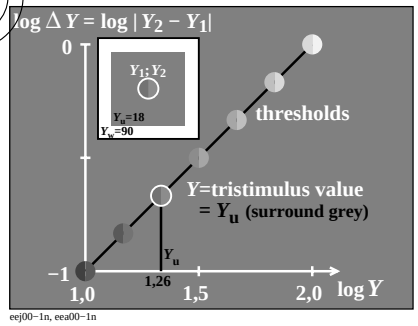
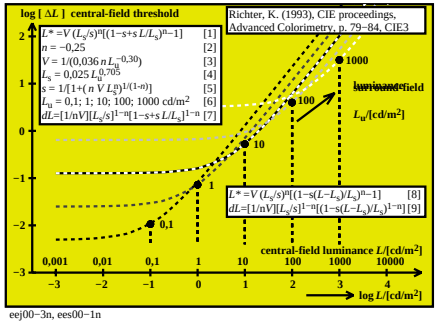


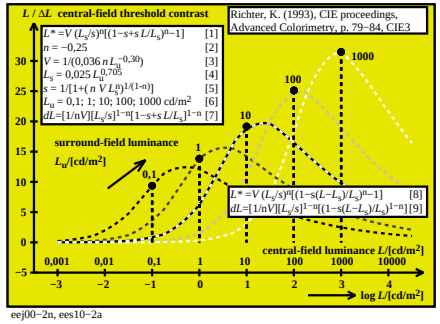
eej00−1n, eea00−1n

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 U
$L^*_U = 100\ (\ Y\ /\ 100)^{1/2,4}$
description with CIELAB 1976
$L^*_{CIELAB} = 116\ (\ Y\ /\ 100)^{1/3,0} - 16$
adaptation on surround black N
$L^*_N = 100\ (\ Y\ /\ 100)^{1/3,0}$

eej00−4n, eea00−4n



eej00−3n, ees00−1n



eej00−2n, ees10−2a

Weber-Fechner law in CIE 230:2019 for threshold colour differences of surface colours; relations between tristimulus value, lightness and luminance

The *Weber-Fechner* law describes the lightness L^*_r as ***logarithmic*** function of L_r.
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IEC 61966-2-1 uses a similar potential function $L^*_{IEC} = m\ L_r^{1/2,4}$.
The *Weber-Fechner* law is equivalent to the equation: $\Delta L^*_r = c\,L_r$ [1]
Integration leads to the logarithmic equation: $L^*_r = k \log(L_r)$. [2]
Derivation leads for ΔL^*_r=1 to the linear equation: $L_r/\Delta L_r = k$=57. [3]
For ***Adjacent*** colours in offices the standard contrast range is **25:1**=90:3,6.

Table 1: CIE tristimulus value *Y*, luminance *L*, and lightness *L**

Colour (matte)	Tritimulus value	office luminance	relative luminance	CIELAB lightness	TUBJND lightness
(contrast) (25:1=90:3,6)	Y	L [cd/m²]	$L_r = L/L_u$	$L^*_{CIELAB} \sim m\ L_r^{1/2,4}$	$L^*_{TUBJND} = k \log(L_r)$
White W (paper)	90 =18*5	142 =28,2*5	5	94 =50+44	40 =k log(5)
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Black N (paper)	3,6 =18/5	5,6 28,2/5	0,2	18 =50−32	−40 =k log(0,2)

For the lightness range between L^*_r=−40 and 40 the constant is: k=40/log(5)=57

eej01−1n

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eej01−3n

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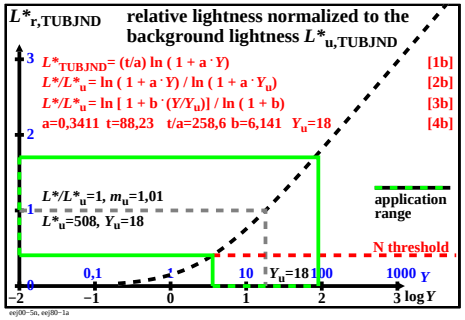
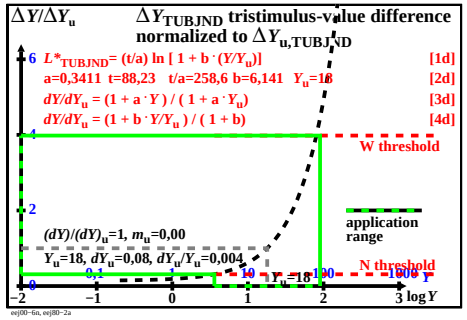
eej01−4n



eej00−5n, eej80−1a



eej00−6n, eej80−2a

Properties of the visual system and use cases for the copier and display output

According to ISO 9241-306:2018 the luminance of the white display and the white paper shall be equal to avoid fatique and incease well-being of users.
The illuminance 500 lux von ISO 8995-1 corresponds to the luminance 142 cd/m².

