

Consistent Colour Appearance

ICC Toronto Graphic Arts Day

13th October 2017

W Craig Revie, Fujifilm

CIE TC8-16 chair

CIE TC8-16

Consistency of colour appearance
within a single reproduction
medium

Consistent colour appearan x

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

ICC: EVENTS:

All ICC Events

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

Upcoming ICC Meetings

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 Conference, Jakarta, March 17

2015

iccMAX Webinar April 22

Medical Imaging Experts Day Mar 4

Other ICC Medical Imaging meetings

NPES-ICC Color Management Conference Feb 12

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 TC8-16 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.

This page is provided by ICC to assist CIE TC8-16 in its work. PLEASE NOTE THAT THIS PAGE AND RELATED DOCUMENTS ARE PROVIDED ON AN INFORMAL BASIS AND SHOULD NOT BE CONSTRUED AS BEING CIE PUBLICATIONS OR IN ANY WAY ENDORSED BY THE CIE

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

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 TC8-16 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 TC8-16 project plan** (Yasuki Yamauchi)
Consistent colour appearance assessment


Meeting notes

Start times indicate the time the presentation started in the **meeting recording**

Informal Workshop on Consistent Colour Appearance at RIT
 Rochester Institute of Technology
 1 June 2017

Agenda

SEARCH ICC : GO

Got a question about ICC Profiles or colour management?  Ask Phil

ICC: LIVE TOPICS:

iccMAX

iccMAX Reference Implementation - v2.1.8 released

New ICC White Paper on iccMAX Calc programming

New ICC video

Research fund

ICC Medical Imaging Working Group

Profile security

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 CxI for printing spot inks

What is FOGRA39?

Consistent colour appearance

CIE - INTERNATIONAL COI x

www.cie.co.at/index.php/Technical+Committees

TC 8-16: Consistency of Colour Appearance within a Single Reproduction Medium

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.

Chairs: [Craig Revie](#) (GB) & [Yasuki Yamauchi](#) (JP)

<http://www.cie.co.at/index.php/Technical+Committees>

<http://www.color.org/resources/commonappearance.xalter>

CIE TC 8-16 members

Marc Mahy	BE	Jan Morovic	UK
Claas Bickeboeller	CH	Ronnier Luo	UK
Muhammad Safdar	CN	Danny Rich	US
Yuan Jiang Ping	CN	David Hunter	US
Andy Kraushaar	DE	David McDowell	US
Jürgen Seitz	DE	Don Hutcheson	US
Nikolaus Pfeiffer	DE	Elena A. Fedorovskaya	US
Philipp Tröster	DE	Max Derhak	US
Christine Fernandez-Maloigne	FR	Michael Brill	US
Yasuki Yamauchi (chair)	JP	Po-Chieh Hung	US
Peter Nussbaum	NO	Robert Chung	US
Phil Green	NO	Susan Farnand	US
Chris Bai	TW	Timothy Baechle	US
Craig Revie (chair)	UK		
Gregory High	UK		

28 members, 10 countries, 4 research groups

Overview

A



- Why do the reproductions in set A have similar appearance whereas the reproductions in set B do not?
- Is the degree of similarity of a set of reproductions something that could be measured?

