Consistent Colour Appearance

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What is 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*

Source: Craig Revie, CIE TC 8-16 Consistent Colour Appearance
Work on consistent colour appearance

- Aims to builds 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?

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

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

Source: Yasuki Yamauchi, Yamagata University
Rochester Institute of Technology, USA

- 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


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

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 MUVAApp 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)

www.color.org/resources/r8-13/CCA-gamuts.xalter
Viewing methods & viewing conditions

- 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
Thank you for your attention

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