Common Colour Appearance
– Status Update (12.11.2018)
Agenda

1. Overview and objectives
2. Fogra Common Colour Appearance experiment
3. Evaluation of CCA by means of colour names
4. Outlook / next steps
1. Overview and objectives

Does Common Colour Appearance exist?

Measuring Common Colour Appearance

Colour names and other approaches

... using already available tools (gamut mapping algorithms)

Metric for evaluation of Common Colour Appearance

Research project 10.057

QUALITY
2. Fogra CCA experiment

Decision points for colour path
I which set of pictures?
II to which RGB gamut? how?
III to which proofing system (gamut)? how?
IV back to which RGB gamut? how?
V/VI which soft- / hardproofing system?
VII using which strategy to ...
IX ... convert to which gamut? how?
2. Fogra CCA experiment
## 2. Fogra CCA experiment

### Total scores for all experiments (raw data)

<table>
<thead>
<tr>
<th>R</th>
<th>S</th>
<th>P</th>
<th>W</th>
<th>D</th>
<th>L</th>
<th>FP</th>
<th>SP</th>
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<td>720</td>
<td>485</td>
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</table>

- **Winners:** Strategy 3, 5, 6
- **Midfield:** Strategy 1, 2, 7
- **Loser:** Strategy 4

Visualisation of the ranking using the „Football Game“ method; more details in the whitepaper.
2. Fogra CCA experiment

Does Common Colour Appearance exist?

Measuring Common Colour Appearance

Metric for evaluation of Common Colour Appearance

Colour names and other approaches

... using already available tools (algorithms)

Based on our results YES
3. Evaluation of „Common Colour Appearance“ through colour naming
Evaluation of CCA

**Issue:**
Conventional colorimetry is used to evaluate colour differences, but not different colours. Due to the oversized Colour spacing classical methods are not suitable to evaluate this.

**Solution:**
Different colors are identified by different names.

Example:
Reference: Fluorescent green
Cover of a magazine: "Apple Green",
Inner part magazine: (on web offset paper) "Aquagrün" (aqua green)
Newspaper printing: "pale fern green."

Therefore development of a metric based on colour names.
Where do the colour names come from?

Color psychology experiment from Mylonas, MacDonald and Griffin:
https://colornaming.net/
### Database for colour names

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<tr>
<th>Source</th>
<th>colournaming.com</th>
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<td>Author</td>
<td>Dimitris Mylonas</td>
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<tr>
<td>Language</td>
<td>British English</td>
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<tr>
<td>Date of Data</td>
<td>Jun 14</td>
</tr>
<tr>
<td>To</td>
<td>Philipp Tröster - Fogra</td>
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<table>
<thead>
<tr>
<th>Colour Names</th>
<th>Frequency Order</th>
<th>Mean in CIELAB (sRGB)</th>
<th>Mean RGB</th>
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<td>m_a*</td>
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</table>

Tabel with 489 colour names
Colour names

Problem:
On typical CMYK color spaces there are large areas without overlapping -> counting of the color names is not goal-oriented.
Scaled colour names

Colour names are displayed in the CIE-LCh colour space. The chroma $C_{FN} = C$ of each color name is rescaled by the following rule:

$$C_{FN} = C \times \frac{C_{ref}}{C_{max}}$$
For the following steps, it makes sense to transform the colour names into a visually equidistant color space.
Voronoi diagram

Voronoi diagram or Dirichlet decomposition are available for all dimensions. Illustration here 2D.

By a given set of points a division of the space into separated regions is achieved.

Points are called centers

- Regions are characterized in such a way that each point of a region is closer to its own center than to that of the other center.

From Georgi Feodosjewitsch Woronoi (1868-1908), Russian mathematician
Voronoi diagram

Voronoi colour centres in CIE-LAB

3D Voronoi diagram in the CIELAB room. The fabnames are the centers.
Example: How to count?

- One shall be counted for the green way.
- For the brown path only very little should be counted, since the path is far away from the centre relative to the region.
Evaluation of the 7 strategies

This basic principle of counting colour names between Lab values is used for applied any gamut mapping strategy S.

\[ d_S(LAB) = \frac{\sum_D \varepsilon \text{Druckbedingungen} \Delta(LAB, S(LAB, D))}{|\text{Druckbedingungen}|} \approx \text{Anzahl traversierter Farbnamen} \]

Subsequently, it is checked whether there is a correlation to the colour psychological experiment of Fogra.

Compare with 10.057: „Concept for the colour management based data preparation and reproduction in the publishing industry“
CCA – Status Update (12.11.2018)
4. Outlook / next steps

- Further development of the evaluation method based on colour names
- Development of web-based tool for evaluation of CCA by means of CIELAB measurements of a control wedge (Fogra Media Wedge „RGB“ V3.0) → will be made available on the website
- Finalising the „official“ research project in Jan/Feb 2019

Project website
Questions?