

**PRELIMINARY
PROGRAM**

CGIV 2006

**3rd European Conference
on Colour in Graphics,
Imaging, and Vision**

**University of Leeds
United Kingdom
June 19-22, 2006**

Cooperating Societies

The Color Group (Great Britain)
Colour Group of South Africa
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Deutsche Gesellschaft für Angewandte Optik, DGaO
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French Color Imaging Group
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Conference Overview

The Third European Conference on Colour in Graphics, Imaging, and Vision (CGIV) will be held at the University of Leeds, United Kingdom, on 19-22 (Monday–Thursday) June 2006. On behalf of IS&T and the CGIV 2006 committees I would like to invite you to attend this exciting event.

CGIV 2006 builds on two preceding conferences: CGIV 2002 (Poitiers, France) and CGIV 2004 (Aachen, Germany). Some particular highlights of this year's programme follow:

- First, we received a record-breaking 190 paper submissions, of which slightly more than half were accepted by the expert review committee. The rigorous review process ensures that the conference will offer presentations of the highest technical quality.
- CGIV2006 is scheduled as a single-track programme, with six conventional sessions—colour science, colour vision, computational colour, colour in computer graphics, colour image processing, and multi-spectral imaging—and two new In response to strong demand, image quality and colour reproduction have been added (see page 9).
- On Monday, prior to the start of the technical sessions, CGIV is offers two exciting programmes. In the morning you may choose from seven short courses—covering topics from colour science for HDTV and digital cinema to multispectral imaging—given by knowledgeable instructors (see page 3). In the afternoon, the ICC (International Color Consortium) hosts DevCon Europe '06, a special symposium for users and product developers working with ICC-based color management, particularly ICC v4 (see page 8).
- During the conference reception on Tuesday evening, attendees will have the opportunity to visit the laboratories of those working in areas related to colour science at the University of Leeds.
- And finally, the conference banquet, held on Wednesday night, showcases Leeds Civic Hall, one of the beautiful buildings that makes Leeds a favorite tourist destination. As the modern capital of Yorkshire—home of the famous Yorkshire Dales in the north—and surrounded by renowned historical towns such as Harrogate, Ilkley and Skipton, Leeds offers outstanding local attractions, along with a vibrant nightlife and cultural scene.

We look forward to showing you stunning views under the bright June sun. Please join us this summer in Leeds where all of these colourful attractions await you at CGIV2006.

—Ronnier Luo, General Chair

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CGIV 2006.**

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Venue

CGIV 2006 will take place on the campus of the University of Leeds, located a few minutes walk from the downtown area in one of the most vibrant cities in Great Britain.

Leeds's colourful past is witnessed in the elegant arcades and numerous other examples of Victorian, Edwardian, and Georgian architecture found throughout the city. Much of its heritage has recently been lovingly restored and preserved, as witnessed by the attractive renovations of the Corn Exchange, Victoria Quarter, County Arcade, and Leeds Market Buildings. More

information about the city can be found at www.leeds-uk.com.

Acclaimed for the quality of its teaching and research, the University of Leeds is one of the largest universities in the UK. An emphasis on innovative research and investment in high-quality facilities contribute to the majority of its departments being rated "excellent" both nationally and internationally. The University is one of the top ten in the UK for research and is internationally acknowledged as a centre of excellence in a wide range of academic and professional disciplines.

Housing and Transportation

Getting to/from Leeds

Leeds is served by Leeds Bradford International Airport, which has an excellent Website (www.lbia.co.uk/) with detailed information on flights and ground transportation. Direct flights are available from Amsterdam, Frankfurt, Geneva, London, Paris, and many other European destinations. The Website contains a complete list of cities served with non-stop flights, and a PDF of flight times/destinations.

The University is also one hour from Manchester Airport via direct train service

Additional directions and information on getting to the University of Leeds may be found at www.leeds.ac.uk/visitors/getting_here.htm. Weekly local bus passes are available and can be purchased the first time one boards.

Housing

Special arrangements for on-campus accommodations have been made for CGIV participants. Dorm rooms, with breakfast included, are £26 with shared

bath; £36 for private facilities. Reservations for these rooms may be made using the housing form on page 16.

Please note: On-campus housing must be confirmed by April 18, 2006, so please reserve your room now.

There are a number of hotel and bed & breakfast options within the city of Leeds that can be found by searching the Web. Below are some options; all rates include full English breakfast. Hotels should be booked directly.

Leeds Riva Hotel (3-star)

www.sleepinnleeds.com/
Single/double: £45-110

Queens Hotel (4-star)

www.e-travelguide.info/queens
Fri., Sat., Sun.: Single £75, Double £85
Midweek: Single £99, Double £109

Radisson Hotel (4+star)

www.leeds.radissonsas.com
£125 single, £135 double

Tutorial Program: Monday, June 19, 2006

T01: Colour Science for HDTV and Digital Cinema

8:30 am – 12:30 pm (4 hours)

Instructor: Charles Poynton, consultant

Digital HDTV production and digital movie making present important and challenging applications of colour science, colour image coding, and colour management. This course explores the application of colour science to HDTV and digital cinema. The technologies of HDTV and D-cinema—from camera and scanner technology, through processing, to digital cinema display equipment and film recorders—are detailed. The application of colour science to each of these steps is explained, and how colour appearance models are finding new applications in this domain is outlined.

Benefits

This course will enable the attendee to:

- Evaluate the contrast ratio and gamut constraints of various image coding systems
- Understand colour image coding for HDTV and digital cinema
- Understand the colour signal processing required to process cinema-class imagery

Intended Audience

Scientists; programmers; visual effects and post-production supervisors; composers; digital imaging technicians; and video, HDTV, and digital cinema engineers, will all find the course useful.

Charles Poynton (www.poynton.com) is a specialist in the physics, mathematics, and engineering of digital colour imaging systems, including digital video, HDTV, and digital cinema (D-cinema). A Fellow of the Society of Motion Picture and Television Engineers (SMPTE), Poynton was awarded the Society's prestigious David Sarnoff Gold Medal for his work to integrate video technology with computing and communications. In

February 2003, his second book, Digital Video and HDTV Algorithms and Interfaces, was the 3,339th most popular item on Amazon.com.

