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Culture – Light for Art

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Culture - Light for Art

Agenda

Forms of presentation in museums
Qualitative lighting design
Lighting functions
Global lighting solutions
Efficiency in figures

Forms of presentation in museums

Light enables diverse ways of accessing art. The spectrum ranges from a neutral atmosphere for the objective appreciation of art to emotional presentations for individual trips of discovery.

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Culture – Light for Art

Exhibits on a neutral background

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Strikingly emphasising artworks

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Differentiated presentation of objects in the room

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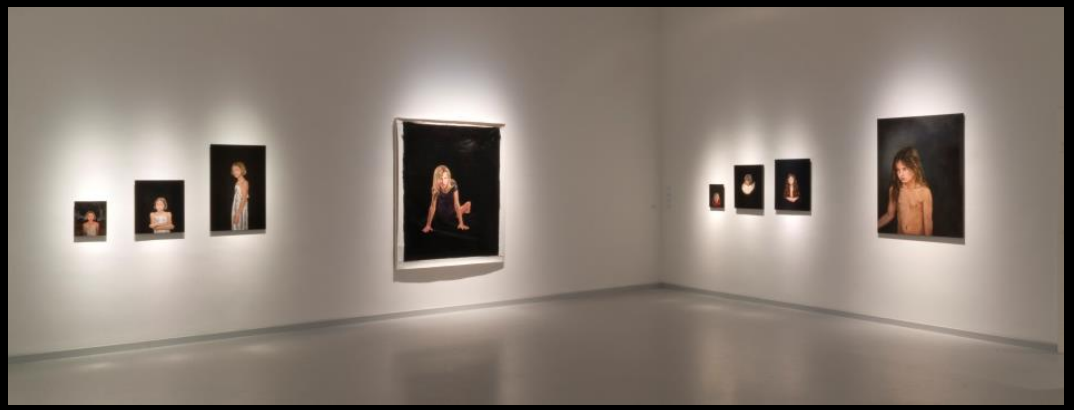
Perspectives with museum lighting



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Designing light for art

Qualitative lighting design

Holistic consultation with exhibition projects brings together conservation needs with the design-related ambitions of architects and the technical requirements of engineers.

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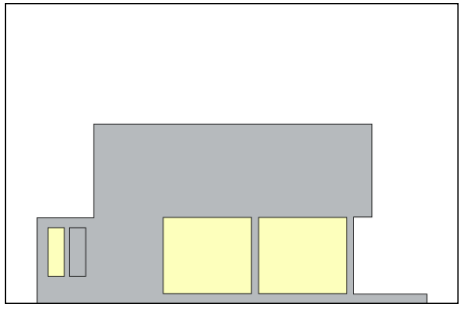
Designing light for art

Support for holistic lighting design

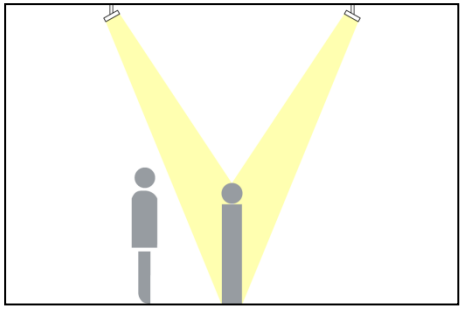


Technical planner

- Museum expertise
- High product quality
- Extensive guarantee

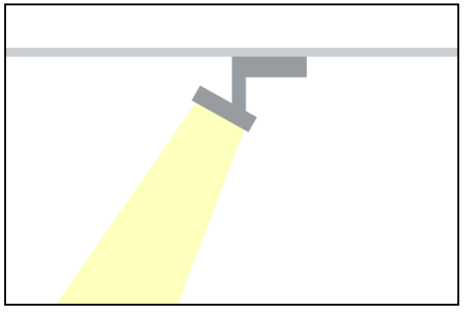
Design planner

- Corporate lighting concepts
- Inspiration
- Global consultation



- Flexible lighting systems
- Museum-compliant lighting technology
- Support for lighting calculations

- Qualitative lighting design
- Assessment of the light effect
- Planning aids



- Maximum system compatibility
- Precise lighting technology
- Photometric data

- Consistent luminaire systems
- High-quality design
- Complete technical documentation

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Designing light for art

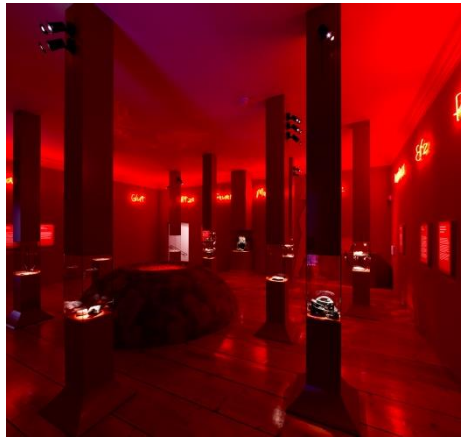
The grammar of light

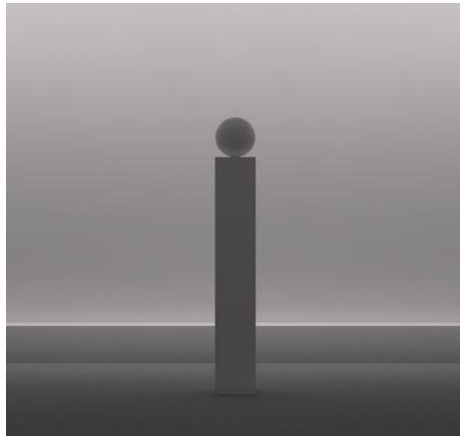
Qualitative lighting design

- General lighting via vertical surfaces for good orientation

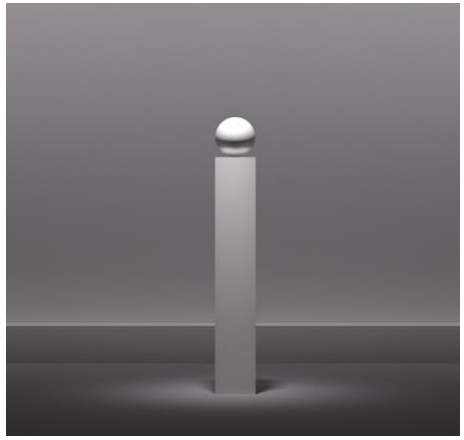
– Accent lighting for presentation and hierarchies of perception

– Decorative light for admiring and as an aesthetic end in itself

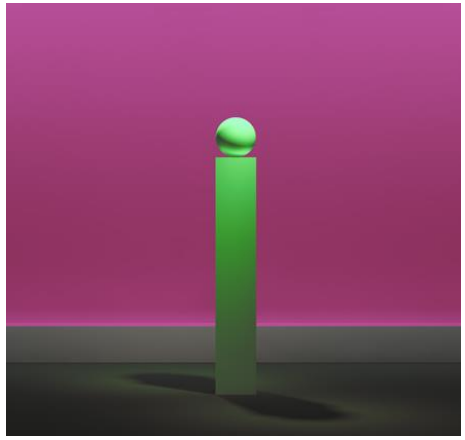




Light for seeing



Light for looking at



Light for viewing

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Designing light for art

Achieving unity with vertical lighting

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Designing light for art

Creating hierarchies using lighting levels

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Designing light for art

Presentation with differentiated light distributions

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Designing light for art

Thinking in terms of lighting functions

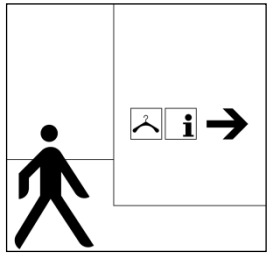
From the outside space and exhibition to the café

Three questions for analysis of the lighting task

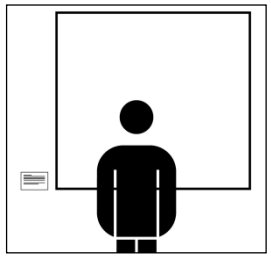
– Why do we illuminate?

– What can light achieve?

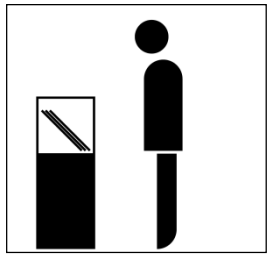
– What is the lighting solution?



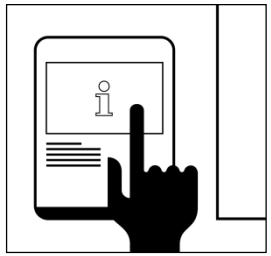
Welcoming



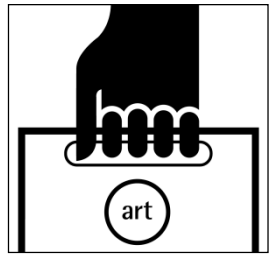
Experiencing



Conserving



Discovering



Marketing

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Welcoming

Art Gallery of Ontario, Toronto / Canada. Photographer: Thomas Mayer, Neuss

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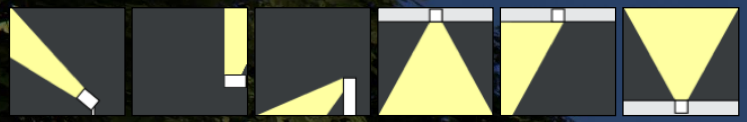
Welcoming

Levels of qualitative lighting design



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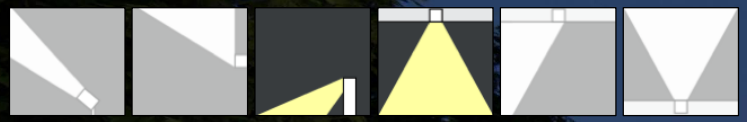
Welcoming

Levels of qualitative lighting design



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Welcoming

Levels of qualitative lighting design

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Welcoming

Levels of qualitative lighting design

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Experiencing

Arario Museum Tapdong Cinema, Jeju / South Korea. Photographer: Sebastian Mayer, Berlin

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Experiencing

Levels of qualitative lighting design

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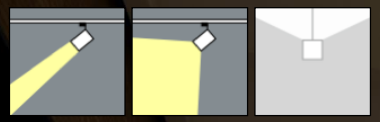
Experiencing

Levels of qualitative lighting design



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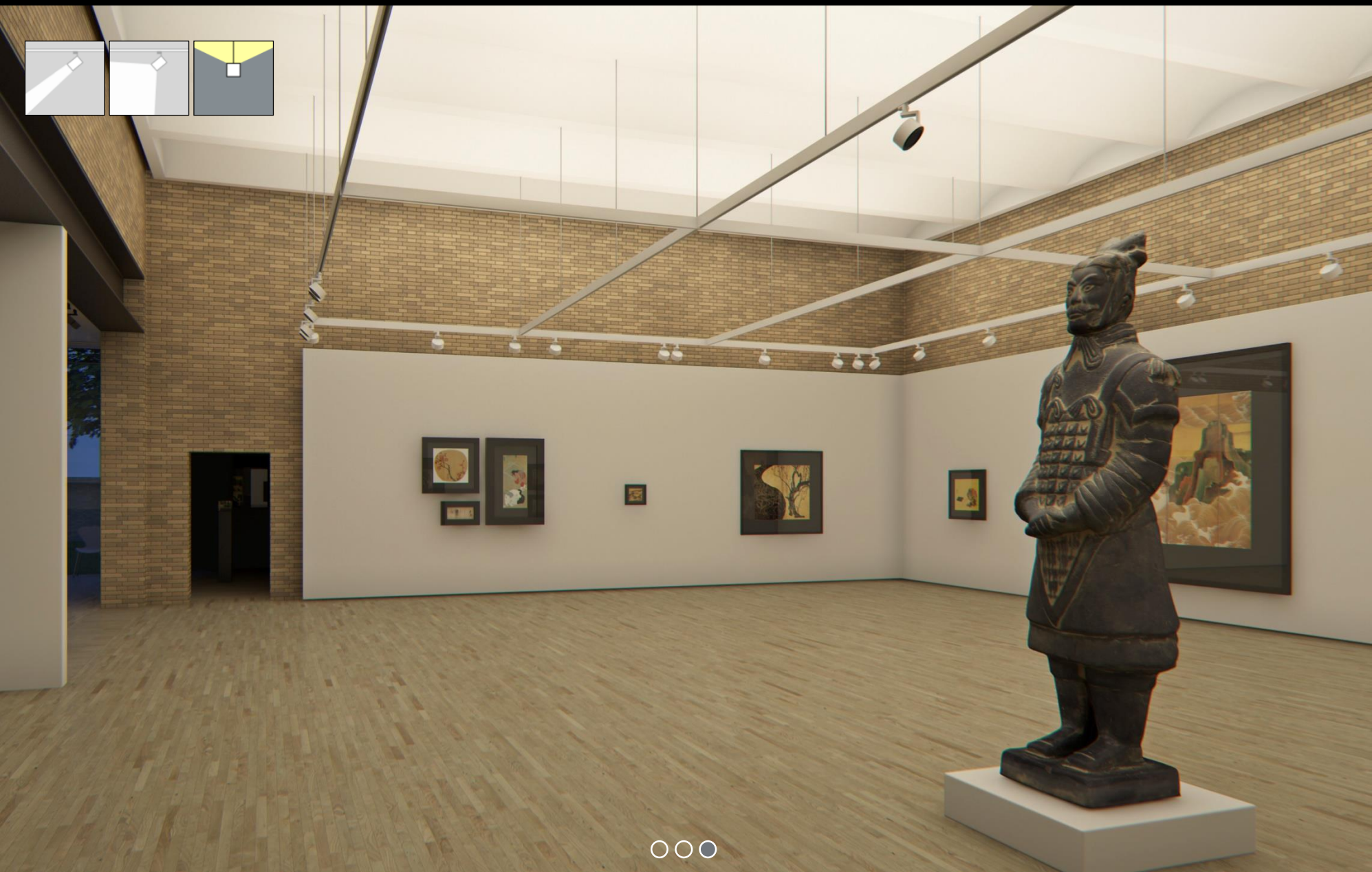
Experiencing

Levels of qualitative lighting design



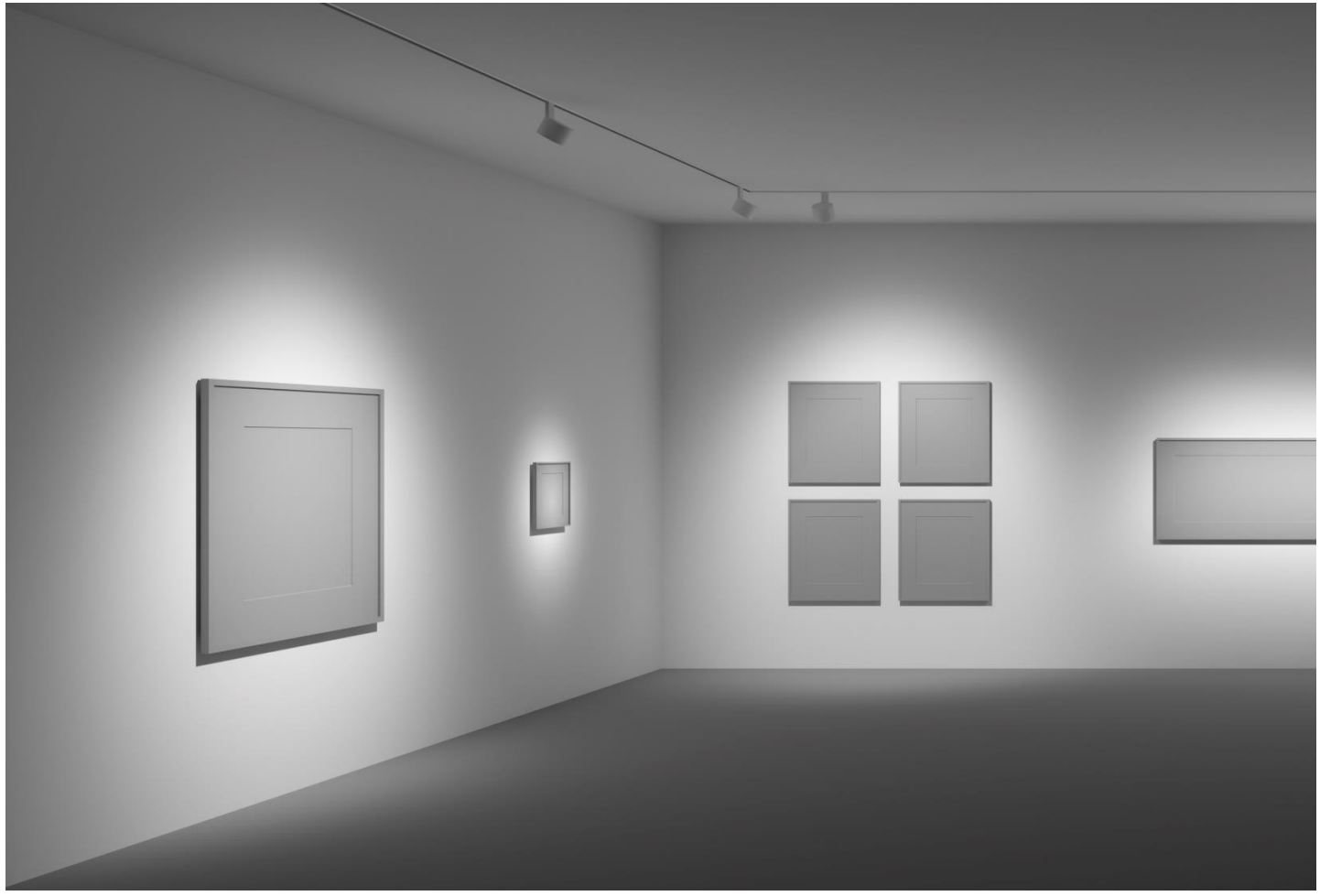
Experiencing

Light for pictures

Variant 1

Accent lighting

- Light for looking at guides the observer's eye
- Exhibits are given greater importance
- Directed light for brilliance and good modelling