B



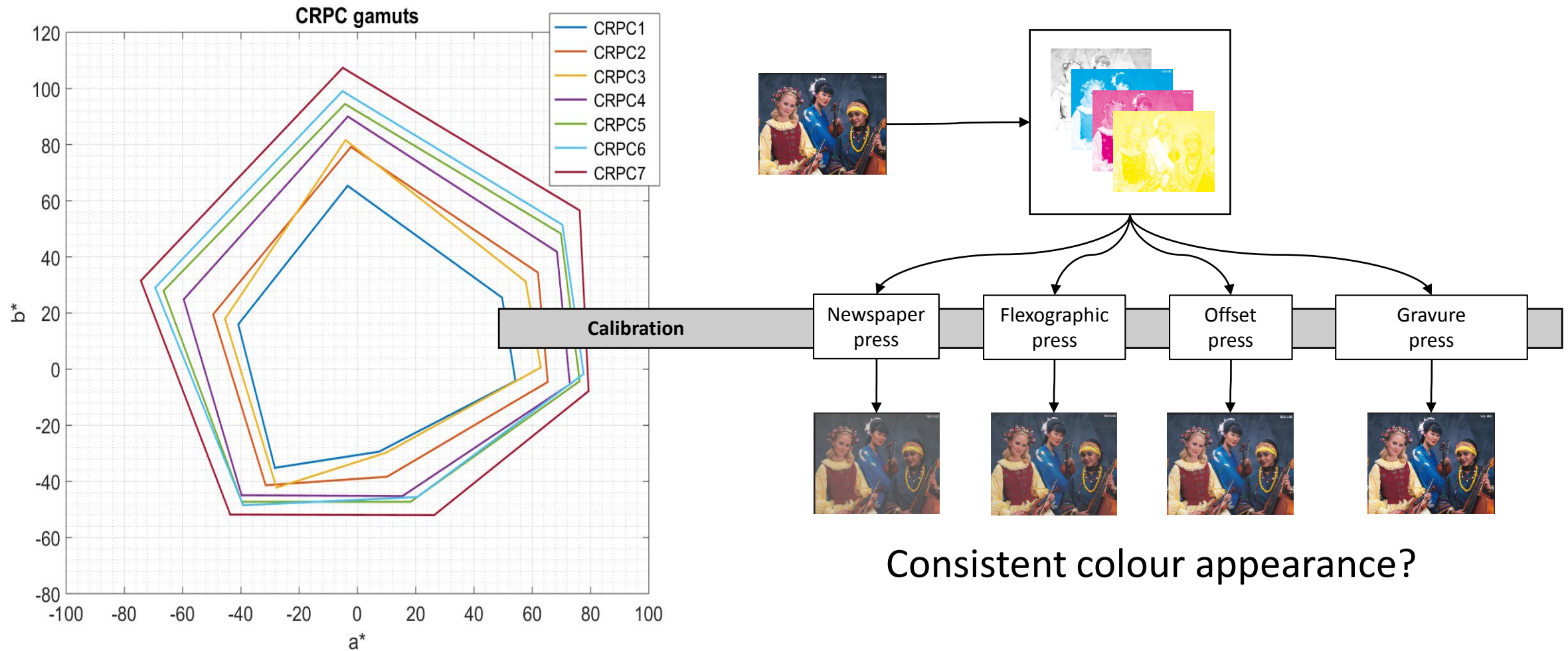


Some questions that currently have no answers:

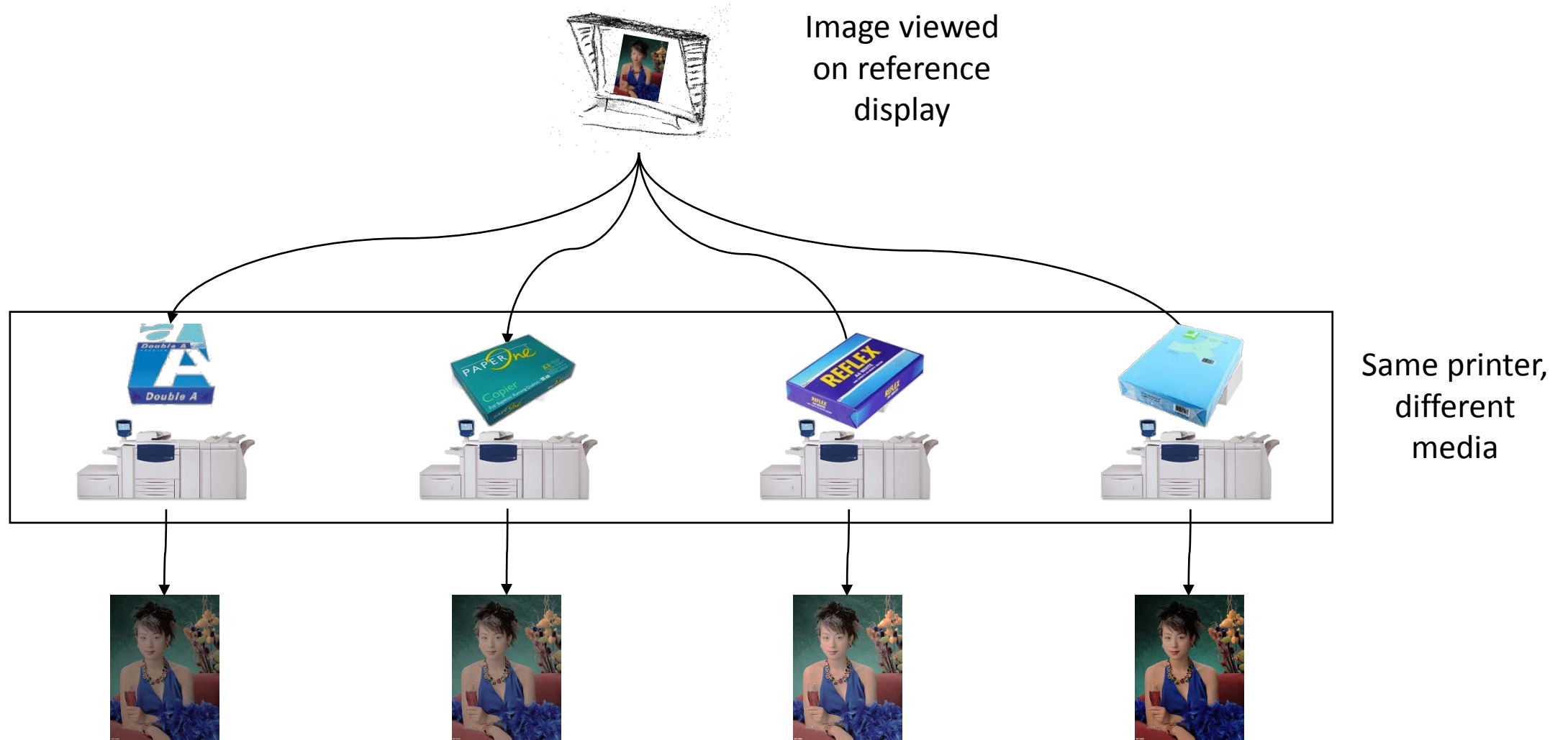
- Do all observers agree that a set of reproductions have consistent colour appearance?
- Given a set of printing systems is there a single set of reproductions that observers agree are the most consistent set?
- Does consistent colour appearance depend on image content?
- Are there regional or cultural differences that influence this choice?

Why would such a metric be
useful?

Characterised Reference Printing Conditions (ISO/PAS 15339)



Consistency across different print media



Consistent colour appearance between prints and with display image?

Flexible print (RGB) workflow



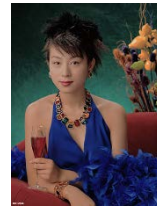
Print contract is agreed based on a **reference display image** or **reference print** from a standard digital printing system