T02 - Critical Issues in Colour Measurements for Colour Management

8:30 – 10:30 am (2 hours)

Instructor: Danny C. Rich, Sun Chemical Corp.

Reproducible and reliable colour management requires accurate colour profiles. Obtaining accurate colour profiles requires absolute colour measurements. This tutorial describes the most critical issues in producing absolute colour measurements. These issues are not normally discussed in product literature or operator training manuals. Methods for identifying and addressing these critical issues will be presented.

Benefits

This course will enable the attendee to:

- Identify the components of a spectro-colourimeter and the functions of each
- Describe the differences between calibration and standardization
- Determine when each function is appropriate
- Establish which components are most critical
- Decide what properties of the imaging medium are likely to influence the results of colour measurements
- Discover methods for testing and validating the colour-measuring instrument, as well as for validating the measurements of the test images
- Learn techniques and computations for correcting or compensating the influences of the imaging medium and/or the colour-measurement instrument

Intended Audience

This course will be of interest to engineers and technologists who are responsible for

making and interpreting colour measurements in colour image reproduction. It will also interest those who must create device profiles that produce the highest level of predictability in the communication and reproduction of coloured images.

Danny C. Rich has bachelors and masters degrees in optical physics and a doctorate in colour science from the Rensselaer Colour Measurement Laboratory under the direction of the late Fred W. Billmeyer, Jr. He has been published on all aspects of colour science and technology and is active in colour measurement standards organizations such as ASTM E12 on Colour & Appearance, ISO TC130 on Graphic Arts, and in CIE Division 2 on Measurement of Optical Radiations. Rich is currently head of the Colour Research Laboratory at Sun Chemical Corporation, the world's largest producer of printing inks.

T03: Colour Vision and Colour Appearance

8:30 – 10:30 am (2 hours)

Instructor: David H. Foster,
University of Manchester

The aim of this tutorial is to introduce the physiology, physics, and psychophysics of human colour vision and colour appearance. The first part of the tutorial concentrates on the absorption spectra of the rods and cones of the eye, the luminosity function, adaptation and von Kries scaling, post-receptoral coding, colour-opponency, and spectral sharpening. In the second part, critical complicating factors are reviewed, including spectrally selective absorption in the lens, ocular media and macular pigment, and retinal inhomogeneity and rod intrusion. The third part introduces the sensory and perceptual cues underlying judgment of surface colour, including cone contrast and spatial ratios of cone signals, mean chromaticity, surface highlights, chromatic variance, and the role of cognition and memory. The last part deals with the experimental evaluation of surface-colour perception, including colour naming, achromatic adjustment, and asymmetric

colour matching, as well as provides an analysis of the limitations of visual judgments with geometric stimuli and images of natural scenes.

Benefits

This course will enable the attendee to:

- Describe the spectral sensitivities of the receptors of the eye and the major chromatic and achromatic properties of post-receptoral coding
- Appreciate the complicating effects on colour perception of pre-receptoral absorption, its variation from individual to individual, and rod intrusion
- Identify key sensory and perceptual cues underlying judgments of surface colour, their relative significance, and the role of memory and cognition
- Compare the main experimental methods of evaluating human surface-colour perception and analyze the limits of visual judgments with synthetic and naturalistic stimuli
- Assess the adequacy of colour-appearance models and display devices in relation to these visual limits

Intended Audience

This course is intended for scientists, engineers, analysts, and students interested in colour appearance and colour reproduction. No specialist background in biology or psychology is required.

David Foster, professor of computational neuroscience in the Faculty of Life Sciences, University of Manchester, received his BSc (1966) and his PhD (1970) in physics from Imperial College London—under the supervision of W.D. Wright and K.H. Ruddock. He also holds a DSc in biophysics (1982) from London University. Foster was appointed lecturer at Imperial College in 1970 and has subsequently held professorships at Keele University, Aston University, UMIST, and Manchester University. His research, concentrating on visual psychophysics and colour vision, has led to the publication of more than 150 papers. Foster is a Fellow of the Institute of Physics, the Institute of Mathematics and its Applications, and the

Optical Society of America. He co-founded the journal Spatial Vision in 1984 and is now Advisory Editor. Foster is also Associate Editor of Computers in Biology and Medicine and a member of the Editorial Board of Vision Research, with particular responsibility for colour vision.

T04: Transforms for Colour and Spectral Reproduction

8:30 – 10:30 am (2 hours)

Instructor: Mitchell Rosen,
Rochester Institute of Technology

This course is designed to introduce the student to issues and potential solutions surrounding image processing for high-quality colour and spectral reproduction. It will begin with the underlying transforms used in colour processing for traditional colour management and build a foundation for incorporation of spectral aspects in a reproduction. Standard methods for parameterizing colour processing transforms will be covered. The goals of spectral colour management will be explained followed by discussion of how the current colourimetric processing chain can be modified to enable delivery of spectrally specified output.

Benefits

This course will enable attendees to become familiar with the underlying transformations that service the following colour management situations:

- Colourimetric input and output
- Spectral input, colourimetric output
- Spectral input and output

Students will also be exposed to methods for spectral gamut mapping.

Intended Audience

This course is designed for those who want a picture of the colour processing aspects of colour management as it is currently implemented and who wish to see how spectral colour management might be implemented. Potential students would include scientists,

Tutorial Fees

if you register by May 19

2-hour Member	€100/\$120
2-hour Non-member	€120/\$140
2-hour Student	€50/\$60
4-hour Member	€160/\$190
4-hour Non-member	€180/\$215
4-hour Student	€80/\$95

After May 19, prices go up €20/\$25.

IS&T reserves the right to cancel classes in the event of insufficient advance registration. Please indicate your interest early.

engineers, and managers who are responsible for understanding current and future trends in colour reproduction.

Mitchell Rosen, assistant professor with the Munsell Colour Science Laboratory of the Center for Imaging Science at RIT, performs research in the areas of colour management, spectral imaging systems, museum imaging, and eye movement analysis. He teaches graduate courses on colour systems and tutorials on colour management and colour reproduction. Before joining RIT, Rosen spent a decade in the research labs of Polaroid. He is Color Imaging editor of IS&T's Journal of Imaging Science and Technology and is active in organizing international conferences on spectral imaging. His website is www.cis.rit.edu/rosen and he can be reached at rosen@cis.rit.edu.

