Annual Report
of the
National Illumination Committee of Great Britain

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1st October 2024 to 30th September 2025

National Illumination Committee of Great Britain

Report for the year ending 30 September 2023

CIE-UK meetings have continued to be held. The Trustees met three times and there were two meetings of the National Illuminating Committee. The AGM was held on 5 December 2024 as a hybrid event in Birmingham. This is a pattern we would like to continue one meeting of the Trustees and NIC in person each year.

We were pleased to be able to support a number of members to attend the Mid-Term Meeting in Vienna in July 2025 under the 1975 Fund and also to provide bursaries to a number of students to attend. Three of the Keynote presentations are available to view via the CIE website.

Allan Howard continues to support the Lighting Liaison Group as the Secretary.

CIE-UK did not participate in the International Day of Light (16 May) in 2025, although CIE delivered a webinar exploring the profound impact of light on human health. The recording of this engaging session is now available to watch on the CIE Vimeo channel.

The Trustees have continued to monitor the investments with 1-2-1 and Brewin Dolphin. Both investments seemed to have performed well over the last year. The Trustees are confident that the returns from the investments can continue to meet requests for travel and other funding within the charitable aims of the organisation.

CIE continued to offer a publication to National Committees during the year: CIE x050:2023 (Volume 1) | CIE x050-Vol2:2023 (Volume 2) Proceedings of the 30th Session of the CIE, Ljubljana, Slovenia, September 15 - 23, 2023. The Trustees decided to offer this free to all CIE-UK members who request it, but we have been facing challenges distributing it due to the size of the files.

CIE-UK values the support of our two Sponsoring Organisations, the Institution of Lighting Professionals and the Society of Light and Lighting. Members receive 66% discount on CIE publications, so please make use of this. CIE-UK also benefits from sales to people in the UK through a discount to our annual subvention to CIE.

We value feedback from our members, so please contact us if there are things we can do better or if you have suggestions for developing the membership.

An organisation like CIE-UK can only exist through the financial support of its members and the time given freely by the Trustees. I would also like to acknowledge the tireless work of Allan Howard, our secretary. He ensures we do the right things at the right time, as well as providing us all with relevant information.

Finally, I extend thanks to you all for your support to CIE-UK and to CIE more generally.

John O'Hagan

Chair CIE-UK

Treasurers Report December 2025

The Trustees presented their annual report and accounts for the year ended 30 September 2025

The charity number is 257185 and the working name of the charity is CIE-UK

Reference and Administrative Information

Trustees

- Dr J O'Hagan *Chair*
- Mr Allan Howard *Secretary*
- Mr Nigel Parry *Treasurer*
- Prof Steve Fotios
- Mr Peter Thorns
- Dr Jim Uttley

Principal Office

c/o CIBSE, 91-94 Saffron Hill, London, EC1N 8QP

Independent Examiner

R A Nelson FCA, MacIntyre Hudson, Lyndale House, Ervington Court, Harcourt Way,

Meridian Business Park, Leicester LE19 1WL

Bankers

CAF Bank Ltd, 25 Kings Hill, West Malling, Kent ME19 4JQ

Solicitors

None appointed

Investment managers

Brewin Dolphin Securities

1-2-1 Investments

Budget 2023-24

The income and expenditure position for last year is outlined below.

Income	Budget	Actual to date
Membership	£ 10,420.00	£ 8,787.00
Sales	£ 600.00	£ 710.11
Investment income	£ 11,000.00	£ 10,040.28
Total £	£ 22,020.00	£ 19,537.39
Expenditure	**Budget**	**Actual to date**
CIE/BSI	£ 11,500.00	£ 11,974.26
Website	£ 250.00	£ 393.60
Bank Charges	£ 60.00	£ 54.00
Members support Ljubljana, Slovenia, +	£ 20,000.00	£ 15,739.20
Total	£ 31,810.00	£ 28,161.06
income / expenditure	-£ 9,790.00	-£ 8,623.67

Budget 2024-25

The last years income and expenditure for the year.

Income	Budget	Actual
Membership	£ 10,930.00	£ 9,050.00
Sales	£ 700.00	£ 856.28
Investment income	£ 11,000.00	£ 12,182.58
Total £	£ 22,630.00	£ 22,088.86

Expenditure	Budget	Actual
CIE/BSI	£ 12,000.00	£ 11,393.62
Website	£ 250.00	£ 300.00
Bank Charges	£ 60.00	£ 60.00
Members support AGM / Vienna/Colour	£ 32,000.00	£ 22,741.68
Total	£ 44,310.00	£ 34,495.30
income / expenditure	-£ 21,680.00	-£ 12,406.44

Budget 2025-26

The proposed income and expenditure for the current year

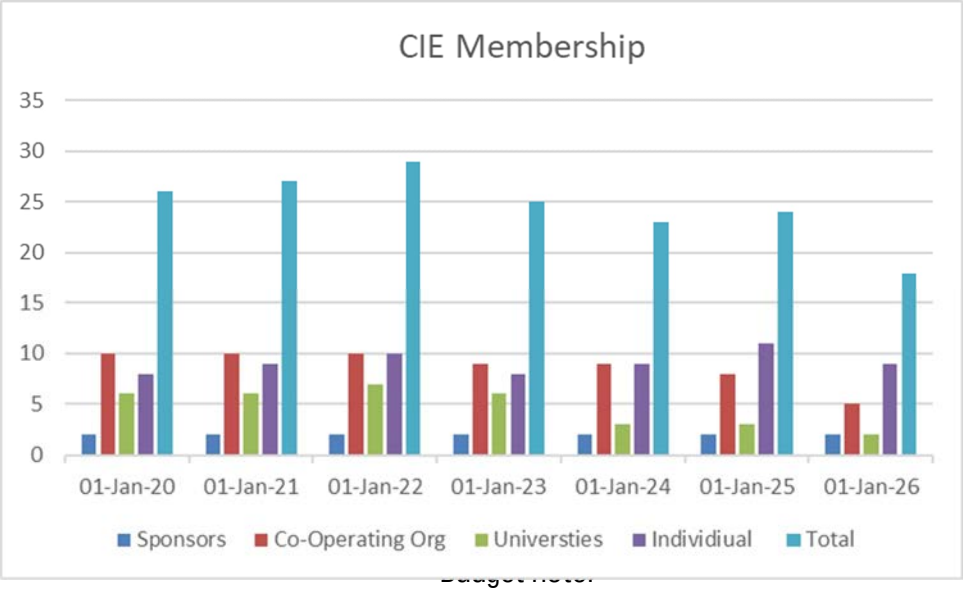
Income	Budget	Actual to date
Membership	£ 10,630.00	£ 7,165.00
Sales	£ 700.00	
Investment income	£ 11,000.00	
Total £	£ 22,330.00	£ 7,165.00

Expenditure	Budget	Actual to date
CIE/BSI	£ 12,000.00	
Website	£ 300.00	
Bank Charges	£ 60.00	
Student Bursary	£ 5,000.00	
Members support (c/f Vienna)	£ 10,000.00	£ 5,647.28
Total	£ 27,360.00	£ 5,647.28
income / expenditure	-£ 5,030.00	£ 1,247.72

Fees	2024/25	2025/26	2026/27
Sponsors	£1,550	£1,600	£ 1,660
Co-Operating Org	£495	£510	£ 530
Universities	£260	£270	£ 280
Individual	£120	£125	£ 130

CIE UK Membership consists of:

	Sep-21	Sep-22	Sep-23	Sep-24	Sep-25	Dec-25
Sponsors	2	2	2	2	2	2
Co-Operating Org	10	10	9	9	8	5
Universities	6	7	6	3	3	2
Individual	9	10	8	9	11	9
Total	27	29	25	23	24	18



Our Bank balance at 30th September 2025 was £40,021.48, and confirmed we have paid our dues to CIE and BSI

The Vienna Mid-Term meeting attracted significant interest with around £20,000 being indicated to date from CIE UK members and another £11,000 allowed for student support as required. I had allowed some £32,000 in the budget to cover these claims plus additional claims. The claims were a little lower than anticipated and a number were late to be claimed and paid in the current financial year

Investments

Investment pot 1 – managed by 121 Advice Ltd

Our investment with 121 Advice stood at £210,255 on 24 November 2025, an increase of 8.0% from the same time the previous year. Our investment manager provided this brief report: "Markets continue to remain volatile with an upward trajectory over the longer term. News regarding inflation and interest rates continues to be positive in most major markets. Markets were spooked back in the spring by Donald Trump's global tariff announcements, but markets have moved to absorb this information and move ahead. No changes are required to the portfolio at present, and we continue to monitor the situation."

A breakdown of the asset allocation for our investment in this fund is shown below.

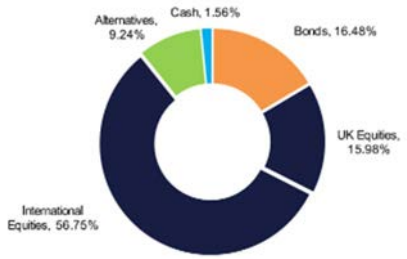
Asset allocation as at 24th November 2025

Asset allocation	% allocation	Value
Money Market Instruments (Inc Cash)	2.18%	£4,590.24
Bonds	24.09%	£50,656.10
UK Equities	48.70%	£102,392.48
Overseas Equities	19.44%	£40,881.08
Multi Asset	4.06%	£8,541.15
Specialist	1.52%	£3,193.90
Total	**100.00%**	**£210,254.96**

Investment pot 2 – managed by Brewin Dolphin

Our investment with Brewin Dolphin stood at £371,272 on 31 October 2025. The investment fund stood at £348,632 on 31 October 2024, so we have seen an increase in capital of 6.5%. In addition to the increase in capital growth, we have also received gross income from the investment of £9,295, representing a gross yield of 2.5%. Overall, the fund has provided a total annual return of 9.4% (net of all charges).

A breakdown of our asset allocations is shown below.



Overall, our investments are performing adequately, and our investment managers do not suggest making any significant changes.

Investments plus CAF Bank ~ £723,000

Financial Report to Charity Commission

Our reports to the Charity commission are up to date

Nigel Parry
Hon Treasurer
Thursday 4th December 2025

CIE Division 1: Vision and Colour

Terms of reference

The Terms of Reference of Division 1 are:

To study visual responses to light and to establish standards of response functions, models and procedures of specification relevant to photometry, colorimetry, colour rendering, visual performance and visual assessment of light and lighting.

Division Officers:

Division Director: Kaida Xiao (GB)

Division Secretary: Li-Chen Ou (TW)

Division Editor: Peter Hanselaer (BE)

Associate Directors: Vision Yoko Mizokami (JP)

Colour Aditya Sole (NO)

Activities and achievements

Activities and achievements of the Division during the year October 2024 – September 2025 were as follows:

Division 1 annual meeting held in Vienna, Austria, 11th July 2025, with Technical Committee meetings 10th July 2025.

- 4 TCs are finished and closed following TC report published (TC 1-84, TC 1-91, TC 1-92, TC 1-98)
- 1 JTC is closed without report (JTC 17)
- 1 reportership is closed with report (R 1-63)
- 1 new TC was established (TC 1- 104)
- 1 new JTC proposal is received
- 3 new reporterships were established, 4 new reportership proposal are received
- 2 new Liaisons were established (L 1-11 ISO TC 1-30, L 1-12 ICC)

Publications

CIE Publications:

CIE 256:2025 Measurement of Human Skin Colour

Human Skin Colour Database (version 2025, CIE 256:2025)

CIE 255:2025 The Functional Visual Field

CIE 253:2024 Overview of Methods for Evaluating Colour Rendition of White-Light Sources beyond Colour Fidelity

Status of Technical Committees

Division 1 started the year with 4 Vision and 7 Colour technical committees, 3 joint technical committees, and 1 Vision and 5 Colour reporterships., 2 Vision and 2 Colour technical committees and 1 joint technical committee were closed during the year. 1 new Vision Colour technical committee and 2 new reporterships were established during the year.

Technical Committees Summary:

TC	TC Chair	Title	Status	Year Est.	Latest Activity Report
TC1-84 (V)	Nana Itoh	Definition of visual field for conspicuity	Published report: CIE 255:2025 Closed	2011	2023
TC1-91 (C)	Yandan Lin	Methods for evaluating the colour quality of white-light sources	Published Report: CIE 253: 2025 Closed	2012	2023
TC1-92 (C)	Kaida Xiao	Skin colour database	Published report: CIE 256:2025 with associated database Closed	2013	2024
TC1-95 (C)	Minchen Wei	The validity of the CIE whiteness and tint equations	Working Draft in progress	2015	2021
TC1-96 (C)	Ronnier Luo	Advances in colour appearance models	Committee Draft	2015	2024
TC1-97 (V)	Jan Henrik Wold	Age- and field-size-parameterised calculation of cone-fundamental-based spectral tristimulus values	Python application developed.	2015	2024
TC1-99 (C)	Ronnier Luo	Modeling two-dimensional colour appearance scales		2020	2024
TC1-100 (C)	Ronnier Luo	To recommend CAM16-UCS as the CIE uniform colour space		2023	2024
TC1-101 (V)	Sei-ichi Tsujimura	Influence of ipRGCs on brightness perception		2023	2024
TC1-102 (C)	Changjun Li	Method for calculating CIE tristimulus values		2023	2024
TC1-103 (V)	Steve Fotios	Research Methods for Psychophysical Studies of discomfort from glare		2024	2024

New Technical Committees

TC	TC Chair	Title	Status	Year Est.	Latest Activity Report
TC1-104 (V)	Andrew Stockman	Verification of the physiologically relevant CIE 2006 LMS cone fundamental CMFs and their linear transformation the 2015 XYZ CMFs		2025	-

Joint Technical Committees

TC	TC Chair	Title	Status	Year Est.	Latest Activity Report
JTC12 (D2/D1/D8)	Alejandro Ferrero	The measurement of sparkle and graininess		2018	2024
JTC16 (D1/D8)	Minchen Wei / Shining Ma	Validity of chromatic adaptation		2018	2021
JTC17 (D1/D2/D8)	Frédéric Leloup	Gloss measurement and gloss perception – a framework for the definition and standardization of visual cues to gloss.	Closed without Report	2019	2023

Reporterships

DR	Reporter	Title	Year Established	Latest Activity Report
R1-60 (C)	Ruili He (from 2023)	Future colour-difference evaluation	2013	2024
R1-62 (C)	Sophie Jost	Typical LED spectra	2014	2024

R1-64 (C)	Changjun Li	Real colour gamut	2015	2023
R1-67 (C)	Youngshin Kwak	Revisiting correlated colour temperature	2016	2024
R1-69 (V)	Shao-Tang Hung	Applicability of metrics for evaluating reflected glare on displays	2017	2024
R1-70 (C)	Jisoo Hwang	Visual assessment methods of perceptual colour shifts in HDR luminance conditions	2020	2024
R1-72 (C)	Luke Hellwig	Developments in colour appearance research and models	2024	-
R1-73 (C)	Ashraf Maliha	Modelling contrast sensitivity functions across a large parameter space	2024	2024
R1-74 (C)	Shining Ma	Corresponding colour datasets for 3D objects	2024	-

Research Forum

RF	Convener	Title	Year Established	Latest Activity Report
R1-60 (C)	Jiaye Li (Since 2023)	Matters related to colour rendition	2017	2024

Division 1 Technical Committees:

TC1-84 Definition of visual field for conspicuity

Year Established: 2011

Terms of Reference: To define and classify functional visual fields for universal tasks and develop guidelines for the layout of visual information to increase the visibility of visual signs, displays and markings.

Chair: Nana Itoh (JP)

Closed with publication of CIE 255:2025 *The Functional Visual Field*.

TC 1-91 (Colour) Methods for evaluating the colour quality of white-light sources

Year Established: 2012

Terms of Reference: To summarize available methods for evaluating the colour quality of white-light sources with a goal of introducing methods for industrial use. (Methods based on colour fidelity shall not be included: see CIE 224:2017)

Chair: Yandan Lin (CN)

Closed with publication of CIE 253:2025 *Overview of Methods for Evaluating Colour Rendition of White-Light Sources beyond Colour Fidelity*.

TC 1-92 (Colour) Skin Colour Database

Year Established: 2013

Terms of Reference: 1. To investigate the uncertainty in skin colour measurement and to recommend protocols for good measurement practice. 2. To tabulate skin colour measurements that accord with these protocols covering different ethnicity, gender, age and body location.

Chair: K Xiao (GB)

Closed with publication of CIE 256:2025 *Measurement of Human Skin Colour*.

The database is available online as Human *Skin Colour Database (version 2025, CIE 256:2025)* at: https://bit.ly/4hGiBh6

TC1.95 (Colour) The validity of the CIE Whiteness and Tint equations

Year Established: 2015

Terms of Reference: Based on published and new experimental work the TC shall seek to recommend modifications to the existing CIE Whiteness and Tint Equations to extend their application to Illuminants other than D65. Furthermore the TC shall review the restrictions imposed on the validity of the equations to samples that are measured on the same instrument at nearly the same time, and review the colorimetric limits hitherto set. If enough experimental data justify it, the TC may recommend modifications to the current CIE Equations for Whiteness and Tint.

Chair: M Wei (HK)

WD1 is complete and waiting for committee member comments.

TC1.96 (Colour) Old: A comprehensive model of colour vision, New: Advances in colour appearance models

Year Established: 2016

Terms of Reference: Old: Based on the published work and new experimental work should seek to recommend a model or models of colour vision that predicts of the appearance of coloured stimuli viewed in typical laboratory conditions. This shall include stimuli that appear as both related and

unrelated colours, that are viewed under illumination from photopic down to scotopic levels, and that have varying size. The model shall also include a uniform colour space. New:To present the state of the art in colour appearance modelling in terms of the effect of the stimulus size, and the colour appearance of unrelated colours. In both cases more than one model will be presented, and further experimental work encouraged.

Chair: Ronnier Luo (GB)

The second committee draft report is being revised following further comments.

TC 1-97 (Vision) Age- and field-size-parameterised calculation of cone-fundamental-based spectral tristimulus values

Year Established: 2015

Terms of Reference: 1. Following on from CIE TR 170, to recommend a procedure for age- and field-size-parameterised calculation of cone-fundamental-based spectral tristimulus values, compliant with the principles of the CIE XYZ concept. 2. To deliver a computer program for the calculations.

Chair: Jan Henrik Wold NO

No progress report. (The Norwegian NC of CIE is currently boycotting all international CIE activity, since during the ongoing Ukrainian war, CIE centrally does not boycott Russian participation).

Decision to be made as to where the Python based application will be made available. The application may need updating in the future, for example after TC104 has finished.

Having delivered the computer program, the majority of the TC members have voted to close this committee.

TC 1-99: (Colour) Modelling two-dimensional colour appearance scales

Year Established: 2020

Terms of Reference: To recommend a set of two-dimensional colour appearance scales based on perceptual correlates derived from colour appearance models using existing experimental data, and to provide evidence of the value of these scales in appropriate applications. The scales include whiteness, blackness, vividness, depth (saturation), saturation, and clarity.

Chair: Ronnier Luo (GB)

Due to the late publication of key papers relating to this subject, a two year extension has been granted to complete this work.

TC1-100 (Colour) To recommend CAM16-UCS as the CIE Uniform Colour Space

Year Established: 2023

Terms of Reference: To recommend CAM16-UCS, the uniform colour space based on the CIE recommended colour appearance model, CIECAM16, to be the CIE Uniform Colour Space, CIECAM16-UCS, based on the analysis of existing published experimental data. To recommend conducting field trials involving different materials in different industries using the procedure defined in the report.

Chair: Ming Ronnier Luo (GB)

The committee report is to be submitted to CIE CB.

TC1-101 (Vision) Influence of ipRGCs on brightness perception

Year Established: 2023

Terms of Reference: To prepare a technical report that summarizes the currently available information on brightness influenced by ipRGCs (intrinsically photosensitive retinal ganglion cells or

melanopsin cells) which contain photopigment melanopsin. The report of the committee reviews the literature studies regarding the influence of melanopsin cells on brightness perception including brightness estimation models that take into account the influence of melanopsin cells on brightness perception used in these studies. These brightness estimation models are expected to improve the assessment of brightness perception influenced by melanopsin cells.

Chair: Sei-ichi Tsujimura (JP)

The working draft of the TR has been completed.

A title change to the TC has been proposed, based on the following grounds: ipRGCs receive inputs from cones and rods (e.g., Hattar et al., 2003) and silent-substitution stimuli are designed based on the melanopsin spectral sensitivity curve at the corneal level. Therefore, it is more appropriate to describe the effect in terms of melanopsin influence rather than ipRGCs. Therefore, a title change to for example "Influence of Melanopsin on Brightness" has been proposed. The TC Terms of Reference will also be updated accordingly. If there is general agreement among TC members, an approval through a division ballot will be requested.

TC1-102 (Colour) Method for calculating CIE tristimulus values

Year Established: 2023

Terms of Reference: To recommend a method for the accurate calculation of XYZ tristimulus values from measured spectral reflectance (transmittance) at any equally-spaced wavelength interval, which incorporates the measurement bandpass correction and performs the best among all available methods in terms of closeness to the CIE XYZ definition (1 nm-step summations).

Chair: Changjun Li (CN)

Accumulated 1nm reflectance dataset for evaluating methods; This new reflectance dataset was measured using samples from the Munsell Book of Colour with the measurements made from 350 nm to 840 nm at 1 nm intervals. Many previously published sets of data use the much restrictedrange of 380 nm to 780 nm or even 400 nm to 700 nm, often at only 5 nm intervals.

Review and select available methods for evaluations and comparisons: they are: Direct Selection; CIE-R (one of the CIE recommended); ASTM T5; ClaudioOleari: WT0 and WT2; Optimum WT (LLR); Least Square WT (LWL).

Test results show: Least Square WT performs the best under the D65, D50, A; 9 LED illuminants; CIE-R performs the best under F1-F12; Least Square WT performs the second best.

The members of TC agree to recommend Least Square WT method for computing the tristimulus values under the following reasonings: performs best under D65, A, D50, and LEDL41; and CIE LEDs 1-9; Though CIE-R method performs the best under the CIE F illuminants, LS and CIER are not significantly different in statistical test; F lamps are banned by The European Union in February 2025 and will be gradually phased out globally by the end of 2027, according to the decision of the Fifth Conference of the Parties to the Minamata Convention.

A technical report and implementation in MATLAB , Python and Excel environments are in progress.

TC1-103 (Vision) Research methods for psychophysical studies of discomfort from glare

Year Established: 2024

Terms of Reference: To report on research methods (both research design and statistical analysis) for psychophysical studies of discomfort from glare. The aim is to bring best practices from psychology into the wider awareness of people in the lighting community who wish to use such tools in their own work, to reduce errors that plague the existing literature.

Chair: Steve Fotios (GB)

Several online meetings held. A start has been made on a draft report.

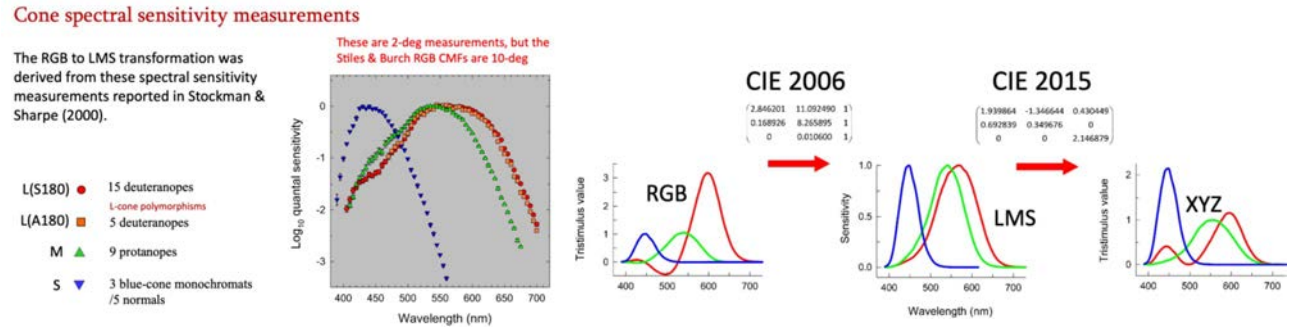
TC1-104 (Vision) Verification of the physiologically-relevant CIE 2006 LMS cone fundamental CMFs and their linear transformation the 2015 XYZ CMFs

Year Established: 2024

Chair: Andrew Stockman (GB)

Terms of Reference: 1) To verify the standard cone spectral sensitivities, colour matching functions and individual differences defined in CIE 170-1:2006, Fundamental chromaticity diagram with physiological axes – Part 1 [1], and in CIE 170-2:2015 Fundamental chromaticity diagram with physiological axes – Part 2 [2] referred to jointly as the CIELMS(06)XYZ(15) model. 2) To test and refine the standard cone spectral sensitivities, colour matching functions and individual differences defined in the CIELMS(06)XYZ(15).

The definition of LMS: CIE Technical Report 170-1: 2006 "Fundamental Chromaticity Diagram with Physiological Axes – Part 1" and the definition of XYZ: CIE Technical Report 170-2: 2015 "Fundamental Chromaticity Diagram with Physiological Axes – Part 2: Spectral Luminous Efficiency Functions and Chromaticity Diagrams" are linked to the Stiles & Burch (1959) CMFs and are based on the work of Stockman & Sharpe (2000). Together, they represent a consistent set of "physiologically-relevant" (i.e.,"correct") LMS, RGB and XYZ CMFs for 2° and 10° vision. These have been adopted by CIE as advisory but not mandatory. It has been 25 years since the publication of the cone fundamentals that became the CIE2006 advisory LMS standards. The determination involved several steps. Potentially, each step can introduce some error. Since the intent is to verify and, if necessary, adjust the CIE 2006 standards, The steps are summarized:



Proposed work:

(1) Review existing published research that has already assessed the $CIE_{LMS(06)XYZ(15)}$ model.