RGB

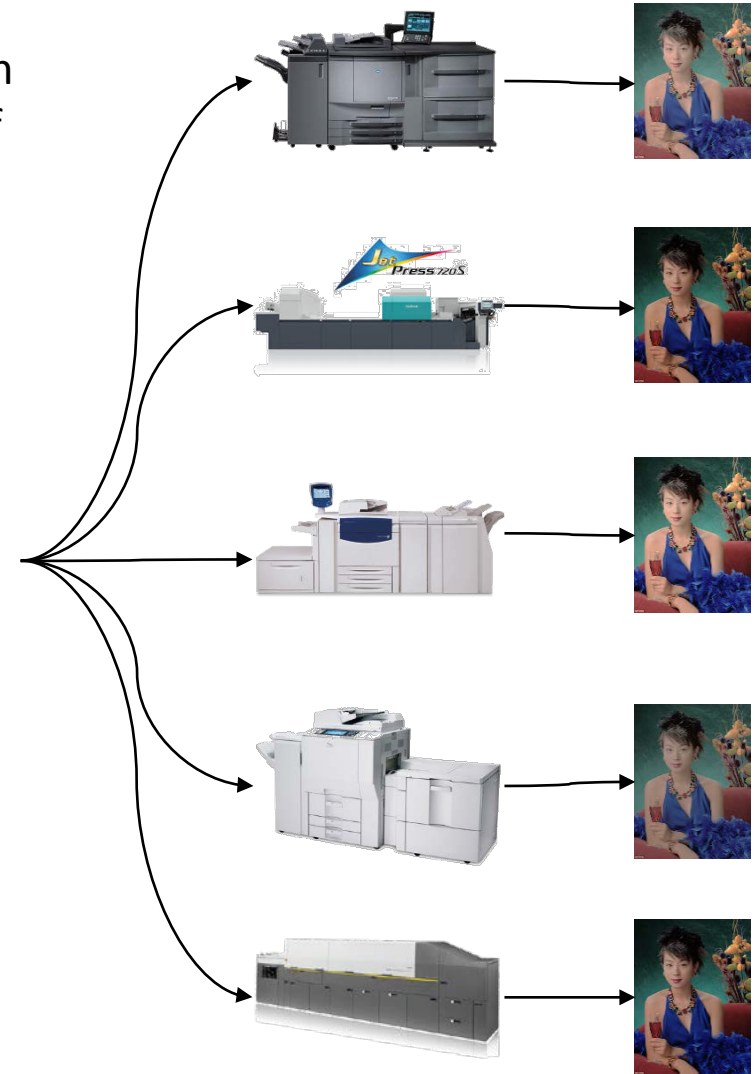


Printing should use all of the available printing gamut but must retain colour appearance of agreed reference



RGB

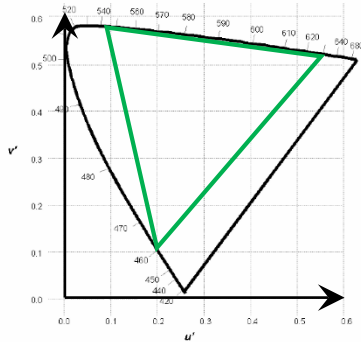
Colour conversion



Consistent colour appearance?

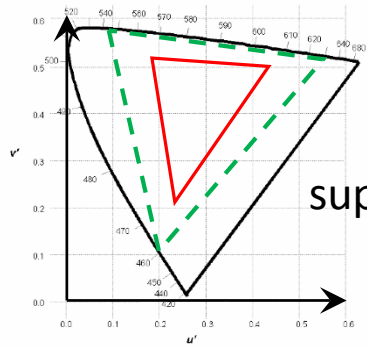
Initial target for CIE TC8-16

Consistency across displays (UHDTV)

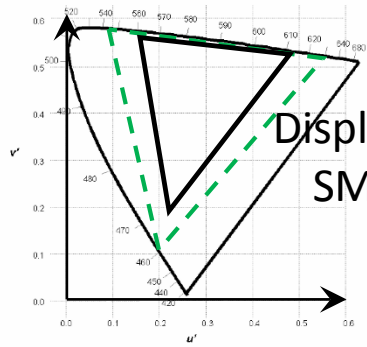


Transmitter uses BT.2020 encoding with very large colour gamut

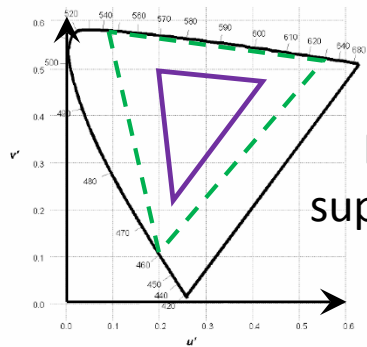
What is needed to achieve consistent colour appearance?



Display A supports BT.709



Display B supports SMPTE DCI-P3



Display C supports sRGB

Brand management



Product packaging



Magazine advert



Newspaper advert



Billboard advert



Vehicle wrap



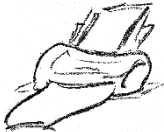
Television / internet

Assessment method
(...on a single reproduction
medium)

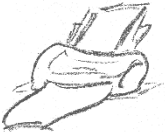
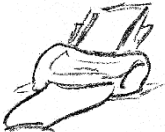
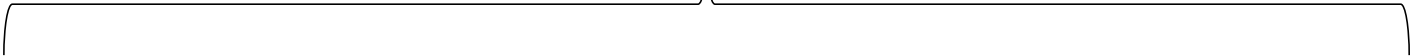
Objective: CCA of printed images



