COMMISSION INTERNATIONALE DE L'ECLAIRAGE
INTERNATIONAL COMMISSION ON ILLUMINATION
INTERNATIONALE BELEUCHTUNGSKOMMISSION

ACTIVITY REPORT
DIVISION 8

IMAGE TECHNOLOGY

February 2010

Division Officers:

Director: Dr. Sabine Süsstrunk CH

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The officers can be contacted via the Division 8 web sites: http://div8.cie.co.at/

Division Terms of Reference:

To study procedures and prepare guides and standards for the optical, visual and metrological aspects of the communication, processing, and reproduction of images, using all types of analogue and digital imaging devices, storage media and imaging media.

This activity report represents an overview of the status of CIE Division 8 – Image Technology at the beginning of 2010.

The Division aims to work primarily by electronic means in order to make efficient progress. This method of working has proved worthwhile and good progress is being made in several areas.

Since its inauguration in September 1998 at a CIE Meeting held in Baltimore, US, the Division has held meetings in Warsaw, Poland (1999), San Diego, USA (2003), and Bejing, China (2007) as part of the CIE Quadrennial meeting. Meetings have also been held in association with the IS&T/SID Color Imaging Conferences each year.

There follows a summary of the status of each of the committees in Division 8 – Image Technology.

R8-08 Image Appearance Model Framework, M. Fairchild (US)

Established: 2008

Terms of Reference:

To publish a report on a framework for still image appearance modelling with example implementations of the each module in the framework. Such modules include the chromatic adaptation transform, spatial contrast sensitivity functions, color space selection, color difference equation, statistical summary of image difference maps, tone mapping techniques, and spatial adaptation mechanisms.

Progress Report:

For various reasons, no significant progress was made in the preparation of this report. However, some of the fundamental research that will contribute to it (in particular better color difference equations) has moved forward and should be published within the coming year. This will allow the framework report to be drafted. The goal is now to complete a first draft by the end of 2010.

TC8-02 Colour Difference Evaluation in Images

Established: 1998

Terms of Reference

To study, develop and recommend methods to derive colour differences for images.

Chairman: M R Luo (UK) m.r.luo@leeds.ac.uk

TC Members

P. J. Alessi	USA
M. D. Fairchild	USA
G. G. Field	USA
J. Gibson	USA
B. Hill	Germany
G. Johnson	USA
M. C. Lo	Taiwan
M. R. Luo	Great Britain (Chair)
D. McDowell	USA
M. Mahy	Belgium
M. R. Pointer	Great Britain
O. da Pos	Italy
B. Rigg	Great Britain
M. Stokes	USA
K. Takemura	Japan
J. Uroz	Spain
J. A. S. Viggiano	USA
H. Yaguchi	Japan

Progress Report

The latest version of the TC 8-02 Technical Report "Methods for deriving colour difference images" was revised and submitted on the 10th of November 2009. It is in the BA and DIV ballot stage. The feedback has been received on the 8th of February with further suggestions to changes.

It is aimed to complete the revision in the first half of 2010.

TC8-07 Multispectral Imaging

Established: 2004

Terms of Reference

To study, develop, and recommend encoding techniques and data formats for the exchange of multispectral images, and to provide test procedures for the evaluation of multispectral imaging systems.