(2) Corroborate the standard cone spectral sensitivities, colour matching functions and individual differences defined in the $CIE_{LMS(06)XYZ(15)}$ model using existing and ongoing measurements that will include many colour-normal observers covering a range of demographics and including colour deficient observers.

(3) If necessary, adjust the $CIE_{LMS(06)XYZ(15)}$ model while avoiding adjustments that fail to maintain the physiological relevance of the functions and link to the *Stiles and Burch colour matching data*.

Joint Technical Committees:

JTC 08 (Colour) (All Divisions) Terminology in light and lighting

Year Established: 2015

Terms of Reference: To address any issues regarding terms and definitions related to the International Lighting Vocabulary (ILV). This includes coordination within CIE Divisions to maintain and update the ILV, coordination with IEC on questions related to the incorporation of ILV terms and

definitions into IEC 60050-845 “International Electrotechnical Vocabulary. Lighting”, coordination with ISO/TC 12 on questions related to the incorporation of ILV terms and definitions into ISO 80000-7 “Quantities and units – Part 7: Light and radiation” and any further terminology issues within CIE.

Chair: Peter Zwick (DE)

No items to report.

JTC 12 (Vision) (D2/D1/D8) The measurement of sparkle and graininess

Year Established: 2018

Terms of Reference: To provide a methodology to measure sparkle and graininess, and to develop a measurement scale. Measurands will be defined and the requirements for their measurements will be well normalized, in such a way that different instruments can provide the same spectrophotometric data from the same specimen. A psychophysical method will be recommended to obtain visual data, and its correlation with the spectrophotometric data will be worked out to develop the measurement scale for sparkle and graininess.

Chair: Alejandro Ferrero (ES)

The measurement scales have been defined. The main content in the working draft has been written. The results of an experiment on sparkle with a large set of samples, have shown that we must include the percentile P99.98 of the visibility of sparkle in the scale. It has been shown by a parallel experiment by Thomas Albrecht and Daniela Schier.

JTC 16 (Colour) (D1/D8) Validity of Chromatic Adaptation

Year Established: 2018

Terms of Reference: The TC will review the existing CATs and propose modifications by including a two-step transform to take the effect of white light chromaticity on degree of chromatic adaptation into consideration and will write a TR.

The TC will review the existing CATs and propose modifications by including a two-step transform to take the effect of white light chromaticity on degree of chromatic adaptation into consideration

Chair: Shining Ma (CN) (since 2023)

The TC is reviewing the datasets and testing the CAT performances.

JTC 17 (Vision) (D1/D2/D8) Gloss measurement and gloss perception: A framework for the definition and standardization of visual cues to gloss

Year Established: 2018

Terms of Reference: To describe recommendations for standardised visual assessment conditions of individual, established cues to gloss, to make recommendations for the definition of a standard gloss observer for individual diagnostic cues and, based on the findings from the above, to suggest optical methods and metrics for describing gloss in correlation with the established gloss cues.

Chair: Frédéric Leloup (BE)

Closed without report.

Division 1 Reporter ships:

DR1.60 Future colour difference-evaluation

Year Established: 2013

Terms of Reference: To report on publications that relate to colour-difference evaluation and uniform colour spaces.

Reporter: Ruili He (GB)

Conducting psychophysical experiments on a WCG display (BT.2020): Unique hue data, and colour-difference evaluation.

Collecting new human perception dataset on HDR and wide colour gamut space

Testing existing uniform colour spaces and colour appearance model using new dataset

Developing new unform colour space (using existing dataset and our new dataset)

DR1.64 (Colour) Real Colour Gamuts

Year Established: 2015

Terms of Reference: To investigate the derivation of a gamut representative of real (non-fluorescent) surface colours and defined by associated spectral reflectance data.

Reporter: C Li (CN)

Existing issues: Both Pointer and ISO reference gamut defined in terms of L*, C* and h under illuminant C and D50 respectively under the convex assumption in CIELAB space. However, this assumption is not true. It was found that both gamuts do not represent the surface gamut well; both gamuts are not convenient to apply in other viewing conditions. It is better to define gamut in terms of reflectance.

Action: Data collection of: A set of reflectance between 400 nm and 700 nm at 10 nm intervals. Total number of reflectance is: 142896. A set of 422 available SPDs including D65, A, D50, LED L41, F series, LEDs

A report is ready. It is expected this reportership will be closed by the next D1 meeting. Whether a TC is needed can be discussed in the next D1 meeting.

DR1.67 (Colour) Revisiting Correlated Colour Temperature

Year Established: 2016

Terms of Reference: To review the literature related to perception of colour of white light sources with a goal to investigate the concept of correlated colour temperature.

Reporter: Youngshin Kwak (KR)

Since the establishment of DR 1-67 in 2016, a few new studies on the visual perception of correlated colour temperature (CCT) have been published, showing some progress. However, the number of studies remains limited, indicating a lack of substantial interest from both academia and industry. Due to this limited body of research, there is currently insufficient evidence to support the development of a new method for determining the CCT.

Therefore, it has been concluded that DR 1-67 should be closed without proposing any further action.

A ballot was conducted, and the closure of the DR was approved (12 in favour, 0 abstention, 0 against).

DR1.69 (Vision) Applicability of metrics for evaluating reflected glare on displays

Year Established: 2017

Terms of Reference:

Reporter: Shao-Tang Hung (KR)

2D reflectance measurement system was developed to measure the angle-dependent reflectance of the surfaces of flat samples. The flat samples are glossy and matte surfaces for simulating the

different surface characteristics of display. The angle-dependent reflectance are calculated and analysed based on the references. The next step is the application of these references.

DR1.70 (Colour) Visual assessment methods of perceptual colour shifts in high-dynamic-range (HDR) luminance conditions

Year Established: 2020

Terms of Reference: Experimental methods for assessing how perceptual colour changes in HDR luminance conditions.

Reporter: Jisoo Hwang (KR)

A report is being prepared.

DR1-72 (Colour) Developments in colour appearance research and models

Year Established: 2024

Terms of Reference: Colour appearance research and models.

Reporter: Like Hellwig (US)

What is the bigger picture of what the field needs to bridge the gap between standardized models and applications? - data handling and availability, standardized metrics for assessing current colour appearance model performances, increased interaction between model users and model developers, improved model construction (simplicity, fidelity to target behaviour).

A report will be written to summarise current research and suggest institutional frameworks for achieving the above goals.

DR 1-73 (Vision) Modelling contrast sensitivity functions across a large parameter space

Year Established: 2024

Terms of Reference: Review of CSFs and models

Reporter: Maliha Ashraf (GB)

Key objectives:

Review existing contrast sensitivity function (CSF) studies and models, define a comprehensive CSF parameter space, recommend standardised methods for measurement, evaluate modelling approaches, identify potential applications, Prepare groundwork for a future CIE Technical Committee.

Information is currently being collated together for a report.

DR1-74 (Colour) Corresponding colour datasets for 3D objects

Year Established: 2024

Terms of Reference: Collect, classify and summarise colour datasets for 3D objects. Compare datasets for 3D objects with 2D datasets.

Reporter: Shining Ma (CN)

The currently available methods to collect corresponding colour data for 3D objects are being summarised and data sets are being collected.

Research Forum:

RF-03: Matters relating to colour rendition

Convener: Jiaye Li (FR) (since 2023)

Terms of Reference: This research forum (RF) is related to CIE strategy top priority topic #2: “Colour Quality of Light Sources Related to Perception and Preference”. The RF will provide a discussion and information- and data-sharing platform to support the development of a comprehensive method that characterizes all colour rendition aspects of white-light sources and lighting systems for general lighting purposes. Topics to be addressed/discussed can include a literature review of existing methods to characterize the colour rendition properties of white-light sources with their advantages and limitations (TC 1-91); a review of CIE activities and publications: e.g. the use of 10-deg CMF instead of 2-deg CMF, CIE 2006 Colorimetry (TC 1-97), CIECAM16 (JTC 10), a new CCT definition (DR 1-67) and/or a new chromatic adaptation transform (JTC 16) and their impact on colorimetry and on the lighting community; and creating an overview of the desired colour rendition-related specification items (from a manufacturer, designer, specifier, and consumer’s point of view) for describing colour “quality” for a selected set of application areas and target groups.

CIE updated its position statement in January 2025 to accept the CIE Rf metric, replacing CRI. Based on CIE input, RF-03 met and defined its future direction:

• Conduct a comprehensive comparison of current colour rendition metrics and experimental methods.

• Establish a colour rendition measure incorporating visual effects based on shared database.

Presentations during the meeting:

• Michael Royer: “PNNL spatial brightness & visual performance research.”

• Qiang Liu: “Quantifying the colour discrimination capability of white light sources.”

• Presentations provided valuable insights and inspiration for future RF-03 work.

A special session on colour rendition metrics was held during the IEA SSLC expert meetings (April 9–11) at ENTPE, Lyon:

• Yoshi Ohno presented: Background on the CIE Rf metric.

• Jiaye Li presented: Future direction of CIE RF-03.

• Audience included experts and policymakers.

A new reportership for a colour rendition database was proposed.

New TC proposal:

None

New JTC proposal

(CIE Div 8) Optimal CMFs for display colour consistency.

Proposed TC Chair: Francisco Imai (US)

Terms of Reference:

To standardize a set of new colour matching functions for self-emissive devices of display system that minimizes colour inconsistency caused by imperfections in the CIE 1931 standard observer. To propose an optimization framework of physiologically-driven colour matching functions to achieve colour consistency amongst electronic displays of different technologies. This framework provides a set of optimized parameters associated with physiological templates and components of the human eye.

New Reportership proposals:

R1.XXXa (Vision) Revisiting flicker metrics

Proposed Reporter: Jiaye (Jane) Li (FR)

This is a revised proposal, Revised Terms of Reference:

The DR will review the current flicker metrics including Pst LM (IEC, 2020), MP (ASSIST, 2015) and its recently revised version MP,2024 (Li et al, in journal review) as well as FVM (Perz, 2017), based on literature review and computational analyses. The DR will develop a detailed TC proposal with a table of contents. The future TC will include an evaluation of metric performance considering visual relevance, measurement reproducibility and variations of results due to measurement conditions and instrumentation, identify problems, and provide guidance on the use of these metrics.

Relation to Existing Work:

CIE 249:2022 – time domain calculation for flicker metrics recommended (proposal for revision discussed). Note: Pst LM's Temporal Contrast Sensitivity Function unsuitable for general lighting flicker prediction.

Pst LM (IEC TR 61547-1, recommended by CIE 249) – long measurement time 180 s, poor perceptual relevance, originally developed to evaluate irritability of power line fluctuation, – significantly affected by power supplies (IEA IC 2023).

MP (ASSIST 2015, Revision 2024) – shorter measurement time 2s, original MP : poor reproducibility, revised MP : much improved reproducibility & perceptual relevance.

Impact:

Strengthens CIE Leadership: Positions CIE as a leader in flicker metric assessment (currently IEC, IES, IEEE active). Targets Specific Technical Issues: characterises existing metrics, demonstrates limitations, and provides well-justified guidance.

Stakeholders: Lighting industry, international committee & regulatory bodies, scientific community.

It was suggested that the ToR be further revised by removing the part following the sentence: "The DR will develop a detailed…". A ballot will be held after a revised proposal is received.

R1.XXXb (Colour) Colour rendition database

Proposed Reporter: Jiaye (Jane) Li (FR)

Relation to Existing Work: - CIE 224:2017, CIE 253:2024, CIE PS 002:2025, CRI outdated, based on obsolete colour space & limited samples, CIE Rf recognised as scientifically accurate for colour fidelity, need of a comprehensive colour quality measure.

• Recent Research - New publications after CIE 253:2024, comparative studies of colour rendition measures exist but with limited data.

Impact: - Address gaps in current colour quality frameworks by supporting standard metrics beyond, fidelity (esp. colour preference). Aligns with CIE PS 002:2025, CIE 253:2024, CIE 224:2017. Contributes to developing comprehensive colour rendition metrics. Enable systematic evaluation of current & new metrics. Supports RF-03, may lead to new TC formation.

R1.XXXc (Colour) Memory skin colour and its acceptability boundaries

Proposed Reporter: Yan Lu CN

Terms of Reference:

Review methodological approaches for psychophysical experiments on memory skin colour, highlighting their strengths and limitations. Assemble a cross-cultural dataset of memory skin colour, including memory colour ellipses and acceptable tolerance. Report on the observer variation and influential factors such as familiarity, cultural and environmental background, and illumination conditions.

Impact:

Extend the scope of CIE TC 1-92: Measurement of Human Skin Colour, from the physical measurement of skin colour to the cognitive dimensions of skin colour perception, specifically the role of long-term memory, familiarity, and cultural background on how skin colour is remembered and accepted across diverse populations. Contribute to the refinement of the Memory Colour Rendition Index (MCRI) for assessing the fidelity of skin colour rendering. Technological benefit – This DR will consolidate existing studies, refine methodologies, and derive memory skin colour centres and tolerance ellipses using CIE colour space. It will quantify observer variability and map acceptable skin tone gamut considering contextual influences. Societal benefit(s) – The results will promote inclusive, culturally sensitive skin applications by aligning memory colour models with global perceptual variations.

Beneficiaries:

Vision and colour science community: offering datasets and insights into memory colour mechanisms and inter-observer variability, supporting the broader field of psychology and neuroscience research. Cultural and social studies: exploration of how cultural background shape skin colour memory and tolerance, informing discussions on representation and inclusivity in visual media. Imaging and display industries: enhancement of algorithms for skin colour reproduction in cameras, monitors, and printers, with potential applications in colour calibration and image quality assessment. Cosmetic industry: supporting the development of personalized products by providing perceptual insights into skin tone memory and cultural expectations. Lighting industry: improving the evaluation of skin colour rendition and contributing to improved light source design for realistic and pleasing skin appearance. AI and face recognition developers: improving face detection, localisation, and tracking by incorporating knowledge of memory skin colour and acceptable chromatic boundaries.

A ballot was conducted, and the establishment of this new DR was approved (13 in favour, 1 abstention,

0 against).

R1.XXXd (Colour) Unique Hue Data

Proposed Reporter: Kaida Xiao (GB)

Terms of reference:

Review methodological approaches for psychophysical experiments on unique hue assessment, highlighting their strengths and limitations. Assemble a unique hue dataset on a wide colour gamut display or projector. Report on the observer variation and influential factors such as observer age.

A ballot was conducted, and the establishment of this new DR was approved (11 in favour, 0 abstention,

1 against).

Next Division 1 Meeting

CIE Division 1 Annual Meeting 2026, Gjøvik, Norway, September 2026.

Report presented by:

Peter Clarke

UK Representative CIE Division 1

30 December 2025

CIE Division 2: Measurement of Light and Optical Radiation

Terms of reference

The Terms of Reference of Division 2 are: To study standard procedures for the evaluation of ultraviolet, visible and infrared radiation, global radiation, and optical properties of materials and luminaires.
To study optical properties and performance of physical detectors and other devices required for their evaluation.

Division Officers:

Division Director:	Dong-Hoon Lee
Division Secretary:	Gaël Obein
Division Editor:	Valéry Ann Jacobs
Associate Directors:	Armin Sperling, Hiroshi Shitomi, Anders Thorseth, Tobias Schneider, Qian (Cherry) Li

Activities and achievements

Activities and achievements of the Division during the year October 2024 – September 2025 were as follows:

TCs and Divisional Meetings

10th to 11th June 2025 in Vienna, Austria

CIE Publications

CIE S 027/E:2024 Photometry of road illumination devices, light-signalling devices and retroreflective devices for road vehicles.

It reports the requirements for measuring electrical, photometric, and colorimetric properties of road illumination and light-signalling devices for vehicles, including their light sources as defined by UN regulations. Measurements are typically taken under DC supply voltage, possibly with electronic control gear. The standard also covers photometric and colorimetric properties of retroreflective devices. Key quantities include luminous flux (total and cumulative), luminous intensity, illuminance, luminance, chromaticity coordinates, spatial chromaticity distribution, luminance factor, and coefficient of luminous intensity for fluorescent or retroreflective surfaces. Geometric aspects such as light-emitting area and contrast ratios of light sources are also specified.

Published: November 2024

Status of Technical Committees

2 -81 Update of CIE 065:1985 (Absolute Radiometers)

To update the existing CIE 065-1985 on the operating principle of absolute detectors of optical radiation.

The technical report is nearing publication with a ballot imminent.

Chair: Geiland Porrovecchio

2-85 Recommendation on the geometrical parameters for the measurement of the Bidirectional Reflectance Distribution Function (BRDF)

To provide geometrical recommendations for the BRDF measurement according to the type of sample under investigation, in order to allow better comparison between the different

instruments, to improve the traceability of the measurements, and to help the user to choose the right angular configuration.

The technical report is nearly finalised.

Chair: Lou Gevaux

2-86 Glare measurement by Imaging Luminance Measurement Device

Glare measurement principles by imaging luminance measurement devices (ILMD) will be studied. Glare metrics are calculated form luminance distribution of the visual environment applying the particular model of vision and calculation methods described in relevant publications. To summarise the characteristics of ILMD and best practice for measuring luminance distributions that allow users to calculate glare metrics.

Chair: Jan Wienold (CH)

2-89 Measurement of Temporal Light Modulation of Light Sources and Lighting Systems

To provide guidance on the measurement of temporal light modulation of light sources and lighting systems. The TC shall first develop a technical note on a measurement protocol that will include recommended measurement conditions and methods to measure waveforms of light (time intervals, duration, bandwidth, photometer requirements, etc.) and frequency-domain power spectra (FFT and other methods) that enable all researchers to report the results with sufficient information of the light investigated in a consistent way. In addition, a technical report shall be developed for the measurement of temporal light modulation of light sources and lighting systems using any existing or new quantities to be developed (i.e. proposed by TC 1-83). Conventional quantities such as modulation depth can also be determined from the measurement data. The TC should analyze the reproducibility and uncertainties related to all quantities.

Chair: Qian (Cherry) Li (CN)

2-91 Optical Measurement Methods of LED Packages and LED Arrays

The purpose of this TC is to define an international standard for the optical measurements of semiconductor light sources (in particular LED packages and LED arrays as defined in CIE S 017-SP1) to the extent to which they emit incoherent optical radiation. Semiconductor light sources in terms of this standard are individual inorganic light emitting diodes or combinations of multiple objects of the same type in different two- or three-dimensional structures, which are distinguished and identified herein as LED packages and LED arrays. This document will not deal with e.g. LED lamps and luminaires as they are already covered by CIE S 025 or other applications of higher integration levels.

The standard shall describe in particular the geometrical arrangements, the electrical, thermal and temporal operating conditions and the measurement of the values of photometric, colorimetric and spectroradiometric quantities. Moreover, measurement quantities and associated measurement procedures are defined for describing the specific properties of LEDs and to take into account the restricted measurement options available during their manufacture or binning procedure.

The document does not cover semiconductor emitters for coherent optical radiation (lasers), nor limit values for evaluating radiation safety.

The document does not cover measurements of bare LED dice (chip or wafer probing).

Chair: Markus Schneider

2-95 Measurement of Obtrusive Light and Sky Glow

To provide guidelines and examples for metrics, measurement methods and corresponding instrument specifications for the measurement of obtrusive light and sky glow including the estimation of measurement uncertainty contributions for the measurement, necessary to validate assessment criteria of its effects on the environment. The proposed guidelines and examples can be used as a common base with reliable and traceable techniques for various disciplines that are dealing with obtrusive light and sky glow measurements, light pollution assessment and research.

Chair: Constantinos Bouroussis (CH)

2-96 Revision of ISO/CIE 19476: 2014 Characterisation of the performance of illuminance meters and luminance meters

To revise the Standard ISO/CIE 19476:2014 and CIE S 023/E:2013 respectively, taking into account the feedback received in the systematic review held in 2019.

Work in technical report is ongoing. Meeting in Vienna discussed performance of photometers, LED UV-index and instrument linearity, revision of annexes (quality indices, spectral mismatch correction factor uncertainties)

Chair: Armin Sperling (DE)

2-97 Revision of CIE S 025/E:2015 Test Method for LED Lamps, LED Luminaires and LED Modules and its supplement

The terms of reference of this TC are to revise CIE S 025/E:2015 Test Method for LED Lamps, LED Luminaires and LED Modules and its supplement, taking into consideration the feedback received and knowledge gained since the introduction of the standard.

The technical report is nearing completion.

Chair: Anders Thorseth (DK)

2-99 Standard File Format for Electronic Transfer of Optical Radiation Data for Luminaires, Lamps and LED modules

To specify an XML exchange format for the transfer of photometric, colorimetric, spectrometric and energy consumption data of luminaires, lamps and LED modules, in the range from UV to IR.

Once the XML exchange format is completed, It would be also provided additional file format as a translation from the original XML, e.g. JSON (JavaScript Object Notation) exchange format.

Chair: Danilo Giannetti (IT)

2-100 Software Validation Spectra, Derived Quantities and Metrics

To define sets of spectral distributions and associated derived quantities and propose comparison metrics for the purpose of validation of software tools.

Chair: Kevin Smet (BE)

Joint Technical Committees

JTC 05 (D6 D2): Review of IEC 62471/CIE S009

To update CIE S009; to take account of revised exposure limit guidelines from the International Commission on Non-Ionizing Radiation Protection; to provide a clearer rational for the definition of the risk groups; and to improve the guidance on measurements in conjunction with Division 2. To work with IEC TC76 and IEC TC34 on the development of product-specific requirements of the revised standard. However, responsibility for the product-specific

requirements will rest with IEC. To work with IEC to produce a dual-logo standard to replace CIE S009/IEC 62471.

Chair: John O'Hagan (GB)

JTC 20 (D6/D2): Wearable alpha-opic dosimetry and light logging methods, limitations, device calibration and data schemes

To write a Technical Report (TR) on wearable a-opic dosimetry and light logging methods, including calibration, and limitations vis-à-vis physiologically relevant quantities.

To write a Technical Note (TN) on the needs and specific recommendations for a data sheet to support research users of wearable light loggers for consideration by manufacturers.

To write a Technical Note (TN) on the needs and specific recommendations with respect to metadata and data schemes for a-opic dosimetry and light logging data collections.

Chair: Manuel Spitschan(DE)

Research Fora

RF-05: Implementation of CIE 2006 Cone Fundamentals in Photometric and Colorimetric Measurements

Since its beginning, colorimetry and photometry were directly related through the CIE colour matching function Y of the CIE 1931 standard colorimetric system which was set to be identical with the spectral luminous efficiency function for photopic vision, V(lambda). It is also well known that V(lambda) is not a perfect match to human vision and in particular it underestimates the visual response in the blue region. The physiology-based function, known as the cone-fundamental-based spectral luminous efficiency function, V_F(lambda), is based on the latest research and again relates photometry to modern (i.e. cone-fundamental based) colorimetry.

RF-05 is being coordinating with CCPR-WG-SP-TG16 (Task Group on Cone Fundamentals)

Report presented by:

Martin Dury
UK Representative CIE Division 2

December 2025

CIE Division 3 Interior environment and lighting design

Terms of reference

Division 3 is concerned with factors which influence the satisfaction of the occupants of a building with their environment, including the effects of both daylighting and electric lighting.

Its objectives are to study and evaluate those factors to provide guidance on relevant design criteria, to study design techniques (including relevant calculations) for the interior lighting of buildings, to incorporate the findings and those of other CIE divisions into lighting guides for interiors in general or of particular types.

Division Officers:

Division Director:	Nozomu Yoshizawa
Division Secretary:	Cláudia Naves David Amorim
Division Editor:	Veronica Garcia-Hansen
Associate Directors:	Anna Pellegrino
	Adrie de Vries

Activities and achievements

Activities and achievements of the Division during the year October 2024 – September 2025 were as follows:

CIE Mid -term meeting – Vienna, Austria. July 4th -11th 2025

JTC 15 completed its work and ISO/CIE 8995-1:2025 has been published.#

A challenge in Division 3 is the workshop for young researchers. In the activity policy of the Division 3 research strategy, the workshop was scheduled to be held annually. In 2024, there was a LightCAP workshop for young researchers, and this year, a workshop on tailoring indoor lighting requirements to meet user needs was held in Vienna. D3 plan to conduct an online workshop for young researchers in 2026.

Status of Technical Committees

TC 3-57 A Generic Discomfort Glare Sensation Model

This TC had to be closed, but will be restarted in the form of a Research Forum to keep the discussion on this highly important topic going.

TC 3-58 (Visual ergonomics and digital display use)

Final document being prepared for approval vote.

TC 3-59 The integration of daylight and electric lighting – photometric, colorimetric and radiometric requirements for the spectral design of lighting

The work of the TC is slightly delayed with respect to the initial work-plan. Over the past year, a preliminary document, which summarizes the outcomes of research carried out on four main aspects of the TC work-plan has been prepared. The document should be expanded into a preliminary technical report within the next months and shared among the TC members for discussion.

TC 3-60 Spectral daylight characteristics

The TC is progressing with the activity of collection, organization and analysis of data measurements. Over the last year, two papers have been published and the delivery of the WD has been planned for 2026.

