Weber-Fechner law in CIE 230:2019 for threshold colour differences of surface colours and two ranges $0,2 \le L_r \le 1$ and $1 \le L_r \le 5$

The *Weber-Fechner* law describes the lightness L^*_r as ***logarithmic*** function of L_r.
The *Stevens* law describes the lightness L^*_{CIELAB} as ***potential*** function of $L_r=Y/5$.
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 linear equation: $\Delta L_r = c_i L_r$ $(i=0,1)$ [1]
Integration leads to the logarithmic equation: $L^*_r = k_i \log(L_r)$ $(i=0,1)$ [2]
Derivation leads for $\Delta L^*_r = 1$ to the linear equation: $L_r / \Delta L_r = k_i$ ($k_0=46$, $k_1=63$) [3]
For colours in offices the **standard contrast range** is **25:1**=90:3,6.

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

Colour (matte)	**Tritimulus value**	**office luminance**	**relative luminance**	**CIE lightness**	**relative lightness**
***(contrast)* (25:1=90:3,6)**	Y	L [cd/m^2]	$L_r = L/L_u$	L^*_{CIELAB} $\sim m\, L_r^{1/2,4}$	L^*_r $=k \log(L_r)$
White W (paper)	90 =18*5	142 =28,2*5	5	94 =50+44	44 $=k_1 \log(5)$
Grey Z (paper)	18	28,2	1	50	0 $=k_0 \log(1)$
Black N (paper)	3,6 =18/5	5,6 28,2/5	0,2	18 50−32	−32 $=k_0 \log(0,2)$

For the two lightness ranges it is $k_0=-32/\log(0,2)=46$ and $k_1=44/\log(5)=63$.

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