



The Norwegian
Colour and Visual Computing
Laboratory



Consistent Colour Appearance

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What is consistent colour appearance?

Set A



Set B



Source: Craig Revie, CIE TC 8-16 Consistent Colour Appearance

- **Visual consistency** across a set of images is desirable, even when exact appearance or colorimetric matches are not possible
 - Note: an **appearance match** may be different from a **colorimetric match**



Work on consistent colour appearance

- Aims to build on previous work on *gamut mapping*, *colour difference* and *image difference*
- Concerned with similarity between a suite of (print) reproductions, with or without a reference 'original'

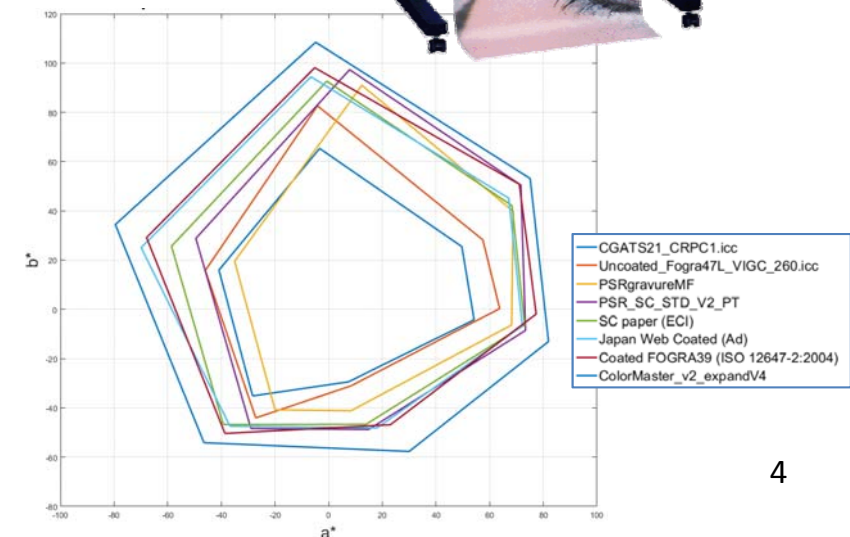


- How to assess similarity?
- Should images be judged individually or as a set?



Commercial Context – Print

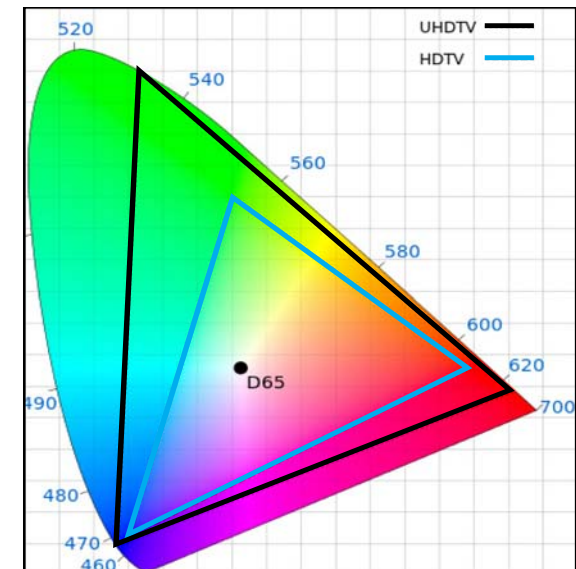
- Digital print technologies are capable of larger (and different) colour gamuts compared to traditional print processes
- There is an expectation to use the available gamut of *each* printing device
- These new technologies are expected to be used *alongside* traditional print technologies
 - e.g. printing and retargeting





Commercial Context – Display

- Challenge from new display technologies and encodings
- Rec. 2020 allows for wide-gamut colour encoding using three monochromatic primaries
- No standard method for consistent gamut mapping or appearance mapping across output devices



Source:
avsforum.com



CIE Technical Committee

- ***CIE TC8-16 Consistency of Colour Appearance within a Single Reproduction Medium***
- Chairs: Craig Revie (GB) & Yasuki Yamauchi (JP)
- Aims to develop:
 - an agreed assessment method
 - a metric of the consistency of colour appearance