TC 3-61 Review of regional daylight requirements to assess the feasibility of global harmonization

This TC is following the work plan. Several activities for the collection, categorization and semantic harmonization of daylighting metrics have been completed over the last year, a journal paper has been prepared and the committee will proceed with the preparation of the final draft report for the end of 2025 or beginning of 2026.

TC 3-62 Resilient lighting

Progressing well and working on the draft document.

TC 3-63 Decision scheme to determine lighting requirements

Currently working on 'breaking down' this complex topic and gathering all necessary insights. Work on this TC is slightly delayed but is expected to progress swiftly.

JTC 06 Energy performance of lighting in buildings (CIE/ISO)

Related to daylighting, two Task Forces (TF) are currently active, respectively on the ISO/ PWI, Light and lighting — Building information modelling properties for lighting — Daylight louver systems, and on the preparation of the document "ISO/CIE NP 25176, Light and lighting — Daylight in buildings — BSDF data generation for complex fenestration systems".

Related to electric lighting a Task Force on Indoor Environmental Quality has been established. This is in response to the energy performance standards moving from indoor air quality to indoor environmental quality, including lighting and acoustics, and the need to develop a rating system similar to that used for HVAC.

JTC13 Depreciation and maintenance of lighting systems (D3/D4, lead by Division 4)

This TC is still struggling to generate progress. There is a potential new co-chair from Division 3 whom will hopefully be able to support progress over the coming year.

JTC 18 Lighting education (D3/D4)

The TC has resumed its activities and is now actively proceeding on the revised work plan. The preparation of the working draft of the report is planned for the end of 2025.

DR 3-37 Use of VR for lighting research in indoor spaces

DR 3-38 Evaluation of the impact of lighting environment on the perception of spaciousness

Both are progressing as planned, expecting to deliver their reports in respectively 2026 and 2027.

DR 3-39 Emergency lighting

This was initiated last year, but there is no information the status of this reportership

In addition

- The Division is working to the revision of the ISO/CIE DIS 15469 on "Spatial distribution of daylight - CIE standard general sky", which is expected to go to the FDIS ballot soon.
- Following a call for experts circulated by ISO/TC 274 Division 3 is now officially represented in the Ad Hoc Group on Daylight recently established in ISO/TC 274 (ISO AGH1 "Daylight"). The group is tasked to research and gather information on daylight requirements as currently referenced in existing building codes, standards, guidelines or rating systems

across various countries, with the aim of identifying possibilities or opportunities for developing a new international standard on daylight provisions in buildings

Report presented by:

Peter Thorns
UK Representative CIE Division 3

26th November 2025

CIE Division 4: Transportation and Exterior Applications Terms of reference

To study and prepare guides for the design of exterior lighting and light signalling.

Division Officers:

Division Director:	Dionýz Gašparovský
Division Secretary:	Steve Lau
Division Editor:	Nigel Parry
Associate Directors:	Steve Fotios
	Sermin Onaygil
	Jerome Dehon

Activities and achievements

Activities and achievements of the Division during the year October 2024 – September 2025 were as follows:

CIE Mid -term meeting – Vienna, Austria. July 4th -11th 2025

For Div 4 this was largely given over to the development of an update to CIE 115, (which feeds into BS5489).

Steve Fotios of Sheffield University chaired a workshop on various aspects of the CIE 115 development requirement comments were proposed and these will be taken forward for consideration. At this time a date of 2028 has been pencilled in for the rapid review update, but we will need to wait into the 2030's for a full new report.

The workshop produced a wide range of comments and will be taken forward for consideration.

So, what was discussed:

There is a lack of background as to where the current road class lighting levels have come from, going forward the CIE will record all decisions and research that leads to such as aspects to help inform future reviews.

Core discussion points included, but were not limited to:

- The application of uniformity, is the current approach correct, or would an approach based upon deviation distribution be more applicable?
- Observer geometry, as mentioned earlier the current geometry is not representative of a wide range of users.
- There is a lack of light pollution consideration.
- Perhaps the impact on human health, if indeed there is one from road lighting needs consideration, little research exists.
- What is the interaction between road lighting and vehicle head lights?
- Should cyclists be within the same classification as pedestrians?

Within the rapid review four classes of user are being considered:

1. Pedestrians
2. Motorists
3. Cyclists (peddle)
4. Other vulnerable users, equestrian, disabled, motor cyclists etc

Aspects being assessed include, reassurance (safety / crime), crash risk, road surface reflectance, environmental considerations etc.

In the longer term:

- How human vision changes with age will be considered.
- Road reflectance, what considerations of object visibility need consideration, what are the right targets to consider for the different users, at present the focus is on the motorist's observation requirements.
- What are the required observation angles?
- Some countries are introducing high speed cycle routes, is there lighting requirement different?
- Should e-scooter riders be considered?

Status of Technical Committees

TC 4-47 Application of LEDs in Transport Signalling and Lighting (Hugh Barton) to be completed in 2025

TC 4-50 Road Surface Characterization for Lighting Applications (Valerie Muzet) 1 yr extension

TC 4-53 Tunnel Lighting Evolution (Jerome Dehon) 1 yr extension

TC 4-57 Guide for Sports Lighting (Alan Smith) Form a TC and appoint a chair

TC 4-58 Obtrusive Light from Colourful and Dynamic Lighting and its Limitation (Steve Lau) WD ready in September

TC 4-59 Guide for Lighting Urban Elements (Diana del Negro) awaiting output from TC meeting

TC 4-60 Road Traffic Lights – Photometric Properties of Roundel Signals (Ron Gibbons) to be issued as a standard – with ISO ready at end of 2025

TC 4-61 Artificial Lighting and its Impact on the Natural Environment (Annika Jägerbrand) No progress to date – review content meet to define work

TC 4-62 Adaptive Road Lighting (Paolo di Lecce) completed and to confirmed at meeting

JTC 01 Implementation of CIE 191:2010 Mesopic Photometry in Outdoor Lighting (Stuart Mucklejohn) Having addressed all comments from the Enquiry Draft stage, the issue of the ballot for Approval Draft by Central Bureau is awaited.

JTC 13 Depreciation and Maintenance of Lighting Systems (Dionyz Gasparovsky+D3) small progress due to lack of contributions to date

JTC 18 Lighting Education (Mandana Khanie D3/Dionyz Gasparovsky)

- No Division 4 participation! need more participates to move forward

JTC 08 Terminology in light and lighting (Peter Zwick) NEW v04 new procedure on how to maintain ILV

Report presented by:

Nigel Parry
UK Representative CIE Division 4
1st December 2025

CIE Division 6: Photobiology and Photochemistry

Terms of reference

The Terms of Reference of Division 6 are: To study and evaluate the effects of optical radiation on biological and photochemical systems (exclusive of vision).

Division Officers:

Division Director: Wei Zhang (CN)

Division Secretary: Laura Bellia (IT)

Division Editor: Eric Liggins (GB)

Associate Directors: David H Sliney (US), Yandan Lin (CN)

Activities and achievements

Activities and achievements of the Division during the year Sept. 2024 to Nov. 2025 were as follows:

There have been no new Division 6 publications or additional events during this period, however there were several related CIE publications and activities supported or led by Division 6 members, as set out with links:

On 12 September, the CIE published its third edition of its position statement on Integrative Lighting:

https://cie.co.at/news/cie-releases-new-edition-its-position-statement-integrative-lighting

On 16 May, the CIE hosted a special webinar by Prof Dr Manuel Spitschan titled “How does light affect human health? From biology to application” to celebrate the International Day of Light

https://cie.co.at/news/recording-available-how-does-light-affect-human-health-biology-application

A recording of the Key Note speech by Prof G.C. Brainard in Vienna (July 2025) has been published:

https://cie.co.at/news/cie-2025-keynote-lecture-3-recording-available-german-subtitles-prof-george-brainard

The CIE has recently (November 2025) published its first position statement on obtrusive light and light pollution. The problems of such unwanted light at night are topical, including for potential health effects. Along with other CIE-UK members, I contributed to the production of the statement.

It is notable that agreeing on the semantics were a distraction, so that while the term light pollution is arguably problematic, it is required since the term obtrusive light – somewhat unaccountably – only includes effects related to visual responses to artificial or anthropogenic light at night. The choice between the terms artificial and anthropic has also proven contentious.

https://cie.co.at/news/cie-releases-new-position-statement-obtrusive-light-and-light-pollution

has emerged from the Ladenburg Roundtable “Light for health and well-being”. I attended the Roundtable remotely, and contributed to the 26 foundational statements outlining up-to-date expert consensus on how light exposure influences human physiology and behaviour.

https://cie.co.at/news/global-alliance-promotes-evidence-based-use-light-public-health-mou-signed-under-light-public

Status of Technical Committees*

JTC 05 (D6/D2) | Review of IEC 62471/CIE S009 | John O'Hagan

John O'Hagan informed the Division 6 AGM that JTC 05 met on 10 July and that it was agreed to remove the third part of the S009 document, so it was then possible to prepare the WD which would be available in the next few weeks. [report as at

JTC 08 (D1/D2/D3/D4/D6/D8) | Terminology in light and lighting | Peter Zwick

This JTC has a cyclical programme to publish editions of the International Lighting Vocabulary "ILV", and so when it publishes updates, it continues to work towards the next update. Wei Zhang related Peter Zwick's report to the Division 6 AGM in Vienna about updates related to the division, in particular on the definitions of "light stimulus", "erythema spectral weighting function / erythema action spectrum", "erythemal dose / erythemal radiant exposure" and "UV radiation", and the introduction of terms "Vacuum UV (VUV)" and the recognition of the term "irradiation dose" as a synonym in the existing term "radiation exposure".

The division also spoke about the coordination with IEC and their "IEV" which should be the same document and have the same updates and the "ILV".

JTC19 (D6/D2) | Terms and Definitions of Horticultural Lighting | Wei Zhang

Wei Zhang outlined the last activities in JTC 19 most recently at the division 6 meeting in Vienna. It was expected that the DIS will be circulated in September 2025 for ballot. Since JTC 19 started in August 2020.

JTC 20 (D6/D2) | Wearable alpha-opic dosimetry and light logging methods, limitations, device calibration and data schemes | Manuel Spitschan

The WD is almost complete, except for a review from David Sliney on some topics. A change the ToR in order to deliver a TR and TN consisting of a template for manufacturers was agreed by the division, subject to balloting the TMB.

*and other Technical Activities

Three Division Reporterships were established as set out:

DR 6-49 | The ipRGC influenced responses to light: From mechanisms to policy. | Manuel Spitschan

DR 6-50 | Optimal Spectral Weighting Functions for Biological and Ecological Effects of Environmental Light Pollution | Altug Didikoglu

DR 6-51 | Simplified terms for ipRGC-related concepts | Jennifer Veitch

DR 6-50 relates to the Fourth Manchester Workshop held earlier in 2024, was the topic of a Technical Meeting at the Vienna conference, and which is also completing a review publication. From CIE-UK, Peter Thorns and I attended this workshop, which has significant connections to topics in Divisions 2, 4 and 6.

Two Research Fora have been recently established as set out:

RF-08 | Circadian Rhythms of the Eye and Skin | David Baeza

RF-09 | Myopia and Daylight Exposure | Luke Price

I am a member of RF-08 which met in Vienna. I am also assisted in my role as convener of RF-09 by my UKHSA colleague Siobhan Patrick as its Secretary. RF-09 has only been held online, and most recently (November 2025) had a presentation on the myopia related research of Dr Raymond Najjar, from National University of Singapore *etc.*.

I have recently (November 2025) been confirmed as a Division 6 Liaison Representative. This is technically two appointments, L 6-12 and L 6-13, to CEN TC 169 WGs 2 and 13 respectively, as these WGs are conducting a joint activity. It was confirmed that the present CIE Division 2 WG2 liaison is not active, and I was previously the liaison to WG13.

Report presented by:

Luke Price
UK Representative CIE Division 6

17 November 2025

CIE Division 8: Image Technology

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.

Division Officers:

Division Director:	Noel Richard
Division Secretary:	Hermine Chatoux
Division Editor:	Manuel Melgosa

Activities and achievements

Activities and achievements of the Division during the year October 2024 – September 2025 were as follows:

CIE Mid -term meeting – Vienna, Austria. July 4th -11th 2025

New TC proposals: Optimal CMFs for Display Color Consistency

Scope: this TC provide description of fundamental work on derivation of colour matching function optimised to improve perceived color consistency across observers and electric display technologies

Open scientific question:

To address non-uniform / textured aspect / appearance

- Joint combination of colour/spectral constituents
- Spatial arrangement of these constituents

To measure it

- Distance to reference
- Perceptual point of view
- Physical point of view
- Uncertainties estimation and management

To display, print, reproduce it

To process, compress, store it

Status of Technical Committees

TC 8-12 Image and Video Compression Assessment (Pascal Bourdon) Dissolution
TC 8-14 Specification of Spatio-Chromatic Complexity (Noël Richard) Report at committee stage (CD), 1 yr extension
TC 8-16 Specification of Spatio-Chromatic Complexity (Craig Revie) Report at committee stage (CD), 1 yr extension
TC 8-17 Methods for Evaluating Colour Difference between 3DColour Objects (Kaida Xiao) WD Ballot in progress, 1 yr extension
TC 8-18 Guidelines for Definition and Evaluation of High Dynamic Range Images and Image Sequences (Mekides Assefa Abebe) In progress
JTC 08 Terminology in light and lighting (Peter Zwick) NEW v04 new procedure on how to maintain ILV
JTC 12 The measurement of sparkle and graininess (Noël Richard) In progress.
JTC 16 Validity of Chromatic Adaptation(Kaida Xiao) TC Chair replaced, 2 year extension
JTC 17 Gloss measurement and gloss perception – A framework for the definition and standardization of visual cues to gloss (Frederic Leloup) Dissolution

Report presented by:

Kaida Xiao
UK Representative CIE Division 8

1st December 2025

APPENDIX A
THE CIE & NIC

Each country participating in the work of the International Commission on Illumination (the CIE) forms a National Illumination Committee (NIC). This Committee is representative of all bodies in that country which have an interest in light and lighting.

The CIE:

- provides an international forum for the discussion of all matters relating to science technology and art in the fields of light and lighting
- co-ordinates the international activities of individuals and organisations, to identify outstanding and fundamental issues pertaining to light and lighting and to find solutions
- develops basic standards for measurement and application design
- publishes Technical Reports and Standards and maintains liaison with other international standards organisations.

The CIE technical programme is divided into seven Divisions covering Vision and Colour; Physical Measurement of Light and Radiation; Interior Environment and Lighting Design; Lighting and Signalling for Transport; Exterior and Other Lighting Applications; Photobiology and Photochemistry; and Image Technology. Each Division establishes Technical Committees (TCs) with international representation of experts, to undertake specific tasks. Each TC is disbanded when the work is complete.

The CIE holds a Sessional Conference every four years, which reviews the latest developments in the field and plans the work of the divisions and their Committees for the next quadrennium.

The CIE Central office is based in Vienna. The Secretary General and her assistants are responsible for the administration associated with co-ordinating the activities of all member countries and for publishing the Commission's Technical Reports and Standards.

The CIE is supported through the time and expertise of individuals, most of whom are associated with companies, institutions and organisations interested in light.

The CIE is supported financially by each country's National Illumination Committee which contributes according to a Central Office allocation based on the scale of assessments for the contribution of Member States of the United Nations Organisation, but with modified upper and lower limits. Each NIC depends on contributions from supporting organisations, income from the sale of published Technical Reports and Standards and from the organisation of seminars.

The National Illumination Committee of Great Britain is supported by sponsoring and co-operating organisations. Many universities and colleges participate, as do Government Departments and official bodies interested in or concerned with the design, development and use of light. There are also representatives of the lighting industry as well as independent consultants and architects representing professional bodies.

The NIC is selects and sends delegates to the sessions of the CIE. It keeps in close touch with developments throughout the world, both in research and in practical applications, by personal contact as well as via the issues of the CIE News and CIE Division Activity Reports. It also ensures that the British contributions are made known and properly recognised in other countries.

Great Britain, one of the founder members of the CIE, established its National Illumination Committee in 1913 and since then has played a major part in the development of the Commission. The original decision to establish the CIE was considerably influenced by Leon Gaster, the founder of the British Illuminating Engineering Society, now the Society of Light and Lighting.

APPENDIX B
CONSTITUTION OF THE NATIONAL ILLUMINATION COMMITTEE AT 30 SEPTEMBER 2024

Officers and Trustees

Chair	John O'Hagan
Vice Chair	Steve Fitios
Secretary	Allan Howard
Honorary Treasurer	Nigel Parry
Vice Treasurer	Jim Uttley
	Peter Thorns

CIE Division Representatives

Division 1	Peter Clarke
Division 2	Martin Dury
Division 3	Peter Thorns
Division 4 / 5	Nigel Parry
Division 6	Luke Price
Division 8	Kaida Xiao

Appendix C

Reports from recipients of the 1975 bursary or student bursary.

As a general principle, funds are available from the 1975 Fund or student bursary to support travel and subsistence to attend CIE business meetings: this includes CIE Division meetings, CIE Board of Administration meetings, and CIE Technical Committee meetings.

Each individual who receives support is required to provide a written report (of around 1,000 words) on the event they attend, or the work they carry out, for distribution to members through the web site and these will also form part of the annual report.

The following are reports have been provided following the CIE mid-term meeting in Vienna.

CIE (International Commission on Illumination)
Mid -term meeting Allan Howard
Vienna, Austria. July 4th -11th 2025

The CIE is the global authority in light and lighting and their mid-term scientific meeting was held in Vienna, home of the CIE HQ, this year and was followed by the annual meeting of the Divisions and their associated technical committees. Jennifer Veitch, CIE President opened the meeting and noted that although the CIE central bureau is based in Vienna , this was the first scientific conference to be held here and the last major gathering was back in 1963, so long overdue.

Around 427 delegates from 40 countries and territories arrived to listen to the papers and mix with fellow minded lighters, which is only a few less than the main Quadrennial meeting held two years ago in Ljubljana, Slovenia and there was a record number of paper submissions this year.
The 4th to 5th July were taken up by CIE organisational meetings for which I did not attend. The event really started on the late afternoon of Sunday 6th with a welcome reception and welcome by the Mayor of Vienna and just a chance to network and socialise. For the main conference session, we were permitted a late start of 09.00 for the first paper, the papers on the 8th and 9th all commenced from 08.30 with all days finishing around 17.45, so long but informative days.

The conference and supporting papers should be available through the adjacent QR code.

Day one.

The keynote address was given by Dietmar Hager and he discussed the multifaceted impacts of light pollution. He theorised that we tend to over light based upon a fear driven society and it is only comparatively recently that we have become aware of the adverse effects of over lighting on the

environment, ecology and health. He noted that on average humans only spend 2 to 5% of their time outside which is not good for us.
It was also interesting to understand just how amazing the human eye is, we can detect and see an object in the night sky in 1/18th of a second yet to record the same object using a camera can take 20 minutes.
There is no need to put fear into people but explain to them, supported by the right research as to how much light is required for a task and raise the awareness and understanding of light pollution.
Following the Key address, the sessions split and had three rooms with different focus for the papers.
I mainly the Division 4 Road Lighting and Division 6 obtrusive light activities which also, the first session was on Exterior Lighting and chaired by Steve Fotios of Sheffield University. There were five short papers:

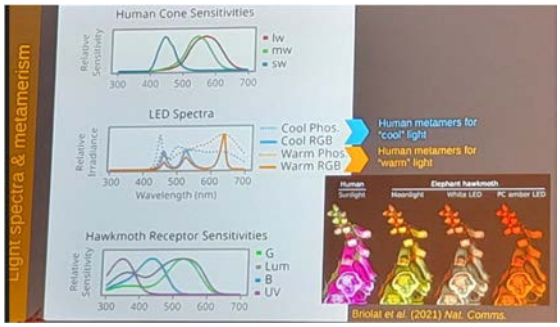
- Effect of fluctuating exterior lighting on impression influence and installation interval
- Integrating emotion and visual dimensions in urbane lighting design, a holistic approach using the PAD model and light field metrics.
- Is the cost 331 software still relevant for characterising the visibility of road markings. Notably a measure of the effectiveness of road markings on differing road surfaces and how this can be measured
- Luminance contrast threshold under road lighting in reversed silhouette vision and silhouette vision. A very good paper on how comfortable we feel in public places due to lighting, and how this can be measured and then fed back to the design process
- Static and dynamic assessment of lighting quality, a field experiment. This considered using artificial light in landscapes based upon ground mounted luminaires that mirror the 'flicker' effect of a candle or firefly and how this creates interest by the users of the space.

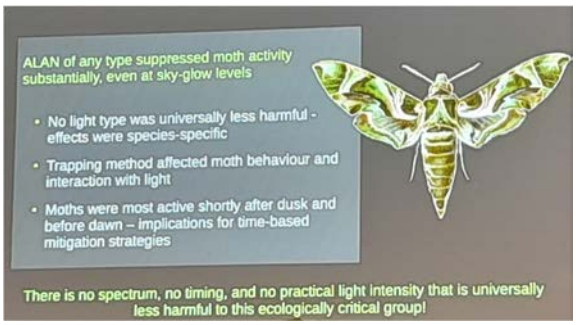
After a networking and exhibition viewing break, the next session had a focus on electric light effect on insects and wildlife.
In part the papers covered some ground that we already understand but all new research is good at providing additional support in this important area of consideration.
Key considerations being:

- LED light sources do not emit UV light.
- When considering UVA light then 350nm is much more effective at attracting insects than 365nm, interesting as most fly 'zappers' are based on 365nm.
- When considering solar exposure, the spectrum changes with the angle of the sun.
- Can we actually reduce the fatal attraction of insects to artificial light? It was noted that CCT is perhaps not the right assessment measure and that we should really look to the light source spectral power (note: I am developing a paper on this topic).
- When considering spectral power it would seem that 'royal blue' is a greater attractor to insects that other colours and shades of blue.

The outstanding paper of this session was resented by Jolyon Troscianko from the UK, a visual ecologist and he focussed on artificial light and moths. Interesting moth fact 1 - Are you aware that moths are the second largest pollinator of plants only to bees?
He discussed how we can look to supporting the function of the ecosystem, the changes to LED lighting have had a large impact especially when manufacturers 'play' with spectra. Interesting moth

fact 2 – moths can see colour at night under almost zero lighting conditions. Short duration exposure to bright light can adversely affect the month and it can take over 90 minutes to regain their night vision and whilst we might consider narrow beam amber light sources as good for bats they are not for moths, interesting moth fact 3 – they are more active at dusk.





The later part of the afternoon was taken up with poster papers. Conferences such as the CIE's offer the opportunity for researchers to present their work in the form of an A) poster, they are given 5 minutes each to present these to the delegates and then they are displayed around the venue and all have the chance to view and discuss the research work with the representative.

Day 2

The keynote speaker was Stephen Westland from the UK and he gave a fascinating paper on the development of AI and looking to the future. AI is not a new idea, and we have claims of the AI taking control back in the 1960s's but there have been a few AI Winters as he described them, but with the vast computing power we now have the impact of AI will be wide. Although he did state that the claims being made by Mr Musk have not come true to date and he thinks that the machine will never achieve a conscious state.

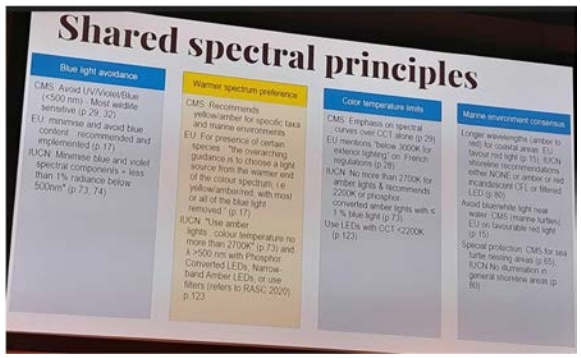
Within the Division 4 meeting stream the day was largely given over to the development of a update to CIE 115 Road Lighting, (which feeds into BS EN 13201 and BS5489). The CIE are undertaking a 'rapid review', only looking at current published research with a longer review being planned to pick up on new research being started.

Several papers were presented in the morning on lighting for pedestrians and cyclists, with consideration for road reflectance's and the environment. The topics being:

- Optimal illuminance for pedestrian reassurance. Essentially research from Sheffield University looking at how assurance of pedestrian at night under lit conditions could be provided with a conclusion that a horizontal illuminance of 7.5 lux provides best assurance.
- Darkness increases the risk of specific crimes, another research paper presented by Sheffield University. So, lighting can improve the perception of safety and thus fear of crime after dark. The evidence is unclear and in part the question has to be does darkness influence crime? Is there a significant difference between day and night when looking at the same time period but in different months and using an assessment process termed the 'Odds ratio'. Based upon crime figures (certain crimes and those in the outdoor environment) darkness does seem to increase certain crimes, but can lighting off-set this risk? It seems the jury is still out but research is ongoing.
- On site characterisation of road surfaces reflection properties for several observer angles, defined within CIE 144:2001. The tables used for road reflectance's do not real represent currently used surfaces and the angle of assessment; drivers eye at 1 degree downwards does not represent all users. Examples were given of cyclists and pedestrians, but I did ask,

what about lorry, coach and SUV drives, their observation height is now much higher. The approach is considering angles of 2 degrees for cyclists and 5 degrees for pedestrians. Indications are that the reflectance R table needs some revision and perhaps other observation angles need consideration.