Experiencing

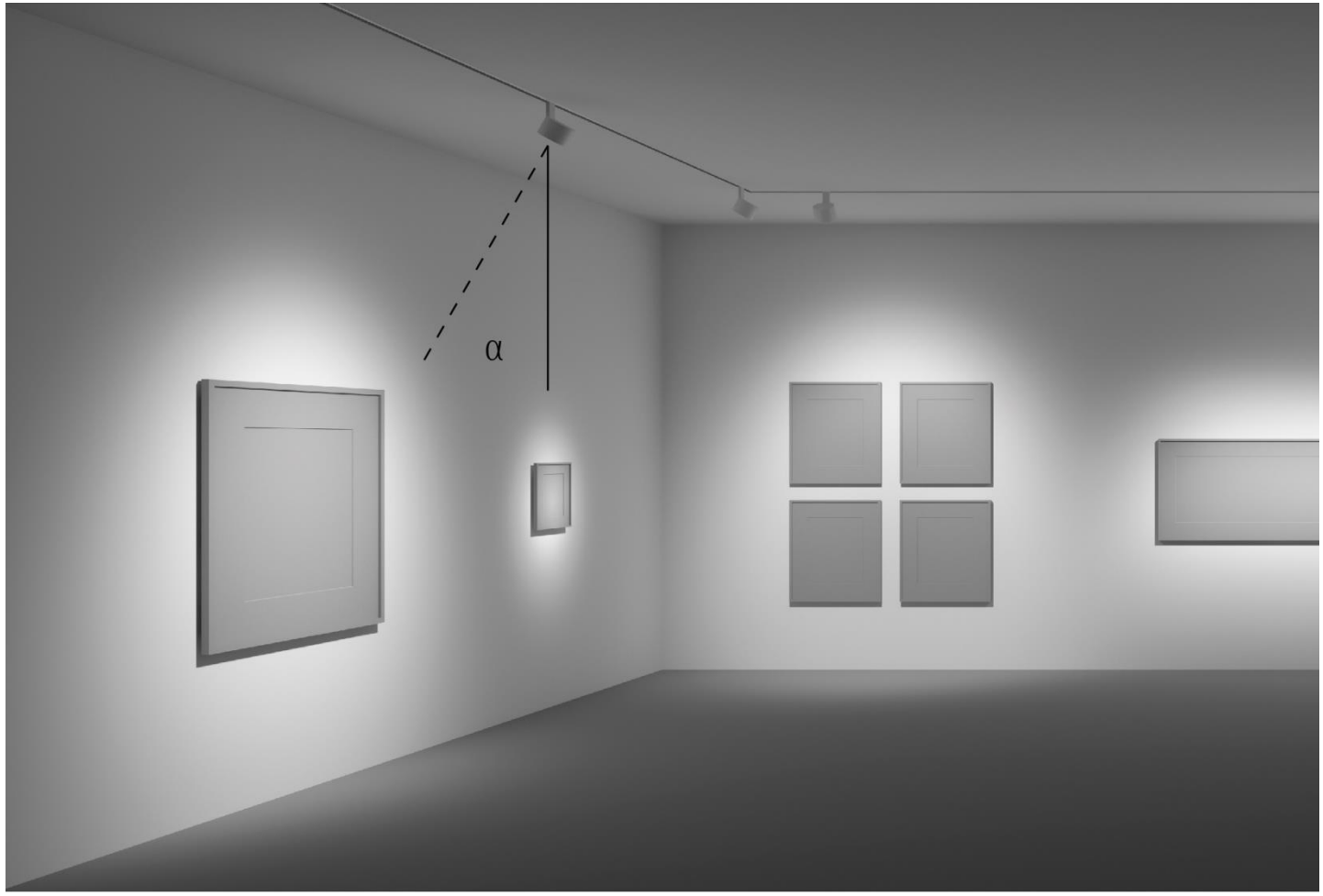
Light for pictures

Variant 1

Accent lighting

Rule of thumb for arranging spotlights and floodlights:

- α = 30° (museum angle)



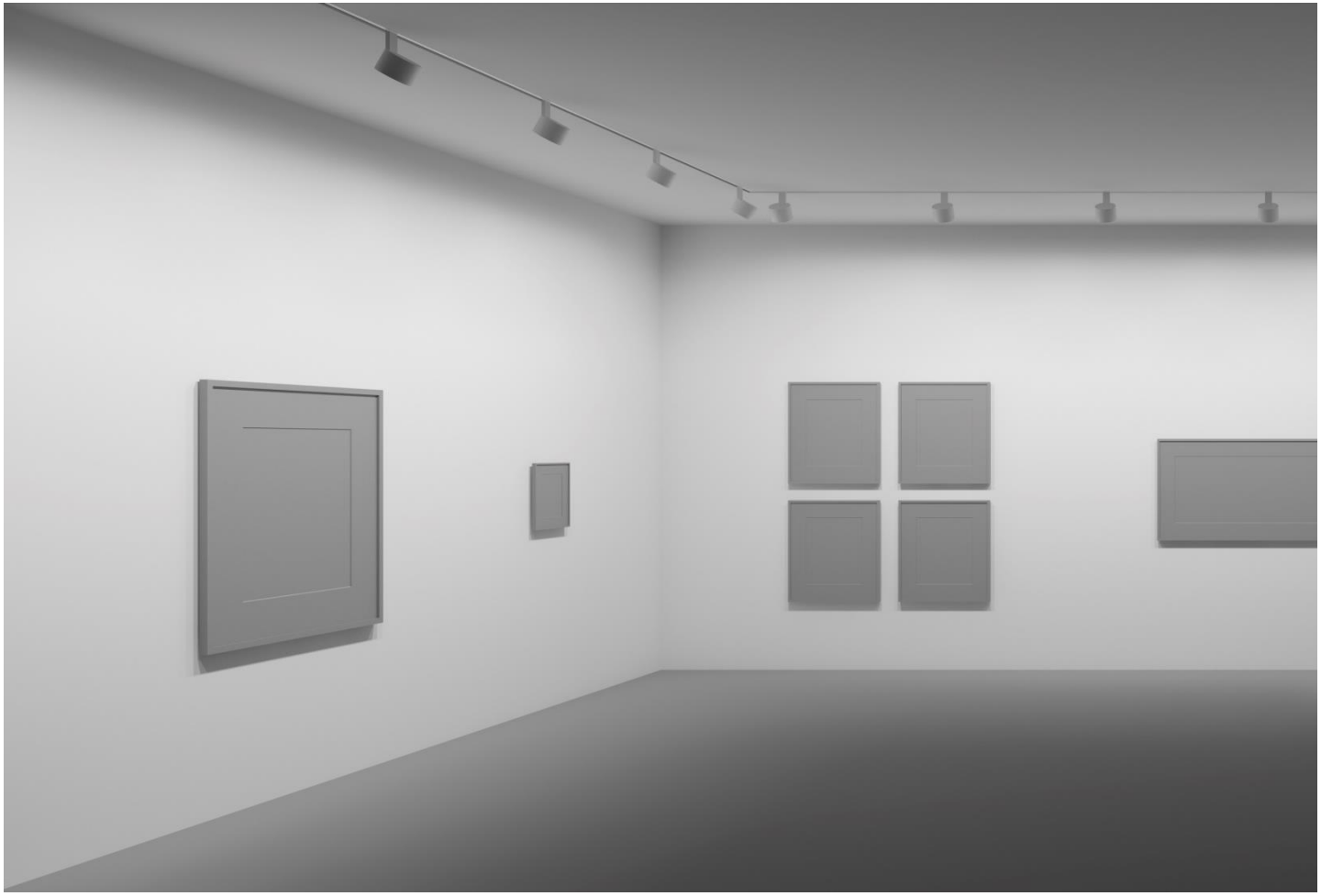
Experiencing

Light for pictures

Variant 2

Wallwashing

- High horizontal and vertical uniformity
- Concise, broad spatial effect
- Pictures and the wall appear to have equal importance
- Luminaires do not need to be readjusted for other picture formats

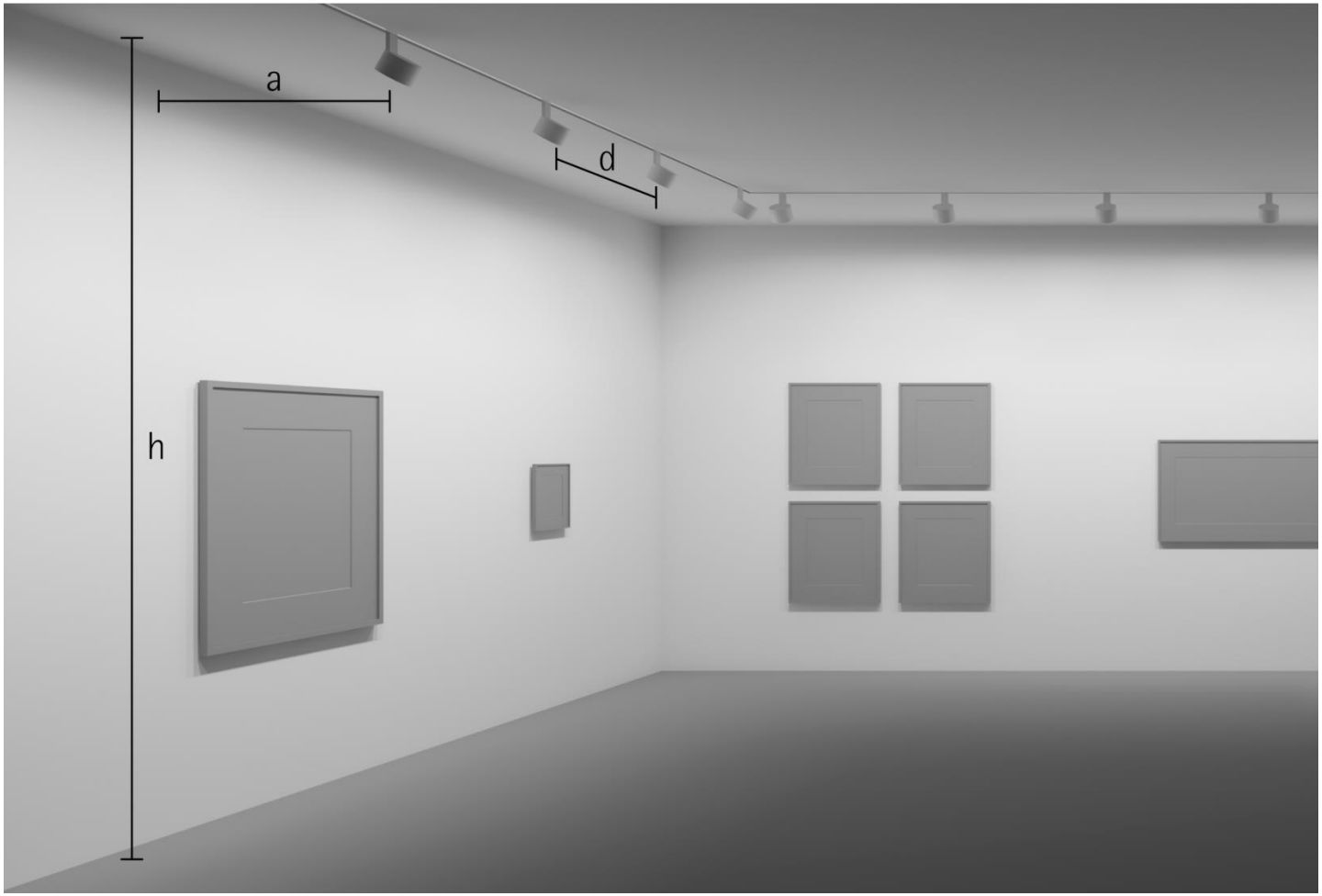


Variant 2

Wallwashing

Rule of thumb for arranging lens wallwashers:

- a = 1/3 x h
- d ≤ 1.3 x a

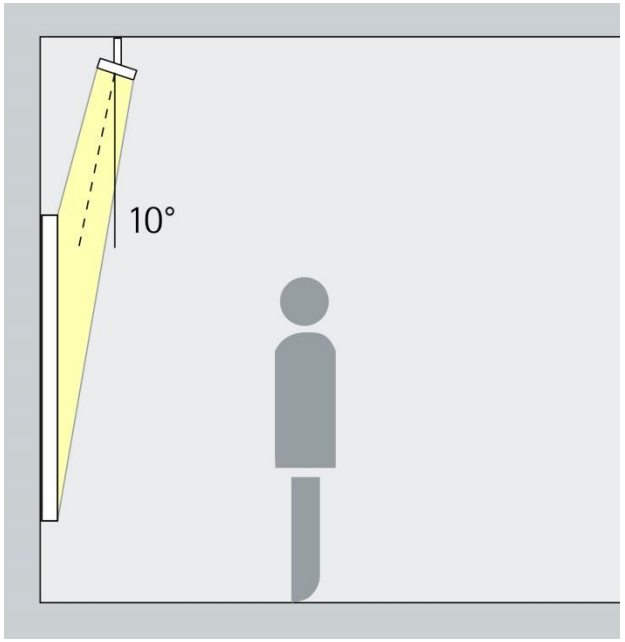


Experiencing

Luminaire arrangements and visual comfort

Angle of incidence <30°

- Disturbing hard shadowing
- Exaggerated structural details
- Low impression of brightness despite high illuminance levels

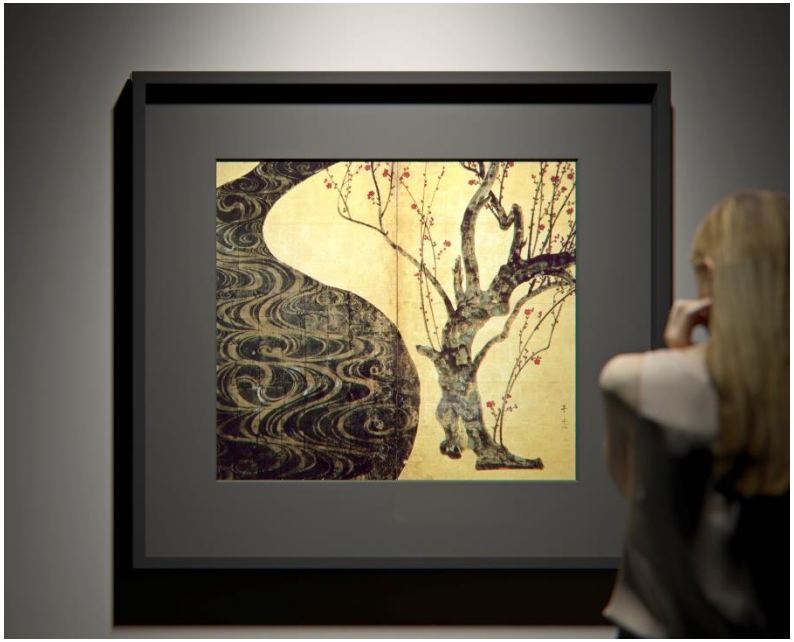


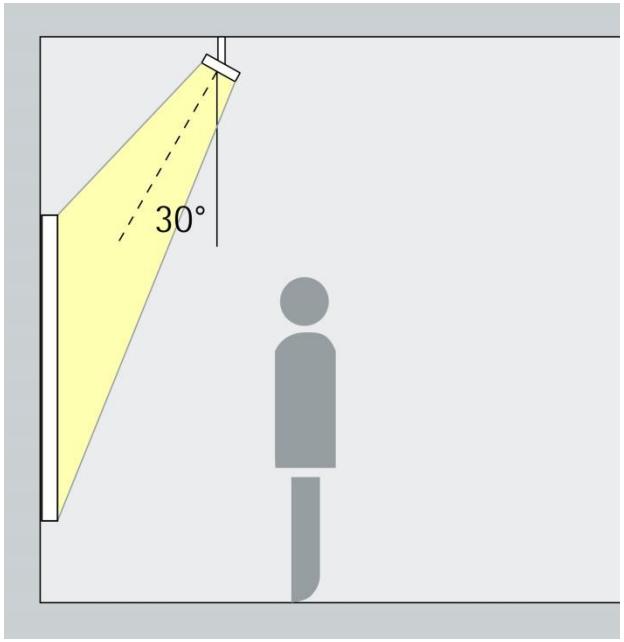
Experiencing

Luminaire arrangements and visual comfort

30° angle of incidence

- Ideal museum angle
- No glare
- Good modelling
- Uniform impression of brightness



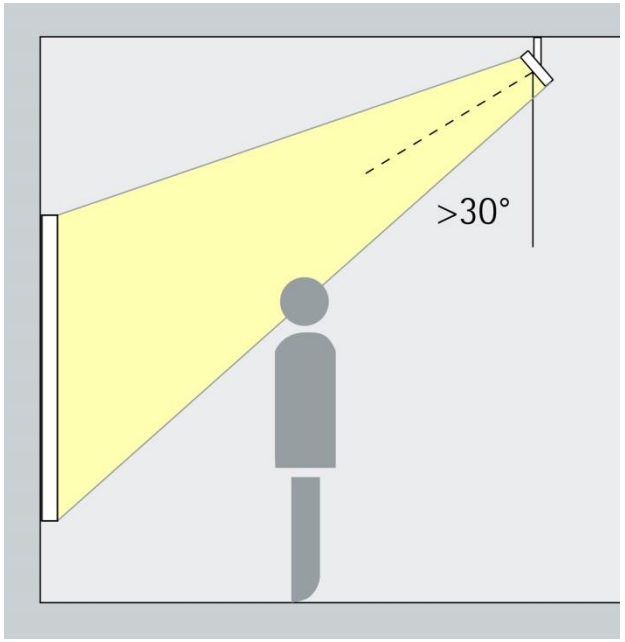


Experiencing

Luminaire arrangements and visual comfort

Angle of incidence >30°

- Danger of shadows from the observer
- Danger of reflected glare
- Low modelling



