



International Commission on Illumination
Commission Internationale de l'Eclairage
Internationale Beleuchtungskommission

(CIE)

International Commission on Illumination: Lighting the Future Together



event voor kennis & innovatie

Kees Teunissen, Woensdag 23 November 2022, 15.00 – 15.30 uur

Kort overzicht CIE

Scope en doelen

Organisatie

Aandachtsgebieden

Activiteiten

Voorbeelden

Voordelen CIE lidmaatschap

<https://cie.co.at/>

https://files.cie.co.at/CIE_Brochure_July_2022.pdf



Light



Vision
& Colour



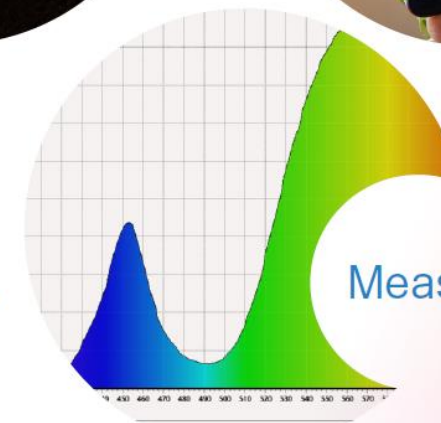
Lighting



Image
Technology



Photobiology



Measurement

Scope en doelen

De CIE verzamelt en genereert fundamentele kennis op het gebied van **optische straling, licht- en beeldtechnologie** en vertaalt deze kennis naar specifieke applicatiegebieden.

De kennis wordt verspreid door middel van **internationale normen, technische rapporten, technische notities, en standpuntbepalingen.**

Samenwerking met andere organisaties, zoals ISO en IEC.

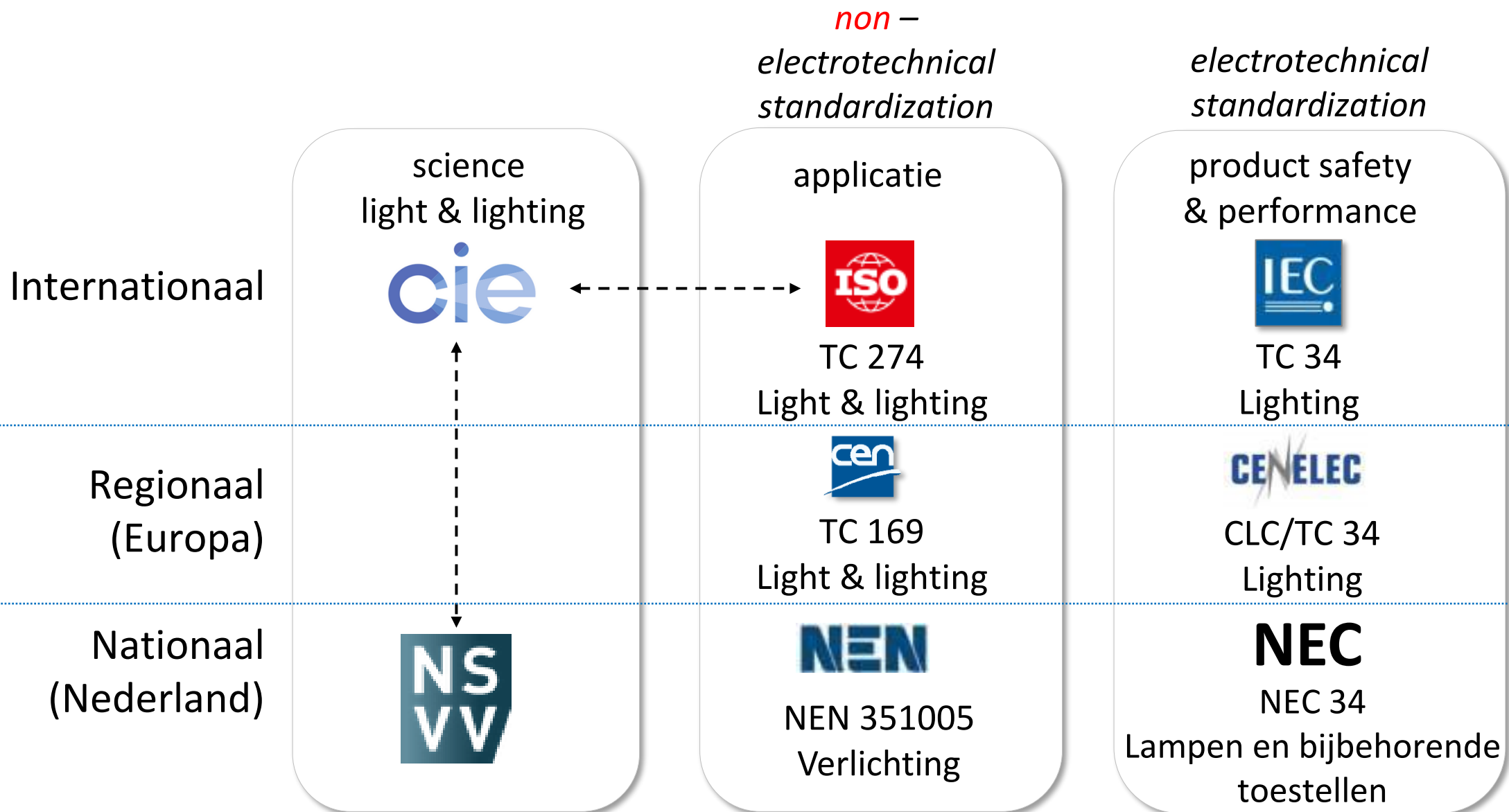
Advancing knowledge and providing standardization

With strong technical, scientific and cultural foundations, the CIE is an independent, non-profit organization that serves member countries on a voluntary basis.

Improve the lighted environment

Since its inception in 1913, the CIE has become a professional organization and has been accepted as representing the best authority on the subject and as such is recognized by ISO as an international standardization body.