Current Research Activity

- CIE Technical committee – set up in 2017



CIE Technical Committee TC8-16
Consistent Colour Appearance

- 4 research sites



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R·I·T



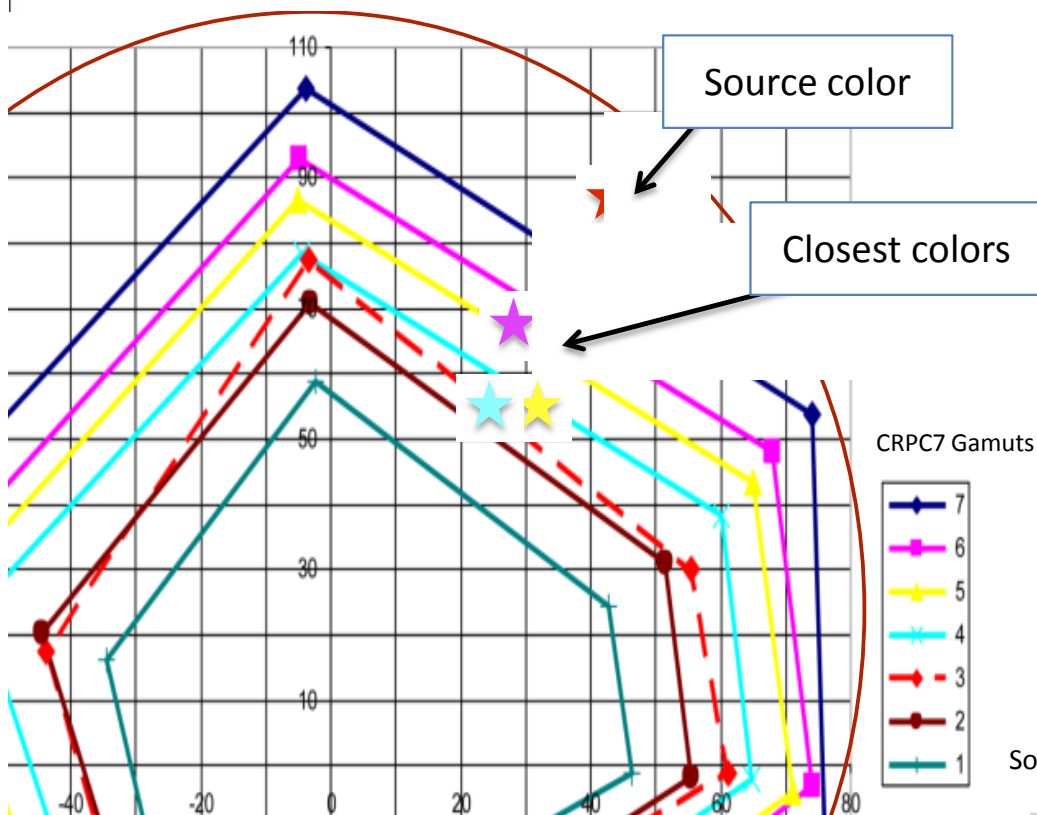
山形大学
YAMAGATA UNIVERSITY





Yamagata University, Japan

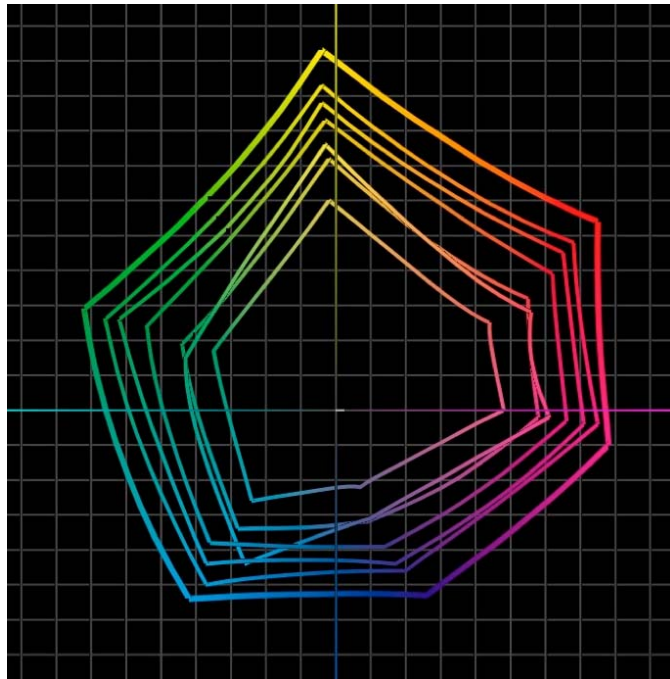
- Gamut mapping of colour patches using 'trend lines'