Experiencing

Light for sculptures

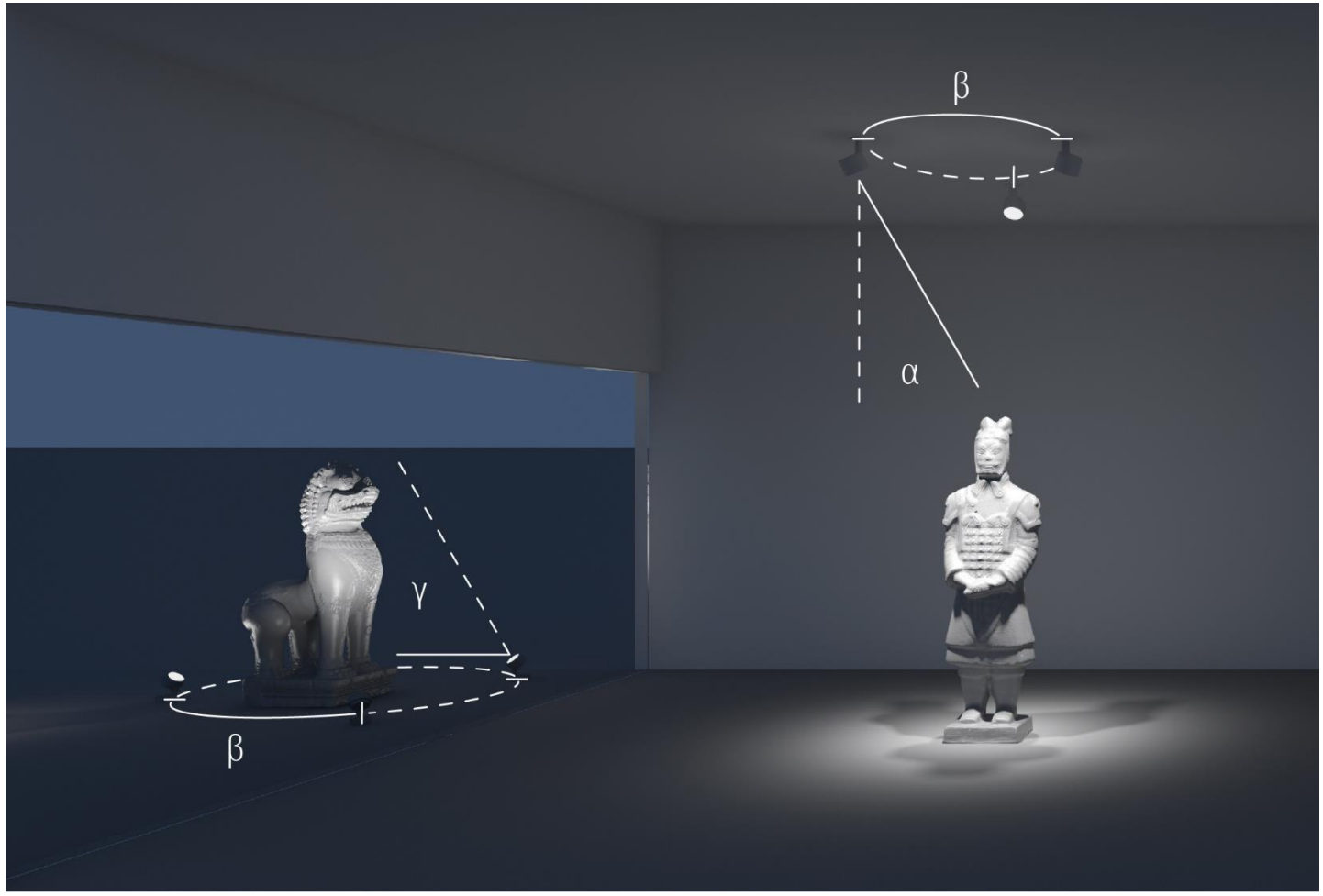
Accenting with spotlights and floodlights

- Light for looking at guides the observer's eye
- Exhibits are given greater importance
- Directed light for brilliance and good modelling

Accenting with spotlights and floodlights

Rule of thumb for luminaire arrangement:

- α = 30° (museum angle)
- γ = 120°

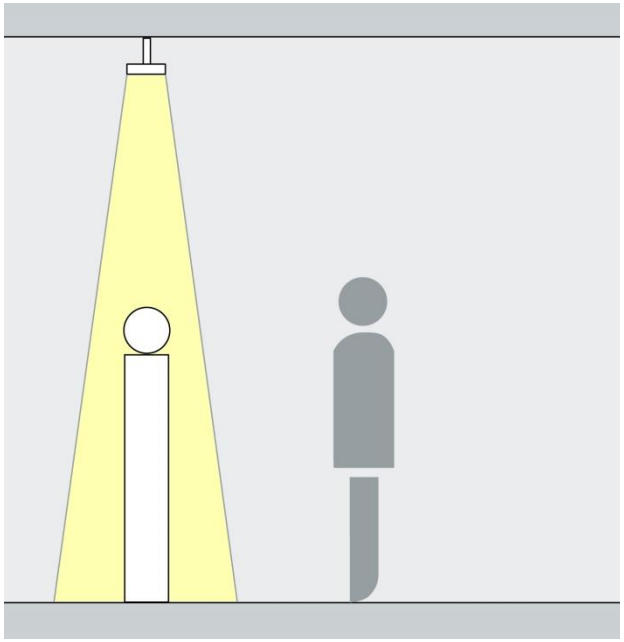


Experiencing

Luminaire arrangements and visual comfort

Angle of incidence <30°

- Strong shadowing
- Exaggerated structural details
- Low vertical illumination

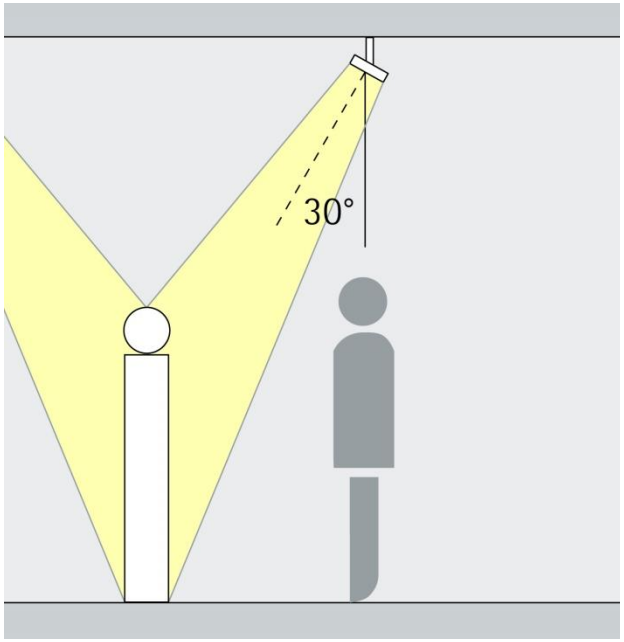


Experiencing

Luminaire arrangements and visual comfort

30° angle of incidence

- Ideal museum angle
- No glare
- Good modelling
- Uniform impression of brightness

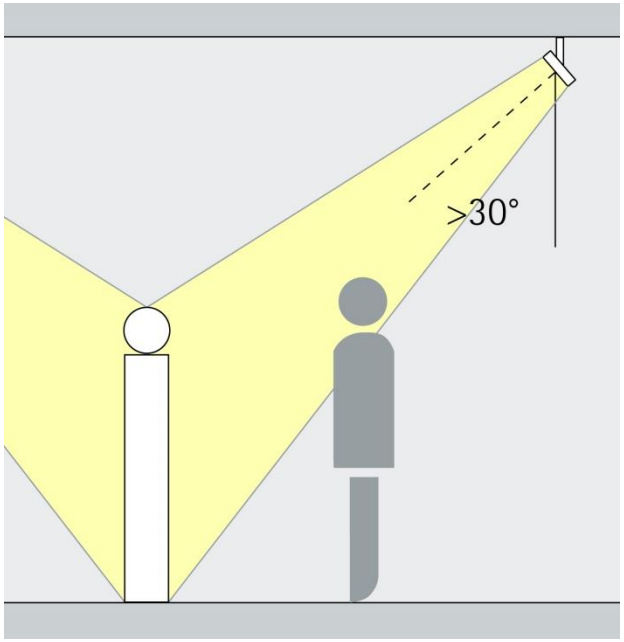


Experiencing

Luminaire arrangements and visual comfort

Angle of incidence >30°

- Danger of shadows from the observer
- Danger of direct glare
- Low modelling



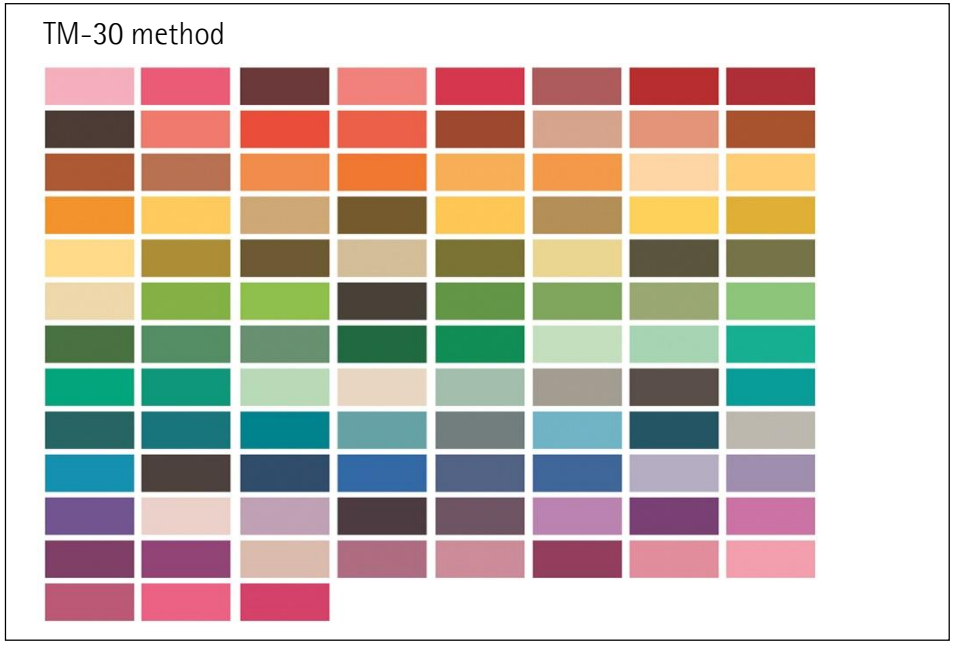
Experiencing

Colour rendering: a quantitative comparison

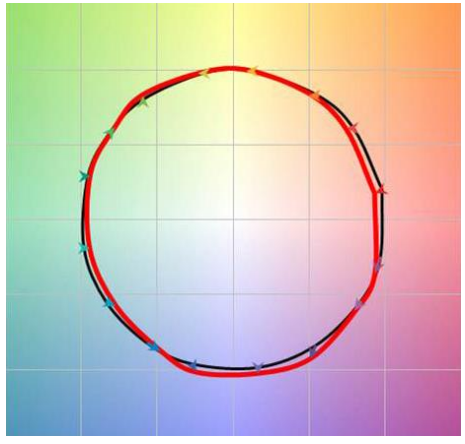
Colour rendering indices: comparison between test light source and reference spectrum

- Determined from calculation
- Not a measure for performance of human colour perception
- Higher colour rendering index does not automatically mean good colour rendering
- Visual sampling is required

Test colours



Colour fidelity – only valid for test colours: does not indicate how good colours are generally rendered.



TM-30 offers visual evaluation of saturation via the colour space

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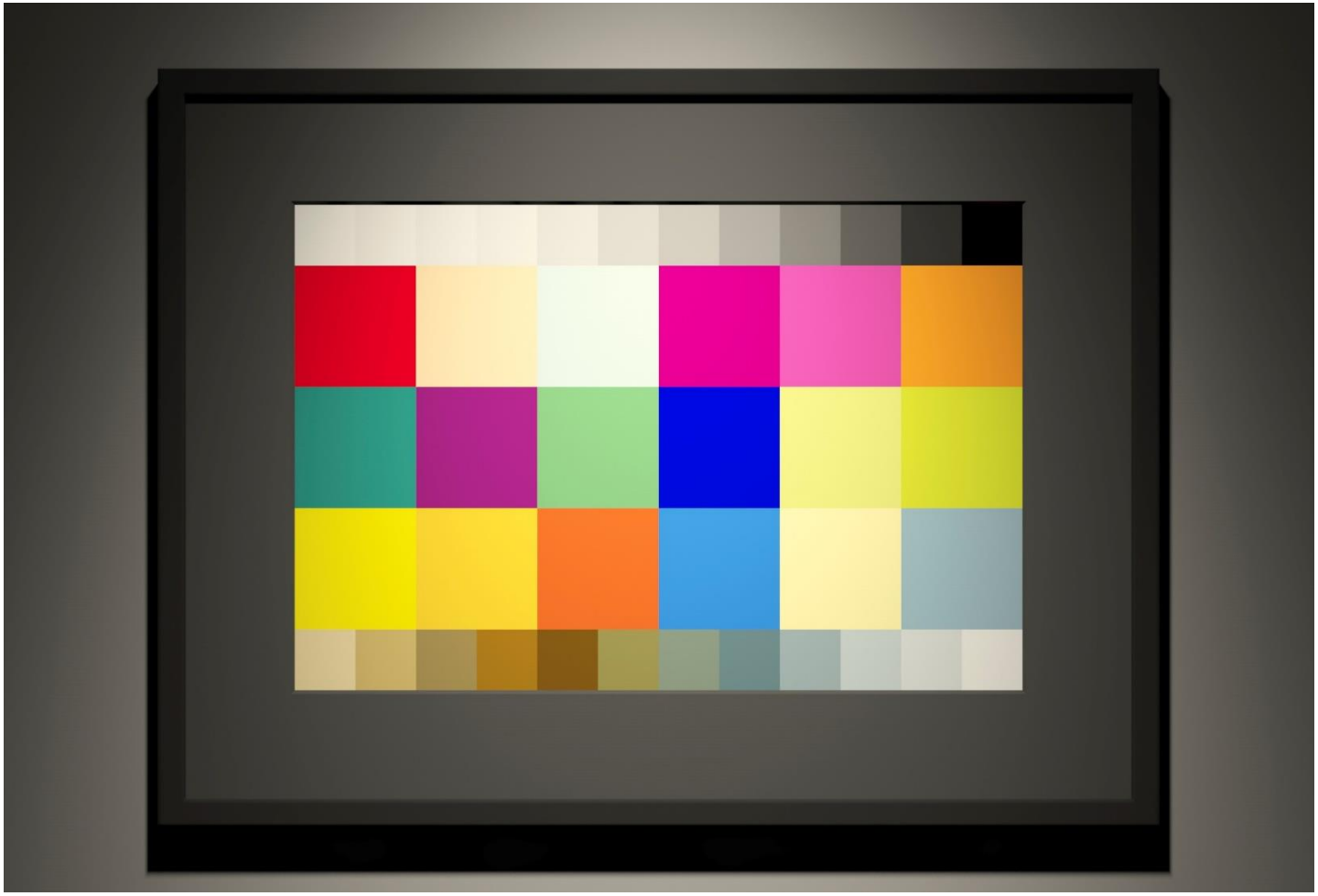
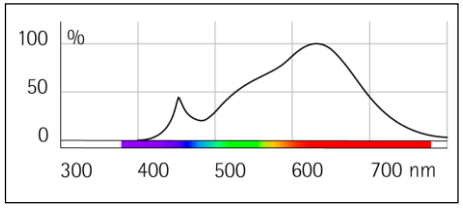
Experiencing

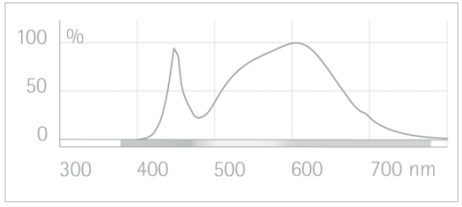
Colour rendering: a qualitative comparison

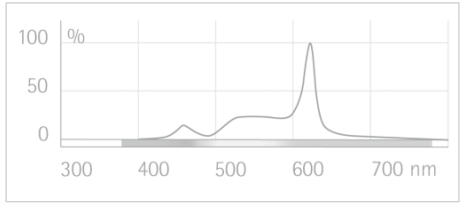
ERCO LED:
3000K, Ra > 90

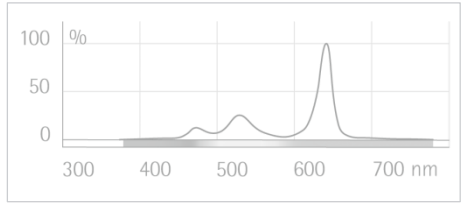
- Wide, balanced spectrum
- Authentic, familiar colour rendering
- Low damage factor