Plaats CIE binnen standaardisatie



Organisatie van de CIE

Lidmaatschappen

- **Nationale Comités (NCs)**
 - Bv. NSVV (CIE NC NL)
 - TC-leden
 - Met stemrecht
- Associate Nationale Comités (ANCs)
 - Geen stemrecht
- Ondersteunende leden
 - Bv. Signify en Admesy

Australia
Austria
Belgium
Brazil
Bulgaria
Canada
China
Croatia
Czech
Republic
Denmark
Finland
France
Germany

Great Britain
Greece
Hong Kong
Hungary
Israel
Italy
Japan
Korea
Malaysia
Netherlands
New Zealand
Norway
Poland

Romania
Russia
Saudi Arabia (ANC)
Serbia
Singapore (ANC)
Slovakia
Slovenia
South Africa
Spain
Sweden
Switzerland
Chinese Taipei (ANC)
Turkey
USA

Organisatie van de CIE

General Assembly

- Presidenten NC's
- Besluitvorming

Board of Administration

- President, VPs, GS, & Divisie Directeuren (DD)
- Strategie
- Monitoring activiteiten

Central Bureau

- Stafmedewerkers
- Support & communicatie

ROLE	NAME	COUNTRY
President of CIE	Peter Blattner	Switzerland
Vice-President Publications	Luoxi Hao	China
Vice-President Technical	Jennifer Veitch	Canada
President-elect	Jennifer Veitch	Canada
Vice-President Standards	John O'Hagan	United Kingdom
Treasurer	Oliver Thissen	Germany
Secretary	Ad de Visser	Netherlands
Vice-President	Ronald Gibbons	United States
Vice-President	Teresa Goodman	United Kingdom
Vice-President	Erkki Ikonen	Finland
Vice-President	Anna Shakhparunyants	Russia
Vice-President	Kees Teunissen	Netherlands
Vice-President	Lorne Whitehead	Canada
General Secretary	Kathryn Nield	Austria

Aandachtsgebieden

De aandachtsgebieden zijn verdeeld over **zes divisies**:

1. Zicht en kleur
2. Meting van licht en straling
3. Binnen omgeving en lichtontwerp
4. Transport en buitentoepassingen
6. Fotobiologie en fotochemie
8. Beeldtechnologie



Division 1 Vision and Colour

How can vision be understood, modelled and predicted?
We study the way humans see and interact with light, that is our visual response to and assessment of light and colour.



Division 4 Transportation and Exterior Applications

Roads, buildings, monuments and other exterior spaces are illuminated; cars, planes and ships use optical signals. We work to optimize exterior illumination, signalling devices and visual aids for all modes of transport.

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Division 2 Measurement of Light and Radiation

We develop methods to evaluate all types of optical radiation from the ultraviolet to the infrared. This includes how we measure the radiation and how it interacts with materials.



Division 6 Photobiology and Photochemistry

What do we know about the effects of optical radiation on biological and photochemical systems? We study its effects on photosensitive materials both organic and inorganic.



Division 3 Interior Environment and Lighting Design

What are the lighting needs to promote health, well-being, comfort and performance in indoor environments? We examine how to improve interior lighting (design) - using both daylight and electric light - for building occupants.



Division 8 Image Technology

How can we make printed and displayed images match what we see? We develop methods to measure and quantify the ways in which images (analogue or digital) are processed, reproduced and distributed.

Activiteiten

Onderwerp	Website
Research strategie	https://cie.co.at/research-strategy
Research fora	https://cie.co.at/research-strategy/research-forum
(Joint) Technische comités	https://cie.co.at/technical-work/jtcs
Publicaties	https://cie.co.at/publications
Conferenties	https://cie.co.at/publications/conference-and-symposia-proceedings
Symposia, lezingen en workshops	https://cie.co.at/news-and-events/cie-events

Technical Work

More information:
cie.co.at/technical-work
cie.co.at/research-strategy

Technical Committees

Experts from around the world, such as yourself, cooperate in our Technical Committees to publish on the scientific and technical aspects of optical radiation, lighting and image technology. The publications prepared might be a Technical Report, a Technical Note or an International Standard.

Research Strategy

The CIE publishes a list of priority research topics needing immediate attention by the research community in support of developments in lighting technology and application.

Conferences, Quadrennial Sessions & Midterm Meetings

These are the key gatherings of the CIE global community. They include formal meetings, technical meetings and a three day conference packed with the latest research and applications of the sciences and technologies using optical radiation.

Research Fora

Research thrives on exchange and discussion. The Research Fora bring together experts and newcomers on topics not yet sufficiently mature for the establishment of a Technical Committee.

Symposia, Tutorials and Workshops

Symposia are focused on a specific topic. They have a call for papers that are published as proceedings. Tutorials improve understanding and applications of CIE publications and are presented by CIE experts. Workshops enable the sharing of information on specific research fields and enable the CIE to plan for future CIE work. All of these may be held online or in-person.

Publications

The CIE publishes international standards, technical reports, technical notes and position statements. Some CIE publications are adopted by or developed in cooperation with our partner organizations including ISO and IEC and the CIPM.

Voorbeeld 1: kleurspecificatie

Tristimulus waarden:

$$X = \sum_{\lambda=380}^{780} SPD(\lambda) \cdot x(\lambda) \Delta\lambda$$

$$Y = \sum_{\lambda=380}^{780} SPD(\lambda) \cdot y(\lambda) \Delta\lambda$$

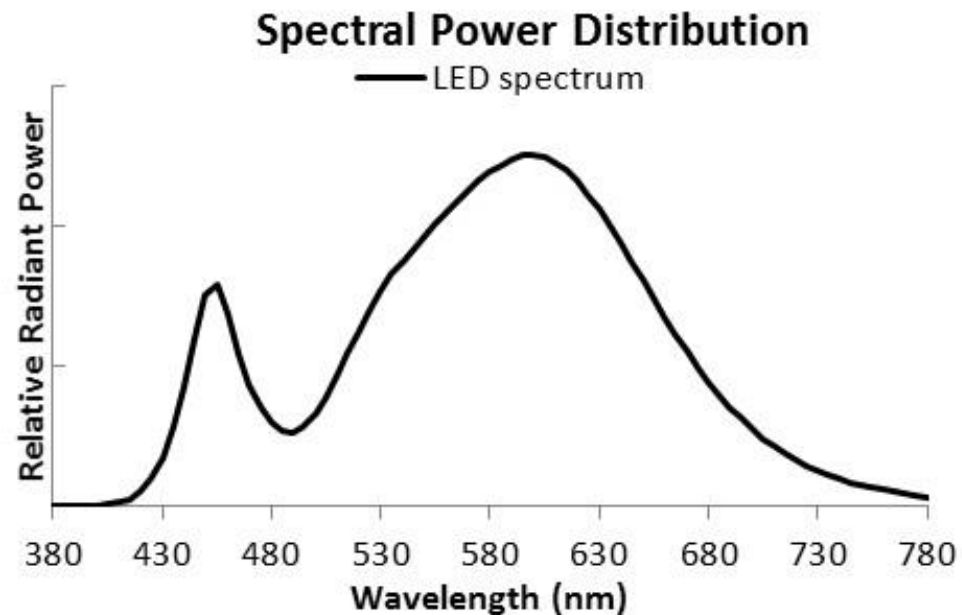
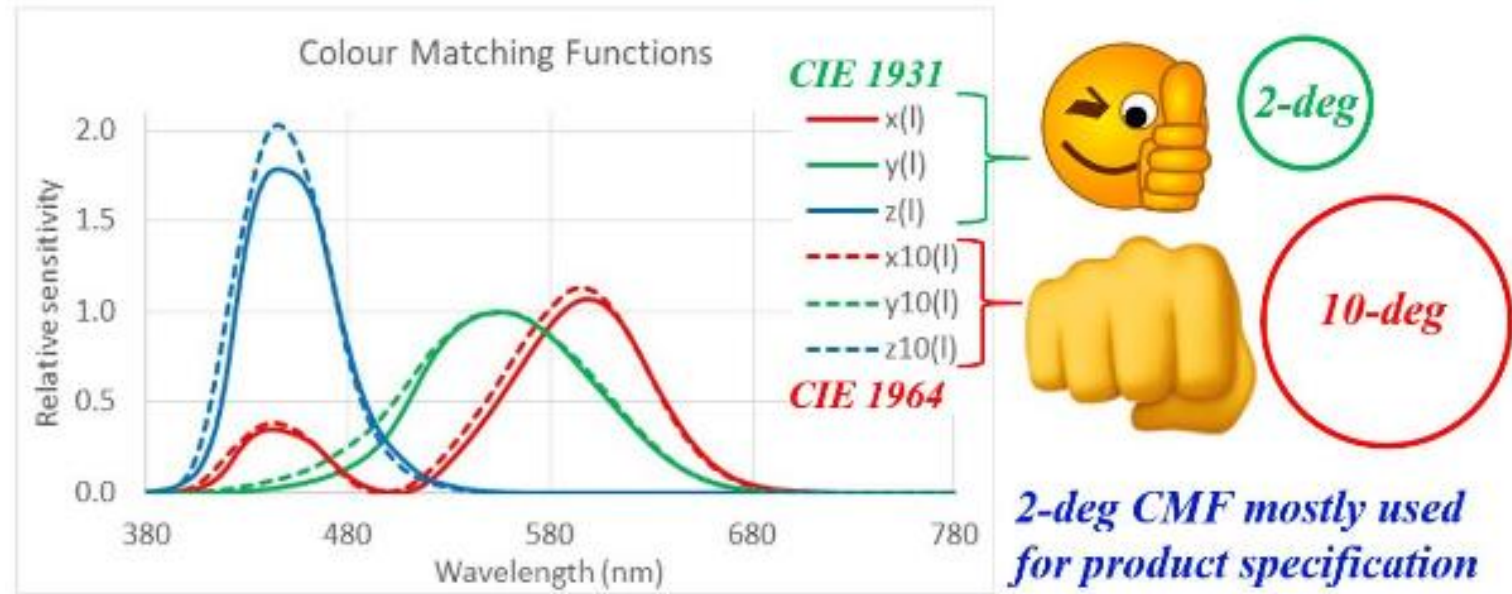
$$Z = \sum_{\lambda=380}^{780} SPD(\lambda) \cdot z(\lambda) \Delta\lambda$$

Kleurcoördinaten:

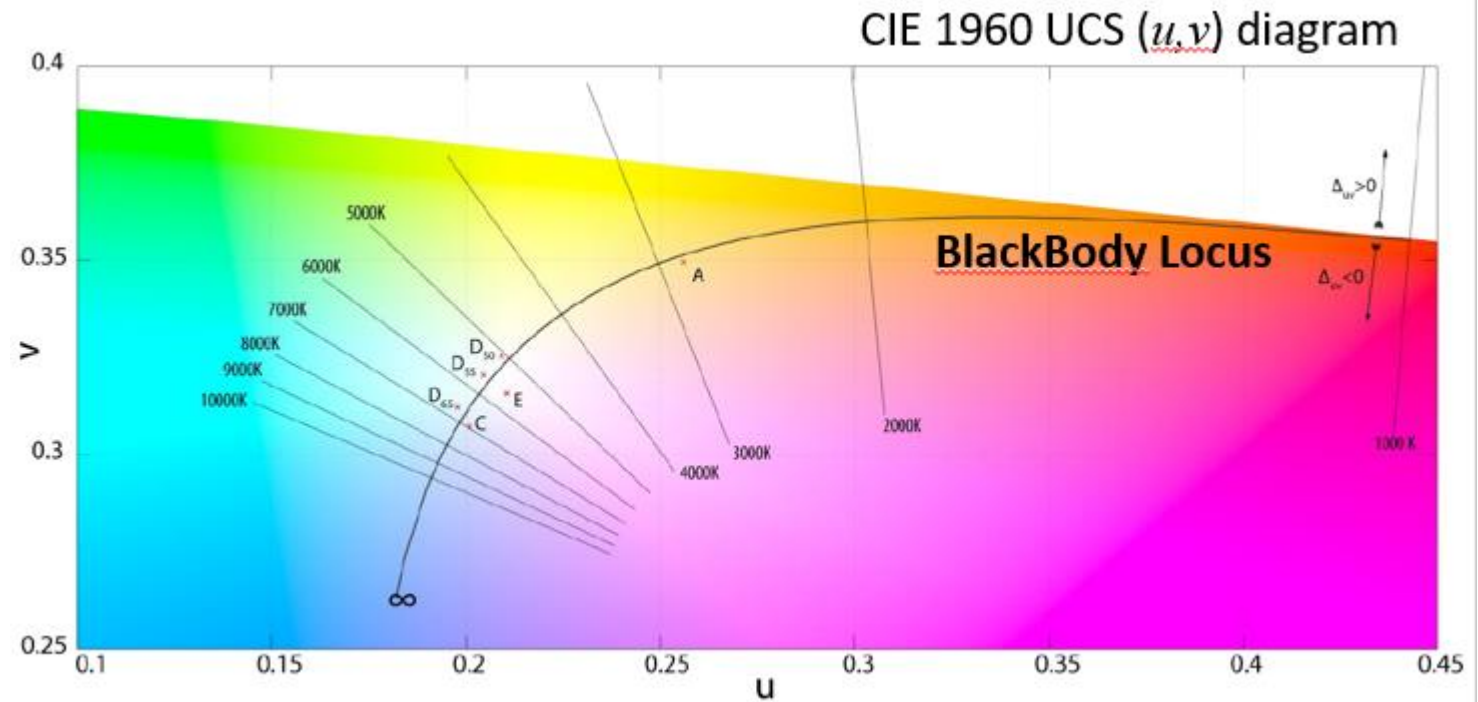
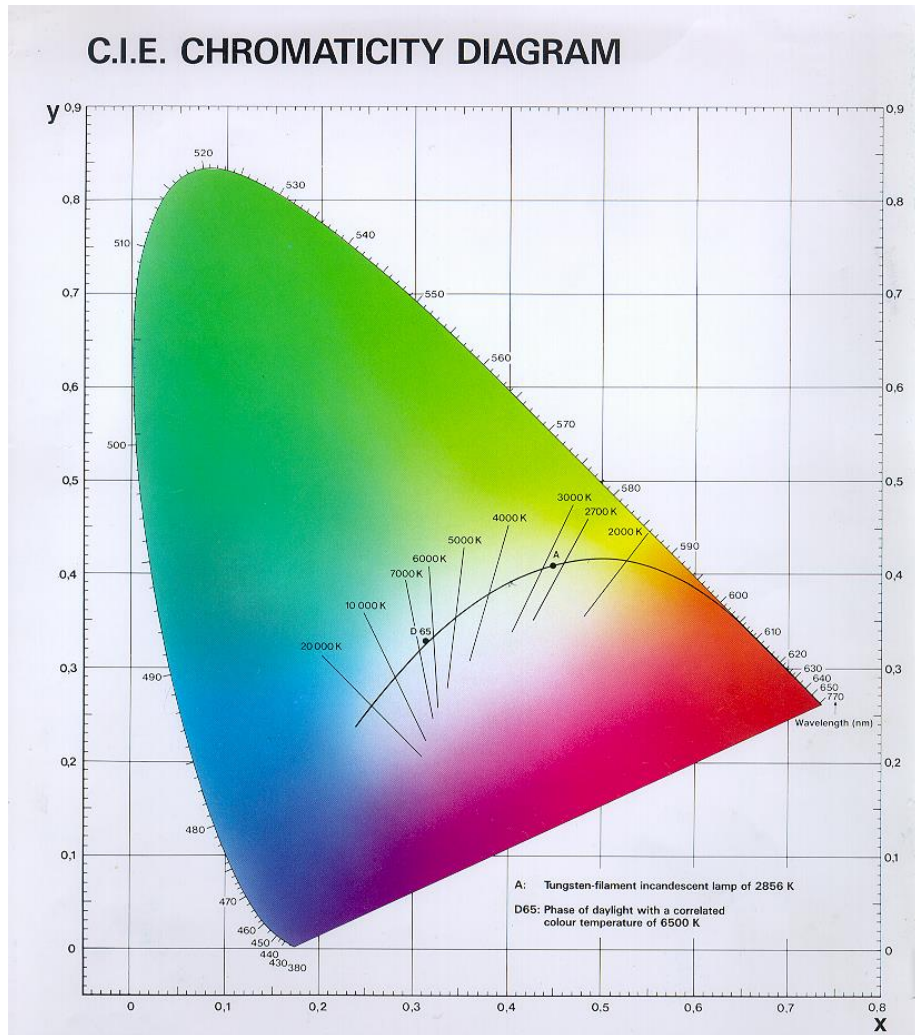
$$x = \frac{X}{X + Y + Z}$$

