TUB registration: 20190501-EE00/EE00L0N1.TXT /.PS
application for measurement of display output

TUB machine technical information: http://farbe.li.tu-berlin.de/EE00/EE00L0N1.HTM

See similar files: http://farbe.li.tu-berlin.de/EE00/EE00L0N1.*

Development of a Technical Report: Comparison between ISO and CIE

process name	process owner	process numbers	document created	ISO stage & vote	CIE stage & vote
NWIP	CIE	TC/MS	WG	20	1
		CIE:DIS	WG	40	2
prelgn	CIE	BA-TCC	WG/TC	20	1
ref WG/TC			WG	40	2
Development WD & Ballot	TCC	TCC+TCMs	WT	20	1
			TC	20	2
Development CD & Ballot	TCC	ISO+TCMs	WT	30	1
		CIE+DD:DT	TC	30	2
Development DIS/FDIS & ballot	CIE	TCC+TCMs	WG/TC	40	1
		+CD	CIE/AD	Y/N+C	Y/N+C
publica-tion of TR	CIE	TCC+TCMs	WG/TC	50	1
		+CD	CIE/TB	50	2

Abbreviations: TR: Technical Report; MS: Technical Committee Member (Class) or Member; WG/TC: Working or Committee Draft; DD:DT and FDIS/AD Enquiry or Approval Draft; U: Disseminate; stm: Stage in CIE Central Bureau; 20: Start of Enquiry; 40: Start of Approval Ballot; Y/N+C/D/U: Vote

yes by public (no bias) | yes by parent committee | yes only by committee

EE00D-1N

Technical Problems to write standard documents in the field of colour vision and image technology.

Problem: For example the standard organizations ISO, CEN, DIN, and CIE use **antiscrp. software**. This software is **incompatible** with the EPS vector graphic of the software *Adobe Illustrator*. However, this image software is used since 20 years in standard documents. How to revise these ISO documents?

Solution: Use the Technical Report ISO 9241-306:2018. Quality of the Technical Report: Many typesetters, Many colours of their 10 step colour scales between white and BLK disappear on page 36. The Word document with EPS graphic cannot be printed on page 36.

Solution 1: The vector graphic files are transferred to pixel graphic files and are included in the Word file.

Disadvantages

1. The test rhombs of ISO standards for **Visibility, readability and resolution** are determined by the pixel software and not by the colour vision perception of users.
2. For example the word file size of ISO 9241-306 increases from 3 to 60 MB.
3. Pixel graphic files are not editable by the standard committees.

Solution 2: ISO 9241-306:2018 is published in pixel graphic (low quality) ISO-stex charts in vector graphic are for downloaded from the **ISO Standard Maintenance Portal**. Therefore the best quality of ISO 9241-306:2009 remains, see http://standards.iso.org/iso/9241/306/ed-2/en/ .

EE00F-1N

Technical Problems to write standard documents in the field of colour vision and image technology.

Problem: For example the standard organizations ISO, CEN, DIN, and CIE use **antiscrp. software**. This software is **incompatible** with the EPS vector graphic of the Software *Adobe Illustrator*. However, this image software is used since 20 years in standard documents. How to revise these ISO documents?

Table 1: Effect of the Standard ISO 9241-306:2018. Quality with vector or pixel graphic, and software or with antiscrp. software.

ISO document	graphic file size	graphic software	antiscrp. software	pixelrhb map resolution	graphic quality
ISO/DIS 9241-306:2017	vector	Adobe Illustrator	EPS	300 dpi	very high
option used in spreadsheet	vector	Adobe Illustrator	EPS	300 dpi	very high
ISO FS 9241-306:2018	60MB	EMF	Yes	300 dpi	very low
EPS prior 9241-306:2018	3 MB	Adobe Illustrator	EPS	300 dpi	very low
ISO FDIS 9241-306:2018	3 MB	Adobe Illustrator	EPS	300 dpi	very low

1) about 30% of the colours disappear; 2) the output is defined by the software, and not by the vision properties of users.
3) if of 16 grays steps are not distinguishable. The minimum requirement is failed.

EE00F-1N

Weber-Fechner law in CIE 230:2019 for threshold colour differences of surface colours

The *Weber-Fechner* law describes the lightness L^*, an *logarithmic* function of L_Y. The *Stevens* law describes the lightness $L^*_{YA0.4/0.4}$ as *potential* function of L_Y=975. IEC 61966-2-1 uses a similar potential function L^*_{Sy}= L_Y ^0.4.
The *Weber-Fechner* law is equivalent to the equation: $L^* = c_1 \cdot \ln(L_Y) + c_2$ [1]
Integration leads to the logarithmic equation: $L^*_Y = k_1 \cdot \ln(L_Y)$
Derivation leads for M^*_Y=1 to the linear equation: L_Y/M_Y=97. [2]
For **Adjacent** colours the weighs the standard contrast range is 25:1=90:3.6.

