

CIE TC 8-16

Face-to-face meeting in Vancouver, Canada

12th November 2018

Chairs: Craig Revie, Yasuki Yamauchi

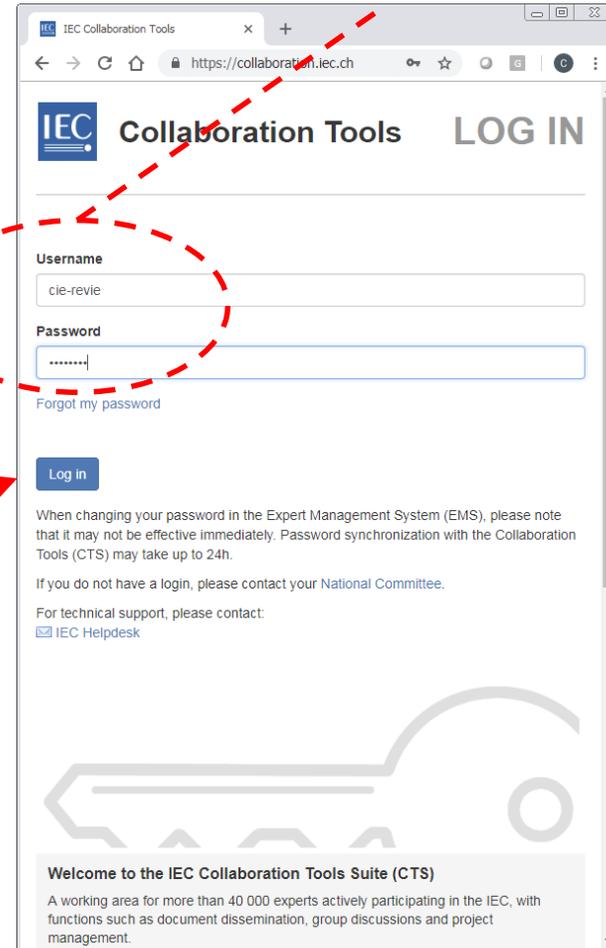
Meeting will be recorded

Agenda

- Introduction (Craig Revie)
- Research project:
 - Fogra (Jaqueline Wittmann)
 - NTNU, Gjøvik (Muhammad Safdar)
 - RIT (Elena Fedorovskaya)
 - Yamagata University (Yasuki Yamauchi)
- Technical Report, proposed structure and anticipated conclusions (Craig Revie)
- Feedback from experts and discussion of ideas
- CIE TC8-16 project plan (Yasuki Yamauchi)
- Summary and next steps

CIE COLFTOOL area for CIE TC8-16

Restricted access – CIE TC8-16 login required



www.cie.co.at

CIE COLLT00L area for CIE TC8-16

Documents

Type	Title	Created on	Created by	Modified on	Modified by	# Att	Download
<input type="checkbox"/>	test	2018-07-12	REVIE Craig	2018-07-12	REVIE Craig	0	
<input type="checkbox"/>	CCA Examples	2018-01-09	REVIE Craig	2018-01-10	REVIE Craig	0	
<input type="checkbox"/>	Reference images	2017-04-28	REVIE Craig	2017-04-29	REVIE Craig	0	
<input type="checkbox"/>	Reference documents	2017-04-11	REVIE Craig	2017-04-12	REVIE Craig	0	

Meeting presentations, recordings and notes

Reference images

Type	Title	Created on
<input type="checkbox"/>	ISO 12640-2,3,4 SCID images	2017-07-10
<input type="checkbox"/>	Roman16 ECI RGB test images	2017-04-28

Reference documents

Type	Title	Created on
<input type="checkbox"/>	A Novel Method to Evaluate the Closeness of Two Colors	2017-09-08
<input type="checkbox"/>	Exploring the Effect of Gray Balance and Tone Reproduction on Consistent Color Appearance (TAGA 2017)	2017-08-15
<input type="checkbox"/>	Predicting Color Image Match (TAGA 2017)	2017-08-15
<input type="checkbox"/>	Perceptually uniform color space for image signals including high dynamic range and wide gamut	2017-06-23
<input type="checkbox"/>	Comprehensive color solutions: CAM16, CAT16, and CAM16-UCS	2017-06-23
<input type="checkbox"/>	DR8-13 Report: Consistent colour appearance	2017-04-13
<input type="checkbox"/>	CIE 159:2004, A Colour Appearance Model for Colour Management Systems: CIECAM02	2017-04-13
<input type="checkbox"/>	CIE 156:2004, Guidelines for the evaluation of gamut mapping algorithms	2017-04-13

Meeting recordings and reference image data files are hosted on the ICC web site (ICC login required)

