

**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>*

EE850-1N

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 response 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  $R_e$ ,  $Y_e$ ,  $G_e$ , and  $B_e$ .

*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>

EE850-3N

**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*).

EE850-5N

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<sub>e</sub> 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  $C_{ab}^*$  and lightness  $L^*$  of this circle as function of hue  $h_{ab}$  serves as reference points of a *device-independent visual RGB<sub>e</sub> system* (compare the reference  $C_{ab}^*$ ,  $L^*$  hue circle of the NCS system).

EE850-7N

TUB-test chart EE85; ISO request and result of CIE work  
 sRGB scaling with different gamma values at a workplace

**Digital rgb<sub>d</sub> exponent transformation and measurement data of three display outputs**

ISO colours in AE49	page 1	page 4	page 8
Name position	$C_{Y8}=288:1$ $(r, g, b)_d^{1,000}$	$C_{Y8}=36:1$ $(r, g, b)_d^{0,775}$	$C_{Y1}=2,25:1$ $(r, g, b)_d^{0,475}$
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>

EE851-1N

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	$C = C_d$ cyan blue (cyan)
$Z$ central grey	neither yellowish nor bluish	$M = M_d$ magenta red (magenta)
$H$ light grey	$G = G_e$ green	$Y = Y_d$ yellow
$W$ white	neither yellowish nor bluish	$O = R_d$ orange red (red)
two intermediate colours:	$B = B_e$ blue	$L = G_d$ leaf green (green)
$C_e = G50B_e$ blue-green	neither greenish nor reddish	$V = B_d$ violet blue (blue)
$M_e = B50R_e$ blue-red	$J = Y_e$ yellow (French jaune)	
	neither greenish nor reddish	

EE851-3N

**Digital rgb<sub>e</sub> exponent transformation and measurement data of three display outputs**

ISO colours in AE46	page 1	page 4	page 8
Name position	$C_{Y8}=288:1$ $(r, g, b)_e^{1,000}$	$C_{Y8}=36:1$ $(r, g, b)_e^{0,775}$	$C_{Y1}=2,25:1$ $(r, g, b)_e^{0,475}$
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>

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