

Beschluss 31/2007 ISO TC159/SC4/WG2 **Ergonomie – Visuelle Displayanforderungen**

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. Bemerkung: Für diesen Tabellentext vergleiche Seite 2 des Dokumentes CIE R1–47, siehe <http://files.cie.co.uk/526.pdf>

SG380–1N

Die CIE Division 1 beschloss in Stockholm im Juni 2008 einen Reportership-Bericht CIE R1–47: **Bunttonnwinkel der Elementarfarben** mit Thorstein Seim (Norwegen) als Reaktion auf die Bitte von ISO TC 159 SC4/WG2 **Visuelle Displayanforderungen** und die Präsentation während der CIE-Tagung in Budapest 2009.

CIE R1–47:2009 Bunttonnwinkel der Elementarfarben listet in Abschnitt 3.6 die mittleren CIELAB-Bunttonnwinkel 26, 92, 166 und 270 von Miescher, NCS und der CIE.

CIE R1–47 definiert die CIELAB-Bunttonnwinkel der CIE-Testfarben Nr. 9 bis 12 nach CIE 13.3 (1985) für die vier Elementarfarben R_e , Y_e , G_e und B_e .
Für den Text der Bitte von ISO TC159/SC4/WG2, den Text der Entscheidungen von CIE Division 1, das Ergebnis, und den freien Download von CIE R1–47 siehe <http://web.archive.org/web/20160304130704/http://files.cie.co.uk/526.pdf>

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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*).
Two CIE Reportership Reports appeared since 2009: **R1–57:2012 (public)** and **R8–09:2015 (CIE internal)** http://web.archive.org/web/20150413002133/http://files.cie.co.uk/716_CIE%20R1-57%20Report%20Jul-13%20v2.pdf
CIE R8–09:2015 (CIE internal). Output linearization methods for displays and printers, with the same technical content of Richter (2016), see http://farbe.li.tu-berlin.de/OUTLIN16_01.PDF

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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 R1–57:2012** ([1] public) and **CIE R8–09:2015** ([2] CIE internal) have relations.
[1] http://web.archive.org/web/20150413002133/http://files.cie.co.uk/716_CIE%20R1-57%20Report%20Jul-13%20v2.pdf
[2] with the same technical content from Richter (2016), see http://farbe.li.tu-berlin.de/OUTLIN16_01.PDF
Possible Result: Definition of a device-independent visual RGB₀ 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 RGB₀ system (compare the reference C_{ab}^* , L^* hue circle of the NCS system).

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Proposed CIE output linearization for printers and offset machines

Printer or offset company

realized output options:

Company preference (Y/N)?
DIN 33872 (CIE?) linearized (Y/N)?
Only one option not specified (Y/N)?

User printer or offset device without or with device specific **PS linearization code** in print output software.

User visual test

with output of DIN 33872-X test charts.
Agrees the output with the user wishes (Y/N)?
If No (N) agreement to the user wishes then:
Output of reference test chart with 1080 colours.
Continues colour change in output (Y/N)?
If Yes, then linearization possible and decision:
Mail the output to a linearization company.

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Linearization company:

Measures 1080 user colours and produces **PS linearization code** for user device and paper

For test charts of DIN 33872–1 to –6 see <http://farbe.li.tu-berlin.de/A/33872E.html>

Advantages of Output Linearization:

- Linear relation between rgb and CIELAB data.
- No loss of visual information for 16 step colour series on different colour devices.
- Grey is printed by black only and not by CMY (complete under colour removal), low cost.

Proposed CIE output linearization for display and data projector devices

Display or data projector company:

realized output options:

One company preference (Y/N)?
One ISO 9241–306 linearized (Y/N)?
Eight ISO 9241–306 linearized (Y/N)?
Only one option not specified (Y/N)?

User display or data projector without or with device specific **up to 8 PS linearization codes** in display output software.

User visual test for up to 8 room light reflections

with output of ISO 9241–306 test charts.
Agrees the output with the user wishes (Y/N)?
If No (N) agreement to the user wishes then:
Output of reference test chart with 1080 colours.
Continues colour change in output (Y/N)?
If Yes, then linearization possible and decision:
Ask display or linearization company for help.

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Linearization company:

Measure 1080 colours of display output with no room light reflection and produces **8 PS linearization codes** for eight room light reflections.

For test charts of ISO 9241–306 see (1,7 and 20MB)
<http://standards.iso.org/iso/9241/306/ed-2/AE09/AE09F0PX.PDF>
<http://standards.iso.org/iso/9241/306/ed-2/AE27/AE27F0PX.PDF>

Advantages of Output Linearization:

- Linear relation between rgb and CIELAB data.
- No loss of visual information for 16 step colour series on different devices.
- Linearized output of whole display for ergonomic work depending on room light reflections, for solutions see ISO 9241–306.