Other CCA resources

Consistent Colour Appearance

www.color.org/resources/consistentappearance.xalter

International Color Consortium

MAKING COLOR SEAMLESS BETWEEN DEVICES AND DOCUMENTS

ABOUT ICC RESOURCES INFORMATION MEMBERS GETTING STARTED V4 iccMAX

SEARCH ICC: GO

Got a question about ICC Profiles or colour management? [Ask Phil](#)

ICC: LIVE TOPICS:

- iccMAX
- New iccMAX version
- iccMAX Reference Implementation - v2.1.1.4 released
- ICC tech note on embedding an iccMAX profile in a v4 profile
- ICC White Paper on iccMAX Calc programming
- ICC video
- ICC Medical Imaging Working Group
- Profile security
- Research fund
- Display calibration
- New PRMG-based exchange profile for digital print
- Profiling tools
- ICC Profile Registry
- sRGB profiles
- ICC user forum
- Why join ICC?
- What is an ICC Profile?
- Using CxF for printing spot inks
- What is FOGRA53?
- Consistent colour appearance

ICC: EVENTS:

All ICC Events

2018

- ICC Color Symposium Hong Kong, 22 October
- Grand Rapids, MI, 30-31 May
- ICC DevCon 2018
- Munich, 25-26 February
- Upcoming ICC Meetings

2017

- Ryerson Toronto Graphic Arts Day, 13 October
- Toronto, 11-12 October
- Prague Graphic Arts Experts' Day, 29 June
- Prague, 27-28 June
- Tokyo, 19-20 April
- NPES/ICC Print Business Outlook Conference, India, 5 Feb

2016

- 2016 ICC DevCon
- ICC Meetings, 4-5 Nov San Diego
- Medical Imaging, 5 Nov San Diego
- Displays & 3D print, 5-6 May Taipei
- ICC Meetings - Taipei
- Print Business Outlook Conference, Mumbai, March 15
- NPES-ICC Color Management

Consistent Colour Appearance

When a set of colour reproductions are judged to have a high degree of similarity, they are often said to have a 'Consistent (or Common) Colour Appearance'. The degree of similarity is generally judged by subjective assessment. Although this term and similar terms are widely used it has no clear definition and there is currently no standard means of assessing whether a set of colour reproductions has common colour appearance.

Following the completion of a Reportership R8-13 on Common Colour Appearance, a CIE Technical Committee TCB-16 has been established on **Consistency of Colour Appearance within a Single Reproduction Medium**, chaired by **Craig Revie** (GB) & **Yasuki Yamauchi** (JP). Information about Reportership R8-13 is available [here](#).

The **terms of reference** of this committee are:

To study and report on sets of reproductions of the same source image that have a consistent colour appearance and are most similar to a reference reproduction, including recommending assessment methods that measure the similarity of reproductions of an image with different colour gamuts, for printed images on substrates with approximately similar characteristics in a fixed viewing environment. Only the effect of colour reproduction on appearance will be considered by this TC and so the assessment will be performed using hard copy or soft copy proofing. To propose a metric which can measure consistency of colour appearance.

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Resources

A set of **test images** have been proposed for use in research on this topic. A set of **print gamuts** are recommended for testing.

Meetings

Next meeting: Face-to-face meeting at CIC in Vancouver, 12 November 2018.

Teleconference

30 August 2017
Meeting recording

Face to face meeting in Lillehammer

Scandic Lillehammer Hotel
11 September 2017

Agenda

- 00:01:40 Introductions and agenda review
- 00:13:00 CIE Technical Committee TCB-16 overview (Craig Revie)
- 00:21:50 FOGRA research project (Andreas Kraushaar)
- 00:46:00 Yamagata University research project (Yasuki Yamauchi)
- 01:10:00 NTNU research project (Greg High)
- 01:30:00 Research plan for RIT (Elena Fedorovskaya)
- 01:57:00 CIE TCB-16 project plan (Yasuki Yamauchi)

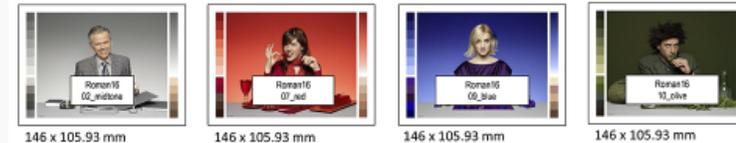
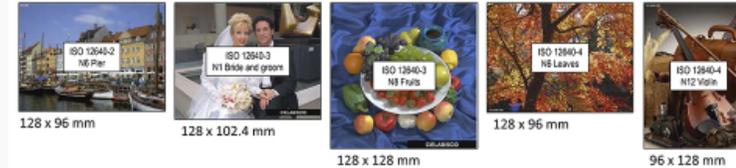
Consistent Colour Appearance - test images

Proposed test images

The following images have been proposed for the testing of **Consistent Colour Appearance**. Our objective is to ensure that results from testing can be shared easily. These images are not freely available but may be obtained from ISO as part of ISO12640 (Part 2: sRGB SCID, Part 3 CIELAB SCID and Part 4 AdobeRGB SCID).