Chairman: Markku Hauta-Kasari (Finland), markku.hauta-kasari@joensuu.fi

TC Members

Roy Berns	RIT, USA
Chris Cox	Adobe Systems, USA
Max Derhak	Onyx Graphics, USA
Jon Yngve Hardeberg	Gjøvik University College, Norway
Patrick Herzog	Onevision
Bernhard Hill	RWTH Aachen University, Germany
Po-Chieh Hung	Konica Corp, Japan
Francisco Imai	RIT, USA
Timo Jaaskelainen	Univ. of Joensuu, Finland
Reiner Lenz	Linkoping University, Sweden
Yoichi Miyake	Chiba University, Japan
Todd Newman	Canon Development Americas, USA
Jussi Parkkinen	Univ. of Joensuu, Finland
Rajeev Ramanath	North Carolina State University, USA
Mitch Rosen	RIT, USA
Rulon Simmons	Eastman Kodak Co., USA
Masahiro Yamaguchi	Tokyo Institute of Technology, Japan
Fumio Nakaya	Fuji Xerox, Japan
Javier Hernandes-Andres	Univ. Of Granada, Spain
Ellen Carter	USA
Peter Morovic	HP
Norimichi Tsumura	Chiba University, Japan
Hideaki Haneishi	Chiba University, Japan
Stephen Helling	Aachen, Germany

Web page: www.multispectral.org

Meetings

The 2009 TC8-07 meeting was held in SCIA2009, Oslo, Norway, on June 17, 2009.
The next physical meeting will be held in CGIV2010 (June 14-18, 2010) in Joensuu, Finland.

Progress Report

The TC work covers the following:

Spectral test sets

- Data sets for simulation and testing
- Definition and fabrication of an experimental spectral test chart
- Test chart of pairs of metameric colors

Definition of sets of color matching functions for typical human observers to be used in multispectral imaging systems for the definition of observer metamerism

Encoding of multispectral image data

- Linear encoding and quantization
- Nonlinear encoding and quantization
- Mixed spectral and spatial encoding

Definition of data formats for the exchange of multispectral image data

Recommendations for the definition of quality of a multispectral system and test procedures
Publications

A TC meeting was held in conjunction with SCIA2009. At that meeting Markku Hauta-Kasari introduced the status of the Technical Report preparation for the definition of the multispectral image format. He has the forms from CIE and is contacting the groups who proposed spectral image formats to begin writing the technical report.

In addition to the multispectral image format, the TC is now working with the primary task of the Terms of References: Spectral test sets. The plan is to collect data in a spectral image database which can then be used as a test database in various research tasks and which can be referenced as a test set in publications. The chairman is formulating a detailed proposal on the process for this task.

TC8-08 Spatial Appearance Models

Established: 2005

Terms of Reference

To study high-dynamic range imaging and to provide methods and examples for evaluating spatial appearance models for such images.
The priorities are to provide the community with techniques for testing and improving existing algorithms, as well as providing a repository for hosting HDR images and tone-mapped versions (as well as experimental results) of said images.

Chairman: G Johnson (US), gmj@mac.com

Progress Report

The goals of this TC center around developing guidelines for testing high dynamic range image rendering. This will include:

- Establishing Standardized HDR Vocabulary
- Summarize State-of-the-Art HDR Experimentation
- Provide Recommendations for Future Visual Experimentation Techniques

The standardized vocabulary is necessary because of:

- Distinct differences between bit-depth and HDR
- Distinct differences in HDR rendering intent:
  maximize visibility, pleasant reproduction, color appearance matches, contrast matching, etc.
- Akin to the color appearance vocabulary:
  brightness v. lightness, chroma v. colorfulness, etc.

Current research topics are:

- Provide an up-to-date reference of existing HDR experimentation
- Techniques used in existing experimentation: ranking, magnitude estimation, paired comparison
- Comparisons to original scenes, or using HDR displays as an original? Are there differences?
- Note that qualifying the display that will be used to evaluate the images is critical to this work. If the display itself is limited then HDR judgment will be impaired.

Online discussion forum implementation is underway, but still with some glitches. The TC submitted an HDR course for SIGGRAPH that would be highly appropriate. Contributing work has been collected for the vocabulary section, which is the main section.

TC8-09 Archival Color Imaging

Established: 2005

Terms of Reference

To recommend a set of techniques for the accurate capture, encoding and long term preservation of colour descriptions of digital images that are either born digital or the result of digitizing 2D static physical objects, including documents, maps, photographic materials and paintings.

