CIE TC 1-63: Validity of the range of CIE DE2000

Year Established: 2003

Terms of reference:

To investigate the application of the CIE DE2000 equation at threshold, up to CIELAB colour differences greater than 5

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For recent publications of the TUB group see: http://130.149.60.45/~farbmetrik/XY91FEN.html

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P. Kittelmann published his thesis in 2010 with the following title:
Visual Assessment of Small and Large Colour Differences and Description with Colour Difference Formulas
(only in German with english abstract)
Berlin University of Technology, Faculty IV, Electric technology and Informatics, see the URL (132 pages, 6,3 MB, PDF format)

http://opus.kobv.de/tuberlin/volltexte/2010/2634/

This publication of *Kittelmann* includes the following abstract:
In the experimental part of this work 40 test persons have determined visual colour thresholds and large colour differences. The experiments were done for surface colours with an illumination of the CIE standard illuminant D65, for the 2° CIE standard observer and for adjacent colour samples. The CIELAB, the CIEDE2000 and other colour formulas were tested.

The colour assessment experiments differ in important points compared to other experiments. By a new optical colour mixture method an exact determination of the colour threshold was possible, and not only the range in which the colour thresholds are located. Problems of the experimental data by borderline or gloss effects of the adjacent samples are excluded.

For the investigation of the large colour differences with a CIELAB colour difference $\Delta E^*_{ab} > 10$ two known research methods are combined to a new one which is independent of a reference, and which may influence the results.

Threshold for adjacent samples

For the colour thresholds and for adjacent samples the average colour difference data are 0.417 for CIELAB and 0.308 for CIEDE2000. For the colour thresholds, and with both colour difference formulas the correlation is by about a factor 2 worse compared to the large colour differences.

Weighting factors red-green and yellow-blue:

Therefore the colour difference formulas CIELAB and CIEDE2000 are not applicable to describe colour thresholds. However, by reduction of the parameters for the red-green a^* and yellow-blue chroma b^* by a factor 2 and 6 compared to the lightness, the threshold results may be described approximately.

Geometric distance of samples:

For the colour thresholds and a small geometric distance (~ 0.5 mm), and a grey colour between the colour samples the CIELAB colour difference increases by a factor 2.4 to 3.5 depending on the reference colour. For a geometric distance larger than 2.0 mm the CIELAB colour difference reaches a saturation value which is by a factor 2.8 to 4.0 larger.

Large colour differences

For the investigation of the large colour differences with a CIELAB colour difference $\Delta E^*_{ab} > 10$, the CIELAB formula shows an insignificant better correlation between the visual assessment and the colorimetric calculation compared to the CIEDE2000 formula.

Key words: color difference, CIELAB, CIEDE2000, color threshold, surface colors, colorimetry

In February 2011 there was a meeting of several members of TC1-63 in Berlin. It was agreed that the final CIE Technical Report of TC1-63 shall include the following chapters:

1. **CIE TC1-63: Terms of Reference**
2. **Test charts and CIELAB data for the study of large colour differences.**
3. **Results from different countries** (DE, ES, CZ, GB).
4. **Standard deviation and correlation in term of stress values.**

5. **Results for small colour differences** (Kittelmann, Witt, Melgosa, Luo, Roseman, ...)**.**
6. **Standard deviation and correlation in term of stress values.**
7. **Conclusions.**
8. **Literature.**