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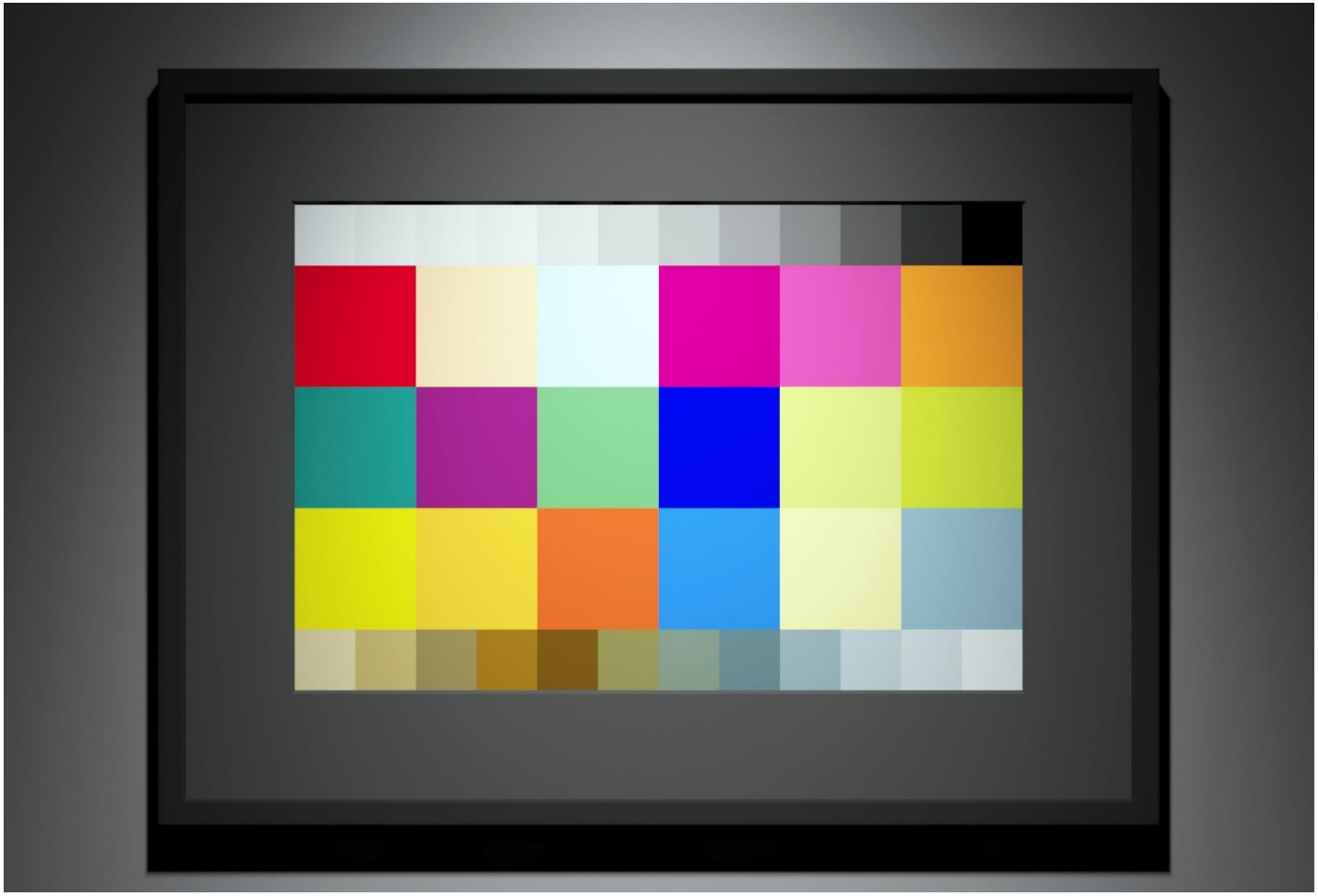
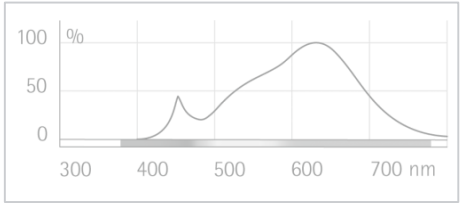
Experiencing

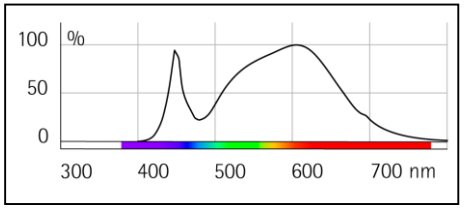
Colour rendering: a qualitative comparison

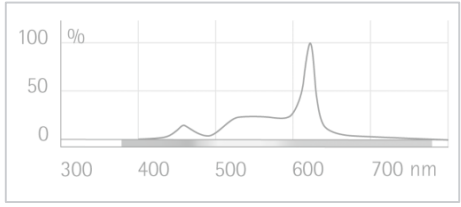
ERCO LED:
4000K, Ra > 80

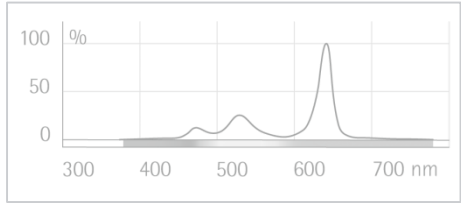
- Wide, balanced spectrum
- Authentic colour rendering
- Colour impression similar to daylight











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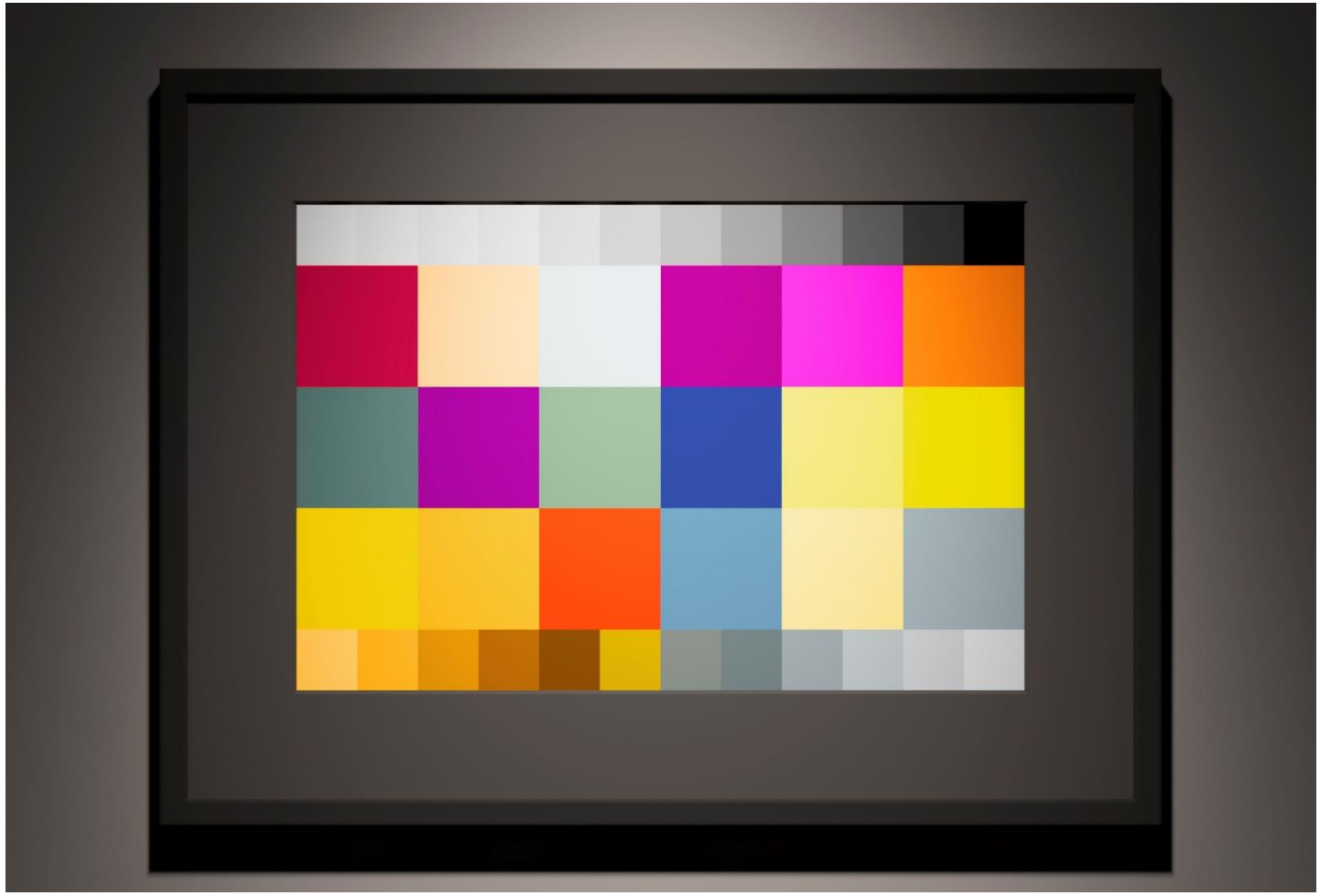
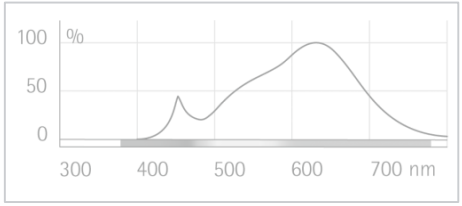
Experiencing

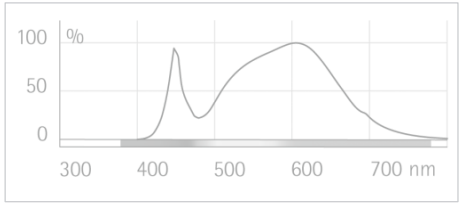
Colour rendering: a qualitative comparison

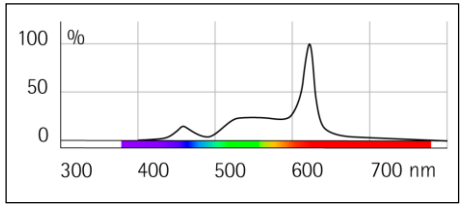
LED module:
2700K, Ra > 90

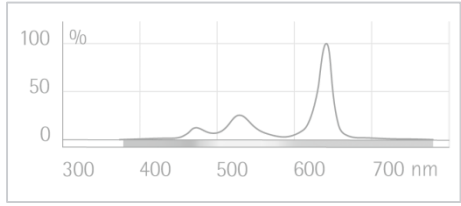
- Modelled spectrum
- Over saturation of certain colours (e.g. red)
- Colour nuances are more difficult to differentiate











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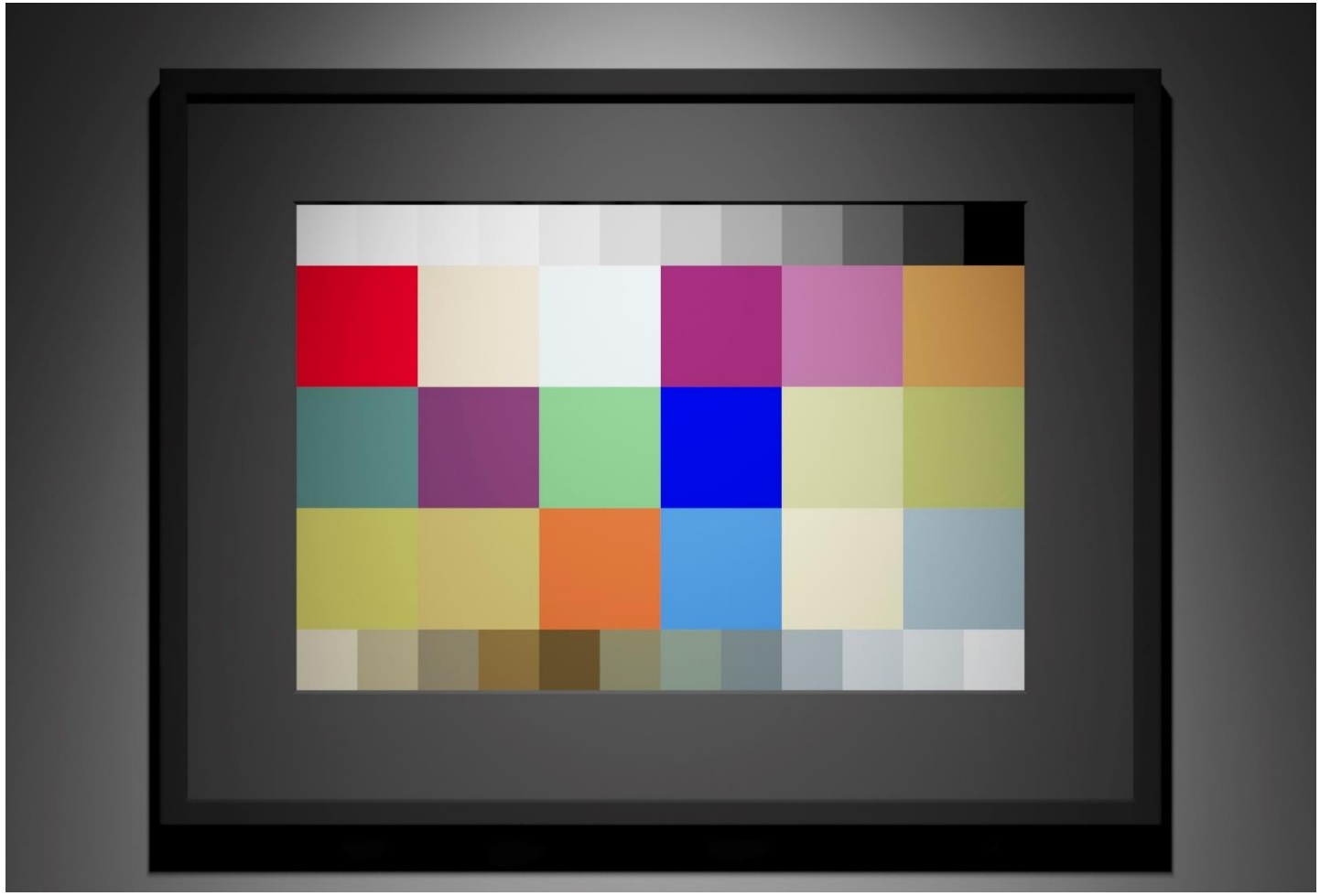
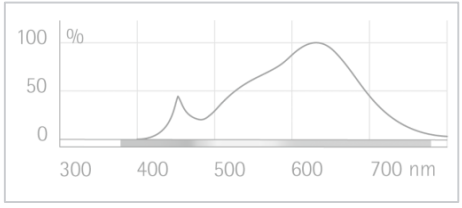
Experiencing

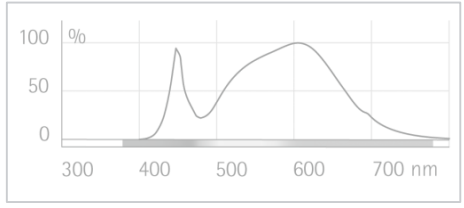
Colour rendering: a qualitative comparison

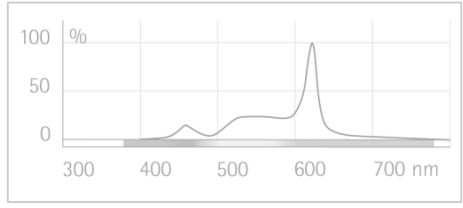
RGB LED:
2700K, Ra < 20

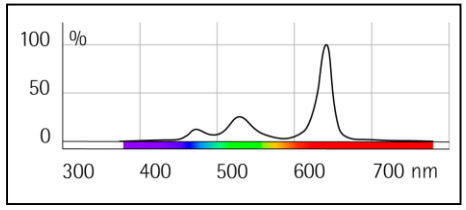
- Gaps in the spectrum
- Only colours can be rendered with a red/green/blue component
- Unsuitable for museum lighting







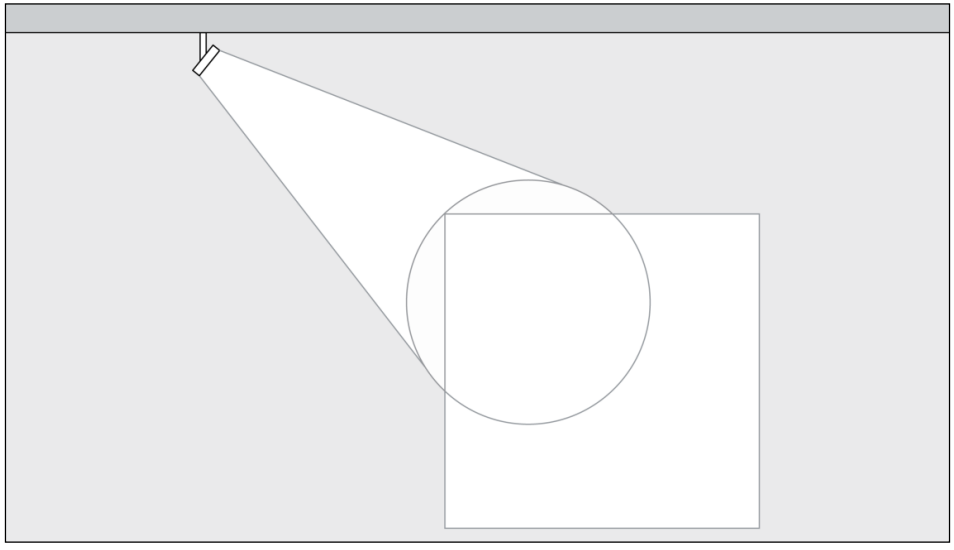


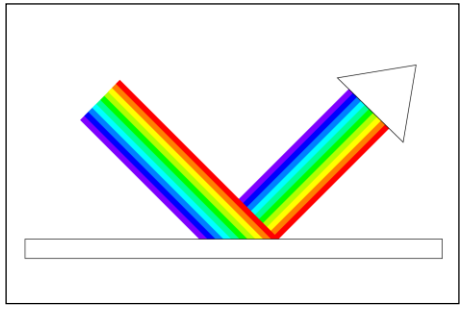


Colour perception: fundamentals

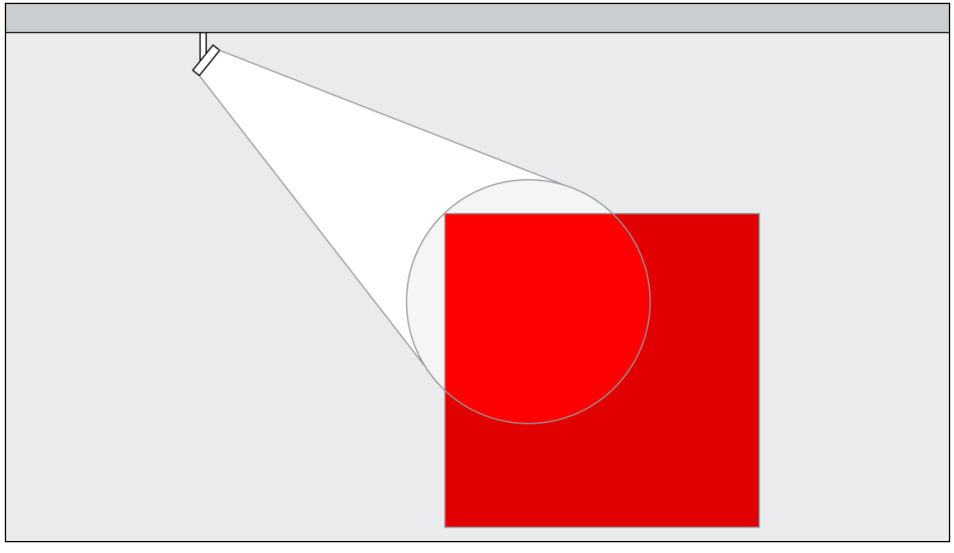
Light colour and object colour

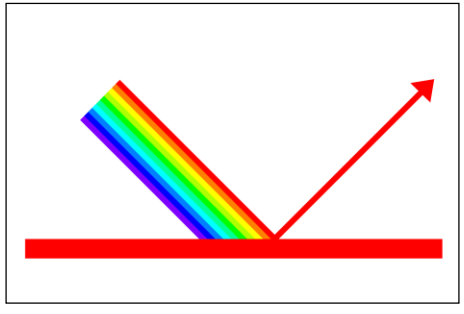
- The colour stimulus depends on the light spectrum and the colour of the object's reflecting material
- White light with a wide spectrum is needed to detect colour nuances
- Only spectral ranges are reflected corresponding to the colour of the object