T05: A Framework for the Assessment of Image Quality

10:30 am – 12:30 pm (2 hours)

Instructor: Peter G. Engeldrum, Imcotek

Image, print, picture, and display quality are often considered “subjective” and in “the eye of the beholder,” with the implication that image quality (IQ) cannot be put on a quantitative footing. Compounding

this confusion is the concept that IQ depends on where you view the problem. A process engineer will feel that the process controls IQ. Developers of image processing algorithms feel that image processing is where the action is. Of course, both these and all other imaging related subsystems contribute to image quality.

A Framework for the Assessment of Image Quality puts the various pieces together in a unified way; a systems perspective. Using the Image Quality Circle (IQC) as the framework, this tutorial paints the big-picture view of image quality. The IQC is a practical and useful tool used by major imaging hardware consumables manufacturers.

Benefits

This course will enable the attendee to:

- Have a comprehensive understanding of the concept of image/print/display quality
- Use the IQC as a process for managing and developing the image/print quality of imaging and consumable products
- Have a unique perspective on IQ, and practical tools for IQ assessment, whether a seasoned IQ expert or an IQ “newbie”
- Apply the IQ framework described in this tutorial across the complete product development organization, including marketers and market researchers
- Understand IQ and how its many facets can be unified
- Identify visual perceptual attributes—the “nesses”
- Understand basic psychometric scale types
- Conduct simple scaling studies
- Be able to develop image quality product specifications/requirements

Intended Audience

This tutorial is intended for scientists,

engineers, product program managers, and students, who have a responsibility for, or an interest in, IQ. No prerequisites are required.

Peter Engeldrum, the developer of the IQC, is president of Imcotek, a technical consulting firm that assists organizations in finding solutions to imaging system and image and colour problems. With more than 25 years of experience with imaging and colour systems, he has worked with a variety of imaging and display technologies. Engeldrum has been active in the areas of image and colour quality, colour scanning, colour printing and display, photography, and colour imaging over the Internet. He was a faculty member at the Center for Imaging Science, Rochester Institute of Technology, where he received his degrees. Engeldrum is a member of several professional societies and is an IS&T Fellow. He has also served on several corporate advisory boards and has several patents and patents pending in the areas of display calibration and Internet imaging.

T06: Colour Appearance Modelling

10:30 am – 12:30 pm (2 hours)

Instructor: Ronnier Luo, University of Leeds

This tutorial covers six areas: techniques for generating experimental data; the structure of CIE 1997 and 2002 colour appearance models (CIECAM97s and CIECAM02); the correlates provided by the model; the visual phenomenon predicted by the model; more recent development for removing some anomalies; and its capability in predicting colour differences.

Benefits

This course will enable the attendee to:

- Learn experimental techniques for scaling colour appearance
- Compare the performance of colour appearance models
- Understand the structure, correlates, and predicted visual phenomenon of CIECAM97s and CIECAM02
- Apply colour appearance modelling to image reproduction

Intended Audience

This course is intended for colour engineers and research scientists involved with colour reproduction, as well as imaging device and computer software developers. Knowledge of fundamental colourimetry is assumed.

Ronnier Luo, professor of colour and imaging science in the Department of Colour and Polymer Chemistry, University of Leeds, holds approximately 250 publications in colour and imaging science. Luo is a Fellow of IS&T and the Society of Dyers and Colourists. He was also the recipient of the Centenary Medal from the Society of Dyers and Colourists (2004), the Royal Photographic Society's Davies Medal (2003), and Bartleson Research Award (1994).

T07: Introduction to Multispectral Colour Imaging

10:30 am – 12:30 pm (2 hours)

Instructor: Jon Hardeberg,
Gjøvik University College

Conventional colour imaging science and technology is based on the paradigm that three variables are sufficient to characterize a colour. However, in particular due to the effect of metamerism, three colour channels are often insufficient for high-quality imaging e.g., for museums and digital archives. In this course we introduce the concept of multispectral colour imaging and show how increasing the number of colour channels beyond three can resolve limitations of conventional image capture and reproduction systems. Several practical systems for multispectral colour image capture and reproduction will be described, along with their strengths and weaknesses. We will discuss the calibration and characterization of multispectral colour imaging systems, and briefly introduce some of the current research topics in the field.

Benefits

This course will enable the attendee to:

- Understand the basics of colour science, in particular metamerism
- Decide between 3-colour and multispectral approaches
- Understand the issues and tradeoffs involved in the design and practical realization of multispectral colour imaging systems
- Learn methods to evaluate the performance of multispectral acquisition systems
- Know where to find more information about this subject, equipment, and tools

Intended Audience

This course will be of interest to a wide audience; image scientists, archivists, quality engineers, and others charged with choosing, developing, and managing imaging systems that may require multispectral colour image capture and reproduction. It will be particularly beneficial to take this course in connection with T03: Transforms for Colour and Spectral Reproduction.

Jon Y. Hardeberg is a professor of colour imaging at Gjøvik University College in Norway, where he leads the Norwegian Colour Research Laboratory. In addition to teaching courses in colour imaging and media representation, Hardeberg is does research on various topics of related to colour imaging, such as device characterization, gamut visualization and mapping, image quality, and multispectral image acquisition and reproduction. His book, Acquisition and Reproduction of Colour Images: Colourimetric and Multispectral Approaches, is considered a reference title in the area of multispectral colour imaging.

On-campus Housing

Deadline:

April 19, 2006

See pages 2 and 16 for details.

Special Leeds Program

ICC DevCon Europe '06

For Users and Product Developers Working with ICC-based Color Management

Monday, June 19 — 13:00 to 18:30 (includes two 30-minute breaks)

Rupert Becket Lecture Theatre, Michael Sadler Building, University of Leeds

Digital information today includes color, but how should it be encoded or processed for a specific application? DevCon Europe '06 provides practical advice using real-world examples to help those who want to implement or use ICC v4 color standards. Experienced developers and users within the imaging, printing, and publishing color community share their knowledge in a series of tutorials designed to answer all your questions.