Table 1: CIE trimixmatrix value Y, luminance L_Y and lightness L^*

Colour (matte) surface	Trimixmatrix value	office luminance	CIE lightness	relative lightness
(xxxxxxx) (25:1=90:3.6)	Y_{CIE} [cd/m²]	$L^*_{Y,A=0}$ $=L^*_{Y,A}$	$L^*_{Y,A=0}$ $=L^*_{Y,A}$ $-k_1 \cdot \ln(L_Y)$	$L^*_{Y,A=0}$ $=L^*_{Y,A}$ $-k_1 \cdot \ln(L_Y)$
White W	90	142	5	58
(paper)	>18*5	>28.2*5		>50+44
Grey Z	18	28.2	1	50
(paper)				>+log(1)
Black N	3.6	5.6	0.2	18
(paper)	>18/5	28.2/5		>18-log(5)

For the lightness range between L^*_Y= -40 and 40 the contrast is: k=400/log(5)=57

EE00J-1N

Weber-Fechner law in CIE 230:2019 for threshold colour differences of surface colours

The *Weber-Fechner* law describes the lightness L^*, an *logarithmic* function of L_Y. For local adaptation to **Adjacent** colours there is a *similar constant* **100:1**.
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IEC 61966-2-1 uses a similar potential function L^*_{Sy}= L_Y ^0.4.
For *separate* colours on a grey surround there is a *visible contrast* 25:1=90:3.6.
see *K. Richter*, 2006, Relation of *Weber* and *Stevens* law at achromatic threshold.
http://farbe.li.tu-berlin.de/A/BASAT.PDF

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EE00J-1N

References and access in archive-web sites with navigation Basic Reference

[1] CIE Toolkit for Technical Work, see
http://www.cie.co.at/index.php/Publications/Technical-resources
[2] ISO What delegates and experts need to know
http://www.iso.org/iso/home/standards/iso_guides.htm
[3] How to write standards, see ISO/IEC Directives
https://www.iso.org/iso/home/ks-write-standards.pdf
[4] *K. Richter*, 2018, How to read the **Adobe Illustrator** EPS with broken links
http://farbe.li.tu-berlin.de/WIN/_html_IPS_1N.pdf

Table 1: Access of ISO-TC42 members to CIE Division 1 2017

Navigation for Reviewers of CIE Div1 Meeting Activity (AR)
http://web.archive.org/web/20170624033195/http://div1.cie.co.at/?t_cu_id=544
Navigation for Reviewers of Meeting (MR), Activity (AR), Reporter(RR)
http://web.archive.org/web/20181004082001/http://div1.cie.co.at/?t_cu_id=544
List of event from 300 CIE documents:
http://web.archive.org/web/*/http://files.cie.co.at/*

WIMP and direct access to public BAM documents until 2010
http://web.archive.org/web/20081119034852/http://www.pa.bam.de/index.html
Most content of this BAM web site has been transferred in 2018 to:
http://farbe.li.tu-berlin.de/A/index/A1.html

WIMP access to public ISO/IEC JTC1/SC28 documents until 2006
http://web.archive.org/web/*/http://www.jtc1sc28.org/jtc1sc28/doc/jtc28sc/ ; http://web.archive.org/web/*/http://www.jtc1sc28.com/jtc1sc28/*

EE00K-1N

Access of ISO-TC42 members to working documents of CIE Division 1

CIE Div1 *Vision and Colour* produces 3 zone document types compared to ISO:
CIE Div1 Reports: **Award (AR), Meeting (MR), and Reporter(RR).**
There were requests of ISO committees to the CIE for a colorimetric support.
In some cases a CIE TC was created to solve this ISO problem with a discussion between the CIE and ISO committees. Reports of CIE Div1 are available for anyone. In other cases the CIE maintains a Reporteurship Reporter to write a (public) RR. Many Reporters liked this job because the copyright remained by the author.

Table 2: Access of TC42 members to CIE Liaison documents?

CIE document created	until 2017	since 2018	copy-right	public access to CIE documents
CIE D1 Annual Meeting Report D1MR	CIE Website	internal CIE Website	CIE	until 2017, see WIMP archive
CIE D1 Annual Activity Report D1AR	CIE Website	CIE Website	CIE	until 2017, see WIMP archive [1]
CIE D1 Reporteurship Report D1RR	CIE Website	CIE Website	Author	until 2017, see WIMP archive [1]
CIE D1 WD/CD/FDAM	CIE Website	CIE Website	CIE	until 2017, see WIMP archive
CIE D1 TR or IS	public, see CIE Website	CIE Website	CIE	CL-TC42 access
D1TR, D1IS	CIE div 1	CIE div 1	CIE	CIE div 1