White light on white objects





White light on coloured objects

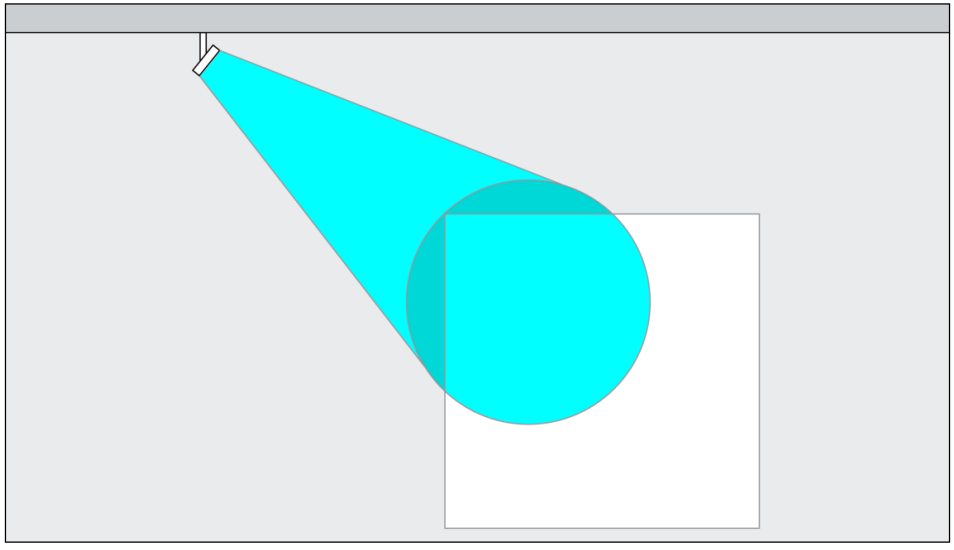
Experiencing

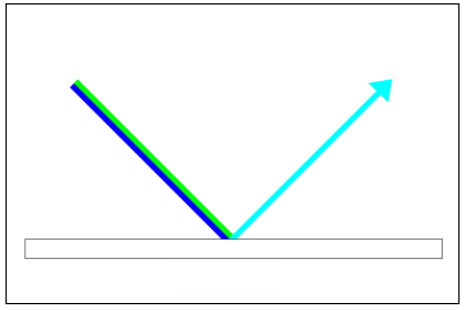
Colour perception: fundamentals

Light colour and body colour

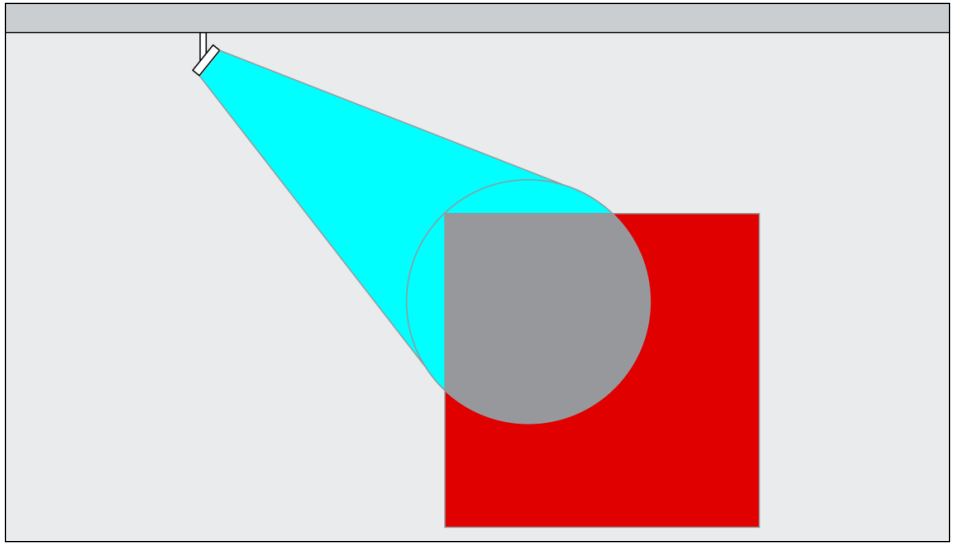
- Colour sensitivity corresponds to the mixed colour of the reflected light

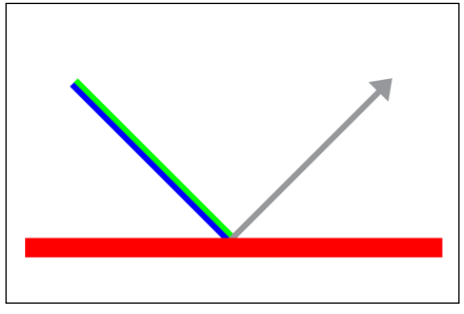
- Missing components in the spectrum cannot be reflected





Coloured light on white objects





Coloured light on coloured objects

ERCO

Conserving

"Leonardo da Vinci/1452-1519" exhibition in the Palazzo Reale, Milan / Italy. Photographer: Dirk Vogel, Altena

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Conserving

Levels of qualitative lighting design

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Conserving

Levels of qualitative lighting design

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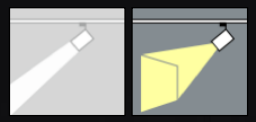
Conserving

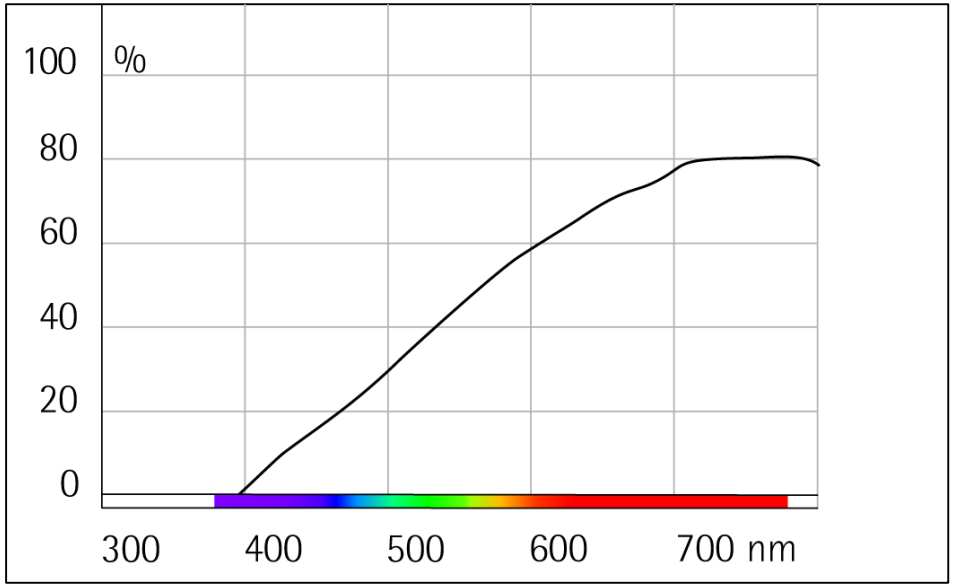
Levels of qualitative lighting design



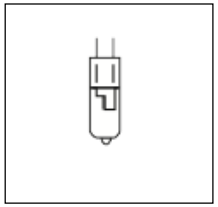
Conserving

Characteristics of electromagnetic radiation

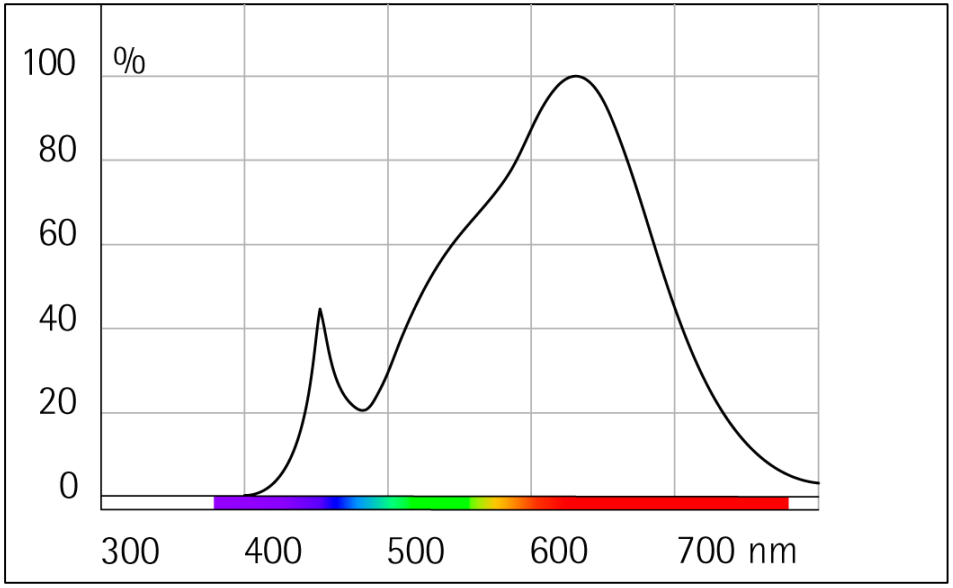
Spectrum of halogen lamps



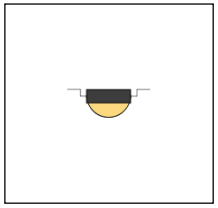
In addition to light, high levels of UV and IR radiation



Spectrum of ERCO LED warm white



Radiation is limited to the range visible for people

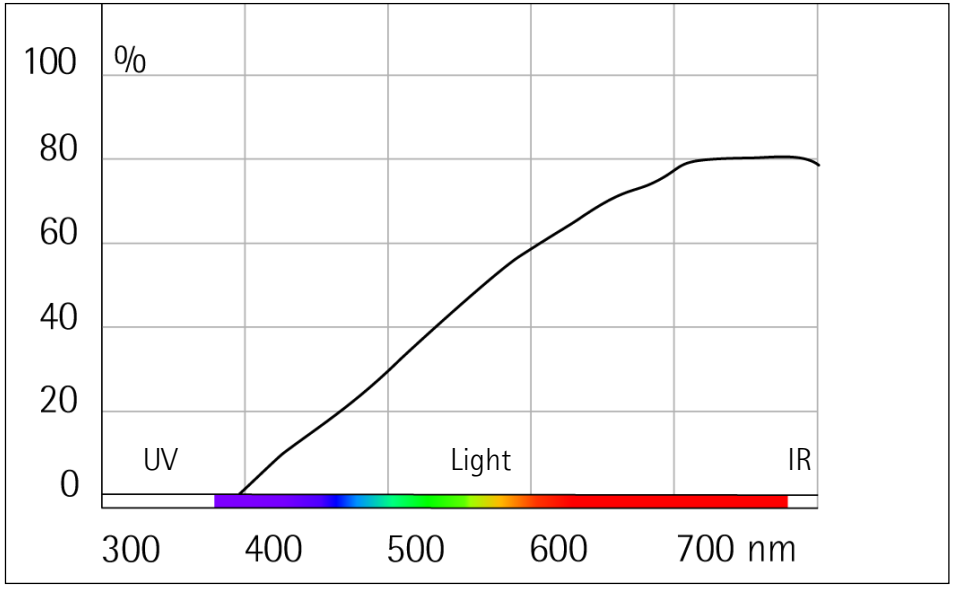


ERCO

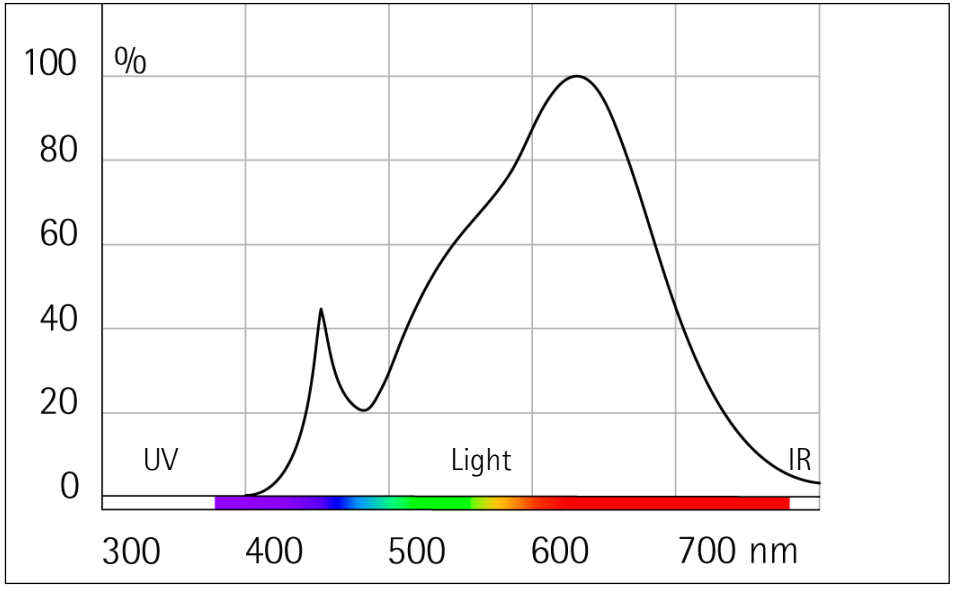
Conserving

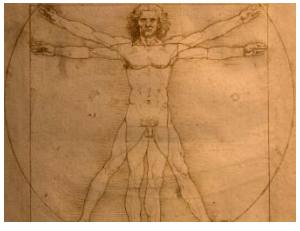
Characteristics of electromagnetic radiation

Possible damage due to halogen lamps



Possible damage due to LED light





UV radiation:
-weathering
-chalking
-yellowing

Light:
-fading

IR radiation:
-chemical, biological or mechanical decay

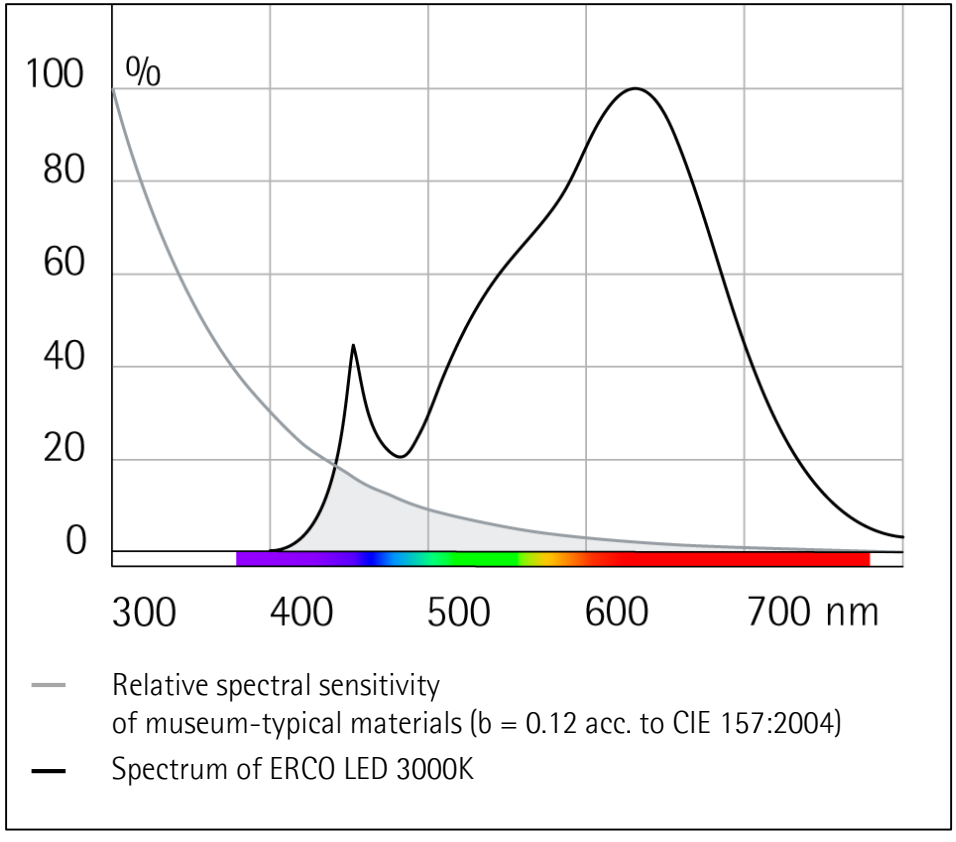
Light:
-fading

Conserving

How to limit damage caused by illumination

Specify light sources with low damage factors

- Short wavelengths have higher damage potential
- Relative damage factor = flat-rate value for museum-typical materials
- LEDs with warm white light colour have the lowest value



Influence of the spectrum:
Blue object colours reflect rich-energy short wavelengths and therefore do not fade as quickly.