- Machine based learning based real-time prediction of lighting classes in adaptive road lighting systems.
- Comparative analysis of international light pollution guides in ecology. Towards evidence-based mitigation strategies and ecological thresholds. Essentially a review of three approaches to the consideration of light pollution considerations with attention to wildlife. CMS Convention on the Conservation of Migratory Species of wild animals, EU European Union policy brief 25 and IUCN International Union for Conservation of Nature.



After lunch Steve Fotios of Sheffield University chaired a workshop on various aspects of the CIE 115 development requirement comments were proposed and these will be taken forward for consideration. At this time a date of 2028 has been pencilled in for the rapid review update, but we will need to wait into the 2030's for a full new report.

So, what was discussed:

There is a lack of background as to where the current road class lighting levels have come from, going forward the CIE will record all decisions and research that leads to such as aspects to help inform future reviews.

Core discussion points included, but were not limited to:

- The application of uniformity, is the current approach correct, or would an approach based upon deviation distribution be more applicable?
- Observer geometry, as mentioned earlier the current geometry is not representative of a wide range of users.
- There is a lack of light pollution consideration.
- Perhaps the impact on human health, if indeed there is one from road lighting needs consideration, little research exists.
- What is the interaction between road lighting and vehicle head lights?
- Should cyclists be within the same classification as pedestrians?

Within the rapid review four classes of user are being considered:

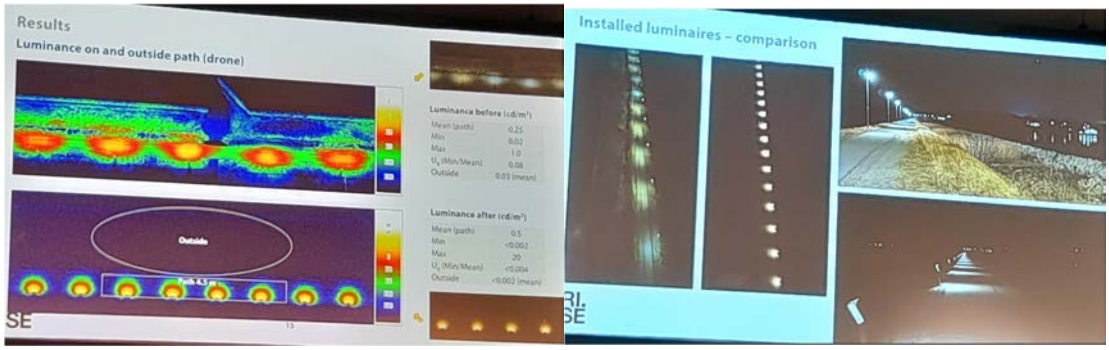
1. Pedestrians
2. Motorists
3. Cyclists (peddle)
4. Other vulnerable users, equestrian, disabled, motor cyclists etc

Aspects being assessed include, reassurance (safety / crime), crash risk, road surface reflectance, environmental considerations etc.
In the longer term:

- How human vision changes with age will be considered.
- Road reflectance, what considerations of object visibility need consideration, what are the right targets to consider for the different users, at present the focus is on the motorist's observation requirements.
- What are the required observation angles?
- Some countries are introducing high speed cycle routes, is there lighting requirement different?
- Should e-scooter riders be considered?

The last session on day two considered assessment of lighting installations with the focus being on light measurement from unmanned drones using digital luminance mapping.

- Anthropogenic light at night
- Spill light in a sensitive coastal area comparing two different lighting installations. The review looked at a remote coastal path in Sweden where before it was lit using 6m columns and was replaced with a lighting system of low-level bollards with a good light distribution just on the path and PIR detection of users. The second installation had very poor uniformity but much less light spill. Photometric assessment was undertaken using photometers as well as luminance mapping using a drone. Overall, 80% of users did not feel their use of the path was impacted, 20% felt less secure / happy and an equestrian user said they no longer used the path as the lights coming on and off scared the horse which they considered dangerous. This last point being interesting and is a user of such routes that we don't really consider.



- Determination of natural reference levels of illumination and exposure in the night environment for the assessment of light pollution levels. The moon is present in the night sky for 50% of the night-time and provides an illuminance of cc 0.25 lux and our exposure to moon light varies with the different seasons.
- Metrology of outdoor light emissions at night using unmanned aerial platforms
- The obtrusive light measurement with unmanned aerial vehicle.

  These last two papers were very similar, it is interesting that luminance mapping is being considered through drone technologies, when we do this on the ground (we have the equipment in the UK) an assessment needs five images of which each is taken at a different exposure and then combined, how this is done from a flying platform could present difficulties but images provided were good. Also different counties have different laws, requirements and training for drone users and a lot of built-up areas do not permit such activities.

The second day finished with further poster paper discussions and viewings.

Day 3

The first session was taken up by CIE Divisions 1 and 8 with papers considering aspects of vision and colour and also Division 2 photometry and radiometry. With papers covering:

- Development of a database for fabric visual appearance
- Skin colour perception in human faces
- Increasing performance in the office when working with monitors
- Integrated lighting for enclosed species focussing on visual and non-visual effects to improve workers well-being.

The second session was more back to exterior lighting and again CIE115 considerations with papers on:

- Lighting public spaces for people well-being. In cities there is a large percentage of people who work shifts so at certain times of the year they are travelling to and from work in the dark and therefore most of their 'working' day they are exposed to artificial light.
- The presence of road lighting leads to mor cycling, darkness tends to deter people for cycling and lighting may over come that factor if the right lighting is provided.
- Biomotion lighting enhances cyclist conspicuity. Biomotion relates to lights attached to the rider, the research shows that drivers at night will recognise the movement of lights attached the riders' legs as they go up and down as a cyclist ahead at a much greater distance that fixed cycle lighting and high visibility clothing. There is an issue when the rider 'coasts' as their legs stop moving so perhaps fixed rear cycle lights that mirror the movement may be the answer. It was commented that just getting cyclists to use lights and wear reflective clothing would be a start.
- New concept for road lighting to improve the visibility of cyclists in shared road space. The research indicates that looking to vertical illuminance of half a lux more than the horizontal illuminance level aids visibility. The question is can this actually be achieved with current luminaires?
- Lighting levels on a tram platform, an exploration study. This was quite interesting, and the term platform is wrong (lost in translation) as it considered lighting requirements for tram drivers when the trams and motor traffic share the same space / road areas. Essentially the Standards do not cover this, what are the tram driver visibility needs, their observation height is higher than that used for motorists and like modern cars they have very bright running / driving lights. Also, as an aside cyclists need to be aware of the tram track lines. Research is required.

The afternoon looked to papers considering:

- Road surface reflectance.
- Effect of R-table measurement dispersion on road lighting quality criteria.

- Measuring the reflectance properties of wet road surfaces.
- A road reflectance analytical function built from BRDF models.
- Modelling changes over time I the reflectance properties of different types of road surfaces.
- Investigating the accuracy of road surface reflection based on road robin measurements.

  These papers were similar, the reflectance of the surface is important when undertaking M Class assessments / designs as this can result in under or over lighting, the latter wasting energy. There are many different road surfaces these days, some aid the removal of water that they are porous. The concern is that we do not really understand all the surfaces, how these factors change as the surfaces ages and have little control on the surfacing used. As we know water really modifies the road surface and can increase surface glare from street lighting, especially luminaires with a non-uniform light source. It was interesting to note that road surface changes are different in tunnels than roads, perhaps a sunlight consideration.

The conference session then was drawn to a close, the next Quadrennial meeting will be in 2027 to be held in China.

Division 4 Technical Meetings

The three-day Conference was followed by two days of Technical Committees (TC's) and the Annual Divisional 4 meeting.
The list below are the current active Division 4 committees

- TC4-62 Adaptive Road Lighting Chair Paolo Di Leece

  The meeting was packed with around 20+ members in attendance and more on-line. The report is complete and confirmed to move the working draft to produce a finished report. The meeting discussed if and how to take the research forward to encompass new developments.

TC 4-47 Application of LEDs in Transport Signalling and Lighting (Hugh Barton) to be completed in 2025.

TC 4-50 Road Surface Characterization for Lighting Applications (Valerie Muzet) 1 yr extension

- A number of presentations were given on various aspects of onsite measurements.
- 4 meetings in last year, 2 new members – have a working draft by end of 2023. Revisions on calculation and methodology. Looking to collect r-tables for report.

- Make some new definitions as not in ILV.
- A further extension requested and drafted to ED 2026, to be published 2027?

TC 4-53 Tunnel Lighting Evolution (Jerome Dehon) 1 year extension. A well-attended TC, Allan Howard is the TC UK representative and those present discussed key developments being proposed and confirmed some definitions. It is hoped that the TC will report in 2026.

TC 4-57 Guide for Sports Lighting (Alan Smith) Form a TC and appoint a chair

TC 4-58 Obtrusive Light from Colourful and Dynamic Lighting and its Limitation (Steve Lau) WD ready in 2025, this relates to digital media displays and I am the UK representative of the TC.

TC 4-59 Guide for Lighting Urban Elements (Diana del Negro) awaiting output from TC meeting

TC 4-60 Road Traffic Lights – Photometric Properties of Roundel Signals (Ron Gibbons) to be issued as a standard – with ISO ready at end of 2025

TC 4-61 Artificial Lighting and its Impact on the Natural Environment (Annika Jägerbrand) No progress to date – review content meet to define work

TC 4-62 Adaptive Road Lighting (Paolo di Lecce) completed and to confirm at meeting

JTC 01 Implementation of CIE 191:2010 Mesopic Photometry in Outdoor Lighting (Stuart Mucklejohn) ready to produce based upon final ballot

JTC 13 Depreciation and Maintenance of Lighting Systems (Dionyz Gasparovsky+D3) small progress due to lack of contributions to date

JTC 18 Lighting Education (Mandana Khanie D3/Dionyz Gasparovsky)

- No Division 4 participation! need more participates to move forward

JTC 08 Terminology in light and lighting (Peter Zwick) NEW v04 new procedure on how to maintain ILV

JTC 13 Depreciation Maintenance of Lighting Systems Chair Dionyz Gasparovsky

On Working Draft 3 and planning on regular monthly meetings to ensure good progress

<u>Further Progress reports:</u>

Reporterships: updated progress reports

DR 4-53 Environmental Aspects of Obtrusive Light from Outdoor Lighting Installations (Constantinos Bouroussis) on going

DR 4-54 Lighting for Cycling – Establishing the State of Knowledge (Jim Uttley) produce a Technical note

RF-06 Toward a new CIE reference observer non-biological (Paola Iacomussi) early stages

RF-07 Obtrusive light and buildings (Peter Thorns/Dionyz Gasparovsky) not started

New work item proposals

DR proposal: Lighting and Crime – establishing the state of knowledge (Steve Fotios) produce tech note

DR proposal: Optimal lighting criteria for pedestrian reassurance (Steve Fotios) produce tech note

DR proposal: Lighting for safety and security of outdoor work places (Dionyz Gasparovsky) development stage

TC/RF proposal: Fast track update of CIE 115 (Steve Fotios) produce from pt 1 &2 tech note

Formation of Expert Groups (EGs) for specific areas (Dionyz Gasparovsky) four areas – outdoor workspace, sports, architectural, transportation,
Light pollution

Future meetings and events

2026, October 13-14, Torino (IT), Annual D4 Meeting & Workshop "Future topics in Road Lighting"
2027, July 09-17, Nanjing (CN), CIE Quadrennial Session
2028, June/July or September/October, High Tatras (SK), Annual D4 Meeting Workshop/Tutorial/Symposium
2029, CIE Mid-term Session options are :

- Tutorial on Urban Lighting Masterplanning, 2nd Instalment, Bratislava (SK)
- Workshop "Lighting up the cities!", Hangzhou/Shanghai (CN)

Programme

The programmes should be available through the QR code.

Notes of thanks:

- I would like to thank CIE-UK for providing a 60% bursary to enable my attendance at this conference, I am a member of CIE, a Trustee and their secretary.
- With thanks to Nigel Parry (OrangeTek and CIE Division 4 Editor) for some of the content taken from a report we both produced for the Institution of Lighting Professionals Journal.

Report on Attendance at the CIE Conference 2025 - Vienna

Dates: 7th – 9th July 2025

Reporter: Billy Muhamad Iqbal – School of Architecture and Landscape, University of Sheffield

Role: Participant and authorship of one paper (ID120)

Conference paper title:

Fotios, S, Iqbal, B, Alshdaifat, A, Uttley, J, Tolan, G, Yazdi, G (2025). "Biomotion lighting enhances cyclist conspicuity", Proceedings of the 31st Session of the CIE. Vienna, Austria, July 7-9, 2025.

Conference Review

1. Introduction

I had the opportunity to attend as a conference participant at the recent CIE Conference held from 7th to 9th July 2025 in Vienna. As a PhD student currently engaged in research related to bicycle lighting in the dark environment, this event presented a valuable opportunity to deepen my understanding of contemporary lighting issues. My intention in attending was twofold: to broaden my technical knowledge—particularly in aspects relevant to my current academic work—and to develop my professional network by connecting with researchers, students, and professionals from various countries.

2. Attendance Considerations

My motivation for attending the conference was to explore the latest developments in lighting research, particularly in areas intersecting with lighting technology in urban space. Specifically, I hoped to gain insights that might inform and improve the framework of my ongoing research.

Moreover, lighting has a significant role in shaping both human experience and perceived safety, I was interested in how current international practices are addressing the trade-offs involved—particularly between visibility, safety, energy use, and environmental impact. Besides that, I also aimed to broaden my network, and the event did not disappoint. I met fellow students and researchers from the Netherlands, Germany, Japan, and other UK universities, opening doors to possible future collaborations.

3. Key Themes and Insights

Hot Topics

One of the most prominent themes of the conference was light pollution. This topic surfaced repeatedly, both in keynote presentations and in workshop discussions. There's a growing recognition that lighting at night, while essential for safety and visibility, has unintended ecological and health consequences when not applied thoughtfully.

In several sessions, experts presented findings on how excessive or poorly designed lighting contributes to the disruption of ecosystems—particularly for species that rely on natural phototaxis for orientation and survival. This issue, while sometimes overlooked, is becoming increasingly central in lighting discourse.

Personal Research Connection

One presentation that I found particularly influential was about the effects of outdoor lighting on animals. It was eye-opening to learn how overly bright nighttime lighting disrupts insects and wildlife behaviour, particularly in nocturnal environments. While this might not directly overlap with my own research, it connects in an important way. I'm currently looking into how cyclist's conspicuity that navigate through dark environment. If future ecological policies start limiting or even removing street lighting in certain zones to protect wildlife, then having reliable (conspicuous), independent lighting systems on bicycles becomes even more essential. These systems need to do more than just help

cyclists see and be seen—they also have to be designed carefully so they don't end up adding another problem.

Highlights from Presentations and Papers

Several presentations were particularly noteworthy and have significantly shaped my understanding:

- Keynote 1 by Dietmar Hager focused on the multifaceted impacts of light pollution, covering everything from the impact of blue light to biodiversity disruption. His work reinforced the importance of cross-disciplinary approaches in lighting design.
- Keynote 3 by George Brainard talked about how light doesn't just help us see—it affects our hormones, sleep, and overall health. He shared how NASA used this knowledge to change lighting on the ISS and how similar changes are happening in everyday spaces like schools and workplaces. It shows how lighting plays a much bigger role in our well-being than most people think.
- Annika Jagerbrand's paper (ID 315) compared international light pollution guidelines in ecology, highlighting the lack of unified standards and the need for evidence-based thresholds to guide lighting practices in sensitive environments.
- Steve Fotios (ID 119) presented a study on the optimal illuminance for pedestrian reassurance, showing that there is a potential for optimal range lighting that promotes feelings of safety without contributing to over-illumination. His WS5 workshop on the revision of CIE 115 was particularly relevant, as it focused on aligning lighting standards with modern needs for roads used by both vehicles and pedestrians.
- Jim Uttley (ID 261) explored how road lighting affects cycling frequency.
- Anna Pellegrino (ID 379) provided valuable insights into how public space lighting can support well-being, based on real-world in-field measurements.
- David Sliney (WS3) discussed how modern LED lighting, especially with higher colour temperatures, can disrupt wildlife behaviour, emphasizing the need for ecologically sensitive lighting design that considers spectral impacts on animals and insects.

4. Key Takeaways for CIE-UK Members

From what I gathered, it might be important for CIE-UK members to be increasingly aware of how light pollution affects not just people, but ecosystems and overall public health. There's a clear trend in the research toward optimizing lighting—providing just enough for comfort and safety without crossing into over-illumination.

While some initiatives are still researching for brighter outdoor lighting for safety reason, there's a growing recognition that such decisions must be data-driven and context-specific. In particular, guidelines should be developed not just for lighting design, but also for when and where lighting can be reduced or maybe eliminated without compromising public safety.

5. Outcomes of Attendance

I found the event highly valuable, both in terms of knowledge gained and connections made. Academically, it helped validate some of the premises of my research while challenging me to think more broadly about the ecological and social implications of artificial lighting.

The conference also give me an insight for a potential gap in current bicycle lighting solutions—particularly how independent lighting for cyclists could evolve to accommodate emerging restrictions on fixed road lighting due to ecological concerns. This opens up a promising area for further innovation, perhaps in adaptive lighting technologies that adjust based on surrounding illumination or environmental cues.

In networking point of view, the experience was also rewarding. I exchange information and new connections with students and researchers from the Netherlands, Germany, and Japan, as well as with peers from other UK institutions. These conversations provided fresh perspectives and may lead to future collaborations or shared projects.

6. Overall Evaluation

Firstly, I would like to sincerely thank CIE-UK for awarding me the bursary to support my participation in the 2025 CIE Conference in Vienna. This financial assistance enabled me to attend the event. Secondly, for the event evaluation, I would rate the conference as very good. The sessions were well-organized and highly relevant, and the speakers were clearly passionate and well-versed in their fields. The combination of keynote presentations, research papers, and interactive workshops offered a well-rounded and engaging experience—particularly valuable for a first-time attendee like me. Most importantly, the event allowed me to reflect critically on how my own research fits into the broader context of sustainable and responsible lighting design.

Attending the CIE Conference inspire me that good lighting isn't just about brightness—it's about balance. Balance in every aspect, but in this year topics: visibility and ecology, between human safety and ecological welfare, and between policy and innovation. I left with an understanding of the challenges in my further research, and hopefully clearer direction for my own research.

Activity Photograph

Opening Keynote Speaker: Dietmar Hager

Day 1 at the Conference – Left to right: Myself and Students from Lighting Research Laboratory led by Prof. Steve Fotios

Student Networking Event at Dschungel Café Fürstenhof

Group Photograph – Lighting Research Laboratory School of Architecture and Landscape University of Sheffield

Last Day at The Conference

Attendance report – CIE Midterm meeting 2025, Vienna, Austria

Funding awarded to: Yutong Chen
Attendance dates: 6-11 July 2025
Actual financial support requested: £ 994.0

Conference review

The conference commenced on July 7, and the opening keynote lecture left a deep impression on me. It addressed light pollution and its multifaceted negative impacts on the economy, ecology, health, and culture, calling for various mitigation measures to alleviate its harm. In the morning, I attended the OS3 parallel session focused on exterior lighting, where Benjamin Legrand's presentation on static and dynamic assessments of lighting quality closely aligned with my research interests. His research methodology and exploration of multiple influencing factors provided me with valuable insights. In the afternoon, I participated in the WS3(D6) workshop on the effects of electric light on insects and wildlife. Although this topic is not directly related to my research, it broadened my understanding of the integration of lighting and biology, as well as the ecological impact of LED lighting, enriching my interdisciplinary perspective. In the evening, I attended a networking event for students, which offered a rare opportunity for academic exchange. During the event, I engaged with scholars and doctoral students from around the world, discussing our respective research topics. This not only expanded my academic horizons but also laid the foundation for potential future collaborations, benefiting me greatly.

On July 8th morning, I attended the OS5 parallel session on "Revision of CIE 115," featuring presentations by my supervisors Steve Fotios and Jim Uttley. Their talks focused on proposing modifications to CIE 115:2010 from a pedestrian lighting perspective and examining lighting's role in crime reduction. The subsequent WS5 (D4) workshop discussed limitations and uncertainties within the standard, emphasizing the importance of ongoing optimization. These discussions are highly relevant to my research area, offering valuable insights for future studies. In the afternoon, I participated in the OS9 session on glare, which closely aligns with my research focus. Michel Vissenberg's presentation on a novel method for measuring discomfort glare—using changes in the comfort view zone as an indicator—provided new perspectives and methodologies that could inform my future work.

On the morning of July 9th, I attended OS12, the parallel session titled "Vision and Color 2." This field was relatively unfamiliar to me, but listening to the researchers' presentations provided me with an initial understanding of how different lighting colors influence perception. In the afternoon, I participated in OS15, the parallel

session focused on "Walking and Cycling", which included a lecture by my supervisor. The presentation mainly discussed enhancing nighttime cyclist visibility through the use of biomotion indicating pedal lights and highlighted the significance of road lighting for cycling safety. These talks deepened my understanding of the latest research directions and practical applications in pedestrian and cyclist lighting. Subsequently, I attended OS17, which covered road surface reflection, where I learned about various measurement techniques, including the reflection characteristics of different pavement materials under dry and wet conditions, and their impact on road lighting effectiveness.

Attendance considerations

My participation in this conference had three main objectives. First, I aimed to keep up with the forefront of lighting science, particularly in pedestrian lighting and discomfort glare, two topics that are closely aligned with my doctoral research. Second, I hoped to learn from the presentations and workshops about the methodologies and experimental designs employed by other researchers, gaining insights that could help improve and optimize my own work. Finally, I anticipated expanding my research perspective and establishing potential collaborations through exchanges with scholars and PhD students from different countries and research backgrounds. All of these goals were realized during the conference.

By attending multiple specialized sessions and workshops, I gained substantial academic benefits. The opening keynote on light pollution made me realize that lighting is not merely a technical issue but is closely intertwined with ecology, health, and culture. In sessions directly related to my research, whether discussions on the revision of the CIE 115 standard or new measurement methods for discomfort glare, I obtained concrete insights. These new research ideas and methodologies will be highly valuable for deepening my doctoral project. Meanwhile, presentations on road lighting, cyclist visibility, and road surface reflectance made me aware of the wide-ranging practical applications of lighting in traffic safety and everyday life, reinforcing my awareness of the importance of connecting research outcomes with real-world needs.

The academic exchanges during the conference were also extremely rewarding. Through discussions with different scholars and PhD students, I learned about the challenges they face in their research and the innovative approaches they employ. These interactions prompted me to reflect on the limitations of my own work and inspired me to consider more diverse research frameworks, such as the introduction and application of interdisciplinary methods. This exchange of ideas allowed me to more deeply appreciate that lighting is not an isolated field, but a complex system

closely intertwined with society, the environment, and human behaviour.

Summary

Overall, the CIE midterm meeting 2025 left a profound and positive impression on me. The conference covered a very broad range of topics, from cutting-edge developments in lighting technology and standards to the latest explorations in interdisciplinary research. It not only showcased the diversity and complexity of lighting science but also made me deeply aware of the field's importance for the future development of society, the environment, and industry. Participating in such an international academic event was highly inspiring academically and also strengthened my confidence in the value of my own research direction.

I am very grateful to CIE-UK for supporting my participation in this conference. This support allowed me to personally engage in international-level academic exchanges, absorb the latest knowledge, broaden my horizons, and gain valuable experience that directly advances my research. I look forward to the opportunity to present my latest research findings and engage in in-depth discussions and collaborations with more international scholars at future CIE conferences.

Yutong Chen
19 August 2025

CIE MIDTERM MEETING 2025 – VIENNA, AUSTRIA, JULY 4-11,2025

CONFERENCE REPORT

I attended the scientific CIE conference between 7 and 9 July in Vienna. I gave an oral poster presentation about my research in the afternoon session on Monday, July 7. My presentation, titled "The Role of Darkness in Robbery and Theft in London," explores this theme. I also added my abstract below.

Abstract

This report explores patterns of criminal activity in London during nighttime hours by analysing Metropolitan Police Service (MPS) crime data from 2013 to 2019, alongside calculated solar altitude at the time each incident occurred. The analysis focused exclusively on crimes with accurately recorded times—those occurring within a five-minute window. For this study, "darkness" is defined as periods when the solar altitude falls below 6 degrees. The results show a statistically significant increase in robbery and theft from the person after dark ($p < 0.0001$). Notably, the proportion of thefts occurring after dark is higher in Central London compared to the city as a whole. The data also reveal a strong correlation between darkness and the frequency of robbery and theft.

ATTENDANCE OF WORKSHOPS AND PRESENTATIONS

On the evening of July 6, an opening event was held at Vienna City Hall, hosted by the Deputy Mayor of Vienna. Without time constraints, I had the opportunity to speak with researchers and exchange ideas about our work(Figure 1).

Figure 1. Welcome event in Vienna City Hall (6th July)

The conference began with the welcome speeches of CIE President Jennifer Veitch, CA, and local host Diana Wernisch, CIE Secretary General. Keynote speaker Dietmar Hager presented the multifaceted impacts of light pollution. In his keynote, Dietmar Hager explored the diverse and often overlooked effects of light pollution. He explained how excessive artificial lighting disrupts ecosystems, harms human health, and diminishes our connection to the night sky. Hager emphasized that light pollution isn't just an environmental issue; it also affects wildlife behavior, sleep patterns, and our cultural appreciation of darkness. He advocated for smarter lighting solutions, such as lower-intensity, properly directed light, to reduce negative impacts while still meeting safety and visibility needs. The discussion session following this keynote lecture was also very insightful. Researchers raised their opinions based on their specialty.