$$y = \frac{Y}{X + Y + Z}$$

$$z = 1 - x - y$$



Voorbeeld 1: kleurspecificatie



$$u = \frac{4X}{X + 15Y + 3Z} = \frac{4x}{-2x + 12y + 3}$$

$$v = \frac{6Y}{X + 15Y + 3Z} = \frac{6y}{-2x + 12y + 3}$$

Voorbeeld 1: kleurspecificatie → aanpassen voor specifieke toepassingen

CIE TC 1.98 (A Roadmap Toward Basing CIE Colorimetry on Cone Fundamentals)

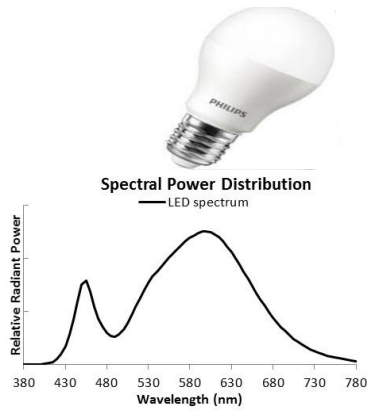
Guide the development of a new, complete, self-consistent system of CIE colorimetric measures, based directly on **cone fundamentals**, with explicit consideration of the impacts of **normal variations** of the cone fundamentals due to **age**, **field of view**, and **individual diversity**

Sensitivity to the light stimulus is determined by

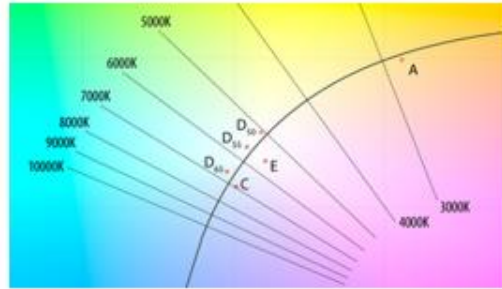
- the ocular media transmission (**age**),
- the macular pigment transmission (**age**, **field of view**, **dietary intake**),
- pigment self-screening ($1-10^{D \cdot S(\lambda)}$) (**field of view**),
- the photopsin cone sensitivity (**peak sensitivity**).

Voorbeeld 2: kleurweergave index (CRI)

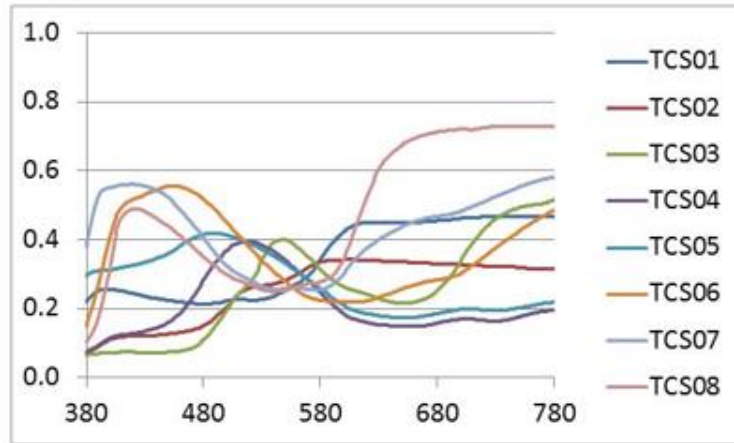
CIE general Colour Rendering Index (R_a) ; CIE publication 13.3-1995



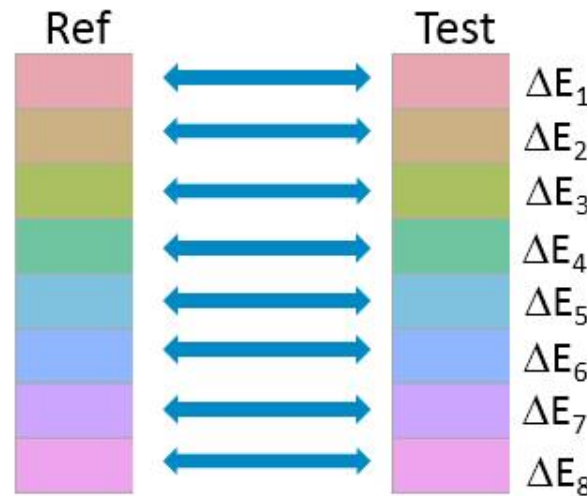
CCT
→



CCT \geq 5000K Phase of Daylight
CCT < 5000K Black Body Radiator



CIE Test Colour Samples



Difference

→ Colour Rendering = Colour Fidelity = CRI = $R_a = 100 - 4.6 \times \Delta E_{av}$
(**Similarity index** ; $R_a = 100$ when test source is "equal" to reference illuminant)