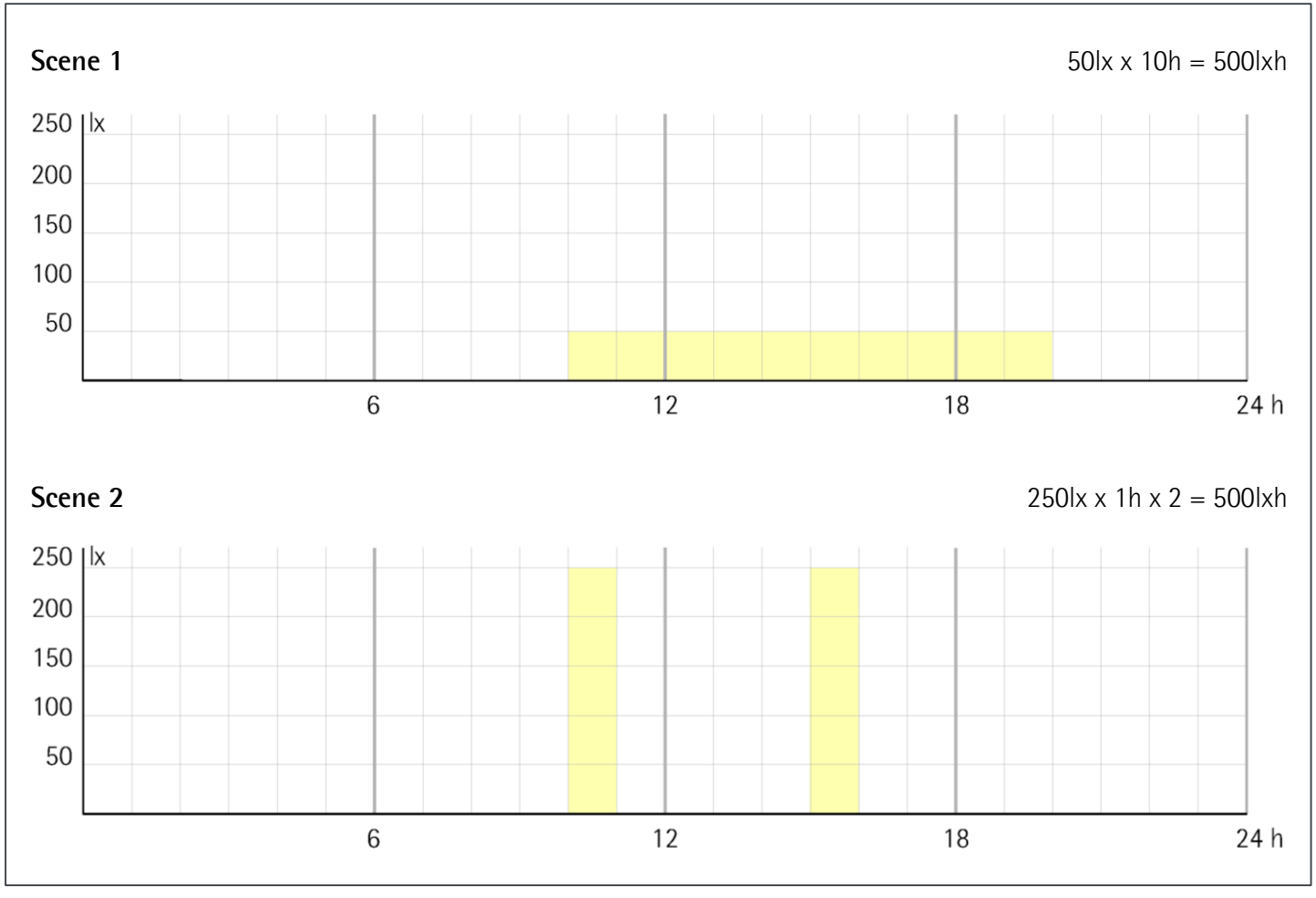
Light source	Relative damage factor f (mW/lm)
ERCO LED 3000K	0.149
QT12-RE with UV filter	0.159
QT12-RE	0.169

Conserving

How to limit damage caused by illumination

Adapt exposure to object sensitivity and visual task

- The less light, the less damage
- But: The less light, the lower the visual acuity
- From a conservation viewpoint, not the lighting level (lx) but exposure (lxh) is decisive



Exposure of exhibits:
Lux hours specify a barely acceptable level of damage but not ideal lighting.

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Conserving

How to limit damage caused by illumination

Determine material categories and exposure

Insensitive

Low sensitivity

Medium sensitivity

High sensitivity

ERCO

Conserving

How to limit damage caused by illumination

Determine material categories and exposure

Insensitive

No limitations

Low sensitivity

200lx at 600,000lxh/a

Medium sensitivity

50lx at 150,000lxh/a

High sensitivity

50lx at 15,000lxh/a

ERCO

Conserving

How to limit damage caused by illumination

Determine material categories and exposure

Insensitive

No limitations

Low sensitivity

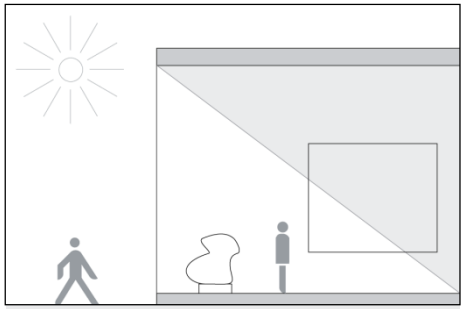
200lx at 600,000lxh/a

Medium sensitivity

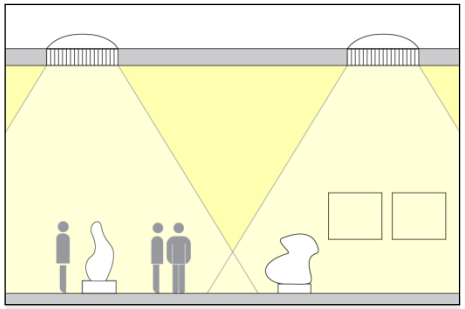
50lx at 150,000lxh/a

High sensitivity

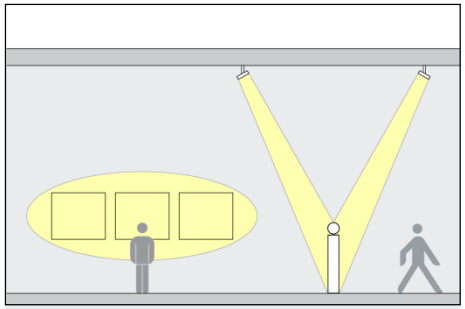
50lx at 15,000lxh/a



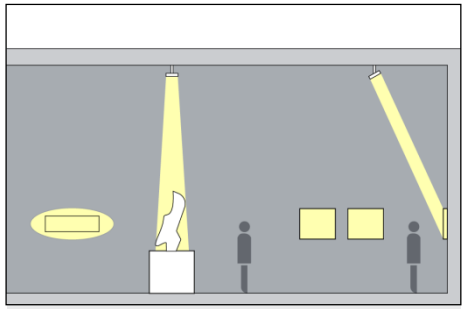
Uncontrolled daylight



Controlled daylight



Limited exposure



Minimum illumination

Where does the 50lx come from in museum lighting?

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Where does the 50lx come from in museums?

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Where does the 50lx come from in museums?

50lx is not conservationally justified but defined from the viewpoint of the observer.

Young people can easily recognise exhibits with bright colour tones and low details at 50lx.

2-3 times the light for rich-detail exhibits, dark colours and older people.

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Challenge for museum lighting

How do museums create impressive visual experiences but simultaneously conserve their exhibits?

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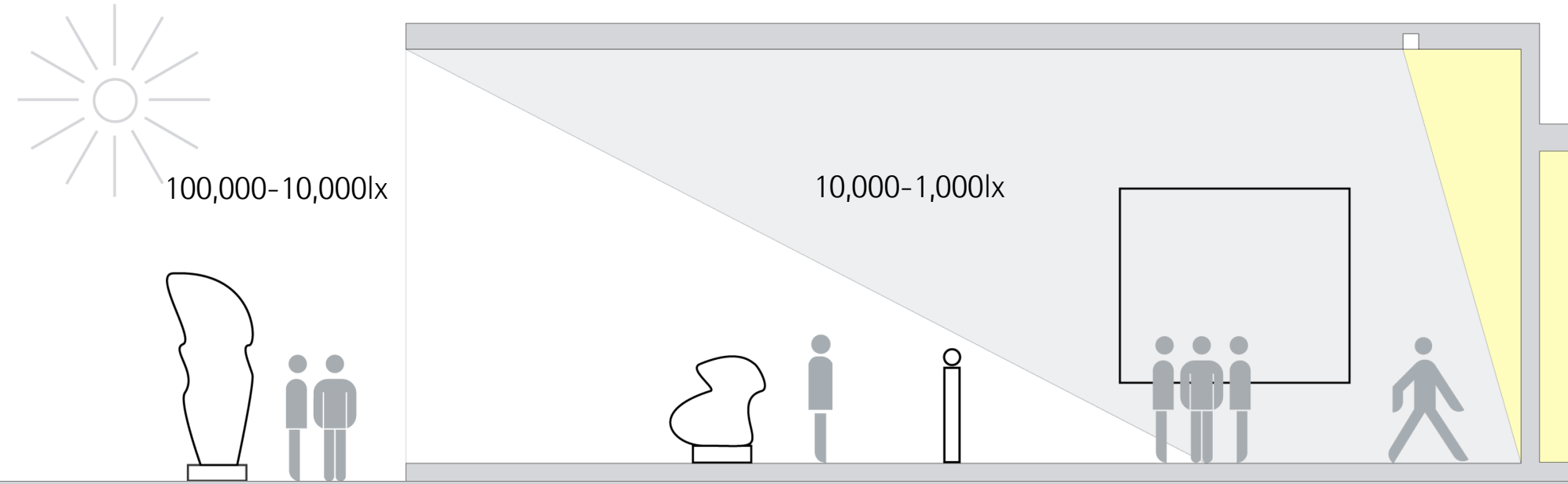
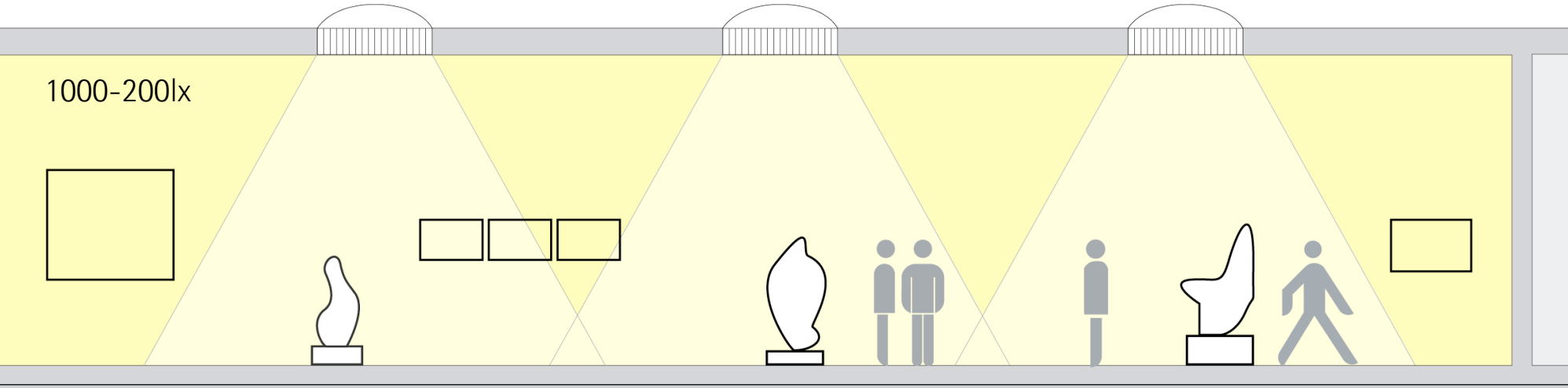
Conserving

Four tips for museum lighting



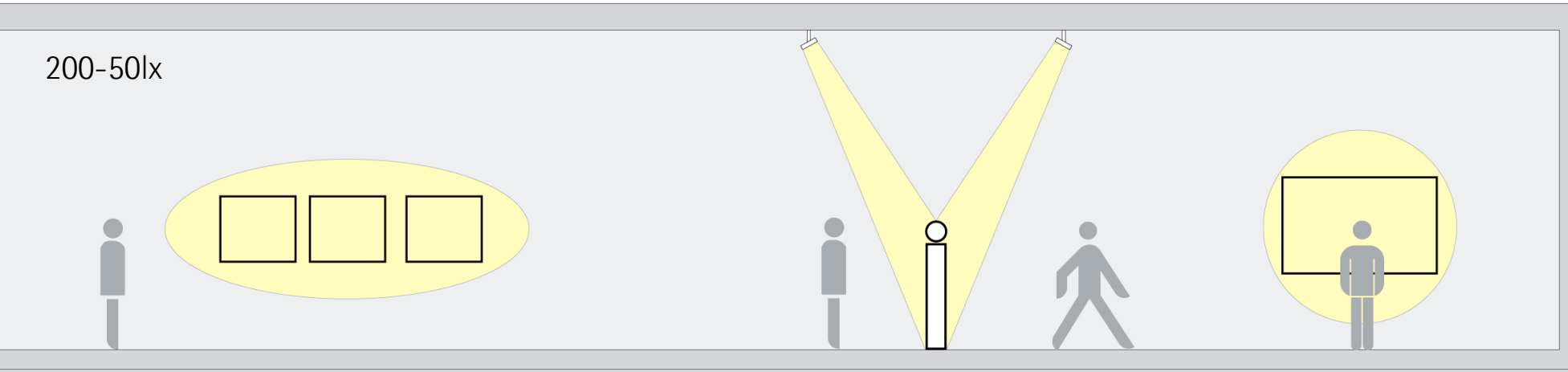
1. Concentrate on vertical lighting

- Guide visitors within controlled light surroundings
- A bright impression of the space despite low lighting levels
- Optimum lighting for paintings
- Good orientation
- Create visual relationships



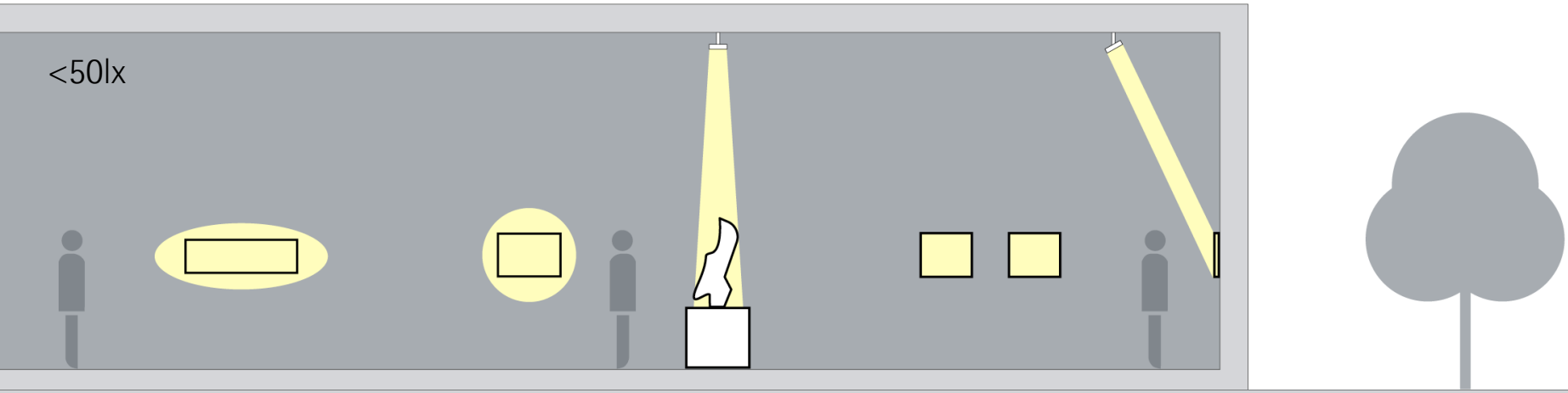
2. Create adaptation paths

- High visual acuity only with an adapted eye
- Adaptation requires time
- Avoid uncontrolled changes in brightness
- Avoid glare caused by luminaires and reflections



3. Utilise the specific characteristics of perception

- Hierarchies in brightness support orientation
- The brightest point is the most important one
- Shadow progressions render spatial forms visible



4. Design based on the dark room

- Striking accents are also possible with 50lx
- Ideal contrast ratio is 1:5 to 1:10
- With low light, increase the contrast with a dark wall colour

