SMART SSL AND DAYLIGHTING A HARMONIZATION ?

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LIGHTING 4.0 – JOINING DIFFERENT WORLDS

Problem

- strictly separated fields of operation
  - artificial lighting – part of the electric installation
  - daylighting – part of façade construction and sun shading
- caused by different trades in building construction

Vision

Using the lighting hardware infrastructure in buildings for complex data acquisition and controls in an Internet of Things to provide new services for the end users.

Can this change *break down the barriers* and shape an *integrated approach?*

DAYLIGHT INTEGRATION

predictive control strategies -
sensor technologies -
shading technologies -

1. Energy saving

DAYLIGHT INTEGRATION

2. Daylight utilization

- optimal illumination
- supplement artificial light

2.1 Visual and Emotional

conditions to „see“ -
mental performances -
mood and impression -

2.2 Non-Visual

- physiological processes
- well-being, health

predictive control strategies -
sensor technologies -
shading technologies -

1. Energy saving

NON-VISUAL EFFECTS – INFLUENCING FACTORS

I **time of day**
(with respect to individual sleep time)

II **light exposure**
(of the last hours)

III **light intensity**
(at eye level)

IV **light spectrum**
(at eye level)

Walch et al. (2016): A global quantification of normal sleep schedules using smartphone data

BIOLOGICALLY EFFECTIVE LIGHTING – 2 APPROACHES

1. Night time approach:
Avoiding of harmful effects of light during the night time

- Melatonin suppression
- Minimisation of the blue light component
- Adjusted intensity at night time

Preventing of long-term disturbance of the circadian rhythm scientifically proven

2. Day time approach:
Increasing the positive impacts of light in the daytime

- Increased intensity at daytime
- Usage of cold white lighting
- Supporting the daylight

Positive health based impact is scientifically only vague proven

"Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity." (WHO)

A LITTLE BIT OF UNCERTAINTY IN BIOLOGICALLY EFFECTIVE LIGHTING

Current standard

DIN SPEC 67600:2013-4 (Biologisch wirksame Beleuchtung – Planungsempfehlung)

Problems

- Only for rooms with a residence time of a few hours
- Colour shifts due to the room interior has to be considered
- Daytime: CCT = 8000K, Nighttime: CCT = 2700K
- …

Critics

KAN (Kommision für Arbeitsschutz und Normung):

DIN can not and shall not be used as basis for any applications

THE VISION – INTEGRATED CONTROL SCHEME

Control strategy under consideration of

- Visual and melanopic needs
- Intelligent sensor technology
- Human-Machine interfaces
- Energy demands

There is *no free lunch.*

BIOLOGICALLY EFFECTIVE LIGHTING – STATE OF THE ART IMPLEMENTATION

1. Daylight focused approach:
(Maximized daylight utilization; minimized artificial lighting usage)

2. Intervention focused approach:
(Activation on specific times of the day; Daylight substitute in winter)

Synthesis

Maximum Daylight utilisation (Daylight systems usage)
&
Complemental artificial lighting (hourly/ seasonal timed)

PSYCHIATRIC CLINIC SLAGELSE DENMARK

Lead Consultant and architect: Karlsson architect/VLA
Photographer: Jens Lindhe

BARTENBACH R&D OFFICE AUSTRIA

A BRIEF EXCERPT FROM A LIGHT LOGGING

A BRIEF EXCERPT FROM A LIGHT LOGGING

Achieving something

good

by doing something

evil

SSL AND DAYLIGHTING A HARMONIZATION

Contemporary lighting controls

- are artificial but are thought and act as if they were natural
- don't consider user specific requirements or demands
- are not able to reflect the changeability of the environment

Future lighting controls

- must provide technological solutions to social problems
- must accept the end user as part of the system to be able to reflect the systematic complexity
- must be highly embedded into social structures to be able to fully utilize daylight under all aspects

Lighting is
technology.
But it is
for people.

BARTENBACHS LIGHT HEALTH INITIATIVE

1. Aims

- pre-competitive platform to discuss existing knowledge & needs
- conduct collaborative studies to increase knowledge

2. Results

- lighting design guidelines
- white papers summarizing state of science

PHILIPS Research

coeLux

Projektleuchten

APPENDIX – LITERATURE

Canazei et al. (2016) Acute effects of different light spectra on simulated night-shift work without circadian alignment.

KAN-Positionspapier „Künstliche, biologisch wirksame Beleuchtung und Normung“ (Stand 15.05.2017)
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DIN SPEC 67600:2013-04 „Biologisch wirksame Beleuchtung – Planungsempfehlung“ (Stand 15.05.2017)
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Pohl W. (2014) Einfluss von Licht auf den Menschen und daraus resultierende Tageslichtlösungen. *ZEBA* Fachtagung – Paradigmen auf dem Prüfstand, Innsbruck

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Canazei M., Dehoff P. (2011) Wirkungen von dynamischem Licht auf die Produktivität am Industriearbeitsplatz. *FNL 27* Tagung, Berlin

Canazei M. (2011) Licht und Beleuchtung von Büroarbeitsplätzen. *ORGATEC* Messe, Dortmund

Canazei M., Pohl W., Bauernhofer K., Papousek I, Lackner H.K., Bliem H.R., Marksteiner J., Weiss E.M. (2017) Psychophysiological effects of a single, short, and moderately bright room light exposure on mildly depressed geriatric inpatients: a pilot study. *Gerontology* doi:10.1159/000455231

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