Reference Printer
Includes media, inks and printer configuration



Production Printers
Includes media, inks and printer configuration



Production Prints



Reference Prints



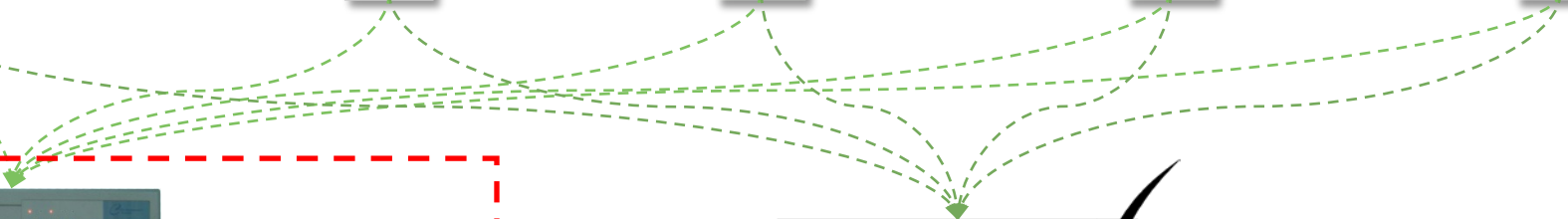
Print Visual Assessment



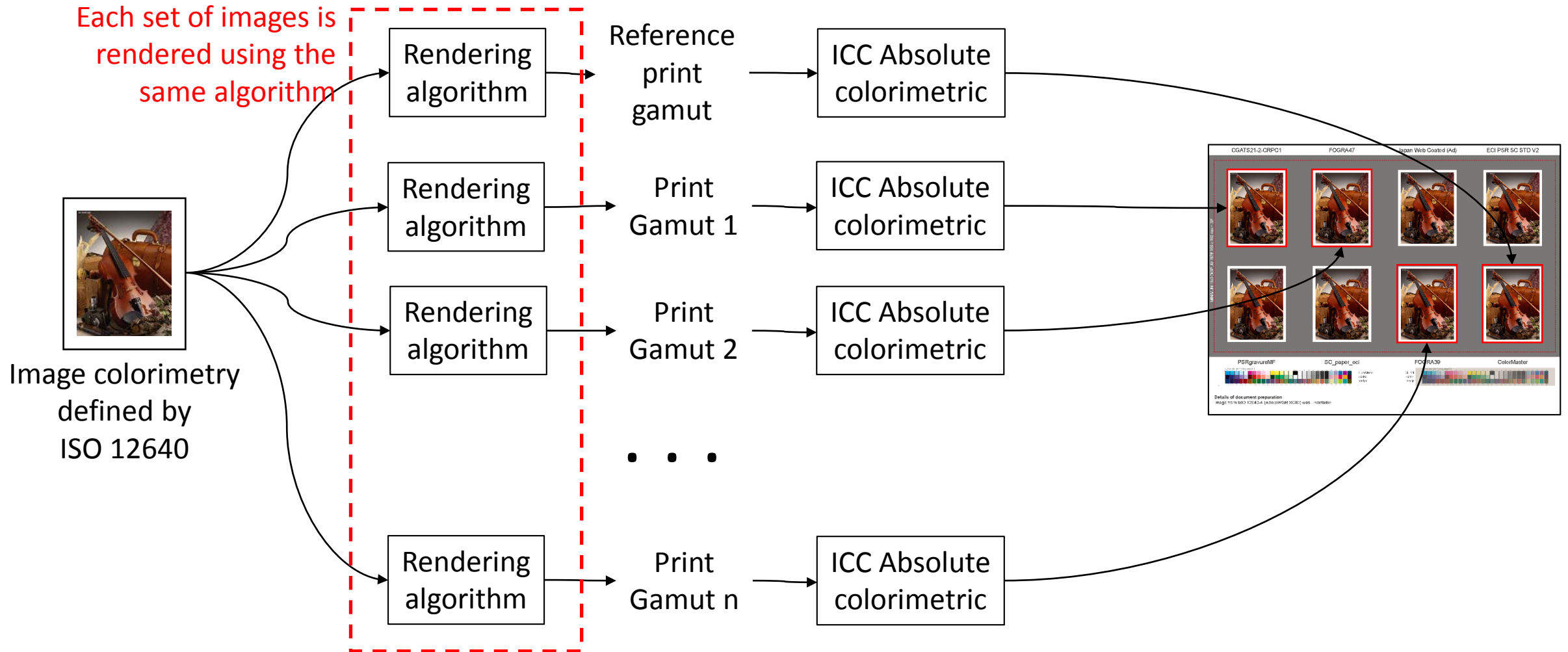
Print Viewing Environment

Print measurement and assessment

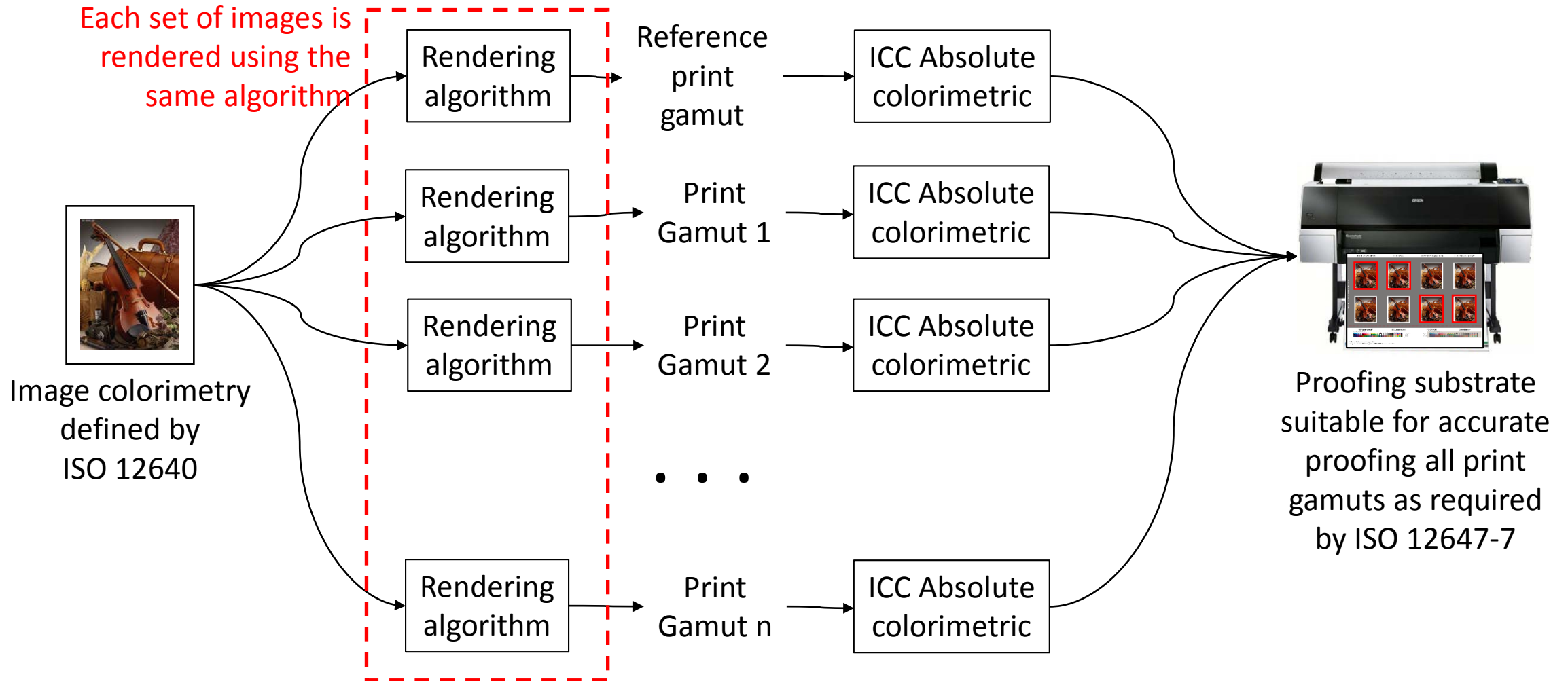