Chairman: R Buckley (US), Robert.Buckley@xerox.com

TC Members

Sergey Bezryadin	US
Barbara Bridgers	US
Melitte Buchman	US
Robert Buckley (Chair)	US
Ellen Carter	US
Carl Fleischhauer	US
Ken Fleisher	US
Franziska Frey	US
Chris Gallagher	US
Scott Geffert	US

Pasco Izzo	US
Jim King	US
Mark McCormick-Goodhart	US
Alan Newman	US
Doug Nishimura	US
Stephanie Ogeneski	US
Steve Puglia	US
David Remington	US
Mitch Rosen	US
Yosi R-Pozeilov	US
Michael Stelmach	US
Maja Strgar	HR
Sabine Susstrunk	CH
Hans van Dormolen	NL
Barry Wheeler	US
Maura White	US
Don Williams	US
Geoffrey Woolfe	AU
Yasuki Yamauchi	JP

Web page http://div8.cie.co.at/?i_ca_id=621&pubid=337

Meetings

2009 – May 4, Washington, DC
2010 – TBD

Progress Report

The TC is collaborating with the US Federal Agencies Digitization Guidelines Initiative, which is a collaborative effort to establish guidelines for the digitization of static visual materials by agencies of the US government. Several members of this initiative are TC members.

In early review of the results from the survey conducted in 2009, the committee recognized that one encoding will not meet the needs of all use cases and content types. Rather than focus on one particular use case and content type combination, the committee will review a range of encoding methods, including spectral and tristimulus based methods, and discuss the applicability, practicality and risk of each in digitizing originals for use cases from the cultural heritage community.

Working with the Still Image Group of the Federal Initiative, the committee initially is concentrating on practical solutions that concentrate on existing RGB and other tristimulus-based methods to encode the data from imaging content in a manner that has a known accuracy, can create an accurate representation of the object when displayed, and where the encoding model is sustainable. A table comparing evaluations of Raw, XYZ, LAB and various RGB encoding exists in draft form.

Publications

Two conference papers were presented on the TC work in 2009.
CIE TC 8-09, *Color Imaging in the Cultural Heritage Community,* ISCC Annual Meeting, June 7, Rochester, NY.
CIE TC 8-09, *Digital Color Preservation and the CIE Committee on Archival Color Imaging,* AIC 2009, October 1, Sydney, Australia.

TC8-10 Office Illumination for Imaging

Established: 2005

Terms of Reference
To report on the spectral power distribution and illuminations levels used to view images in office lighting conditions. The report is to be based on empirical research.

Chairman: Y Yamauchi (JP),

TC Members

Yasuki Yamauchi (Chair)
Masao Aizu
Jordi Arnabat Benedicto
Ellen Carter
Andrew Chalmers
Guihua Cui
Phil Green
Fumio Nakaya
Todd Newman
Ann McCarthy
Danny Rich
János Schanda
Jennifer Veitch
Hirohisa Yaguchi
Eric Zeise

(Observers)
Anthony Calabria
Jack Holm
Marc Mahy

Web page (under construction)

Meetings

Previous TC meeting was held on 11 Nov. 2008 in Portland, OR.
Next TC meeting will be held on 17 Mar. 2010 in Vienna, Austria

Progress Report

A reference light source fixture, for use in comparing measurements to the common reference, has been constructed and circulated to test locations in US, Europe, and Asia. A detailed experimental procedure to use for measuring office illumination characteristics has been written and used in a US, European and Asian locations. The data collected so far has been evaluated with the result that confidence is gained in the measurement procedure and in the value of the reference light source.

Since the Chair of TC changed from Todd Newman to Yasuki Yamauchi at the last Division Meeting 2008, the list of the TC members was checked to keep the active members. As a result, the number of the TC decreased from 20 to 15.

Circulation of the reference light source was re-scheduled, and it completed after getting 4 new data in US/Canada, 6 in EU (Switzerland, Netherland, France and Germany). Oceania and Africa are the last two world areas that are not measured. As for the measurement in Oceania, it is going to be scheduled. As for the measurement in Africa, the Chair is planning to contact the CIE President.