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Discovering

Louvre-Lens, Lens / France. Photographer: Iwan Baan, Amsterdam

ERCO

Discovering

Levels of qualitative lighting design

ERCO

Discovering

Levels of qualitative lighting design

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Discovering

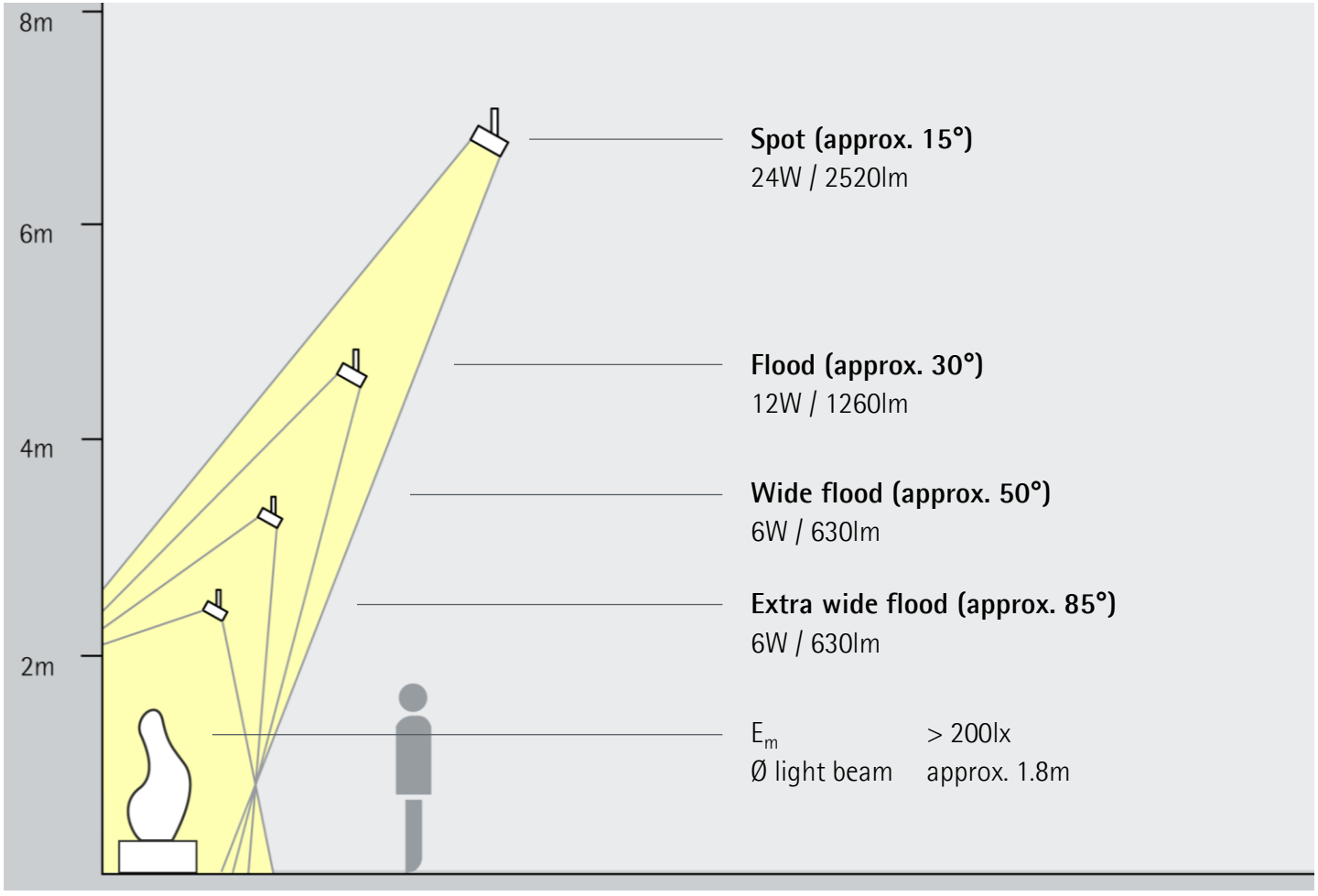
Levels of qualitative lighting design

Discovering

Flexibility in lighting design

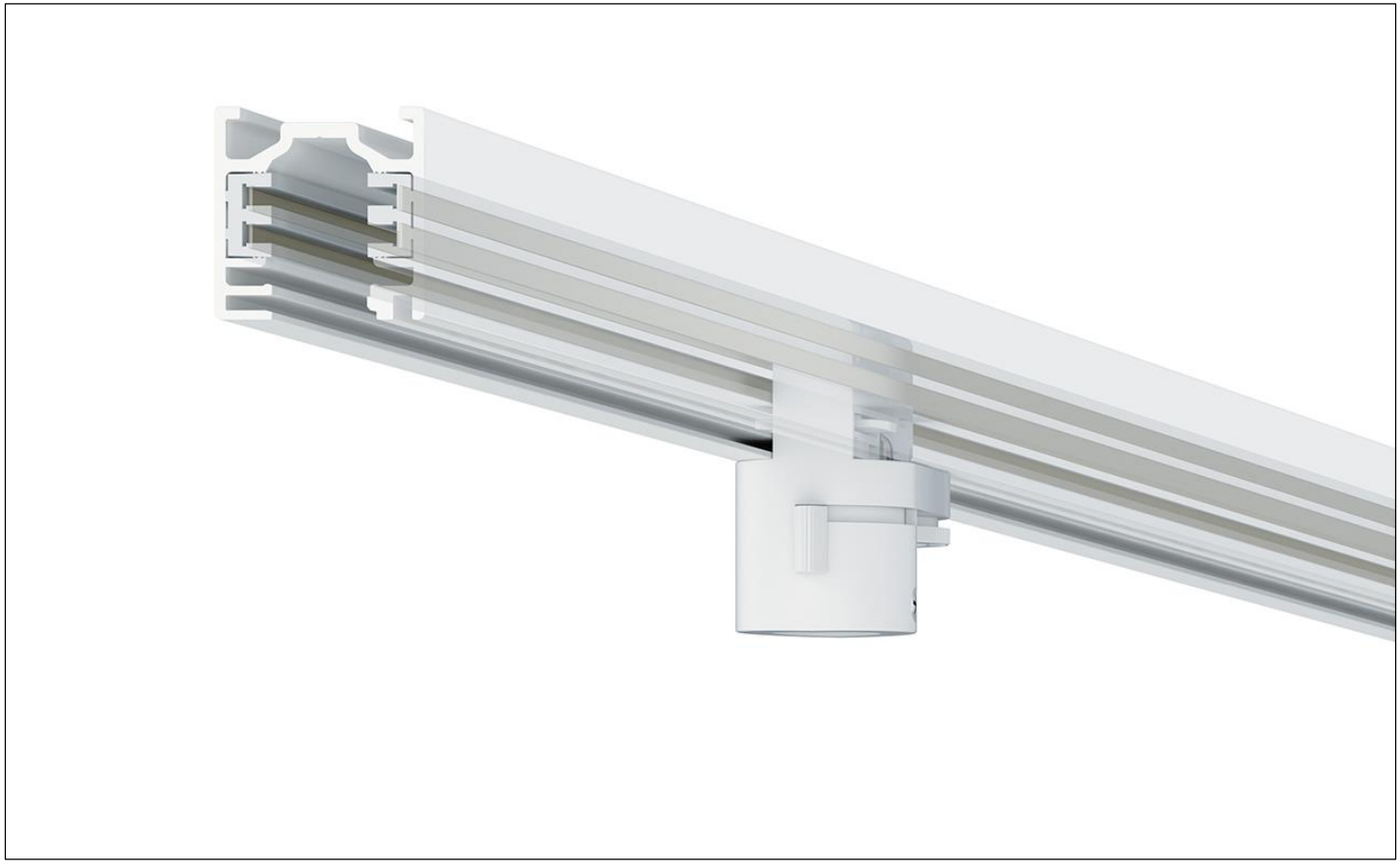
Flexible lighting concepts

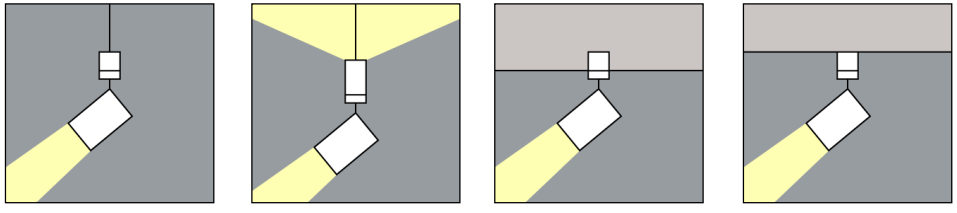
- Design flexibility: interchangeable lenses
- Flexible: cascading performance classes
- Cost control: use next size down if dimming level is below 50%



ERCO tracks

- Flexible infrastructure for lighting
- Emergency lighting with single battery luminaires is possible
- As DALI or 3-phase installation
- Extensive accessories, e.g. schuko sockets, picture hooks and adapters with cable for pendant luminaires



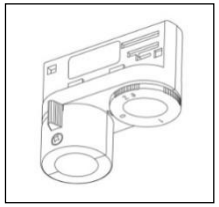


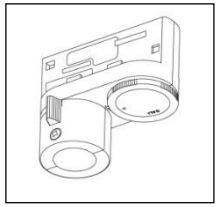
Discovering

Professional use of lighting tools

ERCO track adapter

- Tool-free mounting
- Mechanical fixing and electrical connection in one assembly
- Circuit is selected via rotary button on the adapter





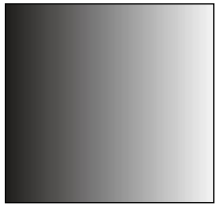
3-phase and DALI adapters are compatible with ERCO point outlets

Discovering

Professional use of lighting tools

ERCO control gear

- In-house developed control units
- For switchable, phase-dimmable and DALI-dimmable light control
- Supplementary potentiometer for manual dimming (with phase-dimmable control gear)



Phase-dimmable down to 1% (mixed dimming)

DALI

DALI-dimmable down to 0.1% (CCR)

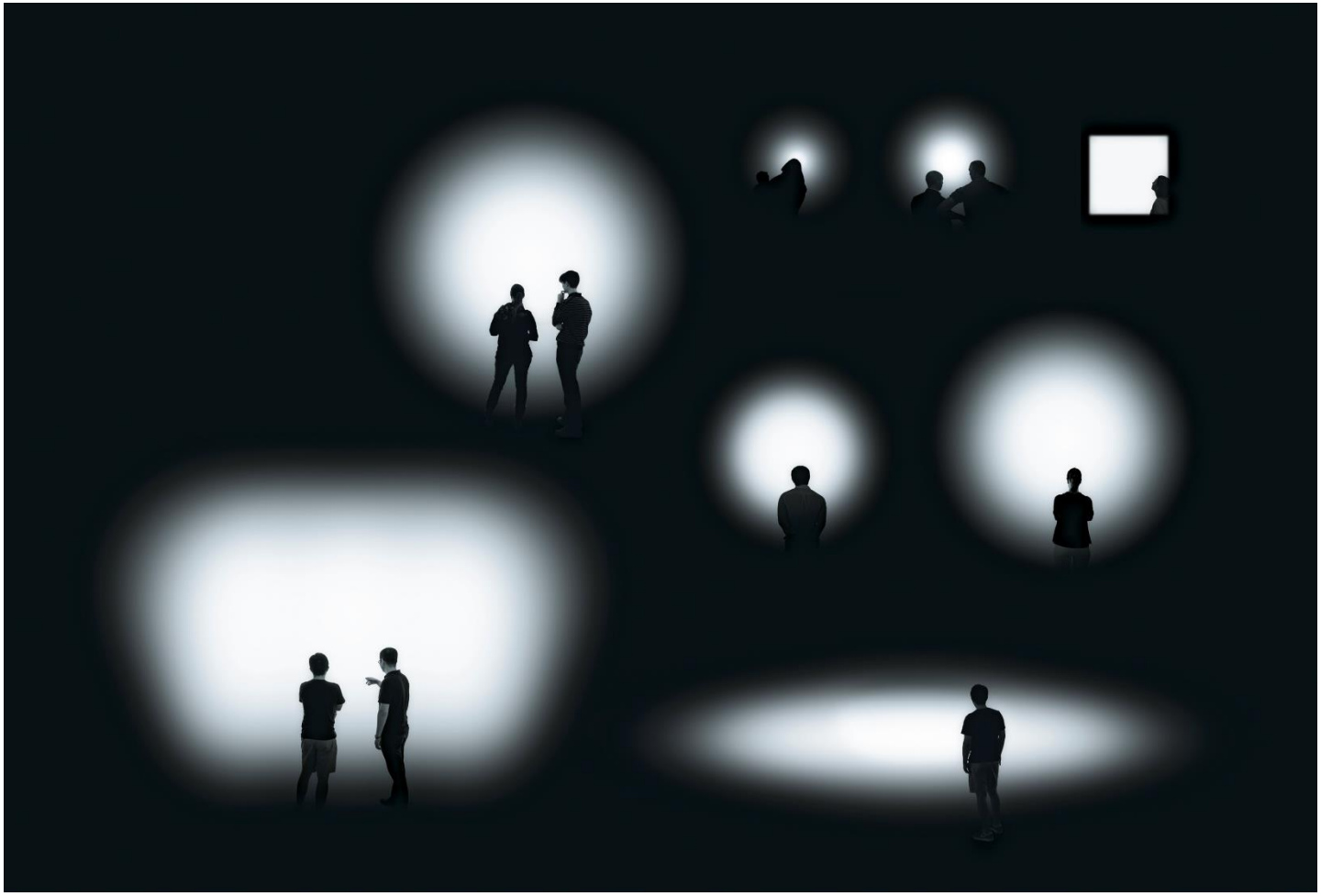
ERCO

Discovering

Professional use of lighting tools

ERCO light distributions

- 7 interchangeable light distributions for track luminaires
- In-house developed / produced lens system
- Projection instead of reflection = precise light beam, no colour shifts, imperfections or spill light
- Accessories for greater visual comfort: snoots, hexagonal baffle, cross baffle



ERCO

Discovering

Overview of light distributions

Spotlights – accent lighting with maximum precision

Striking emphasis of individual pictures via accents

Narrow spot (approx. 6°)	Ø 0.4m at distance of 4m
Spot (approx. 15°)	Ø 1.1m at distance of 4m
Flood (approx. 30°)	Ø 2.0m at distance of 4m

Floodlights – wide-area lighting from short distances

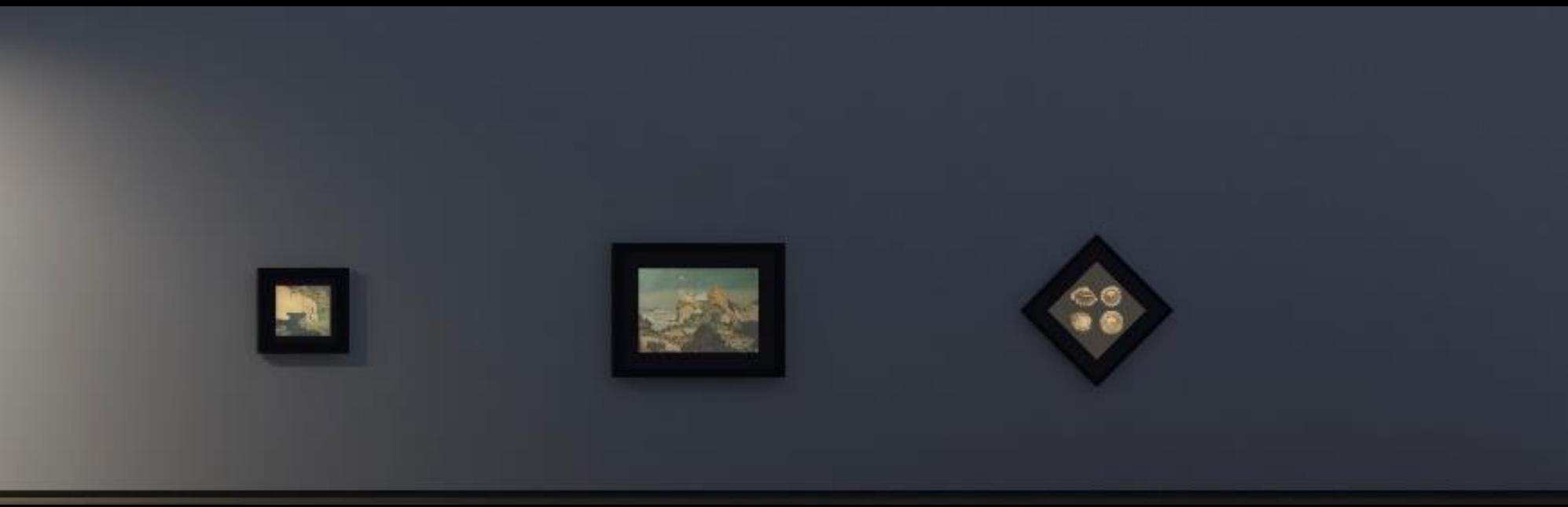
Wide light beam for groups of pictures or large exhibits

Wide flood (approx. 50°)	Ø 3.6m at distance of 4m
Extra wide flood (approx. 85°)	Ø 7.0m at distance of 4m
Oval flood (approx. 65x15°)	Ø 5.0m x 1m at distance of 4m

Wallwashers – perfectly uniform vertical lighting

Uniform illumination for various picture formats and a deep impression of the space

Wallwash	approx. 6 luminaires at 10m with room height of 4m



Contour spotlights – freely adjustable projection planes

A magical impression is created due to freely adjustable light beam

Contour (approx. 23°)	for edge lengths to 1.65m at distances of 4m

Stedelijk Museum, Amsterdam / Netherlands. Photographer: Thomas Mayer, Neuss

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Marketing

Levels of qualitative lighting design

ERCO

Marketing

Levels of qualitative lighting design

ERCO

Marketing

Levels of qualitative lighting design

Global lighting solutions

ERCO lighting solutions comply with demanding conservation specifications, individual concepts for presentation and display and for high visual comfort. Project experience ranges from small, avantgarde galleries to large, renowned museums worldwide.