Voorbeeld 2: kleurweergave index (CRI)

Nadelen CRI

- Slechts 8 (pastel) kleuren
- Kleurverschil t.o.v. referentiebron
 - Absoluut getal
 - Geen richting
- Eén getal (gemiddelde van 8 kleurverschillen)
- **Geen** relatie met preferentie

Voordeel CRI

- Slechts 1 getal
- Gemiddelde kleurafwijking t.o.v. referentiebron (met dezelfde CCT)



CRI=75



CRI=100




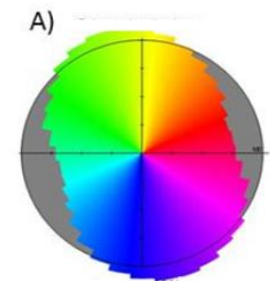
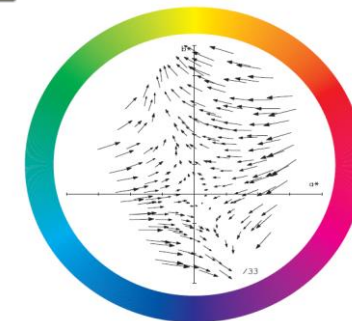
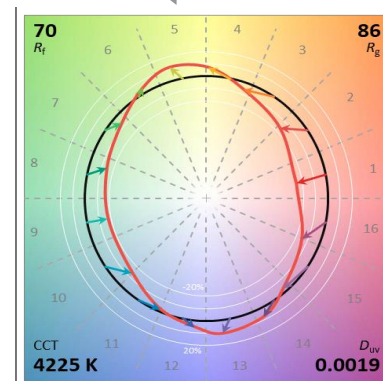
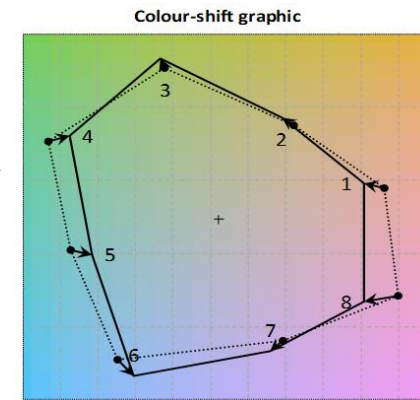
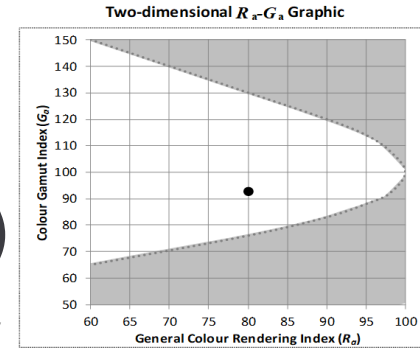
CRI=75

Voorbeeld 2: kleurweergave index (CRI) → aanvulling

CIE TC 1.91 (Methods for Evaluating the Colour Quality of White-Light Sources)

Voorstel bestaat uit zeven methoden:

1. Colour Quality Scale (CQS), 
2. Colour Rendering Index (CRI)-based Colour Rendition Properties (CRI-CRP),
3. Colour Rendering Vectors and Colour Saturation Icon (CRV and CSI),
4. Feeling of Contrast Index (FCI),
5. IES TM-30 Method,
6. Memory Colour Rendition Index (MCRI),
7. Preference Index of Japanese Skin Colour (PS).



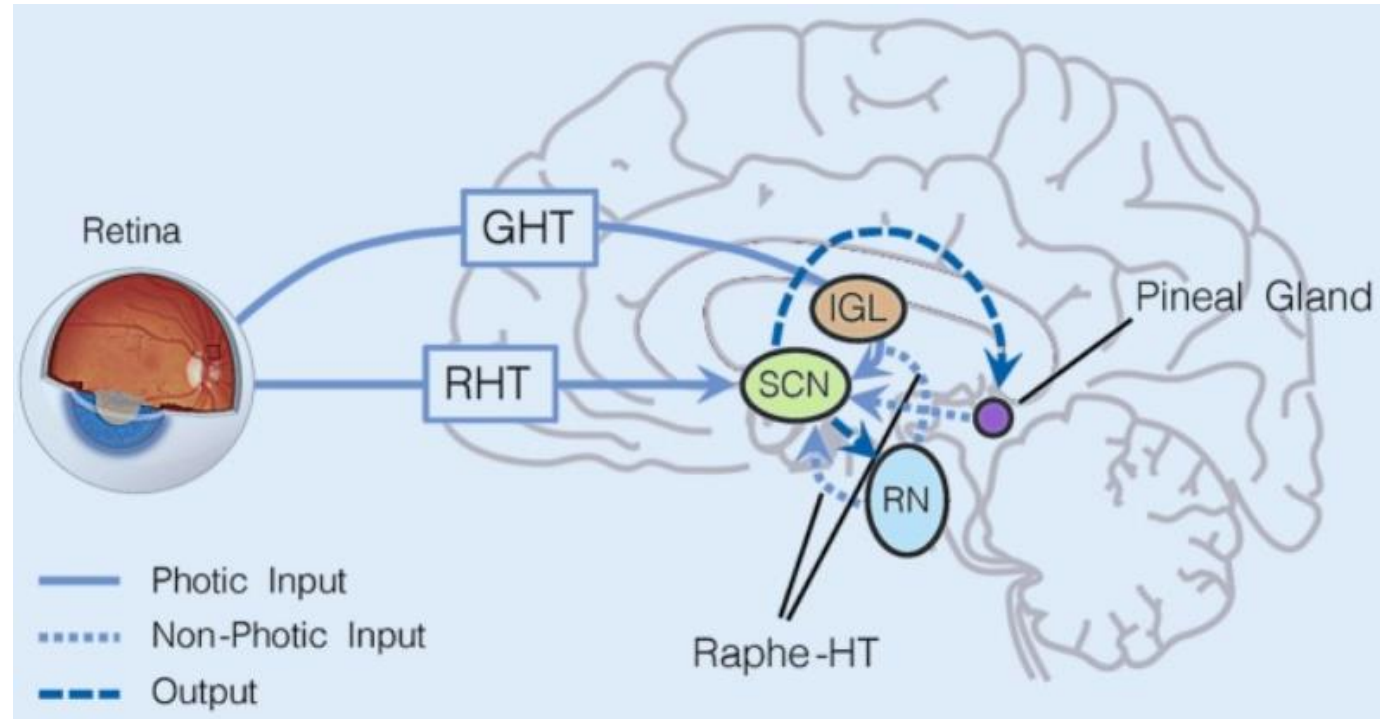
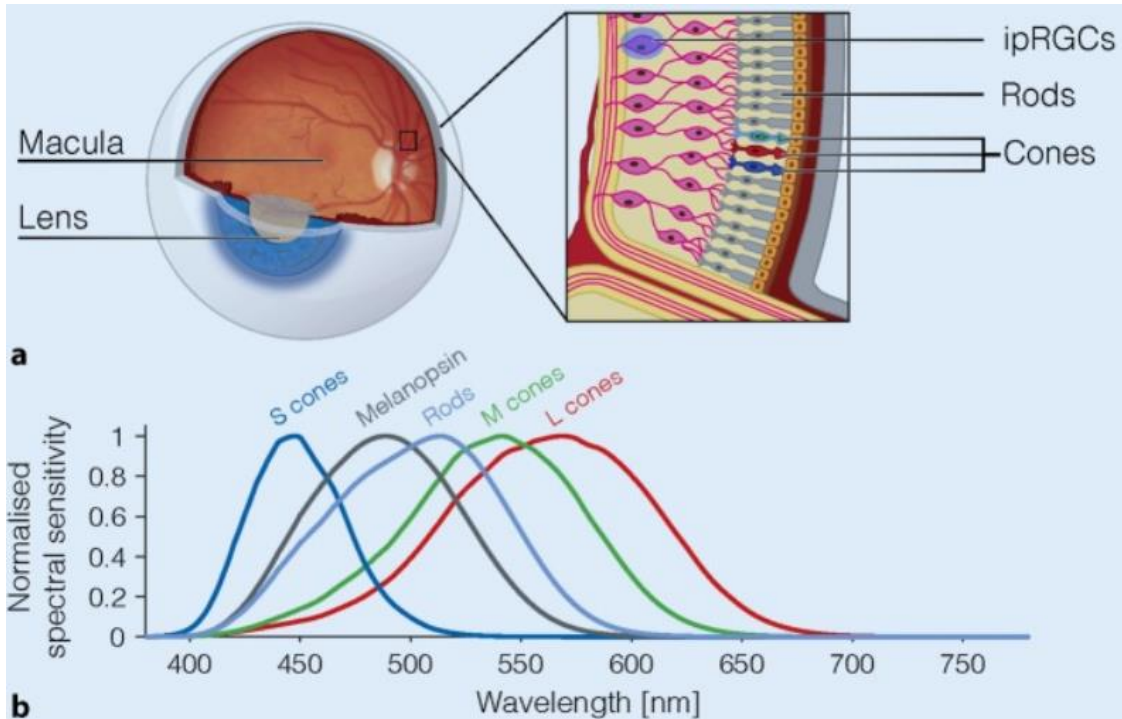
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Voorbeeld 3: fotobiologie