It is suggested that the primary set of images be used for all tests. Where algorithms have been identified that perform well for the primary set, the secondary set be used to test these further.

Suggestions for additions or modifications to these image sets should be made to the **ICC Technical Secretary**.



Primary image set **Hide details**

Reference printing gamuts

Reference name	Characterisation data	ICC Profile
CGATS21-2-CRPC1	NPES CGATS21-2-CRPC1.txt	ICC profile registry CGATS21_CRPC1.xalter
FOGRA47	ICC characterisation data registry FOGRA47L.txt	ICC profile registry Uncoated_Fogra47L_VIGC_300.xalter
PSRgravureMF	ECI eci_gravure_psr_v2_2009.zip (PSRgravureMF_ECI2002.txt)	ECI eci_gravure_psr_v2_2009.zip (PSRgravureMF.icc)
ECI PSR SC STD V2	ECI eci_gravure_psr_v2_2009.zip (ECI_PSR_SC_STD_V2.txt)	ECI eci_gravure_psr_v2_2009.zip (PSR_SC_STD_V2_PT.icc)
SC_paper_eci	Only available from targ tag in ICC Profile	ECI eci_offset_2009.zip (SC_paper_eci.icc)
Japan Web Coated (Ad)	Not available (may be derived from A2B1 and MediaWhitePoint tags)	Adobe detail.jsp?ftpID=4075 (JapanWebCoated.icc)
FOGRA39	ICC characterisation data registry FOGRA39.txt	ICC profile registry Coated_Fogra39L_VIGC_300.xalter
FOGRA53	FOGRA53 characterization data	eciCMYK is an ICC Profile created from the FOGRA53 Characterisation Data

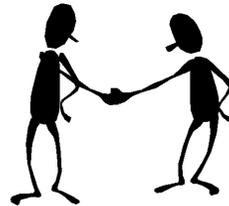
Flexible print (RGB) workflow



Print contract is agreed based on a **reference display image** or **prototype print** from a standard digital printing system



RGB

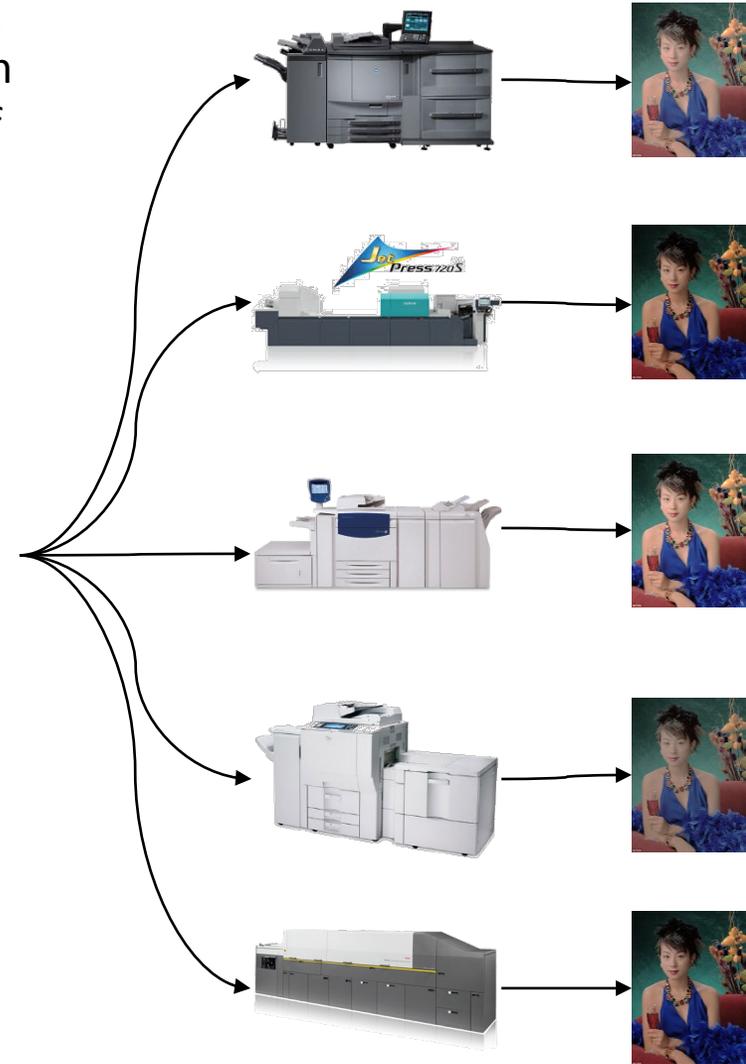


Printing should use all of the available printing gamut but must retain colour appearance of agreed reference



RGB

Colour conversion



Consistent colour appearance?

