Methods for Measurement of Consistent Colour Appearance

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Consistent Colour Appearance

definition

statement
Colour appearance: perception in which the spectral and geometric aspects of a visual stimulus are integrated with its illuminating and viewing environment.

CIECAM02 could be a helpful for studying on CCA.
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Measurement

Instrumental measurement
Physical property

Subjective assessment
Psychophysical experiment

Human vision perception

Colorimetry
Photometry
...

Sensory threshold
Scaling
Ranking
Matching
...

Physical property

Psychophysical experiment

Subjective assessment
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Instrumental Measurement and Modelling

Tele-spectroradiometer
Spectrophotometer

Tristimulus values CIE XYZ

Colour Appearance:
Attributes such as brightness, lightness, colorfulness, hue, etc.

Lighting condition, surrounding, observer adaptation, Viewing conditions

Lighting condition lead to difference observer adaptation; Viewing conditions require multi-angle measurements
CCA is essential for colour management on imaging, printing, textile, packaging and etc.

**Consistent Colour Appearance**

**How to achieve CCA for high quality reproduction?**
- gamut mapping,
- tone reproduction,
- colour balance,
- device characterization, and etc.

**How to measure and evaluate CCA?**
- model, metric

Images from GMG slides
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Colour gamut ➔ Colour reproduced across media with different colour gamuts ➔ Gamut mapping

Reference colour ➔ Available colour

Neutral or near-neutral colours ➔ More sensitive to these colours, it may appear different from other colours

Possible way: using CRPC closest to the device gamut and make a proof

Images from Pre-TC meeting slides
Individual colour tuning by one- or multi-dimensional colour attributes, such as lightness/chromatic contrast, hue, saturation, vividness, depth, clarity, and etc.

Image assessment
assess image appearance likelihood between image sets by rendering image appearance attributes, such as contrast, saturation, noising, sharpening or gamut mapping across media

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Subjective assessment
Assess colour closeness of images or prints by simultaneous comparison or ranking

Observation conditions:
Standard viewing geometry and illuminations
Varying viewing geometry and illuminations

Colour rendering method:
tuning by one- or multi-dimensional colour attributes, such as lightness/chromatic contrast, hue, saturation, vividness, depth, clarity, and etc.

To find out colour appearance tolerance threshold, colour trend or smooth colour appearance transitions for CCA
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Discussion

Is this image content – related?

Is this hue angle – related?

Is this device- and substrate- dependent?

Is this subject – experience related, including memory or cultures?
Thank you for your attention!
Elena Fedorovskaya (RIT) : maintain smooth transition
consider more on visual agreement more than on colour

Jan Morovic (HP) : define a ‘recipe’ first and generate a set of reproductions to understand the common factors first and then look for reliable metric

Greg High (NTNU) : viewing conditions to match real world viewing; observer adaptation to different substrates; a measure for visual similarity; gamut mapping constraints.

Mike Rodriguez : for a set of devices, choose closest CPRC to the device gamut and make a proof, but pay attention to the limitations.

Yasuki Yamauchi (Yamagata University) : a new metric that measures the difference between the test colour to an intermediate colour on the loci of colours followed hue angles
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Reviews

Standardization of assessment method
Print print gamuts
Candidate images (ISO 12640 SCID)
Printing settings for image arrangement
Image sets preparation
Fixed viewing environment ISO 3663:2000 P2
Rank sets of images on how similar, and then preferred as a set
Ask observers to creat a Champion set with best rendering for each gamut algo
CPRC definition: see ISO ***

A common colour appearance model needs to model: differences between a reference and reproduction system (substrate and context); account for different viewing modes (model known appearance effects) and predict a re-rendering and constrained gamut mapping that gives optimal colour appearance.
Elena Fedorovskaya (RIT)

We should use source or reference stimulus where each stimulus is at least two colours and should have at least three or more stimuli (reproductions) to compare against the reference. We are interested in maintaining smooth transitions between stimuli.