- Mapping to individual gamuts, but also to multiple gamuts for consistency
- Perceptual closest is not necessarily the smallest colour difference (ΔE)
- Work on colour patches to be extended to images



Rochester Institute of Technology, USA



ISO 15339-2 (2015). Seven gamuts – CRPC1 (largest) to CRPC7 (smallest) reference printing conditions.

Source: Characterized Reference Printing Conditions, ISO/PAS 15339 Graphic technology – Printing from digital data across multiple technologies

- Intrinsic commonalities in gamut shape, tonal distribution and grey balance
- Allows user to render for one CRPC, but print to another (a bit like assigning a profile)
- Primary objective: to test that Tone Reproduction and Grey Balance are underlying criteria of Consistent Colour Appearance

R·I·T



Fogra, Germany

- Evaluating common appearance through a colour naming approach (as part of Fogra project 10.057)
- Common Appearance – development of an evaluation method for colour reproductions via different output channels (from 2017 as part of Fogra project 10.059)



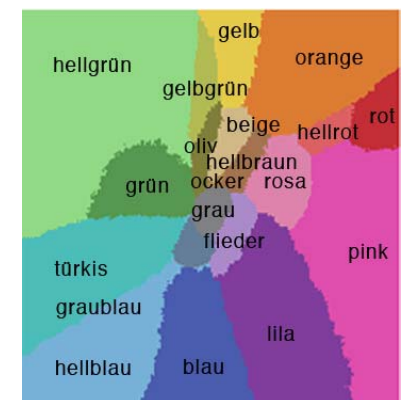
Spanish (n=16)



English (n=19)



Greek(n=18)



German (n=20)

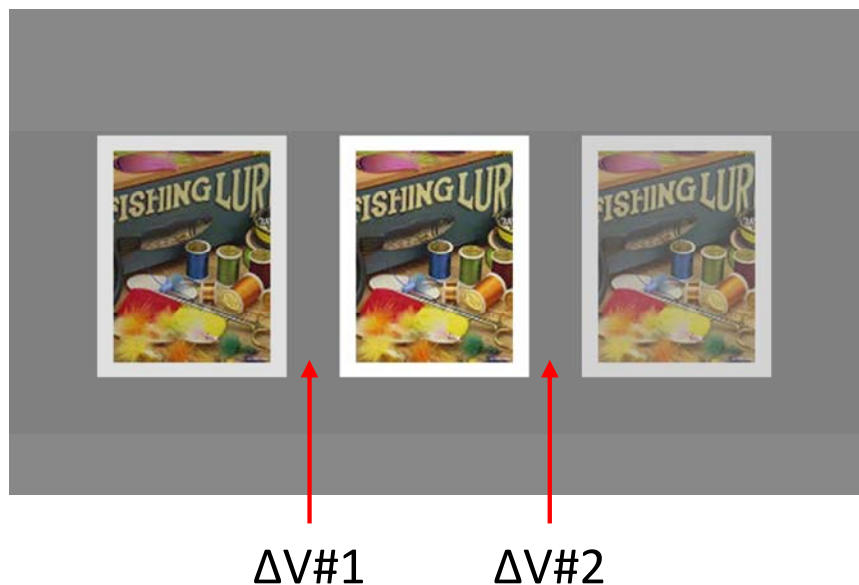
Example: Dimitris Mylonas,
Chair of Study Group on the Language of Colour, AIC
<http://colournaming.com/research>





NTNU ColourLab, Norway

- A *model of consistent colour appearance* and a *metric of visual difference*



- Testing the proposed guidelines for the CIE TC 8-16 (viewing conditions, test images, substrates, etc.)
- The scope of the project is limited to colour appearance; other appearance attributes are excluded*.