Discussion on how to analyze the data has been started. Due to the Chair's unexpected move from industry to academia, the activity of TC has been unfortunately slowed down. The initial trial for categorizing the data into several groups has been done, and it was reported in Green's talk at AIC, but it has not discussed in detail.

Moreover, no progress has been made in how to use the measurement data obtained with a reference light source. It is assumed that the same light source, which served as a standard, should always emit consistently, it is possible to calibrate each measurement instrument by compensating the data. Unfortunately, the idea how to do it has not discussed so far.

Publication

One conference paper was presented on the TC work in 2009.
Green P, Yamauchi Y, and Schanda J, *Progress in the Measurement of Office Illumination*, AIC 2009, September 28, Sydney, Australia.

TC8-11 CIECAM02 Mathematics

Established: 2007

Terms of Reference

To investigate the improvements to the CIECAM02 model to avoid mathematical inconsistencies.

Chairman: C. Li (UK), C.Li@leeds.ac.uk

TC Members

Michel Brill	DataColor
Mark D Fairchild,	Rochester Institute of Technology
Youngshin Kwak	Samsung Advanced Inst. of Tech.
Changjun Li (Chair)	University of Leeds
M Ronnier Luo	University of Leeds,
Nathan Moroney	HP
Sabine Süsstrunk	EPFL
Francisco Miguel Martínez Verdú	University of Alicante

Meetings

TC8-11 held an open meeting in Albuquerque during CIC17 2009.
The next TC8-11 meeting is tentatively planned in conjunction with CIC18 meeting (November 2010).

Progress Report

At the fall 2009 meeting, the Chair of Changjun Li gave an overview of the history of the committee, including the work of Gill, Süsstrunk, and Brill. Then, M. Mahy gave a presentation on the feasibility regions in chromaticity space for test and reference colors under various conditions.

The following was decided as the way forward:

1. A new version of CIECAM02 with the HPE primaries used in place of any version of CAT02 should be vetted. Then, the documentation of the model should be rewritten to reflect the simplification. (Several matrix operations will go away.)
2. The corresponding-color data sets that were used to validate CAT02 should be compared with the predictions of HPE-based chromatic adaptation to discover how much change is made in prediction quality relative to CAT02.
3. Graeme Gill's CIECAM02 modifications should be reviewed and tested. Starting from any point in the valid domain (inside the spectrum locus), if one uses HPE adaptation, one will never encounter most of the pathologies noted by Gill. However, the model may still benefit from Gill's repair of the post-adaptation infinite-slope problem:

The present goal is to develop an interim standard until further improvements can be made. Specifically, the two remaining issues are anticipated to be:

1. Improving the robustness of the revised appearance model to the use of arbitrary range points such as might be commanded in a color-management system.
2. Improving the predictive accuracy of the chromatic adaptation model.

Publication

One conference paper was presented on the TC work in 2009.
Li C, Chorro-Calderon E, Luo MR, and Pointer MR, "*Recent Progress with Extensions to CIECAM02*," CIC17 2009, November 9-13, Albuquerque, New Mexico.

TC8-12 Video Compression Assessment

Established: 2007

Terms of Reference

To establish and report on the display and viewing conditions and materials for video compression quality evaluation in different applications including, but not limited to, web, mobile phones, HDTV, home cinema and digital cinema.

Chairman: Ch. Fernandez-Maloigne (Fr), fernandez@sic.sp2mi.univ-poitiers.fr

TC Members

C. Larabi	University of Poitiers, France
R. Luo	University of Leeds, UK
L. Gloetzer	Technische Leitung, Switzerland
M. Mahy	Agfa Gevaert, Belgium
D. Nicholson	Thalès, France

S. Süsstrunk	LCAV and EPFL, Switzerland
France Telecom	France
Enensys	France

Progress Report

The overarching project name is HAVPQoS (End-to-end Hybrid Audio-Video Perceived Quality of Handheld Services).