Below is the tentative schedule; for the latest program details—including expanded summaries of the tutorials and speaker information visit—www.color.org. You may register directly for DevCon when you register for CGIV2006—see page 17 for rates and details.

T1: ICC Version 4 Capabilities Review, 13:00 – 13:45

This tutorial will provide a review of essential ICC Version 4 capabilities, particularly those that advance beyond the V2 foundation.

Presenter: To Be Announced

T2: The Impact of Workflow on Color Management Systems, 13:45 – 14:30

This tutorial will review the series of workflow models that have been developed within the ICC Workflow WG, focusing on the ways in which such workflow models can be used to derive color management systems requirements and consider how color fidelity through a workflow can be affected by the command and control level of the color management system. **Presenter:** Ann McCarthy, Lexmark International, Inc.

T3: How should device drivers use ICC profiles? 15:00 – 15:45

This tutorial will discuss how to construct device driver interactions with ICC profiles and with operating system color APIs. **Presenter:** Luke Wallis, Apple Computer, Inc.

T4: Under the Hood: the V4 CMM and the New ICC Perceptual PCS, 15:45 – 16:30

This tutorial will introduce the fundamentals

of the V4 CMM color rendering architecture, and provide insight into particular color rendering aspects that may be handled in a CMM, including white point compensation, black point compensation, gamut mapping, and rendering differences as a function of source profile rendering or re-rendering into ICC PCS (ICC profile connection space). **Presenter:** Max Derhak, Onyx Graphics Corp.

T5: ICC V4 Colorimetric Rendering Intents: Applicability, Construction 17:00 – 17:45

This tutorial will examine ICC media relative colorimetric intent construction and the CMM rendering approaches that it supports. **Presenter:** Marti Maria Saguer, Hewlett Packard

T6: ICC V4 Perceptual Rendering Intent: Applicability, Construction 17:45 – 18:30

This tutorial will discuss the details of the enhancement—as it affects particular classes of color rendering and as it impacts construction of the perceptual rendering intent tag data in a V4 profile. **Presenter:** Jack Holm, Hewlett Packard

Wine & Cheese Networking Event 18:30 – 20:00

Technical Program^{*}

Tuesday June 20, 2006

8:50 to 10:30

Color and Computation

Session Chairs: Sabine Süsstrunk, EPFL (Switzerland);
Stephen Westland, University of Leeds (UK)

Welcome

Keynote: Interaction of Light, Paper and Color Halftones: Challenges and Modelization Approaches, Roger D. Hersch, Ecole Polytechnique Fédérale de Lausanne (EPFL) (Switzerland)

Image-Based Control of Skin Translucency, Norimichi Tsumura, Ryoko Usuba, Koichi Takase, Toshiya Nakaguchi, and Yoichi Miyake, Chiba Univ.; Nobutoshi Ojima, Nobutoshi Komeda, Kao Corp. (Japan)

Scale Space Filter Based on Homogeneity Degree for Color Image Segmentation, Laurent Busin, Nicolas Vandenbroucke, Ludovic Macaire, and Jack Gérard Postaire, Université de Lille 1 (France)

11:00 to 12:40

Colour Image Processing

Session Chair: Dietrich Paulus,
University of Koblenz (Germany)

Feature Points Tracking Using Photometric Model and Colorimetric Invariants, M. Gouiffès and C. Fernandez-Maloigne, Univ. of Poitiers; C. Collewet, IRISA; and A. Trémeau, Univ. of St Etienne (France)

A Robust Filtering Method Using OWA Filters: Application to Color Images, Philippe Vautrot, Laurent Hussenet, and Michel Herbin, Université de Reims (France)

Image Sharpening Based on Spatiochromatic Properties of the Human Vision System, María S. Millán and Edison Valencia, Technical Univ. of Catalonia (Spain)

A Selective Encryption for Heterogenous Color JPEG Images Based on VLC and AES Stream Cipher, J. M. Rodrigues and W. Puech, Univ. of Montpellier II (France); and A. G. Bors, Univ. of York (UK)

Validation of a Tooth-Imaging System in Tooth-Whitening Trials, Wen Luo and Paul Brunton, Univ. of Leeds; Roger Ellwood, Colgate-Palmolive; and Iain Pretty, Univ. of Manchester (UK)

14:00 to 15:40

Computational Colour

Session Chair: Reiner Lenz,
Linköping University (Sweden)

Estimating the Information Available from Coloured Surfaces in Natural Scenes, Ivan Marin-Franch and David H. Foster, Univ. of Manchester (UK)

Illumination Induced Changes in Image Statistics, Thanh Bui, Reiner Lenz, and Martin Solli, Linköping Univ. (Sweden)

Spatial Color Image Retrieval without Segmentation Using Thumbnails and the Earth Mover's Distance, Thomas Hurtut, Haroldo Dalazoana, Yann Gousseau, and Francis Schmit, Ecole Nationale Supérieure des Telecommunications; and Thomas Hurtut, Ecole Polytechnique de Montreal (Canada)

Using Local Binary Pattern Operators for Colour Constant Image Indexing, David Connah and Graham D. Finlayson, Univ. of East Anglia (UK)

Fuzzy Color-Based Semantic Characterization of Animation Movies, Bogdan Ionescu, Image Processing and Analysis Laboratory (Romania), and Patrick Lambert, Didier Coquin, and Vasile Buzuloiu, Laboratoire d'Informatique, Systemes, Traitement de l'Information et de la Connaissance (France)

***Note: All papers are oral unless otherwise indicated; Interactive Papers are presented in poster format.**

16:10 to 18:10 pm

Colour Reproduction

Session Chair: Jan Morovic, Hewlett-Packard (Spain)

Spectral Sensitivity Estimation of Digital

Cameras, Carsten Büttner and Klaus Bobey, Univ. of Applied Sciences and Arts; and Bernd Schlichting and Carsten Büttner, Kappa opto-electronics GmbH (Germany)

Calibrating Color Cameras Using Metameric Blacks, Ali Alsam, Gjøvik Univ. College (Norway); and Reiner Lenz, Linköping Univ. (Sweden)