Figure 2. Keynote speaker presentation about the impact of light pollution on nature.

After the opening session, I participated in the Exterior Lighting Session, as my research interest is related to outdoor lighting. Overall, all the presentations were engaging, but I was particularly interested in the studies that examined lighting sources from a technical perspective. One especially intriguing presentation by Kazuki TSUKAGOSHI focused on low-height road lighting technology, which has recently begun to be implemented in Japan. Key finding of this study: Luminance contrast thresholds can be used to predict obstacle visibility under both silhouette and reversed-silhouette vision. These thresholds, measured in laboratory conditions, may help assess real-world visibility under road lighting conditions. As I focus on lighting and safety, this study enhances safety solutions with external lighting. I was not aware of this development before.

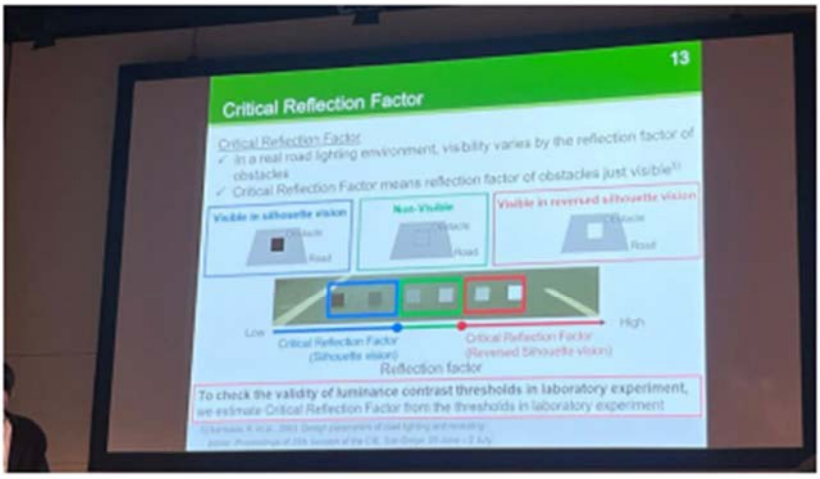


Figure 3. Kazuki Tsukagoshi, luminance contrast threshold under road lighting in reversed silhouette vision and silhouette vision.

I had a poster presentation titled "The role of darkness in theft and robbery in London" (See Figure 4). I briefly explained my method and preliminary results to the conference participants. Quite a few people came to me with questions. I received many helpful comments, and many people found my topic interesting. I feel that people are generally satisfied with the overall outcomes of my study. I have received good feedback, and some of the people suggested other researchers who work on a similar topic, which was beneficial for the network.

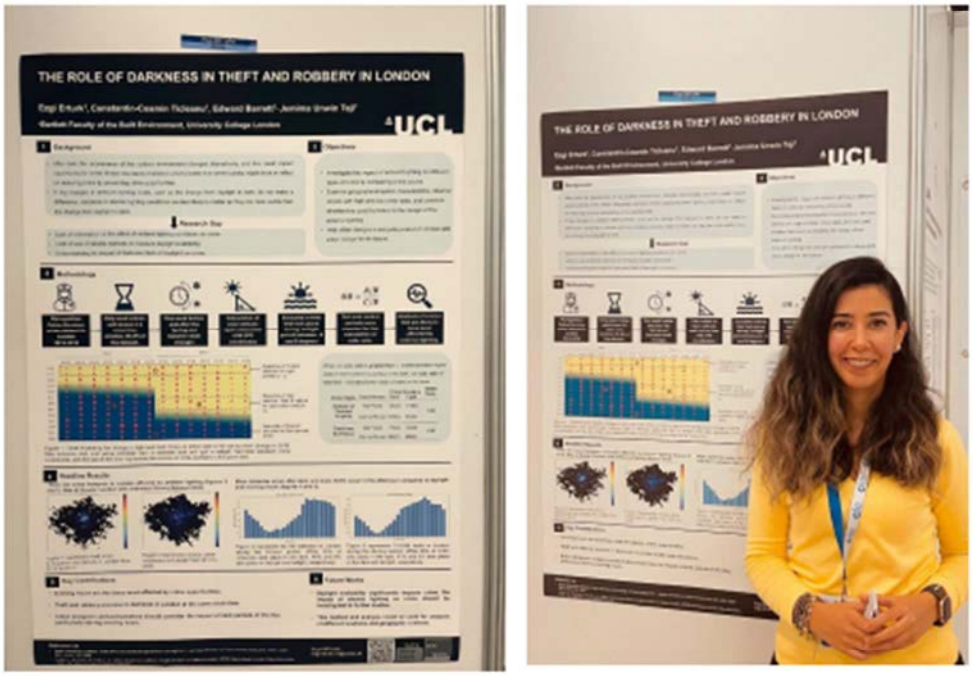


Figure 4. Poster presentation by me.

Another study I found is interesting, titled 'Lighting Public Spaces for People's Well-being: Results from an In-Field Measurement Campaign,' presented by Anna Pellegrino. The study found that the new dynamic LED lighting in Piazza Lambrakis improved energy efficiency, reduced light pollution, and enhanced illumination balance. It remained within safe exposure limits and supported community needs through adaptive, tunable design.

CONTRIBUTION TO THE WORK OF CIE

During my time at CIE, I had the opportunity to attend several Innovative Lighting Technologies meetings. Through these experiences, I was able to contribute to CIE's work and gain a better understanding of the organization's processes. Attending these meetings also allowed me to explore ways to integrate my research into CIE activities. Some examples of the sessions I attended include:

- OS3 D4 - Exterior lighting
- WS1 D1 - Personal colour management for display devices and consumer products
- OS5 D4 - Revision of CIE 115
- WS5 D4 - Rapid revision of CIE 115 lighting of roads for motor and pedestrian traffic
- OS7 D3/D6 - Lighting for health and well-being
- OS10 D3 - Integrative lighting 1
- OS15 D4 - Walking and cycling

Participating in these meetings has boosted my confidence to get involved in CIE activities related to my research area. I plan to develop an action plan based on my recent findings and share progress at upcoming CIE events.

CONCLUSION: The conference poster presentation was directly related to my PhD research. I had the privilege of engaging with seasoned individuals at the conference, who offered me invaluable feedback and a fresh perspective for my future studies. Since my research is relatively niche, it's usually difficult to meet others working in the same area. This conference allowed me to hear about work being done in my field and to connect with researchers with similar interests. Additionally, attending the conference helped me better understand who might be suitable as potential examiners for my PhD viva.

Kind regards,

Ezgi Erturk

Attendance report - CIE Mid-Term Meeting, Vienna, Austria

Submitted to: CIE-UK

Funding awarded to:	Gavin Tolan
Attendance dates:	6-10 July 2025

Summary

I had the privilege of attending the July 2025 CIE Mid-Term Meeting in Vienna as a sponsored participant. One of the highlights of the event was the presentation of a paper that, while not authored or delivered by me, was made possible by my technical input. The visibility of my contribution in this international forum was both professionally rewarding and aligned with CIE's mission to promote international cooperation and the exchange of lighting knowledge.

Among the various topics discussed, two presentations stood out: a particularly compelling session on the ecological impact of vehicle headlight glare especially its effect on nocturnal insects such as moths and a new method to measure discomfort glare in which participants are free to determine their own range of comfortable viewing directions.

Purpose of Attendance

My attendance at the meeting served three main purposes:

1. To represent my contribution to a presented research paper.
2. To engage with ongoing international research discussions.
3. To contribute to and benefit from knowledge exchange.

I am grateful to CIE-UK for your sponsorship, which made my participation possible.

Recognition of My Work

A highlight of the meeting was the presentation of the paper titled *"Biomotion Lighting Enhances Cyclist Conspicuity"*, delivered by Prof. Stephen Fotios. While I was not the primary author or speaker, the results presented were derived from the videos, hardware and software I have been developing over the past year.

Fotios, S, Iqbal, B, Alshdaifat, A, Uttley, J, Tolan, G, Yazdi, G (2025). "Biomotion lighting enhances cyclist conspicuity", Proceedings of the 31st Session of the CIE. Vienna, Austria, July 7-9 2025.

This paper investigates how the conspicuity of cyclists at night can be significantly improved by marking biomotion. The experiment tested whether cyclists with pedal-mounted lights were more easily and quickly recognised than those with conventional frame-mounted steady or flashing lights. Participants viewed simulated night road scenes and identified various road users, including cyclists, pedestrians, and vehicles. Results showed that pedal-mounted lamps led to nearly 100% correct identification and reaction times around 50% faster, compared to only ~30% for standard lighting setups. Similar biomotion benefits were observed in pedestrians and joggers with ankle-mounted lights. The findings support regulatory changes to encourage or mandate biomotion-based lighting for cyclists to improve safety especially on unlit roads and to potentially reduce reliance on road lighting.

My personal contribution to this work was substantial: I was responsible for creating the videos used in the trials and writing the custom software platform used to administer the experiments and

record response data. This technical work formed the foundation for the experimental results presented in the paper.

This recognition on an international platform was both encouraging and validating. Being associated with a presentation at a CIE meeting significantly elevated the visibility of my work and connected it to broader global conversations.

Key Learnings and Observations

The Impact of Headlight Glare on Moths and Nocturnal Insects

Presented by: Jolyon Troscianko, University of Exeter

This presentation formed part of the workshop *Electric Light Effects on Insects and Wildlife*, aimed at those involved in producing and using LED lighting at night for commercial, sporting, and roadway applications.

I found the presentation intellectually stimulating and unexpectedly engaging, as it addressed a topic I had not previously considered. Drawing from both lighting science and ecology, it explored how artificial light particularly high-intensity glare from modern automotive lighting disrupts the visual systems and behaviours of insects.

Key takeaways included findings that moths exposed to intense white or blue-rich headlight glare experience disorientation, disrupted flight patterns, and higher mortality near roadways. These effects can lead to broader ecological consequences, potentially disrupting pollination systems, bird food chains, and overall biodiversity. The presentation also highlighted potential mitigation strategies, such as spectral tuning of headlights and improved directional beam control, to reduce these impacts.

This link between lighting and ecological sustainability was new to me and left a strong impression, highlighting the importance of considering both human and non-human impacts in lighting research.

This session underscored a broader trend in CIE discussions: the growing integration of lighting science with environmental and behavioural fields. As lighting technologies become more efficient and customisable, so too does our responsibility to understand their systemic effects. I left the meeting with a deeper appreciation of how CIE is increasingly a platform not only for standardisation, but also for forward-thinking, cross-disciplinary innovation.

Comfort View Zone: Measuring Discomfort Glare

Presented by: Vissenberg, M.C.J.M., Perz, M., and Sekulovski, D. – Signify Research, Eindhoven, The Netherlands

This presentation caught my attention, particularly as I have recently built equipment and written software for a discomfort glare experiment. My setup used two different evaluation methods: the De Boer scale and a Yes/No option with a 1–6 rating scale, developed by Fotios et al.

Hickcox KS, Fotios S, Abboushi B, Miller N. Correspondence: A new two-step approach for evaluating discomfort from glare. Lighting Research and Technology 2022; 54(1): 91-92.

The paper introduced a new method for evaluating discomfort glare based on the range of viewing directions a person finds comfortable referred to as the *comfort view zone*. Unlike traditional methods that fix gaze or rely solely on subjective scales, this approach allows natural head and eye movement, measuring discomfort based on how much individuals look away from glare sources.

Three experiments were conducted: one demonstrated the method's sensitivity to small differences in glare caused by light intensity changes; another showed that adding a diffuser to an outdoor luminaire reduced discomfort even when illuminance remained constant; and the third, in an office

setting, found increased discomfort from non-uniform luminaires, though this varied with observer position and age.

Overall, the method was found to be sensitive, practical, and more aligned with real-world viewing behaviour. While promising, the authors noted that further testing is required before broad implementation.

Networking and Professional Engagement

While in Vienna, I took part in several informal and formal networking opportunities. I also attended technical working workshops. These provided a clearer understanding of how CIE recommendations are developed and how scientific consensus is built across national and disciplinary boundaries.

Conclusion

Attending the CIE 2025 meeting in Vienna was both professionally enriching and intellectually stimulating. The opportunity to see my work acknowledged at such a prestigious international venue, and to engage with emerging topics such as the ecological impacts of glare, has broadened my outlook.

I deeply appreciate CIE's support and sponsorship, and I look forward to continuing to contribute to the organisation.

Thank you again for this opportunity.
Gavin Tolan

Attendance report – CIE Midterm meeting 2025, Vienna, Austria

Funding awarded to: Heyuan Sun

Attendance dates: 7-10 July 2025

My learning outcomes from the meeting include:

- The conference procedure of the international academic conference
- How to modify the colour and transmittance of glare during outdoor glare experiments
- The specific procedures and methods for modeling a particular lighting scene using 3D modeling software and conducting experiments with VR headsets
- The spatial structure of outdoor lighting (uneven horizontal illuminance) can significantly affect people's sense of pleasure, arousal and control
- How to set the distance between the driver and the OLED screen, as well as the height of the driver's line of sight, in the experimental setup of a driving simulator for ordinary passenger vehicles
- Road lighting plays a positive role in enhancing the safety and confidence of pedestrians on the road
- The requirements for lighting for cyclists may differ from those of pedestrians and drivers. In the future, perhaps they can be classified as a separate category of road users.

Conference review

I arrived in Vienna on the evening of July 6th. The conference began on Monday, July 7th. Dietmar Hager's interesting keynote speech on light pollution kicked off the event, emphasizing that due to the unreasonable design of some building lighting, overly intense light sources weakened the existence of the true night. In the morning's parallel session, I participated in the OS3 conference on external lighting. Reports on outdoor lighting experiments and research were presented, which ingeniously designed and verified the emotional changes and reactions of people to specific outdoor lighting. However, I believe that the design of the variables in some experiments had insufficient limitations and could not fully reflect the viewpoints therein. In the afternoon, I attended a seminar on indoor lighting (WS2), where I learned about the indoor lighting standards and the relevance and practicality of these standards. This to some extent inspired me, and perhaps effective lighting standards can also be established in accidents involving trucks, pedestrians or cyclists. In the evening, I participated in the exchange activity organized by the conference. I introduced and discussed my research content with teachers and students from Japan, who gave me some interesting suggestions. I also listened to some research on indoor lighting design, which interested me a lot. The restaurant of the exchange activity also provided delicious food, and in the restaurant, I had good communication with other students with the same research interests.

On Tuesday, July 8th, I attended the OS5 meeting of CIE115. The reports by Steve Fotios and Jim Uttley left a deep impression on me. They explored the average illuminance corresponding to the best pedestrian safety and discovered that the lighting conditions do indeed increase the risk of certain types of crimes, while some crimes increase under the opposite lighting conditions. Among them, Jim mentioned a clever method for controlling the lighting conditions at the same time.

In the afternoon, I participated in the seminar on revising CIE115. The report mainly proposed that cyclists belong to a group of road users different from pedestrians and cyclists. This has a consistent conclusion with my current research results. Perhaps in the future, my research can well support this

view. Furthermore, I also read some academic posters and learned about the impact of glare on the visual range in daily life.

On Wednesday, July 9th, I attended the OS10 presentation. The report by Nuoyi Li left a deep impression on me. He proposed that in enclosed environments, the integrated lighting system must optimize both visual and non-visual (biological rhythm) effects. By reasonably balancing the colour temperature, illuminance, and lighting schedule, and adopting a gradual adjustment, it can enhance work efficiency, sleep quality, and emotional stability, thereby ensuring the overall health and happiness of workers in extreme environments. In the afternoon, I continued to listen to part of the parallel meeting OS15 (about walking and cycling). Obtaining this knowledge was very useful for me. I learned that by installing lamps on bicycle pedals that mark biological movements, the recognizability of night cyclists can be significantly improved, and the presence of road lighting can effectively reduce the obstruction of darkness on cycling participation, thereby jointly promoting the safety and frequency of night cycling.

Summary

This meeting was rich in content, during which I came across many studies on light in different directions. Many of the topics were unfamiliar to me. However, there were still many studies related to outdoor lighting and pedestrians and cyclists that provided me with many inspirations for eye colour recognition. I also met the members of CIE-UK and spent a wonderful time with two mentors and other doctoral students. I also made some friends with similar research interests, hoping to conduct research on lighting and road safety together with them in the future. I hope to present my research results at the next CIE conference, believing that this will enable more people to see my achievements. Meeting more people with the same research interests and further expanding my research network.

Finally, I am very grateful to CIE-UK for providing financial support, allowing me to attend this meeting and learn useful knowledge.

Heyuan Sun

11 August 2025

Attendance report – CIE Midterm meeting 2025, Vienna, Austria

Funding awarded to: Jim Uttley

Attendance dates: 6-11 July 2025

My contributions to the conference included:

- Two oral presentations: "Darkness increases risk of specific crimes" and "The presence of road lighting leads to more cycling"
- Authorship of four papers (ID119, ID260, ID261, ID120)
- Update to CIE115 workshop about outcomes and implications from D4 Reportership (DR4-54) "Lighting for Cyclists"
- Update to D4 general meeting about Reportership DR4-54, "Lighting for Cyclists"
- Contribution to Technical Committee TC1-103 "Discomfort from Glare: Recommendations for Good Practice in Experimental Research" as member of that TC
- Attendance as an observer at TC4-53 "Tunnel lighting evolution"

The four conference papers I was author on were:

Fotios, S, Uttley, J, Gorjimahlabani, S (2025). "Optimal illuminance for pedestrian reassurance", Proceedings of the 31st Session of the CIE. Vienna, Austria, July 7-9 2025.

Uttley, J, Fotios, S, Falconer, S (2025). "Darkness increases risk of specific crimes", Proceedings of the 31st Session of the CIE. Vienna, Austria, July 7-9 2025.

Uttley, J, Balela, M, Yesiltepe, D, Fotios, S (2025). "The presence of road lighting leads to more cycling", Proceedings of the 31st Session of the CIE. Vienna, Austria, July 7-9 2025.

Fotios, S, Iqbal, B, Alshdaifat, A, Uttley, J, Tolan, G, Yazdi, G (2025). "Biomotion lighting enhances cyclist conspicuity", Proceedings of the 31st Session of the CIE. Vienna, Austria, July 7-9 2025.

Conference review

The conference began on Monday 7 July. The conference opened with an interesting keynote from Dietmar Hager about light pollution – highlighting the ongoing loss of the night sky through excessive or inappropriate lighting. In the morning parallel sessions I attended session OS3 about exterior lighting. A variety of interesting experiments and studies were reported, although I was left with an impression that many of the studies were underpowered and using selective reporting to highlight the most interesting findings. In the afternoon I attended a workshop (WS2) about indoor lighting – although this is outside my normal research area (outdoor lighting) it was interesting to hear the discussions about lighting standards and how relevant and useful these are. In the evening I attended the early career researcher networking meeting. I spoke to a number of young researchers from Japan, they were giving presentations later in the conference. The food was excellent!

In the morning of Tuesday 8 July I gave my presentation about darkness and crime in the OS5 session about CIE115. The talk seemed to be well-received, and I had a number of interesting questions from the audience. Following the conference, I also received some queries in relation to this area of research from Tony Bergen, CIE president-elect.

In the afternoon I attended the workshop about the revision of CIE115, and gave a short presentation about the findings and implications from the Division 4 Reportership I lead about lighting for cycling (see Fig 1). This essentially proposed that cyclists represent a road user group distinct from pedestrians and cyclists, and should therefore potentially be recognised as such in any

future revision of CIE115. However, there is minimal data currently available to inform development of appropriate lighting criteria for cyclists.

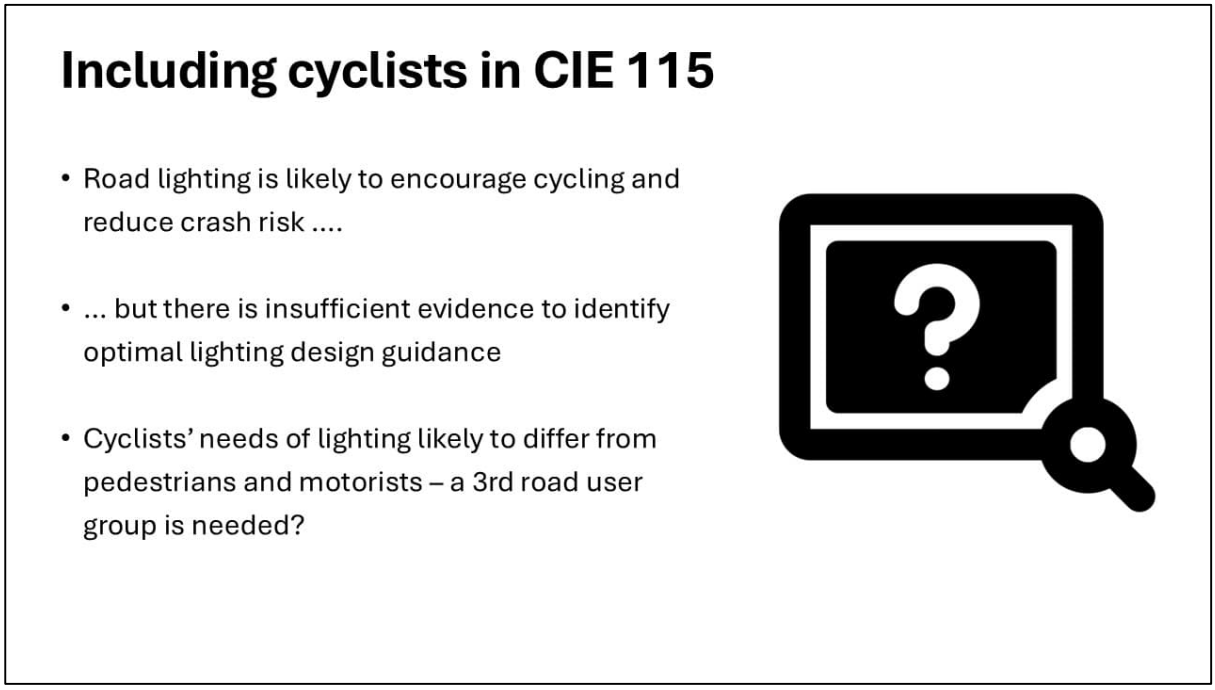


Figure 1. Slide from presentation to CIE115 workshop (8 July 2025) – key implications from DR4-54, "Lighting for cyclists", for the CIE115 rapid revision.

I then attended the parallel session about glare (OS9). This was useful in the context of my membership of TC1-103 which is related to the methods for assessing discomfort from glare.

On Wednesday 9 July I attended the morning keynote from George Brainard about light and human health. This was an extremely interesting overview of the path towards our current knowledge about the non-image-forming impacts of light on humans. Brainard is an interesting and engaging speaker.

In the afternoon I gave my presentation about the impact of lighting on cycling rates, as part of parallel session OS15 about walking and cycling. It was useful to hear the other areas of research related to walking and cycling, and reassuring that this topic is an active and developing research area.

I then attended the parallel session OS17 about road surface reflection, expertly chaired by Nigel Parry. This provided some useful summaries of research in this area, particularly relevant to my own area of research as accurate measurement of road lighting conditions is essential to understanding the impact of lighting on cycling and walking.

Technical meetings review

On Thursday 10 July I attended the Division 4 general meeting in the morning. I gave a brief update about my Reportership on lighting for cyclists (DR4-54). This Reportership is nearly completed and I aim to draft a Technical Note summarising the findings, which I will seek feedback on from a group of Division 4 experts by the end of December 2025. The Division 4 meeting also involved a bit of discussion around the CIE115 rapid revision, which I hope my Reportership findings will feed into.

In the afternoon I attended TC4-53 as an observer. I am interested in this TC as I have an interest in tunnel lighting for cyclists. Cyclists were out of scope for this particular TC, raising the question of future research and technical work to ensure the needs of cyclists are accounted for in the lighting of tunnels.

At the end of the afternoon I attended TC1-103 about measuring discomfort from glare, as a member of this TC. Some very interesting discussions were had about the structure of the TC report and around methods for doing research on discomfort from glare.

Summary

The conference on the whole was informative, interesting and fun to attend. It was nice to catch up with other members of CIE-UK, and to spend some time with the PhD students from Sheffield that also attended. As is usual with conferences, only a handful of research presentations were directly relevant to my work, but it was also useful to hear the wider range of work being undertaken within the lighting research community. I also made a number of useful connections that I plan to follow up on, which have potential for supporting future research into lighting and crime, and lighting for cyclists. In particular, I made a connection with a researcher from the Centre for Tunnel Studies in France, Severine Besson, who I hope to discuss future potential research on lighting for cyclists in tunnels with.

As always, I am grateful to CIE-UK for their financial support that enabled me to attend the conference and contribute to the technical work of the CIE.

Jim Uttley

29 July 2025

Jemima Unwin Teji
Institute of Environmental Design and Engineering, University College London.
14 September 2025

CIE Mid Term Meeting

2025, Vienna, 7-9 July.

"Great science happens during conversations[1]"

At the recent CIE Scientific Conference in Vienna, such rich dialogues were abundant. Inspired by thought-provoking keynote speakers, insightful paper presentations, and an impressive array of posters, I will summarise some of the most captivating topics I encountered: AI and consciousness; Legislating for healthy lighting and The relationship between aesthetics and perceptions at night.