Consistent Colour Appearance Metric



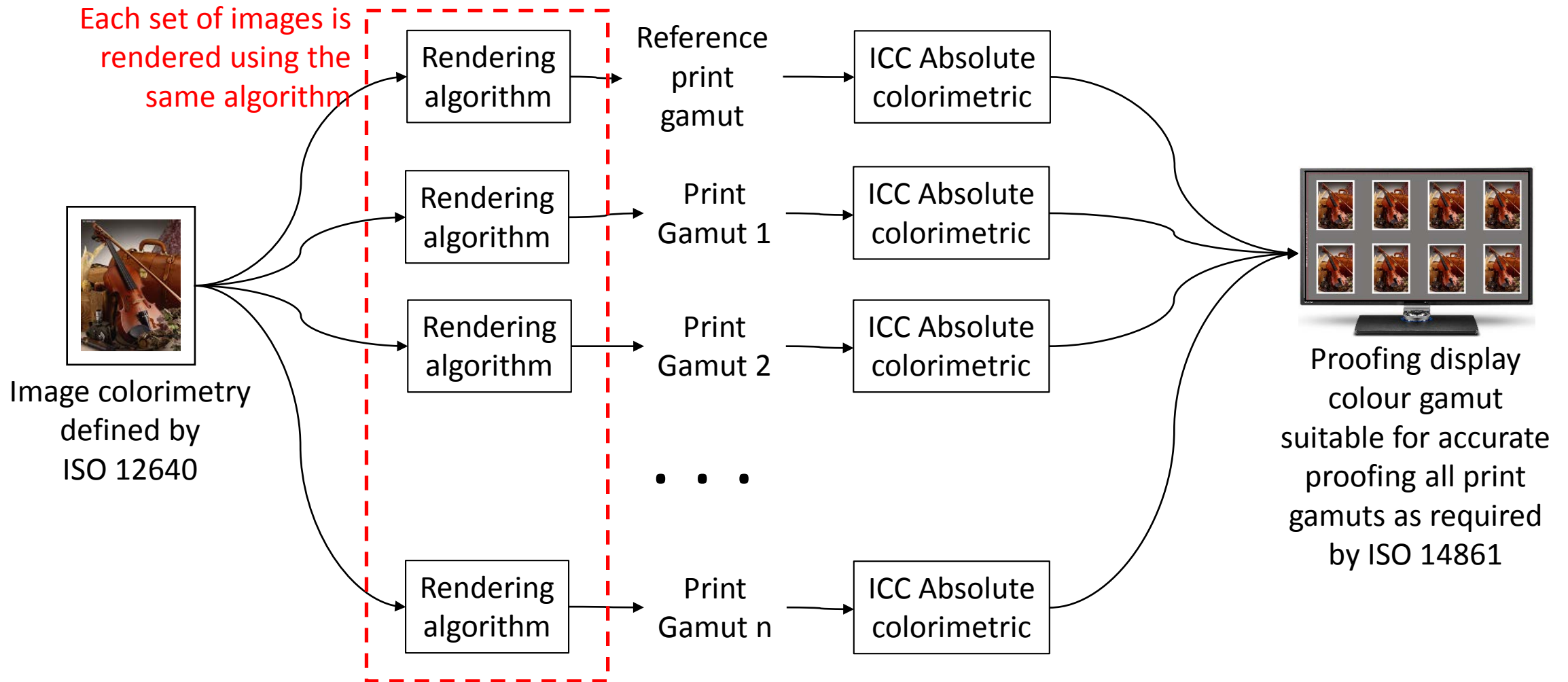
Use of print gamuts



Use of print gamuts (hard copy)



Use of print gamuts (soft copy)



Viewing environment



- ISO 3664:2009 Viewing conditions
- P2 viewing condition
- CIE Illuminant D50
- 500 lx +/- 125 lx (same as ICC PCS)

Hard copy proof



- ISO 12646:2008 Display characteristics and viewing conditions
- ISO 14861:2015 Requirements for colour soft proofing systems
- Display colour gamut must be large enough to simulate all reference print gamuts

Soft copy proof

How could this work in practice?

Flexible print (RGB) workflow



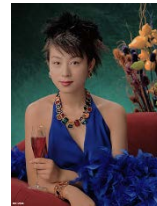
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RGB