Access (not by public) to box 1 | limited or no access for TC42 members

EE00L-1N

Access of ISO-TC42 members to working documents of CIE Division 1

CIE Div1 *Vision and Colour* produces 3 zone document types compared to ISO:
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There were requests of ISO committees to the CIE for a colorimetric support.
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CIE D1 Annual Meeting Report D1MR	public WIMP archive	internal CIE website	CIE	until 2017, see WIMP archive
CIE D1 Annual Activity Report D1AR	public WIMP archive	internal CIE website	CIE	until 2017, see WIMP archive [1]
CIE D1 Reporteurship Report D1RR	public WIMP archive	internal CIE website	Author	until 2017, see WIMP archive [1]
CIE D1 WD/CD/FDAM	internal TC WIMP archive	internal TC WIMP archive	CIE	until 2015, limited TC42 access
CIE D1 TR or IS	public WIMP archive	public WIMP archive	CIE	CL-42 members
D1TR, D1IS	CIE div 1	CIE div 1	CIE	CIE div 1

Navigation for MR, AR, RR: http://web.archive.org/web/20181004082001/http://div1.cie.co.at/?t_cu_id=544

EE00M-1N

Weber-Fechner law in CIE 230:2019 for threshold colour differences of surface colours

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Integration leads to the logarithmic equation: $L^*_Y = k_1 \cdot \ln(L_Y)$.

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For the lightness range between L^*_Y= -40 and 40 the contrast is: k=400/log(5)=57

EE00J-1N

Weber-Fechner law in CIE 230:2019 for threshold colour differences of surface colours

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Integration leads to the logarithmic equation: $L^*_Y = k_1 \cdot \ln(L_Y)$.
Derivation leads for M^*_Y=1 to the linear equation: L_Y/M_Y=97.
For **Adjacent** colours the weighs the standard contrast range is 25:1=90:3.6.
Many problems show the PDF document N1581 of ISO 17/35/SC4/WG2 'Visual Display Requirements'. Many colours of their 10 step colour scales between white and BLK disappear on page 36. The Word document with EPS graphic cannot be printed on page 36.

Table 1: CIE trimixmatrix value Y, luminance L_Y, and lightness L^*

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For the lightness range between L^*_Y= -40 and 40 the contrast is: k=400/log(5)=57

EE00J-1N

Colorimetric scrlm, display, and print for archiving based on the ergonomic Standard ISO 9241-306:2018 for work places

Klaus Richter, Berlin University of Technology (TUB), Germany

Abstract

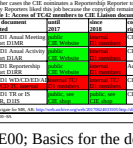
ISO 9241-306:2018 shows colorimetric methods for output optimization of displays and printers. Colorimetric methods are alternative for weak spacing of colour series, visibility and readability is intended.

There are input linearization methods for scanners and photography and output linearization methods for displays, printers and paper. The *by-layer* output of a digital ISO-test chart with 729 colours (0xhex0 rgb* values) for example the *bay* "ISO standard file – ISO print – ISO scan –> ISO file" is closed and the *rgb** values data of the original ISO file are approximately reproduced at the end of the loop. For any hue there is a linear relation in both directions between the *rgb** and the CIELAB L*C*h data. The closed loop and the linear relations are important properties for archiving.

EE01E-1A

Colorimetric scrlm/display: digital input –> printer –> analog output based on the ergonomic Standard ISO 9241-306:2018 for work places

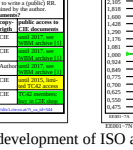
In this default case the printer driver has the relative gamma γ = 1.000.
In other cases the printer driver has the relative gamma γ = 2.105.



EE01E-7N

Colorimetric scrlm/display: digital input –> printer –> analog output based on the ergonomic Standard ISO 9241-306:2018 for work places

In this special case the printer has the relative gamma γ = 2.105.



EE01E-7A

Motivation and Problem

The ideal reproduction for archiving occurs, if the loop:

1. ISO-standard file –>ISO print –>ISO scan –>ISO file
is closed, and the ***rgb*** values in the
start and final file are equal.

2. ISO-standard print –>ISO scan –>ISO file –>ISO print
is closed, and the ***LCh**** values in the
start and final print are equal.

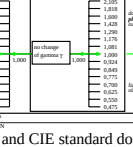
Both goals are approximately possible, if the output linearization method *OLM_16* is applied, see

Richter, 2016, Output linearization method OLM16 for displays, printers and offset:
http://farbe.li.tu-berlin.de/CR/LIN16_01.PDF (similar to CIE 88-99:2015)

EE01E-1A

Colorimetric workflow: digital input –> printer –> analog output based on the ergonomic Standard ISO 9241-306:2018 for work places

In this special case the printer driver has the relative gamma γ = 2.105.



EE01E-7A

TUB-test chart EE00; Basics for the development of ISO and CIE standard documents
Access to data; links and basic references; Visual threshold and *Weber Fechner law*