* Material appearance (gloss, texture, etc.) is addressed within the MUVApp project at NTNU Colourlab



CIE TC 8-16: candidate test images



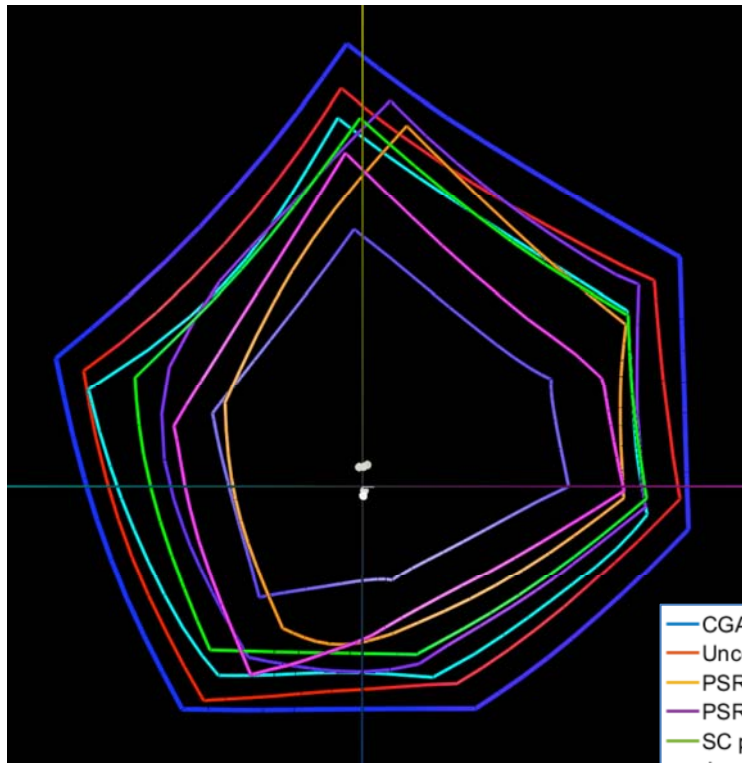
- Common images help us compare results across research sites
- Includes high chroma images that exploit wide colour gamut printers

Final image selection TBC

www.color.org/resources/r8-13/CCA_test.xalter



CIE TC 8-16: candidate print gamuts



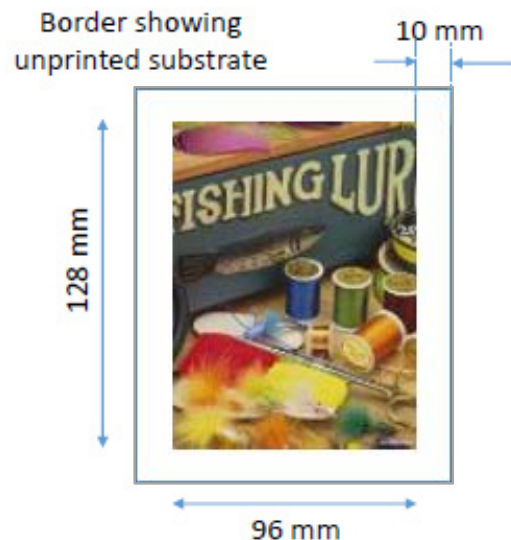
- A selection of different reference print conditions
- At least one ‘pure digital’ colour exchange space
- Differing substrate whitepoints are included (not media relative)

— CGATS21_CRPC1.icc
— Uncoated_Fogra47L_VIGC_260.icc
— PSRgravureMF
— PSR_SC_STD_V2_PT
— SC paper (ECI)
— Japan Web Coated (Ad)
— Coated FOGRA39 (ISO 12647-2:2004)
— ColorMaster_v2_expandV4





Viewing methods & viewing conditions



Munsell N5 grey
background at least
2x white margin



- Proposed method of presentation
– ideal for both printed and
display-based experiments

www.color.org/resources/r8-13/CCA_test.xalter



Support and resources at the ICC website

- Information on recommended setup:
 - Suggested test images
 - Simulated output devices (print gamuts)
 - Viewing conditions & dimensions
- Recordings & PDFs of previous events
 - Updates available as the project progresses



www.color.org/resources/consistentappearance.xalter



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Thank you for your attention

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