Invloed van licht op onze biologische klok

suprachiasmatic nuclei (SCN), intergeniculate leaflet (IGL)
retinohypothalamic tract (RHT), geniculohypothalamic tract (GHT)
raphe nuclei (RN)



Blume C, Garbazza C, Spitschan M. Effects of light on human circadian rhythms, sleep and mood. *Somnologie (Berl)*. 2019 Sep;23(3):147-156. doi: 10.1007/s11818-019-00215-x. Epub 2019 Aug 20.

Voorbeeld 3: fotobiologie

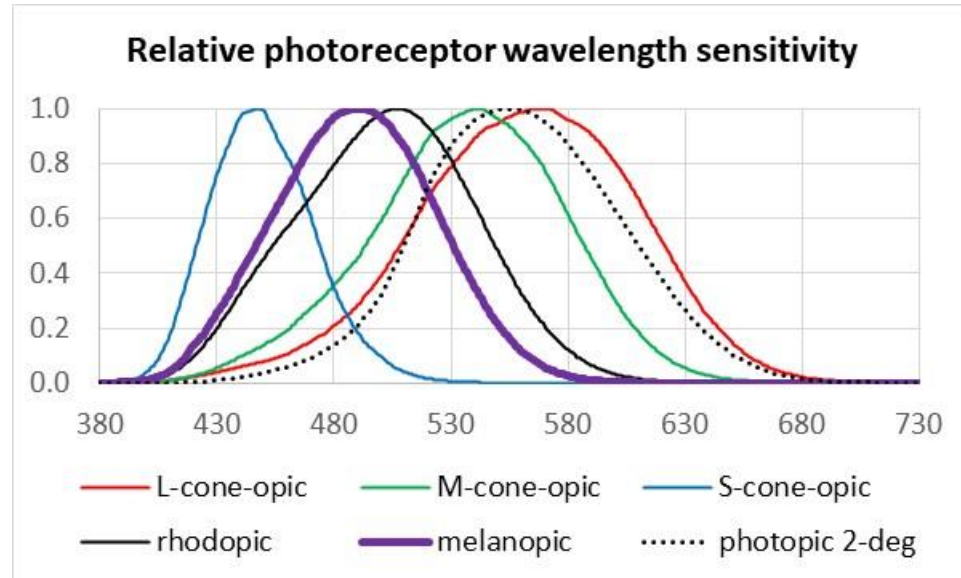
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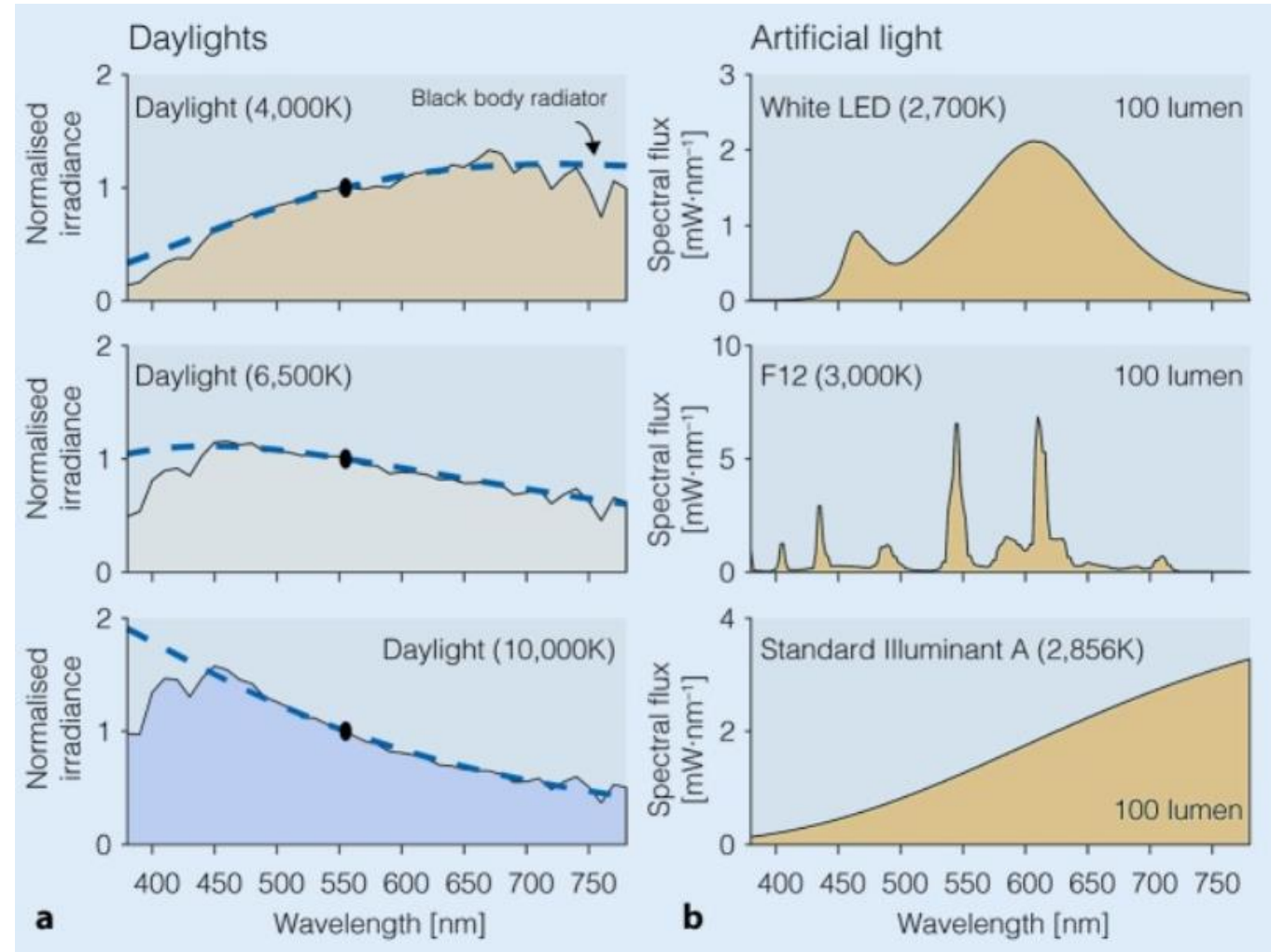
$$Y = \sum_{\lambda=380}^{780} SPD(\lambda) \cdot y(\lambda) \Delta\lambda$$