AI and consciousness

The keynote speech of Prof Stephen Westland took us on a journey through time, beginning with the first algorithms such as K means clustering and ending with some of the vast opportunities presented by AI. The debate at the end culminated in a discussion of the nature of self awareness, evoking ancient ideas on the origins and history of consciousness. Descartes said "I think therefore I am",

[1] No well-documented source directly attributes the phrase "great sciences happens during conversations" to a specific author.

however we would never know if a computer is conscious and whether the emergence of consciousness in non biological systems is possible.

Legislating for healthy lighting

The Division 1 presentations ended with a really interesting discussion on what to do about integrating health metrics into lighting standards. Peter Boyce drew an analogy with a winter coat: A winter coat is required to keep us warm, and needs to fit, but the rest is up to the designed appearance. Standards stop with essentials and the rest is guidance, with no legal force. The question is, do MEDI recommendations fall into the winter coat specification, or are they part of the design? The challenge is how to incorporate individual and lifecycle variations in health needs.

The relationship between aesthetics and perceptions at night

The Division 4 presentations touched on the intangible - the effect of the lit appearance at night on emotions. One of these was the presented paper "Integrating emotional and visual dimensions in urban lighting design: a holistic approach using the PAD model and light field metrics" by Yichen Jiang. The question is whether subjective judgements of lighting translate into behaviour. The informative presentations describing the effects of ambient lighting conditions on crime, traffic accidents, cyclist visibility and pedestrian reassurance by Dr Jim

Uttley and Prof Steve Fotios, suggest that ambient lighting conditions certainly do affect behaviour.

Some other highlights were:

- Images of astronauts velcroing themselves to space station walls to sleep, as detailed in Professor George C. Brainard's inspiring keynote.
- A detailed overview of international light pollution guidelines in ecology by Annika Jagerbrand.
- Innovative use of drones for dynamic luminance mapping showcased by Filip Novak, Constantinos Bouroussis, and Martin Motycka.

In summary, I had a wonderful time at the CIE Scientific conference in Vienna. The event provided a well structured platform for researchers to share their latest findings, engage in discussions, and promote collaboration within their fields. The quality of the new knowledge presented was excellent and innovative, and I look forward to the many fruitful collaborations which I'm sure will emerge from connections made at the conference.

International Commission on Illumination
Mid-Term Meeting, Vienna, July 2025

General Assembly

I attended the CIE General Assembly on Sunday 6th July as the Chair of CIE-UK, representing the UK. The General Assembly (GA) is the supreme authority of the Commission and the members' assembly within the meaning of the Austrian Associations Act (Vereinsgesetz). It is composed of the senior officers of each National Committee or their representatives. Each National Committee has one vote in the General Assembly.

The GA recognised the sad loss of Professor Tianxing Shen, Ad de Visser and Arangelo Arecchi since the last GA.

Jennifer Veitch, the CIE President, reported on activities of the CIE. Two Position Statements have recently been published: CIE PS 001:2024, CIE Position Statement on Integrative Lighting - Recommending Proper Light at the Proper Time, 3rd Edition and CIE PS 002:2025, CIE Position Statement on Colour Quality Metrics, 2nd Edition. Thanks to funding from the Vienna Business Agency, CIE have support for an 18-month campaign (until June 2026) called "Understanding science – Understanding light" which will promote public information online to the world and in Vienna in person with a special focus on light pollution and light and health. The first session under this banner took place on the International Day of Light 2025 (May 16), and featured the launch of the Ladenburg Consortium campaign Light for Public Health. The CIE participated with five other organizations in the development of 26 simple consensus statements and associated graphics to bring to widespread awareness the knowledge that daily light and dark exposure is important to all of us.

Oliver Thissen, the CIE Treasurer, presented the financial position of the CIE. Although the expectation is that a loss will be made for a further year, this helps to reduce the risk of a potential tax liability because of the level of reserves being greater than permitted for a charity under Austrian law. From a longer-term perspective CIE is aiming to increase its revenue streams and to stabilize the CIE income at a slightly higher level, e.g. by long-term event planning to secure and increase income from events, efforts to promote CIE publication sales income and visibility. In parallel the General Assembly approved to implement an index-based increase of the CIE's member dues, starting in 2025.

Vice-President Technical, Tony Bergen, reported on a number of matters. The International Lighting Vocabulary (ILV), published as CIE S 017/E:2020, continues to be maintained by JTC 08, a joint technical committee comprising members from each Division as well as external stakeholders. Rather than have a set revision of the whole ILV, a massive task which last happened from 2015 to 2020, terminology changes can now be submitted as Change Requests (CRs), which includes the proposed change and justification of change for individual ILV entries. There is now a process for JTC 08 to work on these CRs with oversight and approval by the Technical Management Board.

Vice-President Education is a new role with the inaugural post-holder being Luoxi Hao. The CIE has consistently placed strong emphasis on lighting education. In 2020, it initiated the Ad hoc Task Group on Education to explore and address education-related topics within the organization. Building on this foundation, the NC Workshop on Lighting Education in 2022, the Education Workshop in 2023, and the Networking Events for Students held during the Sessions and Midterm Meetings were all designed to engage young scholars and encourage their active involvement in CIE activities. These initiatives also aim to expand CIE's visibility and influence within both academic and professional communities. At the 2023 CIE General Assembly in Ljubljana, the Standing Panel on Education (SP Education) was officially established. Luoxi was appointed Vice-President for Education, responsible for overseeing its work. The panel consists of members from the CIE Governing Board, academic institutions, and organizations involved in training and professional certification.

Secretary General Diana Wernisch presented an update on the work of the Central Bureau over the two years since the Quadrennial Session in Slovenia:

- New Interview Series with CIE Board Members in Industry Magazine LED Professional (2024-2025)
- Three public webinars were implemented (all of CIE's video recordings are available on Vimeo https://vimeo.com/ciescience): International Day of Light (IDL) 2024 (Spotlight on the UN Sustainable Development Goals, 117 attendees), Webinar on the CIE Research Strategy (186 attendees) and IDL 2025 (Light and Human Health, 198 attendees)
- Project for new CIE Events website completed and first implementation with CIE 2025 website
- The CIE newsletter and LinkedIn account were systematically promoted (e.g., in CIE presentation templates, in CIE email signatures)
- - Quarterly newsletters were sent, no. of recipients increased to > 2200 (6,5% increase in 1,5 years)
- LinkedIn community grew by 50% since January 2024, now having >3000 followers. This was accompanied by a strategy involving an increase of postings (on average approx. 2 posts per week)
- The CIE website project completed (new license, text revisions, document updates etc.)
- The CIE Divisions Logos promoted (Division Management Team members can use them in their signature or on websites)
- Print & PDF materials (brochure, flyer, PPT slide deck) updated
- Project Understanding science – understanding light funded by Vienna Business Agency promotes CIE topics specifically to the Austrian public as part of CIE 2025 being held in Vienna and is funding a part-time position for 1,5 years
- CIE partnered with other international associations on the "Light for Public Health" campaign to raise awareness among the public about the effects of light on human health and well-being

There was only one nomination for President-Elect. Therefore, Tony Bergen was elected by 34 National Committees. In 2026, National Committees will need to elect the CIE Governing Board. This starts with the Vice-Presidents with Portfolio and the Treasurer. Once that process is completed, the Vice-Presidents without Portfolio will be elected.

There was a discussion about the fees that National Committees pay to CIE (Subvention). The increase is currently capped at 4%, despite the rate of inflation in Vienna being 5.32%. National Committees will be balloted on whether to approve the extra 1.32% which, if approved, will be the starting point for any future increase.

The National Committees will also be balloted on whether part-terms count towards the limit for a person in a post. The recommendation is that only full terms are counted.

Consideration is being given to increasing the price of some publications.

Proposals to host the 2029 Mid-Term meeting have been received from Germany, Turkey and South Africa. National Committees will be balloted later in 2025.

Advanced registrations for the 2025 Mid-Term meeting were 427 from 40 countries or territories.

The next GA is scheduled for 11 July 2027 in Nanjing, China.

Conference - Monday

The Conference ran from 7-9 July. Apart from the opening sessions each day, three parallel sessions operated throughout the Conference, which presented some challenges for attending all of the presentations of interest.

The Tuesday Keynote Lecture was "The multifaceted impacts of light pollution" by Dietmar Hager. He stressed the historical importance of the night sky to earlier populations and the threats of light

pollution. Dr Hager is an astrophotographer with a website: Stargazer Observatory - Your journey to the stars.

I attended the D4 – Exterior Lighting session, chaired by Steve Fotios. The papers covered a range of topics, such as the impact of fluctuating light, emotional and visual dimensions in urban lighting, visibility of road markings, low profile road lighting and assessment of observer parameters under static and dynamic lighting conditions.

David Sliney was the convenor for a workshop on Electric Light Effect on Insects and Wildlife. The first presentation assessed different light sources to determine which were more likely to attract insects and also birds. The importance of moths and other insects for nigh-time pollination was emphasized. There were indications of whole ecosystems collapsing. The third presentation looked at the combined effects of light and chemicals. Artificial light at night was shown to increase stress-related issues in zebra fish. The final presentation considered the dose-effect relationship for insects and the ecological impact. Although the effect was not pronounced, there were some indications of a dose-response effect.

Conference - Tuesday

The Keynote Presentation was by Stephen Westland on "Applications of Artificial Intelligence in the Colour Industries". He talked about neural networks and his predictions for the future.

I attended the D3 – Daylight session, chaired by Anna Pellegrino. Martine Knoop described her round-robin assessment for daylight assessment. A reference spectroradiometer and fish-eye camera have been sent around the world. Matej Kobav talked about measurements with an affordable fish-eye action camera. Claudia Amorim presented a study that considered daylight and the view out from buildings. The sky, vegetation and water were considered the preferred view, with buildings, cars, etc unpleasant. There were no differences between Brazilian and European populations. Barbara Matusiak carried out a similar study and the difference in perception for the view owner and an observer. Owners tended to mark the view higher than observers. Chikako Ohki assessed the quality of views from office buildings. He used a Sky View Factor and a Near View Factor.

The Workshop on the Rapid revision of CIE 115 Lighting of roads for motor and pedestrian traffic was led by Steve Fotios. There was concern that cyclists were not covered and Steve questioned the need for 6 illumination classes. A two-stage revision is proposed: what is known; and ongoing and planned research.

A joint D3/D6 session followed on Lighting for health and well-being, chaired by Laura Bella. Mehlika Inanici talked about metrology for neuropic response to light, considering a neonatal intensive care unit. Neuropsin's response seems to peak at 380 nm and is potentially important for myopia management. Many LED light sources do not contain violet light, unlike sunlight. A study was carried out to assess spectral light exposures with a model patient lying on their back with ocular access to different light sources. Dandan Hou suggested that there were individual differences in photobiological effects. Experiments were carried out in three regions of China with different climate conditions. Various body parameters were assessed under the different light conditions. Age-related effects on colour discriminations were also assessed. Iza Linders looked at light exposure and sleep quality in intensive care unit patients. These environments are not conducive to good sleep quality anyway, due to noise and the general activity. Ronjdi Shao presented a study on light exposure impact on post-partum sleep, fatigue and mood. They managed to optimise the light exposure to increase sleep duration by about 27 minutes.

Conference - Wednesday

George (Bud) Brainard gave the keynote lecture on Light and Human Health. Of particular interest was his work with NASA to both assess and improve the lit environment on the International Space Station. The crew now have access to a handheld photometer/radiometer and have undertaken 600,000

measurements to date. Bud also discussed the transfer of the knowledge from the ISS work to patients who have suffered concussion and also suffer poor sleep quality.

This was followed by the first D3 session on Integrative Lighting. Anders Thorseth suggested that the 2° observer didn't give a good indication of how people see an environment for real, especially where there are bright surfaces on a dark background. Kate Turley considered lighting preferences for dementia patients. The results weren't conclusive with some patients preferring bright light and others dim lights. Roel Daniels presented on a study to determine whether performance could be increased with appropriate lighting in office environments where workers are primarily working at computer screens. The findings showed no real differences, but one limitation was the young and narrow age range (20-23y) of the participants. Nuoyi Li looked at improving wellbeing of workers who work in enclosed spaces with no windows. Elif Harputluoglu presented a literature review on integrative lighting for educational establishments. The conclusion was that there is usually inadequate lighting in existing buildings.

A D3/D4 Lighting and Circadian Rhythm session, chaired by Yandan Lin, was the last scientific session of the conference. David Baeza was interested in the circadian rhythm of the skin. He linked this to work on the treatment of myopia progression. Sawa Sato talked about spatial impression and object visibility by age and as a function of melanopic equivalent daylight illuminance. Study subjects were asked to complete questionnaires to assess different lighting conditions. Zhenzhen Li covered the effects of nighttime display colour temperature and circadian stimulus on circadian rhythms and visual fatigue. Katja Rebec assessed light exposures using wearable sensors and correlated the results with the subjects' circadian rhythms. Finally, Yingying Huang attempted to quantify the impact of dynamic night-shift display-screen lighting on melatonin secretion. They concluded that switching to low melanomic equivalent daylight illuminance just before bedtime was not sufficient: melatonin suppression was disproportionately driven by early high m-EDI exposure.

Technical Meetings – Thursday/Friday

I participated in three technical committee/Division meetings at the end of the week. I chaired the JTC5 meeting on Thursday morning, covering the revision of CIE S009. JTC8 on terminology met on Thursday lunchtime and the Division 6 annual meeting was on the Friday.

I wish to acknowledge the financial support provided by CIE-UK, which allowed me to attend the conference and meetings in Vienna.

John O'Hagan

26 September 2025

CIE Midterm Conference 2025

Khorshid Meihami
PhD Student at University College London (UCL), attending as a participant and poster presenter.

I had the distinct pleasure of attending the CIE Midterm Conference in Vienna, held from July 6th to July 9th, 2025, with an extended attendance at the Technical Division & TC Meetings on July 10th. This conference proved to be an invaluable experience, offering significant learning opportunities and extensive networking within the lighting community.

Introduction

Title of event/activity attended: CIE Midterm Conference 2025, followed by Technical Division & TC Meetings.

Dates of event/activity: July 6th to July 9th, 2025 (Conference); July 10th, 2025 (Technical Division & TC Meetings).

Attendance Considerations

My primary reason for attending the CIE Midterm Conference 2025 was twofold: as a **PhD student whose research heavily focuses on the effects of light on human health**, particularly in challenging environments like space, this conference represented a critical opportunity to engage with leading experts and cutting-edge research in the field. Secondly, having my **first-ever research poster accepted for presentation**, I was eager to gain invaluable experience in communicating my work to an international scientific audience.

I was specifically looking to gain:

- **In-depth knowledge of the latest advancements** in light research, especially concerning human physiological and cognitive responses to various lighting conditions.
- **Networking opportunities** with established researchers, potential collaborators, and fellow students from diverse backgrounds within the lighting community.
- **Feedback on my PhD research** from experts in the field, helping to refine my methodologies and future directions.
- **Understanding of the broader applications of light research**, beyond my specific area, to enrich my overall academic perspective.

Key Activities

The conference was a vibrant hub of innovation and discussion, yielding several hot topics and particularly noteworthy presentations.

Hot Topics

Several themes consistently emerged throughout the conference, highlighting key areas of focus within the lighting community:

- **Human-Centric Lighting (HCL):** The concept of designing lighting solutions that prioritise human well-being, health, and performance was a dominant theme, encompassing both visual and non-visual effects of light. Many presentations explored how lighting impacts circadian rhythms, mood, and productivity.
- **Light Pollution:** The environmental impact of artificial light, particularly on ecosystems, astronomy, and the night sky, was a significant concern, with discussions centring on mitigation strategies and policy implications.
- **Applications of Artificial Intelligence in Lighting:** Emerging technologies, especially AI's role in optimising lighting design, controlling systems, and analysing data, showcased the future direction of the industry.
- **Integrated Lighting for Enclosed Spaces:** With increasing time spent indoors, the necessity of crafting lighting environments that mimic natural light cycles and improve well-being in offices, homes, and specialised environments (like space habitats) was a recurring discussion point.

For fellow CIE-UK members, I believe the following insights and presentations are particularly noteworthy:

- **Keynote by Dietmar Hager on "THE MULTIFACED IMPACTS OF LIGHT-POLLUTION"**: This presentation offered a compelling and holistic view of light pollution's detrimental effects. It highlighted not just the impact on astronomy but also its critical implications for nature and wildlife. Understanding these broader ecological consequences is vital for all lighting professionals and researchers, urging us to consider the environmental footprint of our designs and installations.

- **Workshop: "TAILORING INDOOR LIGHTING REQUIREMENTS TO MEET USERS' NEEDS"**: Convened by Anna Pellegrino and featuring experts like Craig Bernecker, Adrie De Vries, and Johannes Weninger, this workshop was highly informative. It provided practical approaches and considerations for designing indoor lighting solutions that genuinely cater to the diverse needs and preferences of occupants, a crucial aspect of HCL.

- **Keynote by Prof. George Brainard on "LIGHT AND HUMAN HEALTH"**: This was, for me, the most impactful presentation. Prof. Brainard's extensive research, particularly his work with NASA, offers profound insights into how light affects human physiology and psychology. For anyone involved in health and well-being applications of light, or those interested in extreme environments, his perspectives are invaluable. His talk was a masterclass in combining rigorous science with real-world applications.

- **Presentations on Integrative Lighting for Enclosed Spaces**:

    - **"INCREASING PERFORMANCE IN THE OFFICE WHEN WORKING WITH MONITORS: A PILOT STUDY" by Roel Daneels:** This presentation provided practical insights into optimising lighting for visual tasks and performance in office environments, especially relevant given the prevalence of monitor-based work.

    - **"INTEGRATED LIGHTING FOR ENCLOSED SPACES FOCUSING ON VISUAL AND NON-VISUAL EFFECTS TO IMPROVE WORKERS' WELL-BEING" by Nuoyi Li:** This detailed how integrated lighting strategies can positively impact worker well-being by considering both the visual and non-visual effects of light. Both presentations offer direct, actionable information for improving indoor lighting design.

- **Technical Division & TC Meetings (July 10th):** The discussion on the "Possible effects of daylight and indoor lighting on circadian rhythms of the skin" by Dr. David Baeza was an unexpected but fascinating highlight. It broadened my understanding of light's impact beyond the visual and systemic circadian rhythms, suggesting new avenues for research and applications. This highlights the importance of exploring all biological responses to light.

What I Got Out of the Event/Activity Attended

The CIE Midterm Conference 2025 was an overwhelmingly positive experience that significantly contributed to my academic and professional development.

All my pre-conference aims were successfully achieved:

- I gained **extensive knowledge** of the latest research, particularly on human-centric lighting and its physiological impacts, which directly informs my PhD.
- I engaged in **valuable networking**, meeting numerous experts, including Prof. George Brainard, whose insights are directly relevant to my research. My discussions with Tony Bergen regarding the CIE's structure were also highly beneficial for understanding the broader community.
- Presenting my **first-ever poster** was a significant milestone. The experience of communicating my research and receiving informal feedback was incredibly rewarding and will undoubtedly improve my future presentations.
- The diverse range of talks expanded my understanding of light's applications beyond my specific niche, offering a more holistic view of the industry.

The learning gained from this conference was immense and multifaceted:

- **Deepened Understanding of Light's Non-Visual Effects:** The keynotes and various presentations, especially from Prof. Brainard, reinforced and expanded my understanding of how specific light wavelengths and exposure patterns influence human circadian rhythms, sleep, mood, and cognitive function. This is critical for my research into lighting for astronauts.
- **Insights into Practical Applications and Design:** The workshops and presentations on integrated lighting provided practical methodologies and case studies on how theoretical research translates into real-world lighting solutions for various environments, including offices.
- **Importance of Interdisciplinary Collaboration:** Witnessing the diverse range of topics and the active participation of professionals from various fields (astronomy, biology, engineering, design) underscored the highly interdisciplinary nature of light research and the necessity of collaboration.

- **Refinement of Research Communication Skills:** Presenting my poster and engaging in discussions helped me refine my ability to concisely explain complex research to a broad audience, a crucial skill for any researcher.

- **Understanding of CIE's Role:** My conversation with Tony Bergen provided a clear picture of the CIE's structure, its technical divisions, and its role in setting international standards and fostering research, which is valuable for future involvement.

Overall Evaluation of Event

The CIE Midterm Conference 2025 was an **exceptionally well-organised and highly enriching event**. The quality of the presentations, the calibre of the keynote speakers, and the numerous networking opportunities far transcended my expectations. As a first-time conference attendee and presenter, the supportive environment and the clear guidance from the conference team made the experience remarkably smooth and positive. **The opportunity to meet and converse with a pioneer like Prof. George Brainard was truly inspiring and a direct benefit to my ongoing PhD**. The insights gained, particularly on human-centric lighting and its application in challenging environments, will directly inform and enhance my research at UCL. I am deeply grateful for the opportunity to have attended and eagerly anticipate applying the knowledge and connections I've made to my ongoing studies.

Report of Luke Price (UKHSA) to CIE-UK on the CIE Mid-term Conference 2025

1. Introduction

I attended the CIE Mid-term Conference and Technical Meetings between 6th-11th July in Vienna, to present, learn, network and fulfil various technical roles and interests listed in the section titles below. All links to proceedings can be found online at dropbox proceedings

The Mid-Term was diverse and the technical meetings in particular were well attended, so that overall, this was a valuable trip.

2. 6th July Welcome reception

I joined the Welcome Reception in the Vienna Rathaus on Sunday evening, to hear the opening address from the city mayor, welcoming us to Vienna. This was a good opportunity to meet old CIE colleagues, introduce UKHSA colleagues and meet new delegates.

3. 7th-9th July

On Monday, proceedings began with welcomes from CIE's General Secretary and President. There were 427 delegates from 40 countries registered at the latest count.

3.1 Keynotes

The keynotes began each day. The first was given by Dietmar Hager, an astronomer and keen photographer on Light Pollution. The viewpoint of the ancients and the impact of light pollution on culture were emphasised, as well as work by Thomas Posch, the late lecturer of philosophy and astronomy of Vienna University. It concluded with a metaphor of the injurious effects of light pollution as an amputation injury.

The second keynote concerned Artificial Intelligence and Machine Learning, and was delivered by Stephen Westland. Insights into the use of AI in colour science were within compass, but the lecture discussed the possibility of an imminent third AI winter in global markets, as financiers become frustrated with promises that have not become reality. The keynote was at once a challenging and fascinating insight into one of the main current hot topics in worldwide politics, science and industry.

In the third lecture George 'Bud' Brainard spoke about circadian and neurophysiological responses to light "Light and Human Health", CIE's first eve international metrology standard on this, and his work with NASA designing the current lighting on the International Space Station – and how he was able to introduce hand-held spectrometry to space. He explained how CIE's interest began in 1995, his previous keynote year, and quickly established its first consensus in CIE 158:2009, and touched on some of CIE-UK's own contributions. We also learnt that the average sleep duration in space was approximately 6 hours per night, that quickly accumulates to a powerful sleep debt stress on astronauts. Science's 2023 special edition on light pollution was signposted (6650, pp1116+).

3.2 Division 6 symposium

This began with the conference's best presentation winner: M INANCI presenting on metrology for neuropic response to light: a case study in a neonatal intensive care unit.

Neuropsin (OPN3) is present in the retina and skin, and may have a role in mediating photobiological responses. In vitro, the peak wavelength can be establish from its optical density in solution. Fitting an opsin template then allows for a spectral absorptance curve to be formulated. This was done and used as an action spectrum, based on equivalent daylight illuminances structures, by analogy to CIE S 026:2018, the international standard on ipRGC-influence responses to light, which I am heavily associated. Different exposures were evaluated using this (non-consensus) neuropic EDI construct. The study did not measure neonatal's responses to light.

I have reservations related to several insufficiently supported steps in the process. Absoprtion curves are not action spectra, and do not account for spectral filtering of biological tissues before the

photobiological interaction. Action spectra should be confirmed by careful response studies, which themselves require a confirmed robust response to light. In addition, skin responses should not be conflated with the CIE S 026 metrology, because this adopts some observer characteristics and spectral restrictions peculiar to peripheral retinal photoreception. Most importantly EDI is there for established important applications in lighting, so that they can talk to researchers. Action spectroscopy already has a language for more tentative research stages.

Three presentations (by D Hou, I Linders and S Dai) followed on the responses to light on cohorts of general population, recovering ICU patients and mothers-to-be approaching giving birth. These showed some of the interesting challenges of field work, such as confounding, control and small sample sizes, as well as revealing the potential applications of a better understanding of non-visual responses to light in different population groups.

3.3 Poster: The Performance of Colour Fidelity Metrics under Spectral Perturbations

This is the third poster on colour rendering I have presented at CIE since 2012, which have developed spectral band and spectral fidelity methods for use in objective colour fidelity. Notably these methods employ simplified approaches that do not rely on colour spaces or spectral reflectance files. After the first introduced the concept of spectral entropy, the second investigated the impact of wavelength step, and this poster compared metric performance against the main CIE metrics and sought to develop further improvements. Notably the advantages of incorporating reference spectra and choice of total wavelength range were investigated. Advantages in performance using the current proposed method were explained. There were many more meaningful interactions with delegates than in previous poster presentations, and I felt the concepts and advances were well received.

3.4 Selected other presentations and posters

There were a number of contributions considering the impact on light logger data of worn position and field of view, including the progress since Ljubljana of a field of vision study by S. Bonavia (UCL) using responses of human participants, and suggesting it will confirm the non-visual sensitivity of the central and upper (i.e. images received by the lower retina) fields of human vision.

Many will have stayed on after the Keynote for M Knoop's presentation on a daylight measurement campaign, that is collecting data from several locations to reconsider the basis of the CIE's standard daylight spectra. UKHSA is a potential contributor, but not currently scheduled in the Round Robin structure of the study.