ERCO

Projects

Lighting analysis for exhibition lighting

ERCO

Projects

Lighting analysis for exhibition lighting

Projects

Lighting analysis for exhibition lighting

ERCO

Projects

Lighting analysis for exhibition lighting

Musée Bourdelle, Paris / France. Photographer: Edgar Zippel, Berlin

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Projects

Emperor's forums, Rome / Italy. Photographer: Vittorio Storaro, Rome

German Museum of Technology (Deutsches Technikmuseum) Berlin / Germany Photographer: Dirk Vogel, Altena

Projects

Louvre-Lens, Lens / France. Photographer: Iwan Baan, Amsterdam

Exhibition "Mies van der Rohe: Collages from the MoMA" in the Ludwig Forum, Aachen, Germany Photographer: Thomas Mayer, Neuss

ERCO

Projects

National Portrait Gallery, London / Great Britain. Photographer: Rudi Meisel, Berlin

Ewha Womans University Museum, Seoul / South Korea. Photographer: Sebastian Mayer

The Feuerle Collection, Berlin / Germany. Photographer: Sebastian Mayer

Hangaram Design Museum in the Seoul Arts Center, Seoul / South Korea. Photographer: Sebastian Mayer

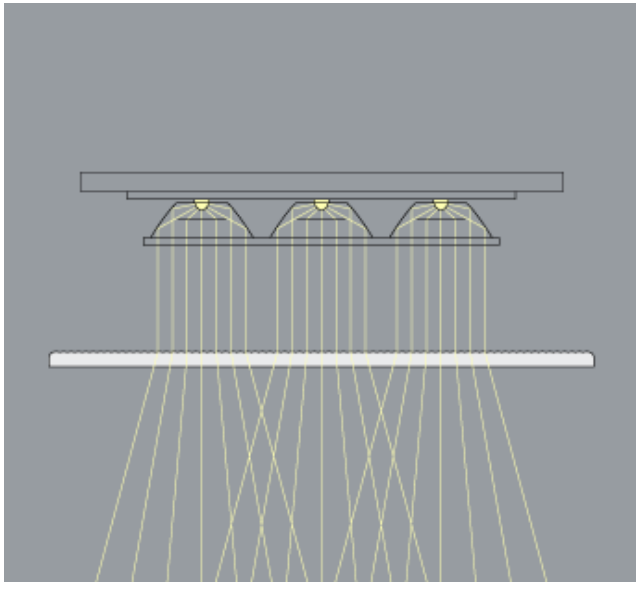
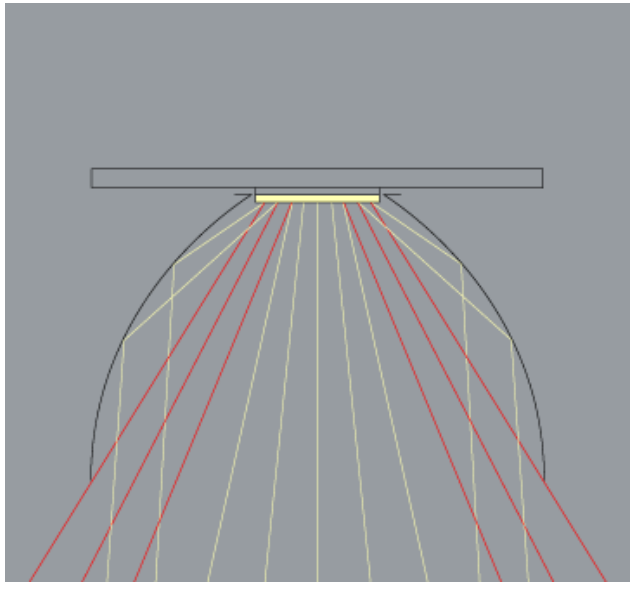
Efficiency in figures

Perception-orientated lighting concepts not only support the storytelling of exhibition organisers, but in combination with precise lighting technology they also reduce investment, installation and maintenance costs for the operators.

ERCO

Case study

Projection- and reflection optics compared

	Projection via lenses	Reflection via reflectors
		
Quality of light and efficiency	- High uniformity - Maximum precision - No imperfections - No colour shifts - Narrow light beams also possible - No spill light losses - Up to 10x higher efficiency (lx/W) compared to reflector luminaires	- Hotspot in the centre - Blurred light beam edges - Not clean beams (e.g. halos) - Partly coloured light cone edges - Only suitable for wide light beams - High spill light losses (red lines)

ERCO

Case study

Achieving unity with vertical lighting

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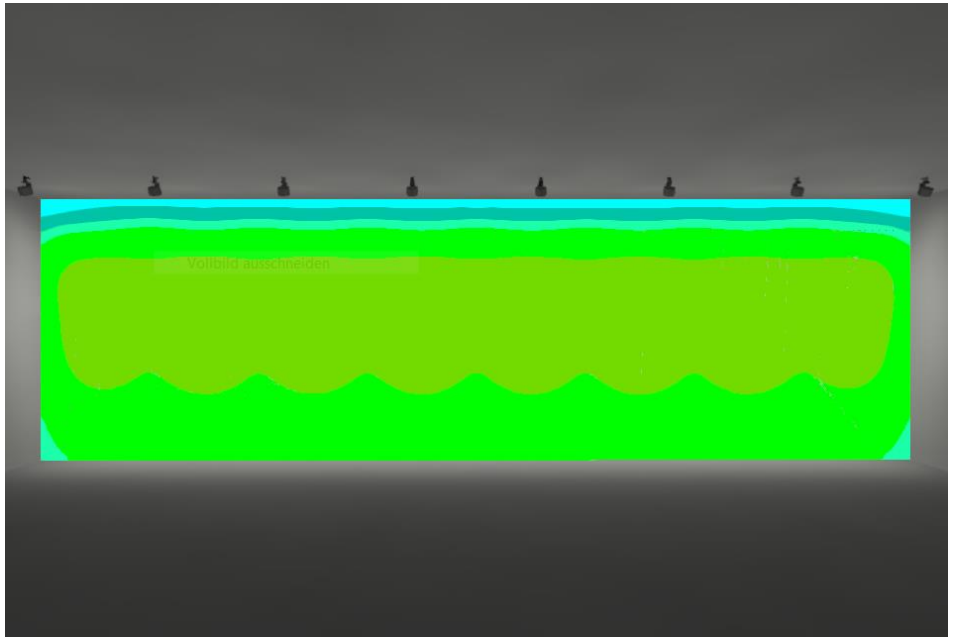
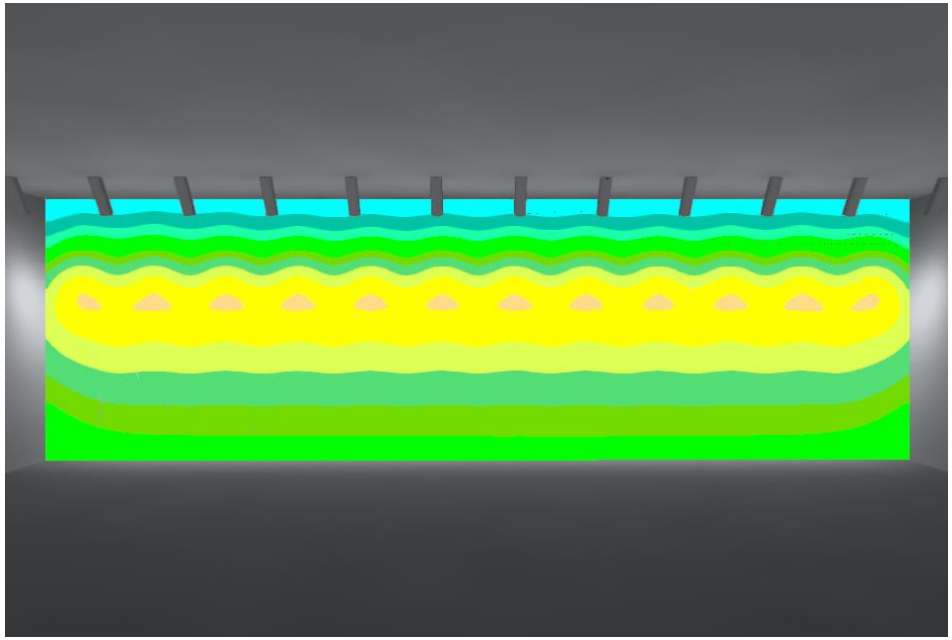
Case study

Achieving unity with vertical lighting



ERCO Spherolit lens technology

Wallwash		
Wattage per area (W/m²)	4.0	
Uniformity (E_{min}/ $\bar{E}$)	0.66	
Luminaires per 10m of wall	8	



Conventional reflector technology

Wallwasher reflector		
Wattage per area (W/m²)	8.4	+ 110%
Uniformity (E_{min}/ $\bar{E}$)	0.5	- 24%
Luminaires per 10m of wall	11	+ 37%

ERCO

Case study

Showcasing with differentiated light distributions

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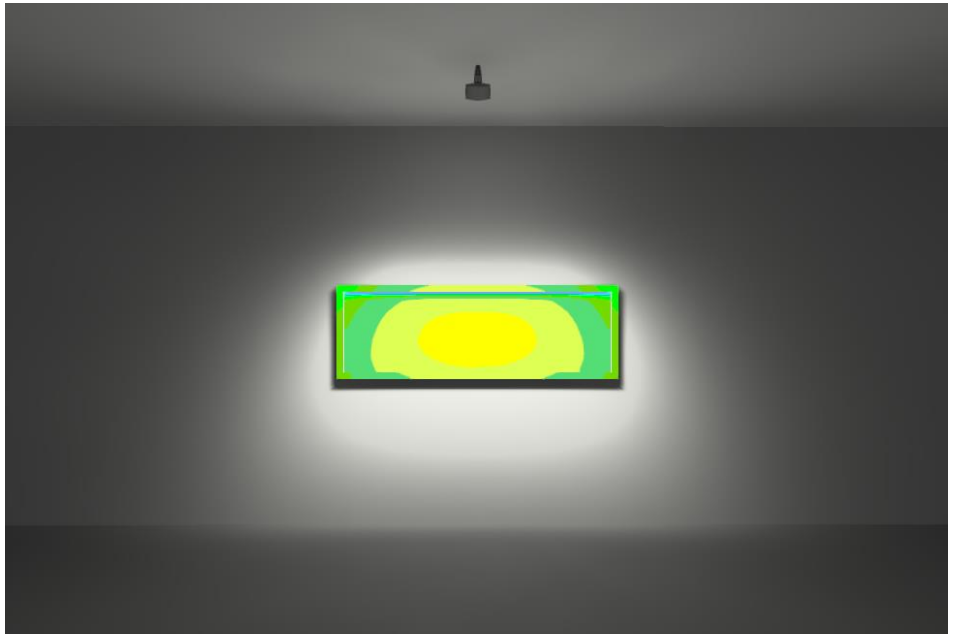
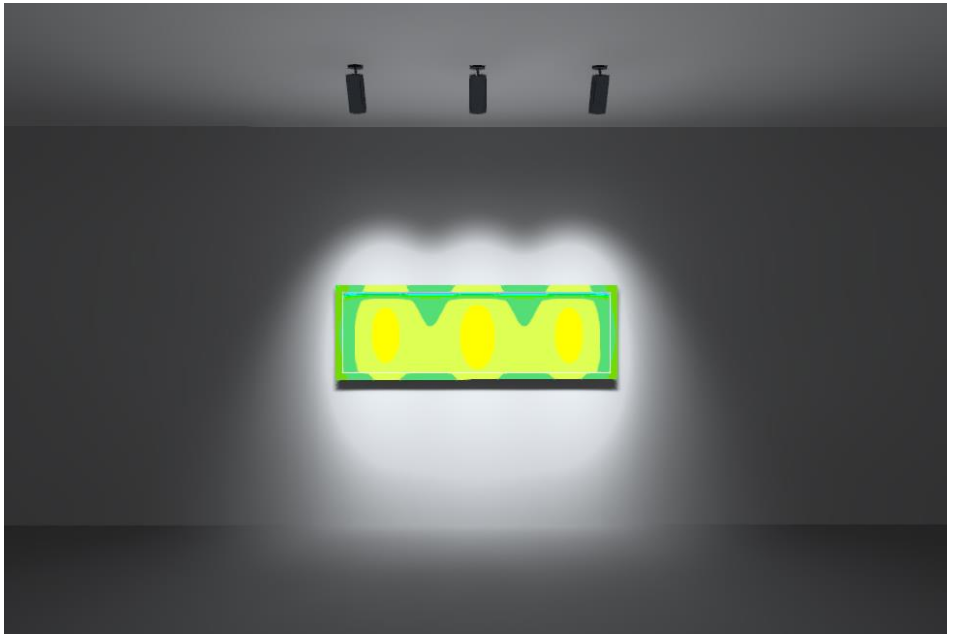
Case study

Showcasing with differentiated light distributions



ERCO Spherolit lens technology

Oval flood		
Connected load (W)	15	
Efficiency (lx/W)	19.0	
No. of luminaires	1	



Conventional reflector technology

Flood reflector		
Connected load (W)	69	+ 360%
Efficiency (lx/W)	6.9	- 67%
No. of luminaires	3	+ 200%

ERCO

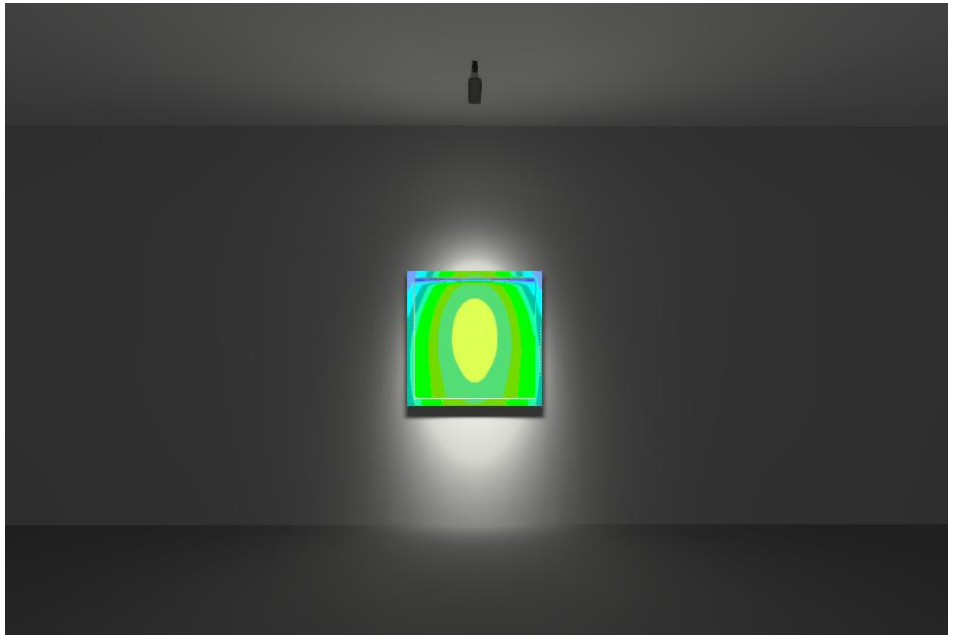
Case study

Creating hierarchies using lighting levels

ERCO

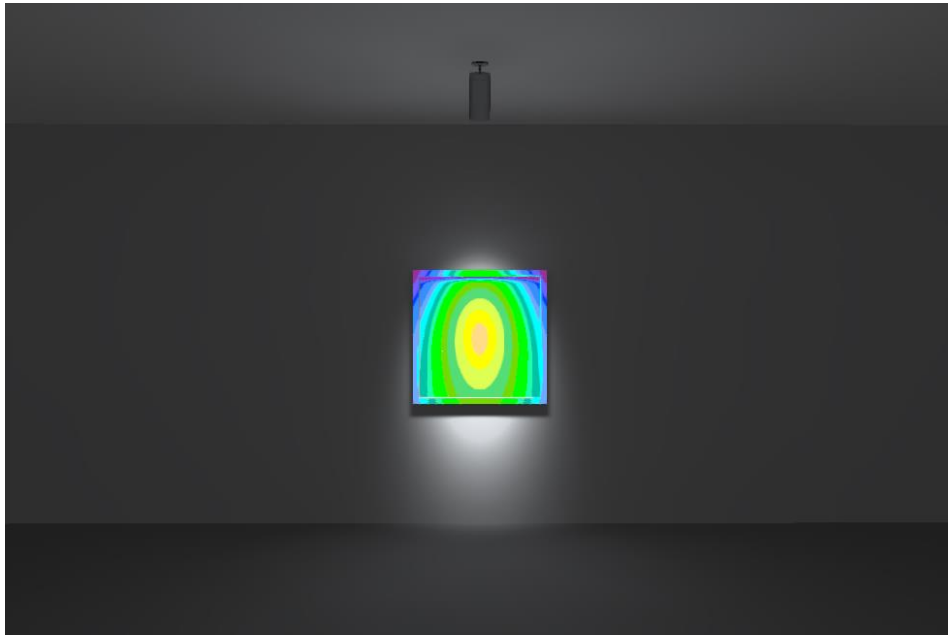
Case study

Creating hierarchies using lighting levels



ERCO Spherolit lens technology

Spot		
Connected load (W):	8	
Efficiency (lx/W)	35.1	
Illuminance (lx)	281	



Conventional reflector technology

Spot reflector		
Connected load (W):	17	+ 113%
Efficiency (lx/W)	15.4	- 56%
Illuminance (lx)	261	- 7%

Light for impressive exhibitions

The diverse range of lighting tasks in galleries and museums demand a flexible light infrastructure. Only in this way do exhibition organisers gain the flexibility to impressively execute their concepts.

ERCO

Culture - Light for Art

Luminaire system

ERCO

Culture - Light for Art

Holistic designs with ERCO

A flexible infrastructure of light for inspiring, perception-orientated displays of art.

Brilliant LED light with excellent colour rendering for maximum conservation requirements.

Precise, interchangeable light distributions for impressive experiences of art.

Culture - Light for Art