A model of consistent colour appearance

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Personal background

- Background in graphic design and print production
- Responsibility for colour management, proofing and pre-media in Design Studios and Advertising Agencies
- Member of UK TC-130 technical advisor group
- MSc Digital Colour Imaging in 2008 at London College of Communication
- Joined the ColourLab in November 2015

Introduction

The project objective is to build a model of
consistent colour appearance for graphic arts
and colour display applications.

The aim is to facilitate colour reproductions across
different output media that create, as close as possible,
an appearance match relative to the context and
viewing conditions of each medium.

The scope of the project is limited to colour
appearance; other appearance attributes are excluded.

Commercial Context – Print

- Digital print technologies 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

Commercial Context – Display

- Challenge from new display technologies and encodings

- Rec. 2020 allows for wide-gamut colour encoding using three monochromatic primaries

- Still no agreed method of consistent gamut mapping or appearance mapping across output devices
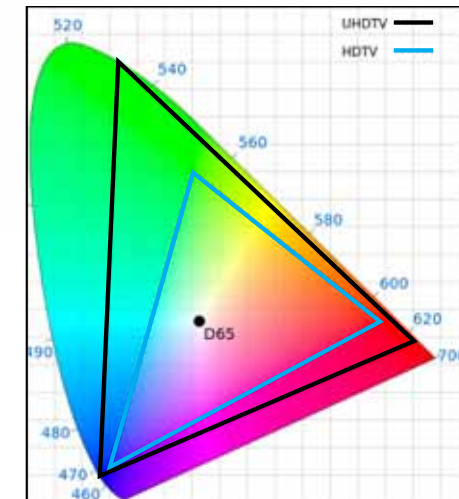
Source: avsforum.com

Current Research Activity

- CIE Reportership R8-13
  Common Colour Appearance

- Proposed CIE Technical Committee
  Consistency of Colour Appearance

Current Research Activity

- Aims to differentiate itself from previous work on colour difference and gamut mapping

- Concerned with similarity between a suite of (print) reproductions, with or without a reference 'original'

- How to assess similarity?

- Which appearance attributes to include?

Source: Craig Revie, CIE R8-13 Common Colour Appearance Focus Group

Areas of interest

- The observer's relationship with multiple images

- Mixed adaptation to substrate white points

- Lightness scaling across media

- Hue preservation and chroma scaling issues

- A metric of colour (dis)similarity

- A model of common colour appearance

The observer's relationship with images

- What makes a consistent 'set' of images?

- Gestalt-like organisation is an important parameter (proximity, similarity, continuation)

- Physical interaction with print is very different to display

Mixed adaptation issues

- Mixed adaptation to substrate white points
 or display white points

- Examine a Graphic Arts
  application of optimised
  mixed or *partial adaptation*

- Investigate *image content*
  as a parameter of colour
  appearance prediction

Mixed adaptation issues

- Paper at *Electronic Imaging 2017*

- Content-dependent substrate adaptation in a soft proofing experiment

- Work needs to be extended to include hard copy patches and images
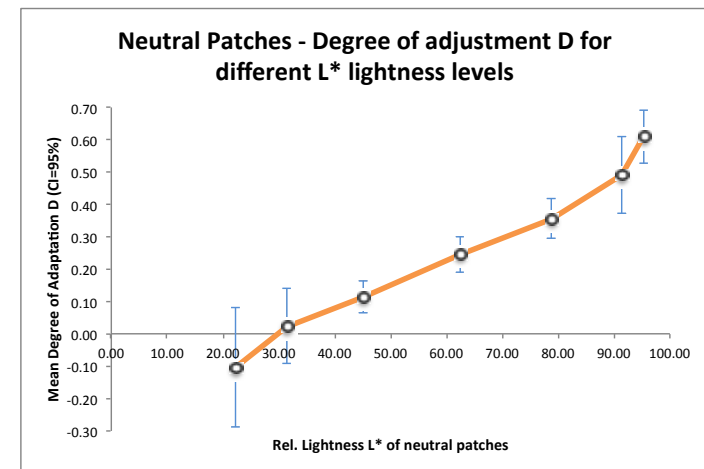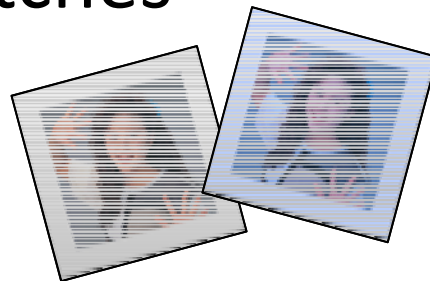
Lightness scaling issues