The project is addressing the following key issues:

- Scalability.
- Audio–Video coding, adaptation and transcoding.
- IPMP and digital right management.
- Network QoS to Perceived QoS mapping
- End-to-end Perceived QoS (subjective test methodologies and objective implementation).

In the near future, mobile applications and services are expected to become the main revenue sources of content providers and network operators. The magnitude of this scheduled transition, however, depends on the ability to efficiently control and manage the end-to-end system. This complete management includes, but is not limited to, efficient coding of audio-video content, scalability for storage and transmission, transport over heterogeneous networks, security of content and perceived quality at user terminals. The HAVPQoS project covers the entire broadcast chain and proposes a new and complete end-to-end prediction and monitoring audio-video perceived quality assessment for mobile environments.

To efficiently manage the multimedia content throughout this overall architecture, the project needs three phases. In the first phase a complete and open platform is developed for the production of multimedia (audio-video) content and its delivery to handheld devices via mobile wireless and broadcast networks. Various distinct technologies will be deployed leading to several configurations of content creators, A/V encoders, digital rights management, transcoders, network operators, services providers and user terminals.

The second phase will focus, for each of the previous configurations, on the technical issues associated with subjective experiments. End-users preferences and expectations play a major role in the service quality assessment. Therefore, the experimental techniques used to validate the end-to-end management must be carefully defined. Up to now, no valid procedure that assesses the perceived quality of services in mobile environment exists. In this context, where all remains to do, HAVPQoS Project phase 2 aims to specify the appropriate material and the accurate experimental protocols, with context-adapted assessment methodologies.

The third and last phase of HAVPQoS deals with the design and development of a framework that enables the objective prediction and control of the end-to-end perceived quality of the delivered services in mobile environment. The basic principle of these metrics is to emulate the behaviour of the end users in order to achieve their expected reaction and accurately predict subjective quality ratings of phase 2. To reach this goal, there is a need to define new performance indicators at various monitoring points and to evaluate the impact (contribution) of each component in the broadcasting chain (to the end user perception).

Technically, HAVPQoS project is structured in 6 work-packages.

WP1 "Project management," aims to provide an efficient project management at all levels.
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WP2 "Scalable content coding and Right management," focuses on scalable encoding that will enable content adaptation and distribution based on provided services and various user conditions.

WP3 "Content delivery (transmission and transport) over heterogeneous networks" focuses on scalable content delivery (distribution?) and resources management based on the perceived quality at the user level.

WP4 "Content display on various handheld devices" focuses on the variety of terminals to be used for content display.

WP5 "Subjective tests platform and experiments methodologies" focuses on subjective assessment tests which represent the most efficient way to estimate perceived quality of a service.

WP6 "Assessment quality metrics development" focuses on the estimation of the end-user Audio/Video perceived quality of handheld services provided over different networks.

WP7 "Dissemination and standardisation" deals with the dissemination of HAVPQoS results to main exhibitions and standardisation organisms.

As HAVPQoS deals with the end-to-end broadcast chain, impacts are expected on the general market of the next generation of handheld services. More specifically, at the service provider level, the reduction of the service cost induced by both scalability aspects and adaptation issues will contribute to the generation of new and innovative services for the market. Other impacts at this level are the significant improvements expected in advanced scalable video coding standards induced by the user preference integration in the rate-distortion process.

At the broadcasters and network operators level, HAVPQoS will offer, by mean of network QoS to perceived quality mappings, more transparency in the performance of the various nodes of the whole architecture (framework), stimulating in this way a rapid development of more efficient technologies.

Finally, at the end user level, HAVPQoS end-to-end perceived quality management will enable users to select and pay for a guaranteed service quality. The IPMP and DRM provided solutions will enable users to get more enhanced and secured services leading to new e-business activities.