Enlighten your Brain – Health Aspects of Human Centric Lighting

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What is Human Centric Lighting?

What is the goal?
Maximizing Energy Efficiency?

Energy Efficiency

Human Health Aspects
# Human Centric Lighting

Considers the non visual effects of light on humans

<table>
<thead>
<tr>
<th>Visual effects</th>
<th>Non visual effects</th>
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<tbody>
<tr>
<td>• Intensity</td>
<td>• Activation</td>
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<td>• Contrast</td>
<td>• Circadian rhythm</td>
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<td>• Patterns</td>
<td>• Inner clocks</td>
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<td>• Movements</td>
<td>• Vigilance</td>
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<td>• Cognition</td>
<td>• Hormones</td>
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<td>• Information</td>
<td>• Well being</td>
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</table>
What is important for Human Centric Lighting:

The combination of
- Radiance
- Spectrum
- Solid angle

and
- Timing

(The right light to the right time!)
What is new?

Human Eye
First evidence of a novel photoreceptor in the human eye in 2001

Rapid Report

An action spectrum for melatonin suppression: evidence for a novel non-rod, non-cone photoreceptor system in humans

Kavita Thapan, Josephine Arendt and Debra J. Skene

Centre for Chronobiology, School of Biomedical and Life Sciences, University of Surrey, Guildford, Surrey GU2 7XH, UK


Action spectrum for melatonin regulation in humans: evidence for a novel circadian photoreceptor.

Brainard GC et al.

J Neurosci 21, 6405-6412, 2001
Intrinsic photosensitive Retinal Ganglion Cells (ipRGC) (3-5% of all ganglion cells)
Retinal “lightflow”

Ganglion Cells

Rods and Cones

Light

Picture: sciencemuseum.org.uk (2007)
Retinal Ganglion Cell
Entrainment and Activation

Visual

Pineal gland - Melatonin

„Activation-Circuit“

„Entrainment-Circuit“

SCN

Light
Entrainment: Synchronisation „inner environment“ with „outer environment“

Activation: Alerting effects of light

PET/fMRI Scan shows activation

Melatonin rhythm

Vandewalle & Dijk 2009
What can Human Centric Lighting do?

- Stabilize the hormonal rhythms
- Enhance Melatonin during the night
- Improve sleep and regeneration
- Activation and more vigilance during the day
- Enhance Resilience against stress
- Less chronodisruption from artificial light
What is proven in scientific studies? Example 1

Lighting for health and well-being in education:

- In educational environments optimized lighting has positive effects on mood, performance, social behavior and also on physical health and wellbeing\(^1,2,4,5,8-11,13\)

- Lack of blue light in the morning can delay the circadian clock, and can lead to tiredness\(^3,12\)

- Tree Dutch studies report better performance in concentration and fewer errors on optimized lighting compared to their controls with standard light\(^10\)

- Lack of daylight has influence on cortisol levels and negative effects on health\(^11\)
Lighting for mental wellbeing, performance and health at work places:

The effect of light on employees’ wellbeing depends on the intensity level during the workday.

More intense light may –

- boost employees’ feelings of alertness and vitality\(^2,6,9,11,12,14\)
- influences individuals’ ability to sustain attention and cognitive performance\(^1,3,5,7\)
- Enhance brain responses\(^13\)
- Light levels during daytime working hours can improve sleep during the subsequent night\(^17,39,40\).
Example: Time of light

According to DIN EN 12464-1 or ASR A3.4

1 Vertical illuminance at eye level
Thank you for your attention!

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**Literature Lighting in Education**

Literature: Lighting for mental wellbeing, performance and health at work places