Film Look in Digital Post Production, Jürgen Stauder, Laurent Blondé, Joshua Pines, Philippe Colantoni, Alain Trémeau, Thomson, Technicolor, Univ. of St. Etienne (France)

Serial Retinex Algorithm for Time-Sequential Processing, Takahiko Horiuchi, Hiroaki Kotera, and Lijie Wang, Chiba Univ. (Japan)

Doubling the Color Gamut Volume of Ink Jet Prints Using a Simple Post-Processing, Safer Mourad, Swiss Federal Laboratories for Materials Testing and Research, and Cary Kornfeld, Swiss Federal Institute of Technology (Switzerland)

The Characterisation of Colour Printing Devices via Physical, Numerical and LUT Models, Mei-Chun Lo and Chia-Wei Chang, Shih Hsin Univ.; Chang-Lang Chen and Jong-Xian Hsieh, National Taiwan Univ. of Arts (Taiwan)

Wednesday June 21, 2006

8:30 to 12:40

Colour Vision/Psychophysics

Session Chair: Anya Hurlbert, University of Newcastle (UK)

Keynote: Colors as "Parts of Daylight,"

Jan J. Koenderink, Utrecht Univ. (The Netherlands)

Spatial Receptive Field Structure of Neurons in Primary Visual Cortex Revealed under Neutral Adaptation Conditions, Bevil R. Conway, Harvard Medical School (USA)

The Linearity of Colour Appearance Mechanisms, Sophie M. Wuerger, Univ. of Liverpool (UK)

Memory for Colours : A Reaction Time Experiment, Valerie Bonnardel, Univ. of Sunderland (UK)

Colour Memory, Peter Bodrogi, Univ. of Veszprém (Hungary)

Investigating Human Chromatic Discrimination of Natural Objects, Thorsten Hansen, Martin Giesel, and Karl R. Gegenfurtner, Univ. of Giessen (Germany)

Color Channels for Stereo Retinex, Brian Funt and Weihua Xiong, Simon Fraser Univ. (Canada)

A Direct Test of the "Grey World Hypothesis", Jeroen JM. Granzier, Jeroen BJ. Smeets, and Eli Brenner, Erasmus Medical Center (The Netherlands)

Individual Variation in Measures of Colour Constancy: What Are We Doing Wrong?, James M. Kraft, The Univ. of Manchester (UK)

Dichoptic Studies of Instantaneous Colour Constancy in Human Vision, John Barbur, City Univ. (UK)

14:00 to 16:30 pm

Interactive Session

held in Parkinson Court

Colour Gamut Boundary Determination for Digital Imaging Medium Using Two-Variable High Order Polynomials, Haisong Xu and Yong Wang, Zhejiang Univ. (China)

Physical Measurements vs Visual Perception: Comparing Colour Appearance in Reality to Virtual Reality, Beata Stahre and Monica Billger, Chalmers Univ. of Technology (Sweden)

Definition of Colour Object Signatures Based on Zernike Moments, Camille Counilh, Jean-Christophe Burie, and Pierre Courtellemont, Université de La Rochelle (France)

Input Device Characterisation: A Comparison Between Iteration and Regression Methods Using Either XYZ or $L^*a^*b^*$, Hossein Izadan and James H. Nobbs, Univ. of Leeds (UK)

Color Calibration of Digital Camera Using

Polynomial Transformation, Tuija Jetsu, Ville Heikkinen, Jussi Parkkinen, Markku Hauta-Kasari, and Birgitta Martinkauppi, Univ. of Joensuu (Finland); and Seong Deok Lee, Hyun Wook Ok, and Chang Yeong Kim, Samsung Advanced Institute of Technology (Korea)

Highlight Removal in Endoscope Images, Vladimir Bochko, Lappeenranta Univ. of Technology (Finland), and Yoichi Miyake, Chiba Univ. (Japan)

Colour Characterisation of Digital Microscopes, Kaida Xiao, Samsung Advanced Institute of Technology (Korea); Guowei Hong and Alastair Gale, Loughborough Univ. (UK); and Peter A. Rhodes, Univ. of Leeds (UK)

Practical Ink Selection for Multispectral Printing in the Graphic Arts Industry, Andreas Kraushaar, Graphic Technology Research Association (Germany)

Colour Constancy in Natural Scenes Independent of an Explicit Illuminant Cue, Kinjiro Amano and David H. Foster, Univ. of Manchester (UK); Sérgio M. C. Nascimento, Univ. of Minho (Portugal)

Benefits and Drawbacks of Two Methods for Characterizing Digital Cameras, Françoise Viénot, Muséum National d'Histoire Naturelle; Blandine Placais, IUT Caen; and Sylvie Sautrot and Mohamed BenChoukha, Université Pierre et Marie Curie (France)

Color Image Retrieval Techniques for a Global Localization of an Indoor Mobile Robot, Anis Chaari, Sylvie Lelandais, and Christophe Montagne, Complex System Laboratory (France); and Mohamed B. Ahmed, RIADI Laboratory (Tunisia)

Spectral Recovery from Natural Scenes with an RGB Digital Camera, Eva M. Valero and Juan L. Nieves, Univ. of Granada (Spain); Sergio M.C. Nascimento, Minho Univ. (Portugal); and Kinjiro Amano and David H. Foster, Univ. of Manchester (UK)

3D Similarity Index for Evaluating Quality of Lossy Compressed Spectral Images, Dobromir Dochev, Vladimir Bochko, Diana Kalenova, Pekka Toivanen, and Arto Kaarna, Lappeenranta Univ. of Technology (Finland)

An Adaptive Median Filter for Colour Image

Processing, Frédérique Robert-Inacio, Institut Supérieur d'Electronique et du Numérique; and Eric Dinet, Laboratoire d'Informatique et d'Ingénierie de la Vision (France)

Color Image Watermarking by Fibonacci Lattice Index Modulation, Soo-Chang Pei, National Taiwan Univ.; and Jun-Horng Chen, Oriental Institute of Technology (Taiwan)

Guideline on Designing Laser Display Primary for Reproducing Real World Object Colors, Seung Ok Park, Hong Suk Kim, and Young Jae Kwon, Daejin Univ. (Korea)