Table 1: Properties of copier and display output

Standard document output	ISO/IEC 15775:2022 copier	ISO 9241-306:2018 display	ISO 3664 print & display	Encoding HDR range display	Transfer HDR−SDR display
tone mapping visual & colorimetric	ergonomic spacing vis. & col.	ergonomic spacing vis. & col.	special separate colors	pleasing? visual?, no definition	pleasing? visual?, no definition
ergonomic output quality	high quality vis. spacing regularity g*	high quality vis. spacing regularity g*	col. quality reflections avoided (HW	low quality, no reflection considered	low quality, no reflection considered
optimized energy consumption	yes according ISO 8995−1	yes 500 lux 142 cd/m^2	yes 500 lux 142 cd/m^2	no, up to 3300 lux 1000 cd/m^2	no up to 3300 lux 1000 cd/m^2
optimized sustainable software SSW	yes, SSW for >3 use cases(P,O)	yes, SSW for >2000 use cases	no, SSW for only 1 use case	no, SSW for only 1 use case	no, SSW for only 1 use case

Display reflection is NOT considered, this is called "stone age image technology".

eej01−5n

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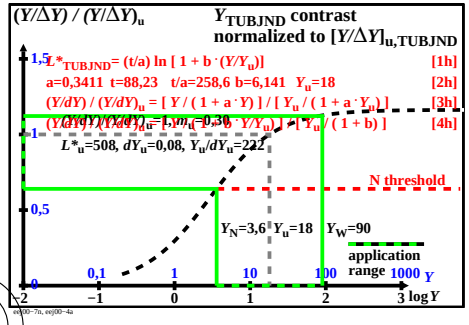
Table 1: Ergonomy, energy consumption and sustainability of output

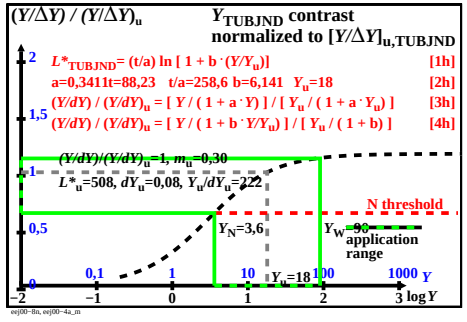
Standard document and device output	ISO/IEC 15775 /ed-2:2022 copier	ISO 9241-306 /ed-2:2018 display	Encoding HDR range display	Transfer HDR−>SDR display
tone mapping visual (vis.) & colourimetric	ergonomic equal spacing vis. & col.	ergonomic equal spacing vis. & col.	pleasing? visual?, no definition	pleasing? visual?, no definition
ergonomic output quality 0 <= g* <=100	high quality vis. spacing regularity g*	high quality vis. spacing regularity g*	low quality, no reflection considered	low quality, no reflection considered
optimized energy consumption	yes, 500 lux according ISO 8995−1	yes 500 lux or 142 cd/m^2	no, up to 3300 lux 1000 cd/m^2	no up to 3300 lux or 1000 cd/m^2
optimized sustainable software SSW	yes, SSW is for >3 use cases (papers)	yes, SSW is for 15·13·11..> 2000 use cases	no, SSW is for only 1 use case	no, SSW is for only 1 use case

Display reflection is NOT considered, this is called "stone age image technology".

eej01−6n



eej00−7n, eej00−4a



eej00−8n, eej00−4a_n

Properties of the visual system and use cases for the copier and display output

Analog test charts according ISO/IEC 15775/ed-2:2022 are available. The *rgb* data are based on slide & negative filmbetween high under and over exposure. The linearized *rgb* image data are linear to L^*_{CIELAB} of a 16 step grey scale.

Table 2: Properties of copier and display output and transfer of contrast *C*.

Standard document and device output	ISO/IEC 15775 /ed-2:2022 copier	ISO 9241-306 /ed-2:2018 display	Transfer HDR -> SDR display
contrast C of test chart material	photographic (P) C=100:1 & offset (O) C=36:1	relative equally spaced rgb data 0 <= rgb <= 1	no test charts HDR: C=100:1? SDR: C=36:1
ergonomic output quality 0 <= g* <=100	photographic & offset both with g*>=80	no and with gamma correction trnsfer g*=10 -> g*>=80	special transfer similar to gamma corection, 1 option?
local (L) and global (G) transfer	only local copier output transfer > 3 options	both local & global output transfer > 2000 options	only global output transfer only 1 option?
example transfer options	L: P <-> O L: P, O <-> A many papers (A)	G: HDR<=>SDR, no Refl L: HDR<=>15 SDR+Refl 15x13..x3 use cases	G: HDR->SDR G: SDR->HDR? only 1 use case

The luminance between the black and white samples is 64*25=1600 for negative film

eej01−7n

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eej01−8n

00	01	02	03	04	05
10	11	12	13	14	15
20	21	22	23	24	25
30	31	32	33	34	35
40	41	42	43	44	45
50	51	52	53	54	55
60	61	62	63	64	65
70	71	72	73	74	75
80	81	82	83	84	85
90	91	92	93	94	95
A0	A1	A2	A3	A4	A5
B0	B1	B2	B3	B4	B5
C0	C1	C2	C3	C4	C5
D0	D1	D2	D3	D4	D5
E0	E1	E2	E3	F4	E5

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eej01−8n