$$Z = \sum_{\lambda=380}^{780} SPD(\lambda) \cdot z(\lambda) \Delta\lambda$$

$$M = \sum_{\lambda=380}^{780} SPD(\lambda) \cdot mel(\lambda) \Delta\lambda$$

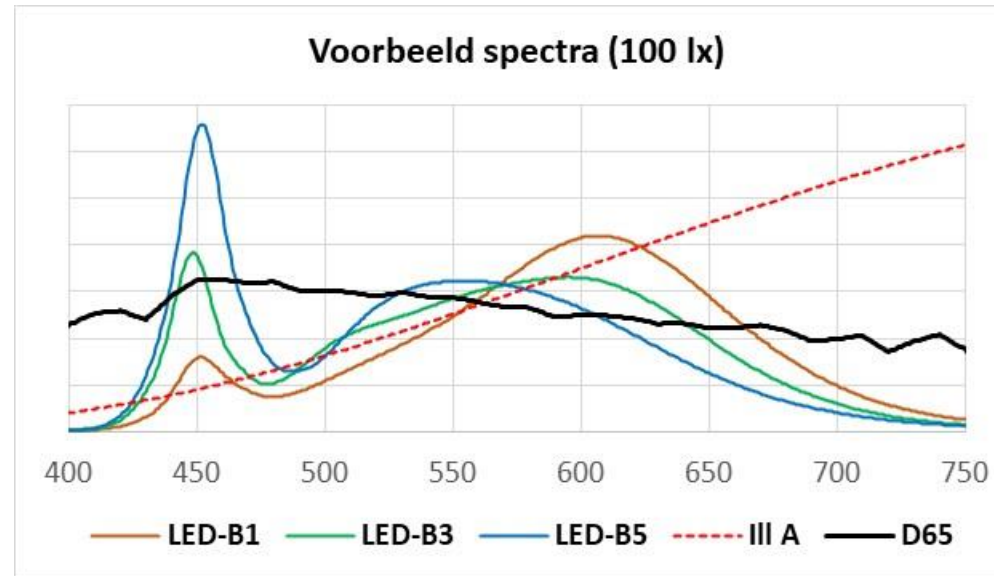
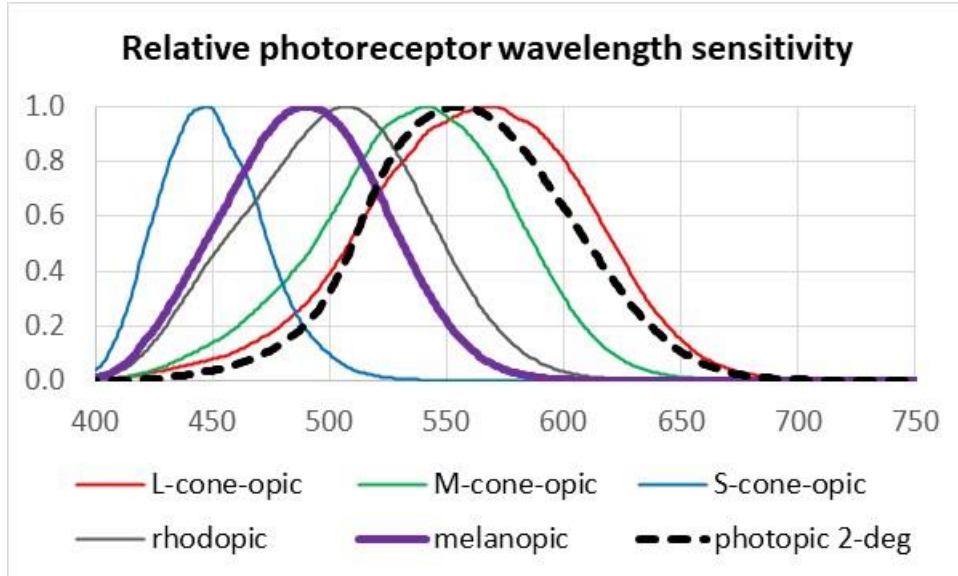


Blume C, Garbazza C, Spitschan M. Effects of light on human circadian rhythms, sleep and mood. *Somnologie (Berl)*. 2019 Sep;23(3):147-156. doi: 10.1007/s11818-019-00215-x. Epub 2019 Aug 20.