Histogram of Fuzzy Ranks for Object Recognition Across Illumination Changes, Damien Muselet and Ludovic Macaire, Université des Sciences et Technologies de Lille (France)

A Color Image Hidden in a Grey-Level Image, Marc Chaumont and William Puech, Univ. of Montpellier II (France)

Estimation of Human Iris Spectral Reflectance Using a Multi-Spectral Imaging System, Meritxell Vilaseca, Marta de Lasarte, Jaume Pujol, and Montserrat Arjona, Technical Univ. of Catalunya (Spain); and Francisco H. Imai, Pixim Inc. (USA)

Spectral Recovery of Artificial Illuminants Using a CCD Colour Camera with Nonnegative Matrix Factorization and Independent Component Analysis, Juan L. Nieves, Eva M. Valero, Javier Romero, and Javier Henández-Andrés, Univ. of Granada (Spain)

Development of an Optimized Flat-Field Correction Algorithm for Digital Cameras, Marta de Lasarte, Montserrat Arjona, Meritxell Vilaseca, and Jaume Pujol, Centre for Sensors, Instruments and Systems Development (Spain)

Quality of LED Based Daylight Simulators, Cheng Li, Changjun Li, and M. Ronnier Luo, Univ. of Leeds (UK); and John Dakins, VeriVide Limited (UK)

Color Transfer to Video Sequence by Color Variance Refinement, Yan Xie, Xiaobo An, and Xueying Qin, Zhejiang Univ. (China)

A Machine Learning-Based Color Image Quality Metric, Christophe Charrier, Gilles Lebrun, and Olivier Lezoray, Univ. of Caen Basse Normandy, LUSAC (France)

Adding Local Contrast to Global Gamut Mapping Algorithms, Peter Zolliker and Klaus Simon, *Swiss Federal Laboratories for Materials Testing and Research* (Switzerland)

Partial Colour Matching: A New Method to Evaluate Colour Appearance in Quantitative Terms, Alexander D. Logvinenko and Lesley L. Beattie, *Glasgow Caledonian Univ.* (UK)

Gamut Intersection for Image Retrieval, Andrei Ouglov, Ali Alsam, and Rune Hjeltnes, *Gjøvik Univ. College* (Norway)

Content and Metadata Based Image Retrieval System for Art Images, D. Chellamuthu, Prema Rani, and Jency Moses, *Anna Univ.* (India)

Colorized Chinese Ink-and-Wash Painting by Region Growing in Each Segmented Marked Sub-Images, Soo-Chang Pei and Yi-Chong Zeng, *National Taiwan Univ.* (Taiwan)

Wheat Head Counting Method Using Color Images, Frédéric Cointault and Bernard Chopinet, *ENESAD* (France)

Computational Model for Perceptual Coarseness Prediction, S. Kitaguchi and M. R. Luo, *Univ. of Leeds* (UK); E. J. J. Kirchner and G. J. van den Kieboom, *Technology Center Colorimetry Akzo Nobel Coatings* (The Netherlands)

A Problem with the Use of XYZ Colour Space for Photorealistic Rendering Computations, Christiane Ulbricht and Alexander Wilkie, *Vienna Univ. of Technology* (Austria)

Effect of Interreflections in a Room on the Colour Rendering of Light Source, Laszlo Neumann and Janos Schanda, *Universitat de Girona* (Spain)

Optimization of Camera and Illumination Directions on Gonio Spectral Imaging Methods, Toshiya Nakaguchi, Masanori Kawanishi, Norimichi Tsumura, and Yoichi Miyake, *Chiba Univ.* (Japan)

Colour-Memory-Dependent Colour Constancy: 2D vs 3D Real Surfaces, Yazhu Ling and Anya Hurlbert, *Univ. of Newcastle upon Tyne* (UK)

Euclidean Colour-Difference Formula in Chroma Compressed OSA-UCS Space, Claudio Oleari, *Università degli Studi di Parma* (Italy); and Manuel Melgosa and

Rafael Huertas, *Universidad de Granada* (Spain)

Color Image Analysis of the Optic Disc to Assist Diagnosis of Glaucoma Risk and Evolution, Edison Valencia and Maria S. Millán, *Technical Univ. of Catalonia* (Spain)

A Colour Feature Extraction Technique for Colour Judgment of Fermenting Tea, S. Borah, S. Biswas, and M. Bhuyan, *Tezpur Univ.* (India); and E. L. Hines, *Warwick Univ.* (UK)

Spectral Sensitivity Estimation for Color Camera Calibration, V. Vurpillot, A. Legrand, and A. Tremeau, *Ligiv Laboratory* (France)

Preliminary Study of the Influence of the Spatial Frequency on Colour Appearance, Olivier Tulet, Mohamed-Chaker Larabi, and Christine Fernandez-Maloigne, *Univ. of Poitiers* (France)

Multispectral Photography of the Famous Mona Lisa Painting, Pascal Cotte, *Consultant* (France)

Multitoning Method Based on Threshold Modulation using MJBMM for Banding Artifact Reduction, Tae-Yong Park, Myong-Young Lee, Chang-Hwan Son, and Yeong-Ho Ha, *Kyungpook National Univ.* (Korea)

Fundamental Considerations Related to Chromatic Adaptation, Nobuhito Matsushiro, *Okidata Corp.* (Japan)

Predict LCDs Real-World Color Performance Based on Generic Image Statistics and the Results of Gamut Mapping, Pei-Li Sun and Chia-Yun Lee, *Shih Hsin Univ.* (Taiwan)

Lightness Filtering in Color Images with Respect to the Gamut, Judith Dijk and Piet W. Verbeek, *TNO Defense, Security and Safety* (The Netherlands)

Color Features Comparison for Segments Matching, Christophe Montagne and Sylvie Lelandais, *Complex Systems Laboratory*; and André Smolarz, *Institute of Information Sciences and Technologies of Troyes* (France)

Comparison of Naive and Expert Observers in the Assessment of Small Color Differences between Textile Samples, David Hinks, Renzo Shamey, Rolf Kuehni, Lina Cardenas, Warren Jasper, and Melih Gunay, *North Carolina State Univ.* (USA)

