Conclusion 31/2007 ISO TC159/SC4/WG2
Ergonomics − Visual Display Requirements

ISO TC159/SC4/WG2 realizes that the colour spaces CIELAB and CIELUV of ***CIE Division 1*** will soon become ISO/CIE standards. In applications we use these CIE colour spaces and *device−dependent* relative RGB colour spaces. For users of visual display systems a *device−independent* RGB colour space is useful. This produces via software the elementary hues Red, Green and Blue for the RGB data 100, 010 and 001 and equally spaced output in CIE colour spaces for equally spaced RGB input. We recommend that ***CIE Division 1*** study the colorimetric definition of such a space, which can be used in visual display applications.

Remark: We have realized that an example colour space of this type is published in CIE X030:2006, p. 139−144. Note: Compare page 2 of CIE R1-47, see http://web.archive.org/web/20160304130704/http://files.cie.co.at/526.pdf

EE85I−1N

At the CIE meeting in Stockholm, June 2008, ***CIE Division 1*** decided to establish the CIE Reportership R1-47: **Hue Angles of Elementary Colours** by *Thorstein Seim (Norway)* in respose to a request of ISO TC 159 SC4/WG2 **Visual Display Requirements** and to present the result at the next CIE meeting in Budapest 2009.

The report **CIE R1-47:2009 Hue Angles of Elementary Colours**
lists in chapter 3.6 the average CIELAB hue angles 26, 92, 166, and 270 of *Miescher, NCS, and the CIE.*

CIE R1-47 defines the CIELAB hue angles **25, 92, 162 and 271** of the CIE test colours no. 9 to 12 according to CIE 13.3 for the four elementary colours $\boldsymbol{R_e}$, $\boldsymbol{Y_e}$, $\boldsymbol{G_e}$, and $\boldsymbol{B_e}$.
For the text of the request of ISO TC159/SC4/WG2, the text of the decisions of CIE Division 1, the result, and the free download of CIE R1−47 see
http://files.cie.co.at/526.pdf or http://web.archive.org/web/20160304130704/http://files.cie.co.at/526.pdf

EE85I−2N

Resolution Busan 18/2009 of ISO/IEC JTC1/SC28 "Office Equipment"
SC28 Review of the AWG recommendation on jn28n1280 (DIN 33872−1 to 6)

The German proposal included the concept of a human visual RGB. SC28 recognizes the importance of correct understanding of the human visual system and the potential importance and application of this understanding to office equipment and office systems. SC28 welcomes the German plan to continue development of the human visual RGB within ***CIE Division 1 and Division 8.***

In addition SC28 welcomes a new proposal from Germany in the future based on this CIE human visual RGB work, potentially in relation to AWG/PWG5 NWI−9
(Office colour space).

EE85I−5N

At the CIE meeting in South Africa, June 2011, ***CIE Division 1*** decided to establish the Reportership
CIE R1−57 Border between Luminous and Blackish Colours by *Thorstein Seim (Norway)*
in response to the resolution 18/2009 of ISO/IEC JTC1/SC28.

In addition ***CIE Division 8*** decided to establish the Reportership
CIE R8−09 Output Linearization Methods for Displays and Printers by *Klaus Richter (Germany)*
in response to the same resolution 18/2009 of ISO/IEC JTC1/SC28.

Both reports **CIE R1−57** and **CIE R8−09** have relations and may appear during 2013 at the CIE web site.

Possible Result: Definition of a *device−independent visual RGB*$^*_e$ system as response to the request of SC28.
All surface colours define a hue circle of maximum chroma located within the CIE (x,y) chromaticity diagram. CIELAB chroma $\boldsymbol{C^*_{ab}}$ and lightness $\boldsymbol{L^*}$ of this circle as function of hue $\boldsymbol{h_{ab}}$ serves as reference points of a *device−independent visual* ***RGB*$^*_e$ *system*** (compare the reference $\boldsymbol{C^*_{ab}}$, $\boldsymbol{L^*}$ hue circle of the *NCS* system).

EE85I−7N

Digital *rgb*$_d$ exponent transformation and measurement data of three display outputs

ISO colours in AE49 Name	position	page 1 C_{Y8}=288:1 $(r, g, b)_d^{1,000}$	page 4 C_{Y5}=36:1 $(r, g, b)_d^{0,775}$	page 8 C_{Y1}=2,25:1 $(r, g, b)_d^{0,475}$
white W_d	**(01, b)**	1,00 1,00 1,00	1,00 1,00 1,00	1,00 1,00 1,00
Light red R_{Wd}	**(01, f)**	1,00 0,50 0,50	1,00 0,58 0,58	1,00 0,72 0,72
Red R_d	**(01, j)**	1,00 0,00 0,00	1,00 0,00 0,00	1,00 0,01 0,00
Dark red R_{Nd}	**(05, j)**	0,50 0,00 0,00	0,58 0,00 0,00	0,72 0,01 0,01
Black N_d	**(09, j)**	0,00 0,00 0,00	0,00 0,00 0,00	0,01 0,01 0,01

A software or hardware *Raster-Image-Processor (RIP)* changes the $(r, g, b)_d$ data of page 1 by an exponent n for the display output. Eight exponents are used in the ISO file:
http://standards.iso.org/iso/9241/306/ed-2/AE49/AE49F0P0.PDF

EE85I−1N

Achromatic colours, intermediate colours	**Chromatic colours, elementary colours**	**chromatic colours, device colours**
five achromatic colours:	***"neither−nor"−colours***	***TV, print (PR), photo (PH)***
N black (French noir)	*four elementary (e) colours:*	*six device (d) colours:*
D dark grey	$R = R_e$ red *neither yellowish nor bluish*	$C = C_d$ cyan blue (cyan)
Z central grey	$G = G_e$ green *neither yellowish nor bluish*	$M = M_d$ magenta red (magenta)
H light grey	$B = B_e$ blue *neither greenish nor reddish*	$Y = Y_d$ yellow
W white	$J = Y_e$ yellow (French jaune) *neither greenish nor reddish*	$O = R_d$ orange red (red)
two intermediate colours:		$L = G_d$ leaf green (green)
C_e = G50B_e *blue−green*		$V = B_d$ violet blue (blue)
M_e = B50R_e *blue−red*		

EE85I−3N

Digital *rgb*$_e$ exponent transformation and measurement data of three display outputs

ISO colours in AE46 Name	position	page 1 C_{Y8}=288:1 $(r, g, b)_e^{1,000}$	page 4 C_{Y5}=36:1 $(r, g, b)_e^{0,775}$	page 8 C_{Y1}=2,25:1 $(r, g, b)_e^{0,475}$
white W_e	**(01, b)**	1,00 1,00 1,00	1,00 1,00 1,00	1,00 1,00 1,00
Light red R_{We}	**(01, f)**	1,00 0,50 0,74	1,00 0,58 0,64	1,00 0,72 0,47
Red R_e	**(01, j)**	1,00 0,00 0,26	1,00 0,00 0,36	1,00 0,01 0,53
Dark red R_{Ne}	**(05, j)**	0,50 0,00 0,13	0,58 0,00 0,32	0,72 0,01 0,38
Black N_d	**(09, j)**	0,00 0,00 0,00	0,00 0,00 0,00	0,01 0,01 0,01

A software or hardware *Raster-Image-Processor (RIP)* changes the $(r, g, b)_e$ data of page 1 by an exponent n for the display output. Eight exponents are used in the ISO file:
http://standards.iso.org/iso/9241/306/ed-2/AE46/AE46F0P0.PDF

EE85I−5N