Voorbeeld 3: fotobiologie: CIE standaard S 026/E:2018

CIE System for Metrology of Optical Radiation for ipRGC-Influenced Responses to Light



	CCT (K)	Illuminance Ev (lx)	Melanopic daylight (D65) efficacy ratio	Melanopic equivalent daylight (D65) illuminance (lx)
Illuminant A	2856	100	0,496	49,6
LED-B1	2733	100	0,406	40,6
LED-B3	4103	100	0,632	63,2
LED-B5	6598	100	0,855	85,5
D65	6503	100	1,000	100

Voorbeeld 4: Unified Glare Rating

CIE 117-1995: DISCOMFORT GLARE IN INTERIOR LIGHTING

$$R_{UG} = 8 \cdot \log \left[\frac{0,25}{L_b} \sum \frac{L_s^2 \cdot \omega}{p^2} \right] = 8 \cdot \log \left[\frac{0,25}{L_b} \sum \frac{I_s^2}{A_p r^2 p^2} \right]$$

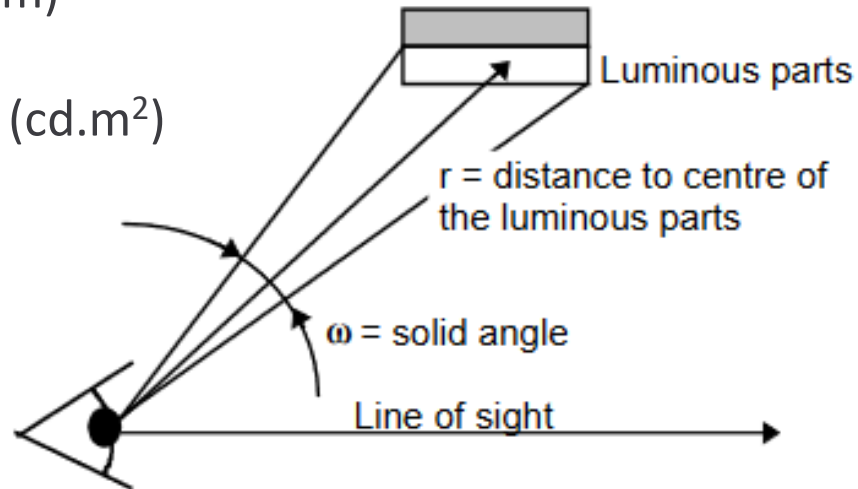
I is luminous Intensity of the luminaire in the direction of the observer

A_p is the projected area of the luminous parts of the luminaire (m²)

r is the distance from the observer to the centre of the luminous parts of the luminaire (m)

p position index

L_b background luminance (cd.m²)

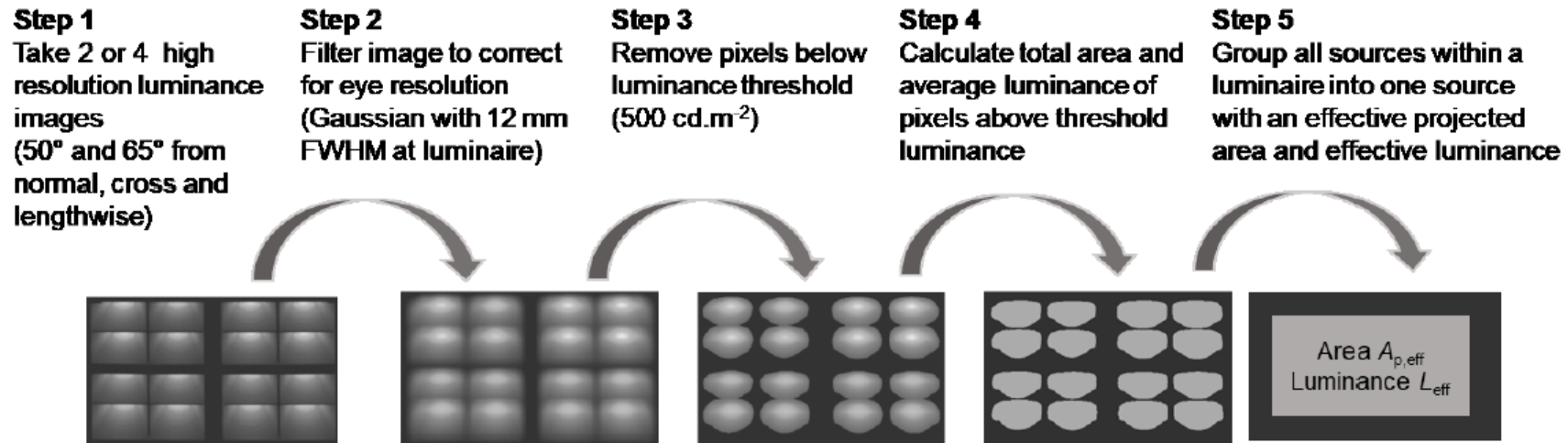


Voorbeeld 4: Unified Glare Rating

CIE 232-2019: Discomfort caused by Glare from Luminaires with a Non-uniform source luminance

$$R'_{UG} = 8 \cdot \log \left[\frac{0,25}{L_b} \sum k^2 \frac{L_s^2 \cdot \omega}{p^2} \right] = 8 \cdot \log \left[\frac{0,25}{L_b} \sum \frac{L_s^2 \cdot \omega}{p^2} \right] + 8 \cdot \log(k^2) = R_{UG} + 8 \cdot \log \left[\frac{L_{\text{eff}}^2 \cdot \omega_{\text{eff}}}{L_s^2 \cdot \omega} \right]$$

k is uniformity correction parameter



CIE 232:2019, figuur 2

Waarom lid worden van CIE

Internationaal platform voor discussie, standaardisatie en kennisoverdracht.

Toegang tot de laatste informatie op het gebied van op het gebied van optische straling, licht- en beeldtechnologie.

Fabrikanten kunnen door deelname nieuwe regelgeving en product specificaties zinvoller maken.

Lokale overheden kunnen onderwerpen op de agenda zetten en deelnemen in technische discussies.

Advance your knowledge with CIE

At its core, CIE is about learning and mutual support.

These advantages await you:

- An international platform for co-operation and exchange amongst professionals interested in the scope of the CIE.
- Clear standards for metrology, products, processes and applications.
- Guidance in application and design.
- Early access to the newest CIE publications.
- Drivers for more efficient and quality orientated solutions.
- Networking opportunities to generate new collaborations and business.
- Recognition of research.
- Support for developing countries.
- Valuable contacts through scientific and educational events.

CIE Newsletter:

cie.co.at/about-cie/newsletter

The CIE provides up-to-date information:

- International standards and technical reports.
- Proceedings of conferences and expert symposia.
- CIE Newsletter and Website.
- Research Fora.
- Documentation of state-of-the-art technology and research.

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