Calculation of the Optimal Colours of Linear Input Devices, Francisco Martínez-Verdú, Esther Perales, Valentín Viqueira, Dolores de Fez, and Elisabet Chorro, Univ. of Alicante (Spain)

Color on Face Recognition: The Critical Band of Spatially Quantized Images, Yao-Ting Ko, National Cheng Kung Univ., and Vincent C. Sun, Chinese Culture Univ. (Taiwan)

Spectral Characterization of a Hyperspectral System for Imaging of Large Art Paintings, Francisco M. P. B. Ferreira, Paulo T. Fiadeiro, Vasco M. N. de Almeida, and Mário J. T. Pereira, Universidade da Beira Interior; and Sérgio M. C. Nascimento, Universidade do Minho (Portugal)

Dynamic Simulation of Colour Blindness for Studying Colour Vision Requirements in Practice, Marcel P. Lucassen and Johan W.A.M. Alferdinck, TNO Human Factors (The Netherlands)

Automatic Red-Eye Removal Based on Sclera and Skin Tone Detection, Flavien Volken, Johann Terrier, and Patrick Vandewalle, Ecole Polytechnique Fédérale de Lausanne (Switzerland)

Improved Retinex Approach for Color Image Enhancement, Taoi Hsu and Kuo-Jui Hu, Shih Hsin Univ. (Taiwan)

Separating Illuminant and Surface Reflectance Spectra from Filtered Trichromatic Camera Measurements, Miguel A. López-Álvarez, Eva M. Valero, and Javier Hernández-Andrés, Univ. of Granada (Spain)

A New Method for Gaussian Noise Reduction in Colour Images by Colour Morphology, F. Ortiz, Univ. of Alicante (Spain)

A Goniometric System for Measuring Surface Spectral Reflection Using Two Robot Arms, Akira Kimachi,¹ Norihiro Tanaka,² and Shoji Tominaga;¹ ¹Osaka Electro-Communication Univ. and ²Nagano Univ. (Japan)

Path-Based Colour Image Segmentation, Clement Fredembach and Graham D. Finlayson, Univ. of East Anglia (UK)

Adaptable Quantization Which Minimizes Distortions Induced by Data-Hiding in Color JPEG Images, Jean-Luc Toutant, William

Puech, and Christophe Fiorio, Univ. of Montpellier II (France)

Comparison of Colour Harmony Models: Visual Experiment with Reflecting Samples Simulated on a Colour CRT Monitor, Ferenc Szabo, Peter Bodrogi, and Janos Schanda, Univ. of Veszprém (Hungary)

Colour Analysis of Rice Using Flatbed Scanning and Image Analysis, Gerard van Dalen, Unilever Research Laboratory (The Netherlands)

High Dynamic Range Multispectral System for Wide Color Gamut Measurements, Jaume Pujol, Marta de Lasarte, Meritxell Vilaseca, and Montserrat Arjona, Centre for Sensors, Instruments and Systems Development (Spain)

16:30 to 18:10

Colour Science

Session Chair: Roy Berns, RIT (USA)

Keynote: Desirable Improvements in Displays, Robert W. G. Hunt, Colour Consultant (UK)

Computing the Number of Distinguishable Colours under Several Illuminants and Light Sources, Esther Perales, Francisco Martínez-Verdú, and Valentín Viqueira, Univ. of Alicante; and María J. Luque and Pascual Capilla, Univ. of Valencia (Spain)

Background Influences on Colour Appearance, Raphael Nicolas and Alain Trémeau, Laboratoire LIGIV (France)

An Algorithm for Categorising Colours into Universal Colour Names, Zhaohui Wang and M. Ronnier Luo, Univ. of Leeds (UK); Byoung-Ho Kang, Heui-Keun Choh, and Chang Yeong Kim, Samsung Advanced Institute of Technology (Korea)

Advance Registration
(conference and tutorial)
Deadline: May 19, 2006

Thursday June 22, 2006

8:30 to 10:30

Colour in Computer Graphics

Session Chair: Werner Purgathofer,
TU Wien (Austria)

Keynote: Authentic Illumination of Archaeological Site Reconstructions, Alan Chalmers, Univ. of Bristol (UK)

Towards Computational Colour Constancy Using Neural Networks in 3-D Colour Spaces, Edwin O. Gómez, Humberto Loaiza, and Eduardo Caicedo, Universidad del Valle (Colombia)

Material and Color Design Using Projectors, Jonathan Konieczny and Gary Meyer, Univ. of Minnesota (USA)

Modeling Light Scattering in Paper for Halftone Print, L. Kumar and P. Jenny, Swiss Federal Institute of Technology (Switzerland)

Colour Accuracy in Computer Simulations for the Study of Illumination Phenomena, Alexa Ruppertsberg and Marina Bloj, Univ. of Bradford (UK)

11:00 to 12:40

Multispectral Imaging

Session Chair: Yoichi Miyake,
Chiba University (Japan)

Learning Techniques in Imaging System Design and Spectral Image Processing, Vladimir Bochko, Lappeenranta Univ. of Technology (Finland); Yoichi Miyake, Chiba Univ. (Japan); and Jussi Parkkinen, Univ. of Joensuu (Finland)

Improvement of Multispectral Image Capture by Compensating for Stray Light, Stephan Helling, Aachen Univ. of Technology (Germany)

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Combined Matrix Based Determination of Control Values for a 6-Primary Display Considering Different Observers, Thomas Boosmann, Aachen Univ. of Technology (Germany)

Spectral Colour Reproduction by Vector Error Diffusion, Jeremie Gerhardt and Jon Yngve Hardeberg, Gjøvik Univ. College (Norway)

A Method for Rendering and Editing Multispectral Computer Graphics, Masaru Tsuchida, National Institute of Information and Communications Technology; Hiroyuki Arai, NTT Corp.; Toshio Uchiyama, NTT Data Corp.; Masahiro Yamaguchi and Nagaaki Ohyama, Tokyo Institute of Technology; Hideaki Haneishi, Chiba Univ. (Japan)

14:00 to 15:40

Colour Image Quality

Session Chair: Christine Fernandez-Maloigne,
University of Poitiers (France)

Image Quality Assessment Models for JPEG and JPEG2000 Compressed Color Images, Z.M. Parvez Sazzad and Yuukou Horita, Univ. of Toyama (Japan)