K Turley presented the results of conducting eight research workshops with dementia patients in NI, in relation to integrative lighting and how they consider lighting use. This was clearly a challenging protocol, and as well as excepted difficulties, highlighted the interest that the patients would potentially have in changes to the lighting, be it for research purposes or generated from recommendations or best-informed design activities. A potential presenter for lighting profession workshop!

Disappointingly, considering other presentations here, the use of CCT continues in many photobiological studies, and it continues to be used as more than a label, effectively being proxy in design and conclusions about light – a role for which it has been shown it is ill-suited. I hope the UK lighting profession can start to educate researchers to this end, and return some of the value of the educational contributions of researchers to the profession!!

4. 10th-11th July

The Technical Meetings were well attended, and held in WKO's offices. My colleague Paul O'Mahoney noted he understand better who was who from these meetings, only after the main conference ended. My other colleague Siobhan Patrick did not stay on, not being involved in these

meetings – it had been decided that RF-09 on Myopia and Daylight Exposure would be held online in August and not in person in Vienna for various practical reasons.

4.1 RF-02 Temporal Light Modulation "TLM" (Research Forum member)

Naomi Miller chaired, and worked through the latest research developments, and attempts to bring consensus to terminology. In particular there were groups, including NM's own, investigating sensitivity to the Phantom Array with a view to generating a new metric, changes from M Perz to the Stroboscopic Visibility Measure to provide a realistic curve at higher frequencies, and a proposal to rename the artefact "Flicker" to be "Direct Flicker". This latter change was supposed to avoid the confusion between the use of the term flicker to describe TLM in general.

My view is whilst the progress is useful, there is often a diversion from practicalities, and that wider existing solutions to the general public problems with flicker could be implemented or at least explored in the field. The UKHSA has had a successful approach in place since circa 2012. Other practical solutions have been developed and proposed in CA, USA.

4.2 Discussion meeting: Anthropogenic Light (Workshop Adviser)

Light pollution continues to be a hot topic, and Rob Lucas, chair of the fourth Manchester Workshop and Professor at Manchester University, attended to open discussions with the wider CIE on the proposals for a spectral curve related to the polluting effect of light, to allow measurements of "light pollution" as it affects ecology at a general or global level. CIE-UK also has Peter Thorns as member of this workshop, which I attended. I act as an adviser instead to avoid a conflict in my official work roles.

This session was useful, establishing interactions with other CIE activities on similar topics.

4.3 JTC-20 Wearable Dosimeters (JTC Adviser)

Manuel Spitschan as chair introduced speakers conducting the performance characterizations of wearable dosimeters for non-visual research (Fabien ELOI) and a standard software platform for time series data of this type (Johannes ZAUNER), both funded under the MeLiDoS project. In answer to my question, the characterization does not consider batch variation for CIE, which is a topic I have introduced with UKHSA colleagues in past publications. With experience in both aspects, I was particularly impressed with the functionality outlined in the open-source software.

The JTC seems to be dominated by the MeLiDoS project, but necessarily aims to provide CIE outputs. It is not clear what processes govern the interactions between different interests, but as an adviser I am not directly involved in the JTC management in any way. The software development integrates many different manufacturers devices into a common format, taking up potential research time rather than the development costs being borne by the industry. If successful, it has the potential to empower researchers, which is the aim.

4.4 Division 6 Annual Meeting (National Committee Representative)

I will provide CIE-UK with a separate report on the Division meeting, including the continuation online on 18th July is included in this report. There are several new RFs (RF-08 below, RF-09 mentioned already), including proposals during the meeting: including RFs on Vitamin D I. Terenetskaya and on alphaopic terminology by J. Veitch. I support these, as well as a potential future RF from the Manchester Workshop IV, whichever division it is convened in. D6 is showing that it may become even more active and produce various Technical Notes and Reports in the coming 2-4 years.

4.5 RF-08 Circadian Rhythms of the Eye and Skin (Research Forum member)

David Baeza as convener. This RF has started with a few online meetings with a small number of participants in 2025. However, I estimate the turnout at this meeting was around 25-35. Yandan Lin and I agreed to DB's proposal to help with the creation of a one page document summarising the

diversity of topics that this RF covers, and help to direct different topics into suitable activities from time to time [description subject to exact confirmation from DB, due to noise etc.].

My feeling before this agreement was that the RF felt diverse in topics and not focussed or structured as much as might be helpful. DB's interest in new research is apparent, as is his appreciation of the wider potential health impacts of these effects, so it is my hope that CIE can find valuable content from the large number of attendees at the meeting.

Report on attending the CIE 2025 Midterm Meeting

Qinyuan Li, University of Leeds

First of all, I would like to thank CIE-UK for funding my attendance in CIE 2025 Midterm Meeting. The meeting was held between 4th July to 11th July, 2025, in Vienna, Austria. The funding provided me a great opportunity to understand the CIE organisation and present my work to experts in the field of colour.

The 2025 CIE Midterm Meeting included a 3-day scientific conference and a 2-day CIE Divisions and Technical Committee meetings. Taking this opportunity, I submitted the paper 'Development of a database for fabric visual appearance' and was assigned a 15-mins oral presentation. The paper present one of the most important parts of my PhD work: Leeds Fabric Tactile Database. The database includes high-resolution fabric images and videos, the corresponding real fabrics, and an extensive collection of fabric tactile perceptual data. In the paper, we described one of the applications of the database: using the features extracted from images and videos to predict the fabric tactile perception perceived from real fabrics. However, it is found that the audience were confused about the use of videos, which I believe I need to add a clear explanation in future presentation. The explanation could include playing one fabric rotation video in the database, explaining the process of generating an image from the video, and illustrating the similarities and differences between video and image. That information will hopefully clarify the use of fabric images and videos and give a better understanding how the prediction in the paper is achieved.

In addition to present the prediction work using our Leeds Fabric Tactile Database, the other important reason for attending the CIE Midterm Meeting is to explore the possibilities of the database. For example, the flat fabric images can be considered as colour patches with added texture, making the database a valuable resource for studying textured colour perception. The draped fabric images and fabric rotation videos also support the investigations into the perception of colour and texture on 3D objects. In the CIE Midterm Meeting, however, it is found that the texture is not popularly reported. The texture-related reports included: (1) paper ID 156 from Dr. Hermin Chatoux et al., where non-semantic images with 3D Gaussian noise were defined and used in the pair comparison experiment. The more textured image was selected by participants; and (2) paper ID 201 from Dr Yan Lu et al., where isolated skin patches were used as textured colour patches in the colour-matching experiment. Both papers indicated that human are sensitive at the texture in the image. However, isolated skin patches covered limited area in the CIELAB colour space, while non-semantic images lack meaningful patterns or realistic surface properties. The real-world textures are less represented and need further investigation. The findings from both papers are strong encouragement for me to use fabric images in Leeds Fabric Tactile Database to study the perception of textured colour, and I plan to build on this as the start of my early career.

In the conference and workshops, one hot topic is individual colour matching functions and individual cone fundamentals. As the display industry grows fastly in the past few years, it has achieved high level of colour reproduction and visual performance. The individual differences in human colour perception attracts growing attention in both academic and industry, aiming to improve the colour accuracy based on individual's true perception and viewing comfort and facilitate the personalised display technology. The figures shown by Prof Andrew Stockman in the workshop illustrated the different yet similar individual colour matching data, and he mentioned that 'individual differences are most easily visualized and modelled as effects on the cone spectral sensitivities or the fundamental LMS colour matching functions'. In addition, one impressive point from Dr Shining Ma is that, when a group of people see a screen or projector together, the individual differences may not as important as expected. Based on the point, Dr Shining Ma presented the work from her group, including individual colorimetric model and the use of simulated individual cone fundamentals to study the perceived white on different displays. The colour differences between reference stimuli and matched stimuli using different CMFs were calculated in terms of

D'u'v', with which I previously had little practical experience. D'u'v' is a metric used to measure colour deviation and colour temperature consistency, commonly applied in light source evaluation and white point shift of LEDs or displays. CIELAB colour difference, on the other hand, is used to measure the comprehensive difference including lightness and chromaticity. Another impressive presentation is given from Molin Li from Zhejiang University who talked about Helmholtz-Kohlrausch effect. One slide showed a comprehensive literature survey of modelling the H-K effect, including the concepts defined in different papers, the comparison between experiment set up and methodology, and the comparison between the models provided from 1950s to 2020s. It is a clear and useful structure to summarise papers related to one specific topic. I also used the similar structure to do literature survey during my PhD, comparing the methodology and conclusion and summarising the key points. However, I did not link them in chronological order, which I will keep in mind to improve the efficiency of future literature survey. Another hot topic is human health and circadian rhythm. Even though the topic is less directly related to my research, it reminds me that all studies will eventually serves people by aiming for better reproduction accuracy, greater comfort, and healthier experience.

In general, it is a great opportunity to attend the CIE Midterm Meeting, to meet and talk with people from academy and industry. As an early-stage researcher, taking the first step by choosing a field that I am both passionate about and skilled in is very important. In addition, insisting on the topic and exploring further possibilities are even more crucial. At the CIE Midterm Meeting, there are many researchers who have deeply explored in the respective fields for many years, accumulating profound experience and contributions. I will take them as an encouragement and continue to develop my own research area, with the hope of making lasting contributions to the study of colour.

Report to the CIE-UK: CIE Mid-Term Meeting 2025 in Vienna

Introduction

- **Title of event/activity attended:** CIE Mid-Term Meeting 2025
- **Dates of event/activity:** 4th to 11th July 2025
- **Name of reporter:** Martin Dury
- **Role/duties relating to attendance:** NPL representative for the CIE-UK

Attendance Considerations

The National Physical Laboratory (NPL) is the UK's National Metrology Institute (NMI). Having a representative attending the CIE Mid-Term meetings and associated Division 2 sessions was driven by a strategic interest in maintaining alignment of metrology at NPL with international developments in optical radiometric metrology, specifically in the photometry and radiometry fields. It is essential that NPL remains informed of technical developments, challenges and trends, emerging standards, and collaborative opportunities that influence both national and international measurement capabilities in optical metrology. As a Principal Scientist at NPL, I am responsible for maintaining a broad and up-to-date understanding of developments in photometry and radiometry.

A key objective was to engage with other NMIs to discuss ongoing and future intercomparisons, technical developments, and areas of mutual concern. Additionally, my involvement in the CIE Division 2 annual and technical meetings offers a valuable opportunity to contribute to CIE technical documents and to assess the implications of new trends, recommendations and revisions for UK stakeholders.

Key Activities

Hot Topics and Technical Discussions

Several technical themes emerged as focal points during the visit:

- **CIE Mid-Term Meeting Presentations:** I attended all presentation sessions. I noted themes running through the presentation sessions on the effects of street lighting and road safety. I particularly valued the opportunity to see oral and poster presentations from NMI colleagues showcasing new developments in their work and progress in international collaboration projects. Several presentations were of direct interest to my work at NPL, such as the assessment of silicon detector stability under UV exposure, especially as I recently publish a paper on a related matter. Additionally, I found the

keynote lectures by Stephen Westland on "Advances in AI for the Colour Industry" and George C. Brainard on "Light and Human Health" very engaging.

- **NMI Reflectance Measurements and Capabilities:** the CIE Mid-Term meeting was an opportunity to meet face to face with colleagues from other European NMIs who have expressed interest in comparing their reflectance measurements capabilities. In particular, we discussed opportunities for collaboration in diffuse reflectance measurements in the 2.5 µm to 20 µm range.
- **Other NMI interactions:** NPL is in the process of upgrading some of its core optical radiometric metrology capabilities and has been in contact with other NMIs who might be interested in acquiring lamps from NPL. I was able to meet face to face with colleagues from other NMIs to discuss this matter and suggest appropriate points of contact at NPL. In addition, we are preparing for a detector spectral responsivity comparison with other European NMIs and are due to start measurements later this year. I was able to meet with colleagues participating in the intercomparison and discuss technical and operational aspects of the intercomparison in-person.
- **Marine Photometry and Measurement Uncertainty:** With CIE-UK colleagues at the General Lighthouse Authorities Research and Development (GRAD) I was able to discuss the status of NPL capabilities that are currently being upgraded, and upon which GRAD rely on for measurement traceability. I also discussed the International Organisation for Marine Aids to Navigation's (IALA) interest in exploring measurement uncertainties in marine light environments. This topic was also mentioned in the CIE-UK/NIC meeting on Thursday 24th July 2025.
- **Industrial Measurement Needs:** Attending the CIE Mid-Term Meeting as NPL's representative provided a valuable opportunity to engage with some of NPL's customers who are also members of the CIE-UK. These conversations helped deepen my understanding of how NPL can better support their needs. I spoke with a CIE-UK colleague and NPL customer regarding the need for higher precision transmittance measurements to support their work. Our discussion gave me clearer insight into how they were using the data that NPL provides, and highlighted ways in which we can continue to support them in the future.
- **Interaction with the CIE-UK:** As I'm still settling into my new role as NPL's representative for CIE-UK, attending the CIE Mid-Term Meeting in person was a valuable opportunity to connect with key figures and engage in meaningful discussions. Notably, I was able to speak with CIE-UK colleagues about NPL's plans for an upcoming online workshop focused on metrology strategy for photometry.

Division 2 Meeting Highlights

The Division 2 meetings provided updates on several Technical Committees (TCs) and research forums:

- **TC2-81 - Update of CIE 065:1985 (Absolute Radiometers):** The technical report on Absolute Radiometers, for which I am a co-author, is nearing publication, with a ballot scheduled for autumn.
- **TC2-85 - Recommendation on the geometrical parameters for the measurement of the Bidirectional Reflectance Distribution Function (BRDF):** The recommendation on geometrical parameters for BRDF measurement is close to finalisation, with a target date of October 2025. Discussions focused on the presentation of BRDF data and the risk of data misinterpretation by inexperienced users.
- **TC2-96 - Revision of ISO/CIE 19476: 2014 Characterisation of the performance of illuminance meters and luminance meters:** The revision of ISO/CIE 19476:2014 addressed performance metrics for illuminance and luminance meters, including LED UV-index considerations, instrument linearity, and updates to annexes covering quality indices and spectral mismatch correction uncertainties.
- **TC2-97 - Revision of CIE S 025/E:2015 Test Method for LED Lamps, LED Luminaires and LED Modules and its supplement:** The 17th meeting of this committee reviewed the nearing conclusion of the revision of the technical report and its supplement.
- **CIE 251:2024 Promotion:** Plans are underway for an online tutorial to promote the LED reference spectrum, also discussed within TC2-77.
- **CIE Research Forum RF-05:** This forum is focused on implementing the CIE 2006 cone fundamentals in photometric and colorimetric measurements. Coordination with CCPR-WG-SP and CCPR-WG-SP-TG-16 is ongoing. Presentations at the mid-term conference explored age-related differences in luminance perception, low-cost adaptations for photometers, and practical methods for cone-fundamental-based photometry. Discussions also considered the perceptual and energy implications of small changes in illuminance.
- **CIE Technical Report 210:2014:** I submitted my review of CIE Technical Report 210:2014 (Photometry Using V(λ)-Corrected Detectors as Reference and Transfer Standards) to CIE Division 2. I found CIE Technical Report 210:2014 to be current and provided recommendations for minor improvements.
- **Future CIE Division 2 Events:**
    - The Division 2 annual meeting and technical sessions will coincide with the NEWRAD 2026 Conference in Jeju, Korea. The conference is scheduled for 13/09/2026 to 17/09/2026.
    - The CIE Division 2 annual meeting and technical meetings are scheduled for 18/09/2026 and 19/09/2026.

- There is a half-day tutorial on Monte Carlo uncertainty analysis scheduled for the afternoon of Thursday 17th September 2026, after the NEWRAD 2026 Conference has finished.

Outcomes and Evaluation

Achievement of Aims

I feel that my visit successfully met its objectives. Attending the CIE Mid-Term meeting presentations, reviewing the conference posters and engaging in technical topics with the presenters provided up-to-date insights into recent developments and ongoing projects in light and lighting, as well as optical metrology. The CIE Mid-Term meeting was also an opportunity to meet with NMI colleagues and connect with colleagues within CIE-UK who gave insights into current challenges and potential opportunities for collaboration. The Division 2 meetings offered a comprehensive overview of ongoing technical work and future directions, reinforcing the importance of UK participation in contributing to and shaping international standards.

Key Learnings

Several important learnings emerged:

- There are opportunities for European NMI collaboration in diffuse reflectance measurements in the mid-infrared range.
- Measurement uncertainty in marine environments is gaining traction as a topic of international interest, with potential for UK leadership through collaboration with GRAD and IALA.
- The need for higher precision transmittance calibrations from industrial stakeholders.

Overall Evaluation

My visit to the CIE Mid-Term Meeting and participation in the Division 2 sessions proved both productive and informative. The event provided a valuable opportunity for meaningful technical exchanges, highlighted emerging areas of concern, and underscored the importance of international collaboration. I found the discussions and presentations to be of a consistently high standard, offering insights that will inform and enrich my ongoing work at NPL.

For CIE-UK members, the following points may be of particular interest:

- The nearing publication of TC2-85 on BRDF.
- The revision of key standards such as ISO/CIE 19476 and CIE S 025/E:2015.
- The relevance of measurement uncertainty in marine environments.
- The potential impact of cone fundamentals on future photometric work.

CIE2025 Midterm Meeting Vienna

Peter Clarke

Division 1 (Vision and Colour) Representative CIE-UK

Conference Comments

Some very good and informative talks were given. There was a lot of new information presented. The following were the thing that stuck me from the talks that I attended:

1. Keynote presentation: The multifaceted impacts of light pollution – Dietmar Hagar

Stars and starlight have been significant from ancient times. Light pollution is obscuring the stars and having effect on the natural environment, the economy and health.

Modern people are spending more and more time indoors and our interaction with the stars has reduced to almost nothing. The naked eye can look at light that has travelled 2.5 million years to reach us. In a built up area it is no longer possible to see the milky way as light pollution has drowned out the star light. We are in danger of forgetting the function that stars do in turning hydrogen into heavier elements up to iron which become available to build planets when the star dies and explodes.

As lighting has become exponentially cheaper light pollution has similarly increased. There is a massive amount of light energy being wasted by either going straight upwards out into space or lighting areas where it is not needed. This light is affecting nocturnal animals and insects, circadian rhythms, immune systems etc and ultimately our own health.

Once we are aware of light pollution, we need to make others aware and together look at way of reducing it by changing how we light building, roads, bridges etc. to direct the light only to where it is needed and lessen environmental effects.

2. Keynote presentation: Applications of artificial intelligence in the colour industries – Stephen Westland

A realistic look at what AI can actually do for us. A history of AI use was presented showing a repeating cycle between excitement with AI techniques leading to advancements, over promising of AI capabilities, disillusionment with under delivering and the lack of fulfilment of AI promises, followed ultimately with reduction and move away from AI techniques into an AI ‘winter’. We are currently in an AI boom, but more and more overpromising is currently being seen. Could this lead to disillusion with AI and a move away from A@I creating an AI ‘Winter’?

Advancement in AI has gone hand in hand with computer power increasing and follows Moore’s Law; allowing the size of the neural networks both to increase and be processed quicker. This has implications for computer data centres and energy usage.

Looking at whether we can achieve super intelligence with machines, some currently available major AI systems were asked some questions concerning colour, which were not answered very accurately by any of them. Does AI actually have awareness or understand anything? AI may be very good at finding patterns in very large amounts of data and linking things together, but does it consider the quality of the data used? As AI use increases, AI models will increasingly be fed with AI generated content. If that content is of low quality it will degrade the output, ultimately leading to poor or unreliable results. AI needs to be used in an informed way.

3. Photodiode stability to UV irradiation

Work on extending the wavelength range of induced junction photodiodes when exposed to UV irradiation shows promise to be able to extend use down from 450 nm to 300 nm, making them feasible for visible light applications.

4. Cone Fundamentals

A lot of ongoing work is being done to base colorimetric measurements on cone fundamentals.

CIE cone-fundamentals have the potential to lead to more versatile photometry than using V(□) by using a cone fundamentals based function V_F(□), which has the potential for the parameters to be personalised according to age, gender, colour vision etc. A mathematical framework was presented to compare different functions, with a view to CIE choosing the best metrics.

There is a known error in the V(□) function which underestimates the light output in the blue part of the spectrum This potentially could be corrected when switching to V_F(□).

A method for modifying existing V(□) light meters with a filter to correct to V_F(□) followed by a multiplication by 100 were presented.

The personal cone function measuring equipment developed by Andrew Stockman and Andy Rider was demonstrated during a workshop.

5. Light Exposure

The European Partnership of Metrology is running a global project looking at quantifying human exposure to light. Some results from wearable sensors place on different parts of the body, e.g.: eye, wrist and chest; were presented showing that the results were highly dependant on the position of the sensor and also on socially acceptable perception.

6. Fabric Database

A database has been developed to aid digital descriptions of fabric without having to have an actual fabric sample. The database not only has images of the flat fabric it also has images of the draped fabric. The images were process for 16 different white points, and also rgb greyscale. Added to the images was terminology to describe the appearance and tactile properties of the fabric. Example terms used were flexible-stiff, smooth-rough, soft-firm, spongy-crisp, warm-cool.

7. Skin colour perception

Perception of the colour of pictures of human skin depends on the context of the image. All images were perceived as lighter and less chromatic, with the facial images perceived as much lighter compared to a similarly coloured skin patch. Different ethnicities were perceived lighter by different amounts.

CIE Division 1: Vision and Colour - Technical and Division Meetings

Technical committees are making good progress. 4 have produced reports (TC 1-84, TC 1-91, TC 1-98, TC 1-92), one of which, TC1-84, has published as: CIE255:2025 The function Visual Field.

One reportership (R 1-63) has closed with a report.

Funding awarded to: Steve Fotios

Event: Midterm Session of the CIE: Conference and meetings of the Divisions and Technical committees
Vienna, 7-11 July 2025

This event combined two events, the conference and the technical sessions.

The conference took place over the first three days. I was a co-author of four papers and delivered the oral presentation for two of these. Submitting papers to a conference is a means to disseminate work in progress to a wide audience and hopefully to receive feedback on this work.

I delivered the oral presentation for these two papers

- Fotios S., Uttley J, Gorjimahlabani S. Optimal illuminance for pedestrian reassurance.
- Fotios S, Iqbal B, Alshdaifat A, Uttley J, Tolan G, Yazdi GBZ. Biomotion lighting enhances cyclist conspicuity.

I was a co-author for two papers delivered by a colleague:

- Uttley J, Balela M, Yesiltepe D, Fotios S. The presence of road lighting leads to more cycling.
- Uttley J, Fotios S, Falconer S. Darkness increases risk of specific crimes.

I coordinated and led one of the workshop sessions - *Workshop WS5. Rapid revision of CIE 115 Lighting of roads for motor and pedestrian traffic*. The key document for Division 4 is CIE-115:2010 Lighting of Roads for Motor and Pedestrian Traffic. There is a well-established need to revise this document, in part because little is known about the basis of current recommendations, but the division has yet to take constructive action. At the workshop I presented ongoing plans by which the revision might be achieved. This proposal was based on two principals:

1. That the revision should be based on the data we already have, not data we are yet to establish.
2. The task should be broken down into several smaller tasks (i.e. motorists, pedestrians, cyclists and other vulnerable road users) rather than this being done within one single technical committee.

Two of the presentations (*Optimal illuminance for pedestrian reassurance*, and *Darkness increases risk of specific crimes*) directly target revision of the P class and were thuis included in the conference session on Rapid revision of CIE115.

In addition I chaired one session of oral papers: Exterior lighting. Monday 10:45-12:25.

I attended the five conference sessions associated with Division 4. This is an increase in sessions on previous years which shows that this is an active division. Some of this work directly targets the proposed revision of CIE115 which I am leading.

On the first evening I attended the Student networking event. This aims to encourage PhD students to meet other students and members of CIE which can otherwise be a challenge. I contributed actively to

As a member of the conference scientific committee I contributed to the review of papers, setting up the schedule, and choosing keynote speakers. There was a focus in this selection to target research on light pollution, and this support dialogue between research of the costs and benefits of lighting, in particular of road lighting after dark. Light pollution appeared to be a hot topic at this conference. While it is not a new topic to lighting audiences, the pollution and application research communities tend to work in isolation of one another.

The technical meetings took place over the next two days. I attended the D4 annual meeting in my role as Associate Director for the division, and chaired the updates of TC progress. The aim of this meeting is to check that technical committees are working to the agreed schedule, to confirm proposed changes in scope and/or leadership, to receive updates from national committees and liaisons with other outdoor lighting related organisations, and to plan ahead for future meetings and tasks.

I led the meeting of TC1-103 (*Research Methods for psychophysical studies of discomfort from glare*) for which I am TC chair, and attended the meeting of TC 4-62 (*Adaptive road lighting*).

TC 1-103 concerns the designs of experiments carried out to measure the degree of discomfort experienced in different luminous environments. I initiated this committee to repeat the achievement of TC1-80 which produced the technical report CIE 212:2014 *Guidance towards best practice in psychophysical procedures used when measuring relative spatial brightness*. By providing recommendations for experimental design, the choice of stimulus magnitudes and precautions to promote credible findings, this TC aims to support advance in research of discomfort from glare which is struggling to reach consensus on suitable models.