Initial target for CIE TC8-16

Current status

- We are now almost half way through the 4 years planned for this TC
- Some research work has been completed
- Several additional research projects are planned
- Some of these results and future plans will be presented today
- Your input and suggestions (and participation) are invited

Introduction to Fogra research project

Fogra has developed an experiment to test currently available algorithms that claim to maintain Consistent Colour Appearance for colour conversion for print. The goal is to order these algorithms according to their ability to maintain Consistent Colour Appearance across a given set of colour gamuts.

A set of reference RGB images are converted to a set of CMYK print gamuts. The RGB images and print gamuts are defined by ICC Profiles. Several mapping strategies use ICC Perceptual Rendering as defined by the ICC Profiles created by different vendors and two mapping strategies use proprietary algorithms. A number of pair comparisons between two sets of images were conducted and the results analysed to determine the relative performance of each algorithm.

These colour algorithms can then be compared with various hypotheses for CCA. One option that shows particular promise uses colour naming boundaries. The hypothesis is that consistency of colour appearance is higher when the number of colour naming boundaries crossed is lower.

This could provide a way to determine whether any given colour rendering algorithm provides better consistency of colour appearance compared to a reference algorithm.

Fogra research project (Jaqueline Wittmann)

Introduction to NTNU research project

A study is being conducted at NTNU which will test the hypothesis that the ICC Relative Colorimetric with BlackPoint Compensation colour rendering algorithm ensures consistent colour appearance.

This will be tested using a set of reference source images and three colour gamuts of different size. The reference source images were converted to each of the three colour gamuts using RC+BPC to form a reference set of rendered images. Several variant images were created by adjusting lightness contrast, chroma, and hue of the reference source images.

Two different sets of images are shown to observer at a time and he/she is asked to scale consistency of colour appearance in terms of colour difference in the range 0-10 where 0 means ideal reproduction as per observer's own perception (memory). The set with the lowest score is retained as an anchor point and the second set is replaced with a different variant set.

NTNU, Gjøvik research project
(Muhammad Safdar)

Introduction to RIT research project

The RIT project builds on many years of printing experience. Traditional printing systems have evolved so that a CMYK image printed on one system looks similar when printed on another. I suppose 'survival of the fittest' applies. In recent years this has been formalised by a system known as near-neutral press calibration or G7 and standardised as ISO/PAS 15339.

The project team at RIT have designed a set of synthetic print gamuts (CMYK) that are defined using the principles of near-neutral press calibration. These gamuts have primaries and secondaries at the same hue angles, use tone reproduction curves that follow the near-neutral press calibration aims and their gamut surfaces are spaced by approximately the same CIELAB distance.

The hypothesis is that CMYK images have Consistent Colour Appearance for this set of synthetic colour gamuts. If so, this would provide a method to generate sets of images with CCA for further study and in addition could be used as the basis for a CCA metric for printing systems.

Second observation

For some kinds of colour adjustment, the 95th percentile of the colour difference between two images is 'just noticeable'. This provides an efficient method for the creation of variant images

RIT research project
(Elena Fedorovskaya)

Introduction to Yamagata University research project

Yamagata University plans to build on previous work done which identifies a set of trend lines in CIELAB colour space.

The initial set of trend lines used the colour gamut boundaries of the ISO/PAS 15339 colour gamuts. There has been some discussion as to whether the use of gamut boundaries in this way artificially influences the trend lines. In a repeat of this experiment, a new set of trend lines will be identified that avoid this constraint of colour gamut boundaries.

A trend line is developed for a single colour in several steps. In each step, observers are asked to select a colour that is a fixed CIEDE2000 colour difference from the previous colour, has a similar appearance but is less saturated. By repeating this process, trend lines can be generated for a set of saturated reference colours.

The hypothesis to be tested by Yamagata University is that consistent colour appearance is maintained for images when image colours are mapped along these colour trend lines.

Yamagata University
research project
(Yasuki Yamauchi)

First thoughts about a Technical Report

- It may be helpful as research projects progress, we start to think about what kind of information we should plan to include in our Technical Report
- Significant work has been done in planning experiments to assess CCA and these should be documented and where possible resources made available for future work
 - Consider how this can be done in a way which is referenceable
 - Some research projects will complete before the TR will be published; we should make sure that all necessary information is clearly documented
- A proposed outline for a Technical Report has been circulated for comment
 - Are there any key sections missing?
 - Sections have named individuals responsible; please check that these make sense
- Key dates: we should plan to complete our report by 1st March 2021

Feedback from experts and
discussion of ideas

CIE TC8-16 project plan (Yasuki Yamauchi)

Summary and next steps

- Next teleconference date?