Reference Free Quality Metric Using a Region-Based Attention Model for MPEG Compressed Videos, Remi Barland and Abdelhakim Saadane, Ecole Polytechnique de l'Université de Nantes (France)

Subjective and Objective Study of Different Video Coders: Application to Video Surveillance, Ludovic Quintard, Mohamed-Chaker Larabi, and Christine Fernandez-Maloigne, Univ. of Poitiers (France)

Affective Attributes in Image Quality of a Mobile LCD, Youn J. Kim and M. Ronnier Luo, Univ. of Leeds (UK); and Seongdeok Lee, Wonhee Choi, and Changyeong Kim, Samsung Advanced Institute of Technology (Korea)

A Novel Technique of Spectral Image Quality Assessment Based on Structural Similarity Measure, Diana Kalenova, Dobromir Dochev, Vladimir Bochko, Pekka Toivanen, and Arto Kaarna, Lappeenranta Univ. of Technology (Finland)

Conference At-a-Glance

Registration (lobby, Michael Sadler Building):
Monday, June 19 – Wednesday, June 21 (7:30–18:30)
Thursday, June 22 (7:45 – 16:00)

Monday, June 19

- CGIV tutorials (see pages 3–7)
- ICC DevCon Europe '06 (see page 8)
- ICC DevCon Europe '06 Wine and Cheese Networking Event

Tuesday, June 20

- Keynote: *Interaction of Light, Paper and Color Halftones: Challenges and Modelization Approaches* Processing
- Technical Sessions
 - Color and Computation
 - Colour Image Processing
 - Computational Colour
 - Colour Reproduction
- Welcome Reception (Clothworkers Courtyard, weather permitting)

Wednesday, June 21

- Keynote: *Colors as "Parts of Daylight"*
- Technical Sessions
 - Colour Vision/Psychophysics
 - Interactive Session
 - Colour Science with Special Keynote by Robert W. G. Hunt: *Desirable Improvements in Displays*
- Conference Banquet (Leeds Town Hall; separate fee required)

Thursday, June 22

- Keynote: *Authentic Illumination of Archaeological Site Reconstructions*
- Technical Sessions
 - Colour in Computer Graphics
 - Multispectral Imaging
 - Colour Image Quality

CGIV2006 Summer Solstice Conference Banquet

Leeds Civic Hall • June 21, 2006

Overlooking Millennium Square, faced with a Roman Corinthian portico of six columns, sporting twin towers on which owls—a symbol of Leeds—perch, and home to the offices of the Lord Mayor, Leeds Civic Hall is acknowledged as one of the finest civic buildings in Britain. Located in downtown Leeds, Civic Hall is a pleasurable stroll from the University campus and local hotels.

Celebrate the summer solstice with colleagues at a reception and dinner, featuring contemporary British cuisine.

Separate registration is required; guests accompanying conference participants are welcome. Approximately 10% of the banquet fee—the hall rental—constitutes a contribution to the Lord Mayor's official charity, which will be named in May by the incoming Lord Mayor.

Cost: €65/\$75

CGIV2006 On-Campus Housing Registration

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Reservations Deadline: April 19, 2006

Deposits can be made by Sterling cheque, bank transfer, or bank card. Cards will be charged an additional 2% service charge. For bank transfer information, please contact Susan Lacey at +44 (0) 113 343 6106 or s.lacey@adm.leeds.ac.uk.

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Notice of cancellation must be given 72 hours prior to arrival date to receive a full refund of deposit.

Check in is 3:00 pm; early arrivals will be accommodated as soon as possible. Check out is noon.

Please advise of any change in date or plan.

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There are many off-campus housing options that can be located through an Internet search (also see page 2), including on the following sites:

- www.bedandbreakfasts.co.uk/
- www.infotel.co.uk/towns/leeds.htm
- www.iknowyorkshire.co.uk/west_yorks/leeds/all_prices/all_types/all_specialities/
- www.hotels.uk.com/accommodation/hotels-accommodation-uk/Leeds/bed_and_breakfast_Leeds.htm

Transportation Notes: Leeds is served by Leeds Bradford International Airport, which has an excellent Website (www.lbia.co.uk/) with detailed information on flights and ground transportation. Direct flights are available from Amsterdam, Frankfurt, Geneva, Paris, and many other European destinations. The Website contains a complete list of cities served with non-stop flights, and a PDF of flight times/destinations.

Please visit www.leeds.ac.uk/visitors/getting_here.htm for additional information.

CGIV2006 Conference Registration

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Conference registration includes admission to all technical sessions, coffee breaks, lunch (T, W, & Th), and the Conference Reception (Tues). Separate fees are required for tutorials, the Conference Banquet (Wed), and ICC DevCon Europe '06. Register online at www.imaging.org/conferences/CGIV2006.

Please note: Due to online configuration limits, those who register online may only register in US dollars and their credit cards will be charged as such. To register in Euros, please fill out a registration form and fax it to IS&T.

Conference Registration (CHECK ONE) until 5/19; after that date, add €85/\$100 TOTAL

<input type="checkbox"/> IS&T Member	€490/\$585	€/ \$ _____
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Tutorial Registration (be sure to multiply number of classes by per course fee and place on total line)

<input type="checkbox"/> T01 (4-hour) Member	€160/\$190	€/ \$ _____
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DevCon Europe '06 (see www.color.org for more information); after 5/19 add €42/\$50

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<input type="checkbox"/> first and second registrant from company	€170/\$200	€/ \$ _____
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Other

<input type="checkbox"/> CGIV Conference Banquet at Leeds Town Hall	€65/\$75	€/ \$ _____
Please choose: <input type="checkbox"/> fish entrée <input type="checkbox"/> vegetarian entrée		
<input type="checkbox"/> Extra CGIV2006 Proceedings CD (special advance purchase and on-site rate)	€50/\$60	€/ \$ _____
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**Please note: To cover bank charges and processing fees, there is a cancellation fee of \$75 dollars
 until June 18, 2006. After that date, the cancellation fee is 50% of the total plus \$75.**

All requests for refund must be made in writing. No refunds will be given after June 30, 2006

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