TC4-62 concerns the installation of controls to permit adaptive road lighting, for example, to reduce the light level at periods of low traffic flow. In doing so this has the potential to reduce the energy consumption and light pollution associated with road lighting. My role in this TC was to re-write the entire report to provide a better structure and a consistent writing style.

CIE-UK supported my attendance at this event through the reimbursement of some of the expenses involved. Without this support it would not have been possible to attend.

At an informal level, attendance at CIE conferences is a chance to engage with colleagues socially, including other members of CIE-UK, other researchers from around the world, and the PhD students from our research group in Sheffield. It is these connections that help to make research and conference attendance a positive experience.

CIE Midterm Meeting Vienna, Austria: July 4-11, 2025

Report by Siobhan Patrick, Higher Radiation Protection Scientist UKHSA

At the CIE midterm meeting, the three excellent keynote speakers reflected very well the hot topics of the conference. The first keynote, by astrophotographer and physician Dietmar Hagar, highlighted the problems caused by light pollution that our society and ecology is facing today, and how we have become disconnected from the stars, which so entranced humans from all cultures that came before us. A particularly striking point that he made was, in showing a picture of the world at night from above, that habitations should not be seen from above – who does that benefit? It is only wasting energy and polluting our skies.

The discussion around light pollution continued throughout the conference, alongside the discussion around road lighting, visibility and safety (or perceived safety) and the effect that the absence of road lighting has on certain groups. Annika Jägerbrand presented an illuminating talk entitled *Comparative analysis of international light pollution guidelines in ecology: towards evidence-based mitigation strategies and ecological thresholds* where she highlighted the consistencies and inconsistencies between guidelines published by three different organisations. It is clear though, that with the different sensitivities of so many different species to consider, the answers to this are far from straightforward. A highlight in the area of outdoor and road lighting was the *walking and cycling* session and in particular Jim Uttley's presentation: *The presence of road lighting leads to more cycling.* He reasoned that cycling is a healthy and sustainable mode of transport, which should be encouraged and presented his data from cycle counters placed throughout five cities showing that the number of cyclists is reduced on paths with no lighting. Steve Fotios' *Biomotion lighting enhances cyclist conspicuity* was also very informative for any would-be cyclists to know how to improve their visibility and Matthieu Iodice presented an interesting method of testing road lighting brightness for public transport under difficult experiment conditions in his talk: *Lighting levels on a tram platform: An exploratory study.* Although not in the same session, it would be remiss not to also mention Yichen Jiang's excellent presentation on outdoor lighting entitled *Integrating emotional and visual dimensions in urban lighting design: A holistic approach using the PAD model.* She considered a variety of 3D lighting designs for plaza-type spaces and studied the link between the resulting horizontal and vertical illuminance asymmetry and how this made the people using the space feel (on scales between unpleasant and pleasant, calm and vigilant and unapproachable and approachable).

The second keynote talk by Stephen Westland brought artificial intelligence to the conference, highlighting a STEM topic which is currently of high interest to the general population. This talk provoked many philosophical questions around the nature of computer understanding, and whether creators of AI tools will ever be able to generate understanding or consciousness and described applications of AI in colour technologies.

The final keynote was by George Brainard on *Light and Human Health* which highlighted well another hot topic of the conference: dynamic lighting for circadian health. He spoke about his long history of work in this area, beginning with his early research on human circadian sensitivity to different wavelengths of light, and the surprise of obtaining results which did not match with known photoreceptors, all the way through to designing lighting to optimise sleep and alertness on the international space station. In the previous day's session on Lighting for health and wellbeing similar lighting schemes (following the recommendations of Brown et al) were described for more terrestrial purposes, in a hospital ICU (Iza Linders) and NICU (Mehlika Inanici) and the homes of new parents (Shujian Dai). Mehlika's talk introduced me to Opsin 5 (neuropsin) which has been found in the skin. It is sensitive to short wavelength violet light, which is typically absent in electric lighting. Iza's talk highlighted how suboptimal the current typical ICU environment is for sleep and recovery, but also how difficult it is to carry out a controlled observational study in such an environment. Shujian's talk highlighted how important sleep in the time after birth is for a new mother's mental

and physical wellbeing, but that a reduction in the time outside the house, and disruption during the night significantly impacts circadian stimulation. Their study looked at installing dynamic lighting with different modes for different circadian points. In this session, an interesting point was raised in the discussion around the relevance of the Brown et al recommendations to patients who are very sick in ICUs.

I also enjoyed the Wednesday morning session on Photometry and Radiometry. In particular, Yuqin Zong's talk *Characterization and calibration of transfer-standard spectroradiometers using a tunable laser* was very interesting and highly relevant to our group, which has to maintain reference spectrometer instruments to a traceable calibration standard, and the halogen lamps which have typically been used for calibration are becoming more difficult to purchase. For this reason, I also thought Oskari Kuittinen's talk, *Broadband light source based on light-emitting diodes for radiometric calibrations in the ultraviolet region,* was very interesting. He presented work looking at two UV LEDs at different wavelengths and a range of phosphors and phosphor thicknesses to create a new UV light source which could be used to calibrate spectrophotometers in the UV region.

My main reason for attending this conference was that, as someone who is quite new to the area, it would be a fantastic opportunity to learn from those working at the forefront across a broad area. It is also a great opportunity to network and get to know others working in the area, fostering relationships and potential future collaborations. I believe both of these aims were achieved, as I was able to expand my knowledge both in areas I already know something of, such as calibration techniques and circadian rhythm lighting requirements, while also learning about topics I have not read much about before such as street lighting, visibility metrics and light pollution. Overall, this was a fantastic event with many excellent and interesting talks and a friendly atmosphere.

Conference proceedings (CIE 2025 Proceedings - Dropbox)

Brown et al, 2022 https://doi.org/10.1371/journal.pbio.3001571

CIE-UK Student Bursary Recipient Report

Title of Event: CIE 2025 Mid-term meeting, Vienna Austria

Dates of Attendance: 6th – 9th July 2025

Awardee: Simone Bonavia

Role and affiliation: PhD Researcher, Institute of Environmental Design and Engineering, UCL

Introduction

I attended the CIE Mid-Term Meeting held at Austria Centre in Vienna, Austria, from the 6th to the 9th of July 2025, supported by a CIE-UK bursary award. As a PhD researcher, my primary aims were to present my research and receive valuable feedback, deepen my understanding of recent developments in the field, engage with international experts, and explore how emerging ideas could inform and enhance my ongoing work.

My contribution to the conference included presenting my research titled "The Effect of Light Direction on Pupillary Light Reflex: A pilot Study" during one of the presented poster sessions. Alongside this, I attended keynote lectures, presentations, workshops, and engaged in informal networking opportunities. My interests aligned with several thematic areas of the conference, including daylighting, interior lighting, lighting for health and wellbeing, integrative lighting, HDR imaging, virtual reality applications, and the ecological impact of electric light. I approached the event with an open mind and the intention to engage with peers and thought leaders across these diverse topics.

Key Activities and Insights

The keynote lectures were an intellectually stimulating start to each of the conference days.

- Dr. Dietmar Hager opened the first day with a compelling talk about the health and ecological risks of excessive artificial light at night. His central message—there is "zero benefit in over-lighting the night" prompting widespread reflection on our responsibilities as lighting professionals.
- On the second day, Professor Stephen Westland offered a thought-provoking critique of artificial intelligence, particularly within the context of the colour industry. He noted that while large language models (LLMs) are very capable of rivalling certain human tasks through sheer computational power, they lack consciousness, reinforcing the irreplaceable value of human creativity and judgement.
- Professor George Brainard delivered a keynote on the role of light in human health, articulating the biological mechanisms through which lighting affects us. His discussion of lighting interventions developed for NASA astronauts was particularly memorable, offering practical examples of research-based design in extreme environments.

A recurring debate on following lighting standards vs lighting originating from the artistic vision was particularly active in the interior lighting session - while standards alone cannot guarantee

good lighting, they serve a role in safeguarding minimum quality—especially in many cases where design expertise is lacking. This conversation directly intersects with my own interests and underscored the need for flexibility and judgement in applying technical guidelines.

The global daylight measurement campaign presented by Dr. Martine Knoop stood out as a key initiative, aiming to collect location-specific daylight data from around the world. The database from this work will be highly valuable for future location and time-sensitive lighting analyses and in work that explores daylight variations.

Workshop 3, on the impact of artificial light at night on the natural environment, reinforced many of the themes introduced by Dr. Hager's keynote, this time with a focus on wildlife. Dr. Jolyon Troscianko's presentation in this session was a particular highlight, providing a scientifically grounded yet accessible explanation of how artificial lighting affects moths. The workshop highlighted the importance of ecological protection when considering light at night.

Throughout the conference, much of the sessions that I attended evolved around the effects of lighting on humans. While our full understanding of the human response to light is still evolving, it seems that aligning with our evolutionary patterns is a sound foundation - daylight during the day and darkness at night remain optimal. As our understanding becomes more nuanced, especially regarding how different aspects of light affect our physiology, this knowledge will be invaluable for designing lighting solutions for those who lack access to natural environments. Research such as that presented by Dr. Mehlika Inanici, Iza Linders and many others, will play a crucial role in this area. Equally encouraging to maximising the use of daylight, were the findings shared by Jan Wienold, demonstrating that meeting the melanopic EDI of 250 lux at the eye during daytime, as currently recommended, does not increase the risk of glare. This opens exciting possibilities for more integrative approaches in lighting design that won't significantly increase energy expenditure.

Professional Engagement and Networking

Beyond the formal presentations, the informal networking opportunities proved equally valuable. Engaging in discussions during coffee breaks, lunches, and social events allowed for deeper insights, collaborative ideation, and valuable feedback on my research.

I had the pleasure of connecting with fellow PhD students from institutions such as the Technical University of Munich, EPFL and Eindhoven University of Technology, some of whom are working on research with overlaps to my own. I also had the honour of speaking with Dr. David Sliney, whose work originally inspired my interest in spatial distribution of light. I was able to briefly discuss aspects of my research with Professor George Brainard and to discuss lighting in night-shift contexts, a topic of particular interest to me.

Conversations with Dr. Kai Broszio, Simon Belgers, and Dr. Katja Rebec were fruitful, as their work shares thematic connections with my project. I also gained practical insights through discussions with Dr. Martine Knoop on access to the data package for worldwide spectral daylight, Dr. Mehlika Inanici regarding implementation of the Lark simulation tool, and Dr. Veronica Garcia Hansen and colleagues, whose research into lighting in intensive care environments is highly relevant to human-centred lighting applications.

These interactions were intellectually stimulating. They affirmed the relevance of my research and helped position it within a broader, interdisciplinary community.

Reflections and Outcomes

Attending the CIE 2025 Mid-Term Meeting allowed me to achieve the objectives I had set prior to the event. I was able to present and discuss my work with internationally respected experts, deepen my understanding of emerging themes in lighting research, gain insight into practical tools and resources for spectral lighting design and expand my professional network for potential collaboration and support.

Future events might benefit from structured practitioner-academic workshops, where case studies, design constraints, and empirical findings can be jointly discussed. There is also a need for further research and discussion towards lighting recommendations for night-shift workers.

Finally, my attendance provided longer-term benefits beyond the event itself. The conference proceedings include several papers I am now keen to explore in greater detail. These resources will support the development of both my PhD thesis and my contribution to ongoing academic and practice work. Additionally, the new professional connections I formed—both with peers and established researchers—will be valuable for future collaboration, knowledge exchange, and academic support

FAO Allan Howard – Executive Secretary CIE-UK
Report on the CIE Midterm Meeting, 06 to 11 July 2025

Technical conference
Monday 07 July
The opening ceremony was followed by the plenary lecture 'The multifaceted impacts of light pollution' in which Dietmar Hager pointed out that over the past 150 years for many people the stars have gone and we are no longer closely connected to light from the sky. Light pollution was described as 'an amputation injury'. One factor contributing to light pollution has been the dramatic reduction in the cost of artificial light from very expensive in the 1880s to cheap in the 2000s. Light pollution is a threat to the natural environment, countries' economies and health. The role of melatonin within the immune system was stressed. To help overcome these difficulties, the lighting industry should strive to make people more aware about light pollution and the importance of exposure to natural light.

Some highlights from the sessions
D4 – Exterior lighting
The presentation by Ikebuchi (ID225) introduced me to Dunnett's for multiple comparisons, I was not previously aware of this approach.

Jiang (ID263) reported on a study with >500 observers using the PAD (Pleasure, Arousal, Dominance) to assess lighting based on a cubic illuminance approach. The conclusion was that layered lighting designs makes people feel comfortable and relaxed.

Girard (ID296) gave an excellent report on the visibility of road markings.

D6 – Workshop on electric light effect on insects and wildlife
Gang Liu (Tianjin University) was unable to attend the conference, David Sliney gave the presentation on his behalf. This highlighted the enormous decline in insect numbers over the past 25 years and the impact this has had on the food chain. Insects are very sensitive to UV and this should be avoided in outdoor lighting.

Troscianko reviewed the importance of moths as pollinators and why their decline would have an impact on food production. Moths have great night vision, hence pollination goes on 24 h.

Xu's presentation was a recording, stressing the problems of chemical and light pollution, this concentrated on flame retardants and light pollution on zebra fish. Illumination at 5 lx was shown to impact melatonin synthesis and non-image forming reactions in zebra fish.

D1, D2, D6 - Presented posters
Ikonen (ID359) drew attention to the problems of labelling of lightsources if the luminous output is given based on $V_{(\lambda)}$ rather than $V(\lambda)$.

Annika Jagerbrand drew our attention to the fact that most of the animal kingdom are nocturnal, humans and birds are exceptions being most active during daylight hours.

Poster session with UCL
The influence of SPD on the growth of red spinach (*Amaranthus Dubius*) (ID151)
X. Cai, J. Unwin Teji & S. A. Mucklejohn

Tuesday 08 July
The opening keynote lecture 'Applications of artificial intelligence in the colour industries' by Stephen Westland was spoilt by poor slides with text that was far too small for the audience to read. The speaker did refer the current AI climate as being the third hype phase, as there has been two AI winters following the previous hype phases, another AI winter is likely to follow. It seems Moore's Law of computing power doubling every two years still applies. The takeaways were most interesting: AI will continue to improve with faster computer speeds and better robotics; AI has always over promised and under delivered, the hype is based on increasing stock prices and raising capital.
Some highlights from the sessions

D4 – Revision of CIE 115 & D4 – Workshop on rapid revision of CIE 115
The first session included excellent presentations by Fotios (ID119), Uttley (ID260), Muzet (ID153), Onaygil (ID236) and Jagerbrand (ID315). However, these did highlight the extent of the task in revising CIE 115. This was the subject of the following workshop, chaired by Steve Fotios.

The rapid revision of CIE 115 will be based on information currently available, a longer term vision is to have a further update based on research currently being conducted and future studies. This workshop was supported by several presentations. Uttley described the findings of his reportership on lighting for cyclists which confirmed cyclists have different visual needs to pedestrians and different eye behaviour. The needs of pedestrians and cyclists have previously been treated as one category.

D2, D4 – Anthropogenic light at night
Kallberg (ID279), Bouroussis (ID301) and Motycka (ID342) illustrated the use of drone-mounted photometers to measure ALAN and light pollution. A common problem was getting permission to fly over sensitive areas.

Novak (ID334) gave an outline of his mathematical description of the moonlight, i.e. the values of horizontal and normal illuminance from the Moon and the corresponding exposure values for any time and place on Earth. The aim of the research was to determine an algorithm for simulating the Moon as a light source. The calculations assume that the Moon is the dominant light source in the natural nighttime environment - its luminance and therefore the illuminance on the Earth's surface varies greatly during the year and on individual days of a cycle.

Poster session
The reliability of LED drivers – Estimated failure rates and trends (ID134)
S. A. Mucklejohn & B. Preston

Wednesday 09 July
George Brainard's overview of light and human health included a fascinating account of his work with NASA on the alleviation of sleep deprivation which resulted in changes to lighting to improve circadian stability. He drew the meeting's attention to the Special Issue of Science, 16 June 2023, on Light Pollution

Some highlights from the sessions
D3 – Integrative lighting 2
Daneels (ID137) found no significant influence of Melanopic Equivalent Daylight Illuminance (mEmEDI) in performance of office workers but this might have been a consequence of the small sample size. The limitations of sample sizes and restricted age ranges were recurring topics during the conference.

D4 – Walking and cycling
Fotios (ID120) highlighted the difficulties of cyclists being seen by other road users at night. The best chance of being seen is having hi-vis clothing or lights on moving parts, i.e. biomotion is the key to being seen. One of the conclusions from the study by Uttley (ID261) was that cyclists are not as conspicuous as they think they are.

Pellegrino (ID379) described some of the studies carried out under the Horizon program ENLIGHTENme, a project dedicated to exploring the impact of urban lighting on human health and wellbeing. This part was directed at older people in three cities and aimed to generate outdoor spaces with a 'Parisian village' with the intention of attracting elderly people to events after dark. Changing the lighting from 150 W HPS to 47 W LED with illuminance and colour controls proved to be successful in all three cities.

D2, D4 – Road surface reflectance
This session, chaired by Nigel Parry, had several reports on road surface reflectance, a key input in lighting design. The session also included discussions on the most appropriate observations angles for the various types of road users

Divisional & Technical Committee meetings - Thursday 10 July - D4 Annual meeting
This was a long, wide ranging meeting which again highlight the work on the rapid revision to CIE 115.

JTC 01 Annual report to D4 - Implementation of CIE 191 Mesopic Photometry in Outdoor Lighting (Chair: Stuart Mucklejohn)
Following the results and comments on ED/TR of JTC 01 the manuscript was revised and sent to Shahidul Islam on 16 April 2025. Shahidul replied confirming he would prepare the AD ballot documents. There has been no advance on this since 16 April.

Mucklejohn and Preston have been invited to join JTC 13 Depreciation and Maintenance of Lighting Systems. However, I was unable to attend the JTC meeting as this was scheduled for Friday afternoon when I needed to travel to the airport for my return flight. I will contact the chair, Dionyz Gasparovsky, later this month.

Summary
The adverse impact of light pollution was the most striking topic of this meeting. There were several other major topics running through the conference many of which related to road lighting. A recurring theme of the meeting was that current road lighting standards largely ignore road users other than private motorists and pedestrians although some recent revisions do recognise the different field of view for drivers of large commercial vehicles. These limitations are becoming increasingly apparent and there is a pressing need to include lighting for other, more vulnerable, road users such as cyclists, motorcyclists, electric mobility scooter drivers and electrically assisted cycle riders. The proposed solution is a rapid revision to CIE 115 which will cover a wider range of road and pavement users and impacts on wildlife.

Another heavily featured aspect of road lighting was the properties of road surfaces and the subsequent changes to r-tables. The French seem to have been particularly well funded for this research.

The difficulties of getting participants with wide range of ages for experiments was another recurring theme. It is very difficult, however, to find a solution to this. For research in academic institutions students seem happy to offer their services as participants in lighting-related studies but everyone is now aware of fact that visual performance changes with age.

There was much discussion about the adverse impacts of artificial light at night (ALAN) on wildlife and on human health. The lack of clarity and agreement about suitable spectral power distributions and illuminances was evident other than the need to limit the blue content of any ALAN. It was also clear from discussions after various presentation that the properties and the variants in illuminances of moon light are not widely recognised by researchers. This problem has been elegantly addressed by a detailed but very complex study by Novák, Baxant, Škoda and Motyčka in ID334.

The use of drones for lighting surveys and measuring light pollution is relatively recent and a couple of papers described measurements from a small, lightweight spectrophotometer attached to a drone. Progress to date has been limited not only by funding but also by getting approval to fly in built-up areas.

The scientific conference was a well organised meeting in a facility that was within easy travelling distance from the city centre. The poster sessions were the one disappointing aspect, these were very crowded and noisy. It could be argued that these problems were due to the success of the conference in attracting so many contributions but with more thought the layout could have been improved with little, if any, additional cost.

The Divisional and TC meetings were disappointing, the rooms at the venue was not laid out in a fashion that made communication between participants easy. The online links, however, seemed to work without interruptions. Catering arrangements were inadequate, especially for lunch, and the sizeable meeting fee represented poor value for money.

I greatly appreciate the financial support from CIE-UK, without this I could not have attended the CIE Midterm Meeting and I would not have benefitted from such a stimulating, highly informative and immensely enjoyable event.

Author: S.A.Mucklejohn Date: 23 Jul 2025

Attendance Report – CIE Midterm meeting 2025, Vienna, Austria

Funding awarded to	: Yohanes Satyayoga Raniasta
Status	: PhD student, The University of Sheffield
Attendance dates	: 7-9 July 2025
Original financial support requested	: £ 1,000.00
Actual financial support requested	: £ 997.51

I attended the conference as a participant (observer) at the main sessions and parallel sessions from Monday, 7 July to Wednesday, 9 July.

Conference review:

Day 1, Monday 7 July:

The first day of the conference began with the main session, which Dietmar Hager opened about the multifaceted impacts of light pollution. He talked about the loss of the night sky due to inappropriate urban lighting design. Then I attended the morning parallel session OS3 D4 on exterior lighting, chaired by Steve Fotios. There were five presenters, and I was taking notes on the research from Benjamin Legrand, in which he assessed lighting quality in an outdoor environment through a field experiment to explore the perception of lighting quality with static and dynamic user positions, involving 43 people in three locations. It was interesting for me, particularly in the method he used, which has some similarity with what I plan to do in my research. In the afternoon, I attend the parallel session WS3 (D6) -Electric Light Effect on Insects and Wildlife. An interesting presentation from Noe: Gang Liu related to the light spectrum insect catches, through an experiment in the park, in which they used the different colours of light sources placed on the tree to attract insects. After the presentation session, I attended the networking event for students in Dschungel Café Furstenhof. I meet other students from Japan, who come here in a group with their supervisors, too. We exchanged contact information and discussed our academic research with each other. Also, we talked about our hopes for our future academic career. Dschungel was a nice place, with fresh drinks and a warm ambience. This session was great; I had a chance to meet new people and chat with other fellows.

Day 2, Tuesday 8 July:

The second day of the CIE conference opened with a main session about AI applications in the colour industries from Stephen Westland. He presents the impact of AI on the computational practice in colour, colometry and colour imaging. It is interesting to follow since AI is being developed rapidly nowadays. After it, I attended the OS5 D4 session, focusing on the Revision of CIE 115. Opened by a presentation from Prof Steve Fotios, where he presented his research related to optimal illuminance for pedestrian reassurance, and using the day-dark method to do it. He is my supervisor, and this presentation was significantly relevant to my PhD research. Another significantly interesting presentation was Jim Uttley's, in which he found that darkness increases the risk of certain crimes using the odds ratio. In the afternoon, I attended the WS5 (D4) session on the Rapid Revision of CIE 115 Lighting of Roads for Motor and Pedestrian Traffic. Prof Steve Fotios led this session, which focused on the M Class and P Class lighting standard revision. It was helpful for me, since the lighting standard, particularly from P class, is relevant to my PhD research. I realised that not all the

standards are fixed. It may be changed based on the evidence found through continuous research, evaluation and practice.

Day 3, Wednesday 9 July:
On the third day, I attended OS10 - D3 Integrative Lighting. One of the presentations on Integrative Lighting in Educational Environment from Elif Harputluoglu was interesting. She presented a systematic review which provides an overview of the current state of knowledge on integrative lighting, highlighting issues related to its application in educational environments. As I previously worked in the education industry and am currently a student at a university, this theme resonates with me. Then I attended the OS15 - D4 session, focusing on Walking and Cycling. I follow the presentation from Jim Uttley: The Presence of Road Lighting Leads to More Cycling, in which, through his research, he confirmed that the deterrent effect of darkness for cyclists was reduced by road lighting. Another presentation from Prof Steve Fotios concerning the biomotion lighting which enhances cyclist conspicuity. Two of those topics were familiar to me and valuable for my incoming fieldwork as part of my research in the PhD program. Another interesting presentation was from Matthieu Iodice, which focused on the Lighting Levels on the Tram Platform. It received a lot of feedback from the audience, both pros and cons. The last session I attended was OS17 - D2/D4 Road surface Reflectance. I follow the presentation from Thomas Faure on the road reflectance analytical function built from BRDF (Bidirectional Reflectance Distribution Function) models. It aims to optimise road lighting by examining the optical properties of road surfaces in detail.

Summary
This was my first CIE conference, where I broadened my understanding of lighting research. It was very informative and interesting. I saw a lot of great research presentations, research posters, and met researchers from around the world. It was a fascinating experience for me. I notice many research areas related to lighting that I had not considered before. Although I may not use all of it for my study, I gain many insights from those events. I also made some new connections with another student in this same research field, with whom I hope to collaborate one day in the future. I also met Peter Boyce, the author of Human Factor in Lighting, a book that gives me a lot of insight into the lighting research field.

I am grateful to CIE-UK for the financial support that enables me to attend the CIE conference. Also, for Prof Steve Fotios and Dr. Jim Uttley, who provide all the support. I hope I can make a significant contribution to CIE in the future.

Yohanes Satyayoga Raniasta
13 August 2025

Fig 1. Me with other PhD students at the CIE Conference 2025 venue, inside the Austria Centre Vienna building.

Fig 2. The members of the Lighting Research Group, University of Sheffield, at the CIE Conference 2025. (Left to right: Dr. Jim Uttley, Dr. Gavin, Livanur, Yutong, Heyuan, Prof. Steve Fotios, Yohanes, and Billy)

Fig 3. I attended the first day keynote speaker session: Dietmar Hager

Fig 4. I attended some of the parallel sessions related to my research