- Lightness scaling for reproduction images where media dynamic ranges are different

NPD vs Input Cyan Tone Value

Print Density vs Input Tone Value
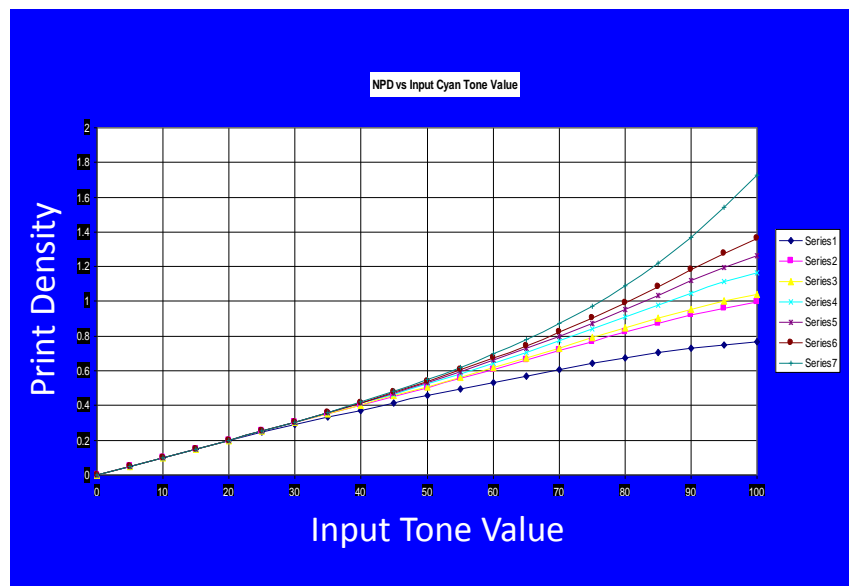
- Can lightness scaling to be optimised for *simultaneous viewing conditions*?

- Some industry preference for *harmonisation of highlights* at the expense of compressed shadow detail

Source: David McDowell, CIE R8-13 Common Colour Appearance Focus Group

Hue preservation and Chroma scaling

- Much previous work on colour gamut mapping

- Traditional print technologies have relied on *intrinsic similarities* of gamut shapes between different media to ensure similarity of appearance
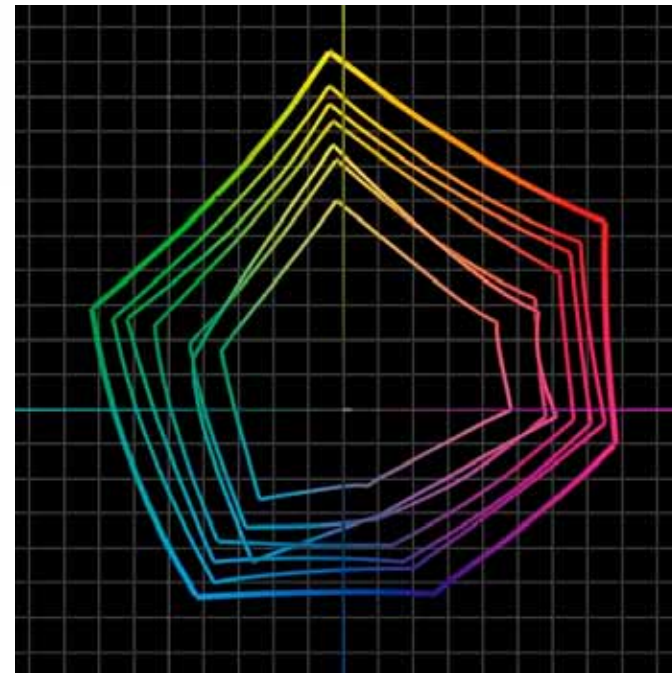
A useful metric…

- A *metric of colour appearance dissimilarity*
- Soft metrology
- Image difference
- Medium gamut constraints
- Extensible framework – other appearance attributes may be added

The model…

- A ***model of Consistent Colour Appearance***, including:
  - print application
  - display application
- Scope limited to colour appearance (other appearance attributes are excluded)

![The Norwegian Colour and Visual Computing Laboratory logo]

Thank you for your attention

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