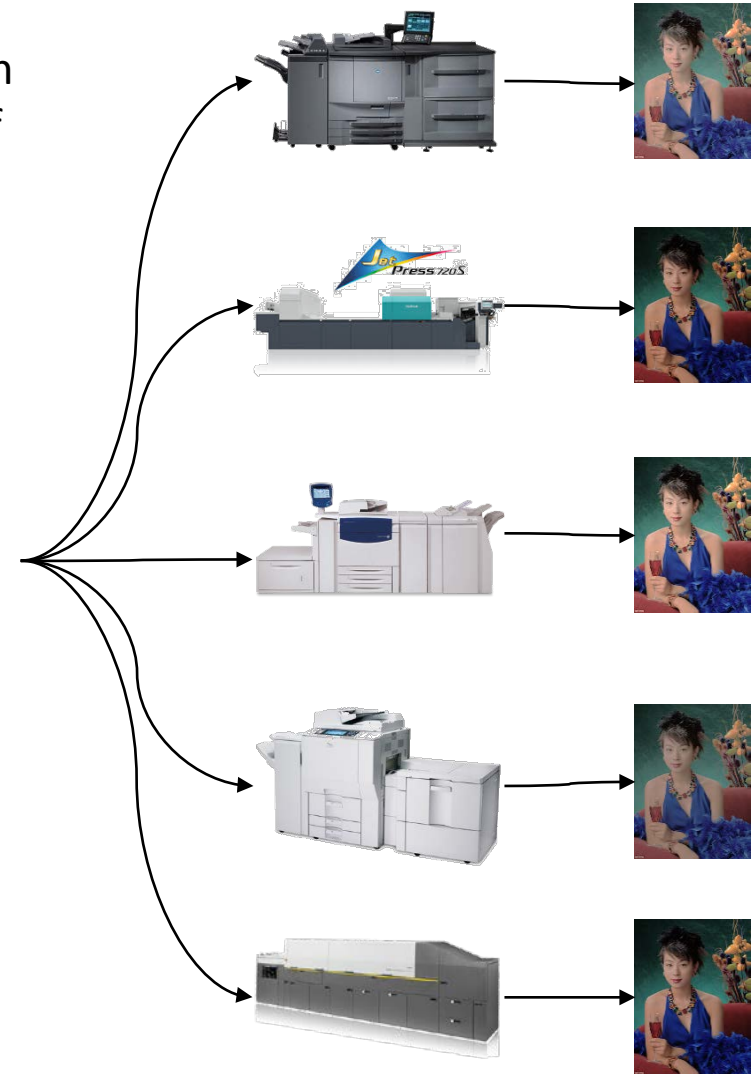


Printing should use all of the available printing gamut but must retain colour appearance of agreed reference



RGB

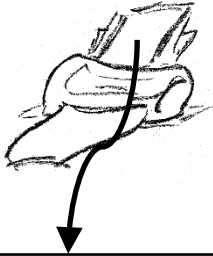
Colour conversion



Consistent colour appearance?

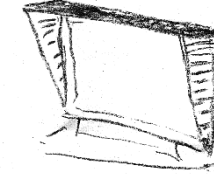
Initial target for CIE TC8-16

Reference print



Wide gamut
reference printer

Reference display image



Wide gamut
reference display

Nulla volutpat
tristique est ac
dictum.
Suspendisse
venenatis
sollicitudin justo
vitae faucibus.
Integer hendrerit
est in nisi blandit
consectetur. Cras
feugiat tellus
fermentum,
mattis purus vel,
pulvinar purus.
Nulla ut
interdum sapien.
Aenean viverra,
ex in vehicula

Lorem ipsum
dolor sit amet,
consectetur
adipiscing elit.
Donec at
scelerisque elit.
Vivamus vitae
massa vel odio.

□	□	□	□	□	□	□	□
□	□	□	□	□	□	□	□

Reference print
created using
CCA algorithm
and provided to
client as part of
contract

Reference
control patches

Reference document
created using CCA
algorithm and provided to
client as part of contract

Print buyer and print
provider use calibrated
display and standard
viewing conditions

Reference
control patches

Nulla volutpat
tristique est ac
dictum.
Suspendisse
venenatis
sollicitudin justo
vitae faucibus.
Integer hendrerit
est in nisi blandit
consectetur. Cras
feugiat tellus
fermentum,
mattis purus vel,
pulvinar purus.
Nulla ut
interdum sapien.
Aenean viverra,
ex in vehicula

Lorem ipsum
dolor sit amet,
consectetur
adipiscing elit.
Donec at
scelerisque elit.
Vivamus vitae
massa vel odio.

□	□	□	□	□	□	□	□
□	□	□	□	□	□	□	□

CCA metric compares reference control patches with control patches on production print(s) as part of acceptance procedure

Two stylized, grey, human-like figures are shown from the waist up, facing each other and shaking hands. The figures are simple, with rounded heads and thin limbs. The text "Thank you for your attention" is centered over the handshake.

Thank you for your attention