Swiss SSL Workshop 12.12.2016

View of a lighting design company on HCL

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Light

visual

non-visual

personally

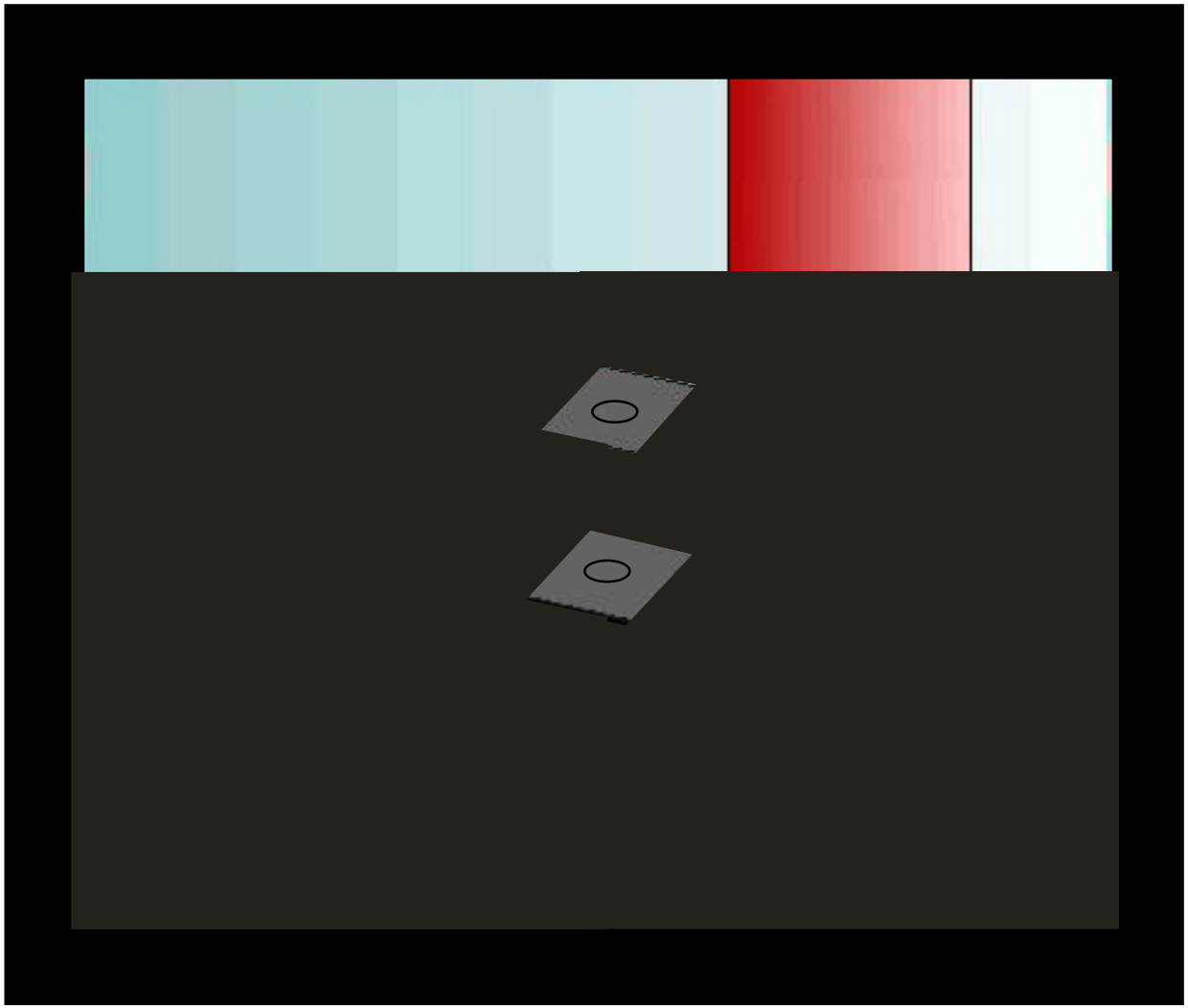
You need light to ……..

- See (visual perception)…..
- feel good (emotion, well-being)…..
- create special atmospheres, appearances, (emotion)…..
- enjoy the beauty (emotion)…..
- trigger your circadian rhythm (health)…..
- create preventive and therapeutic effects (long term health effects))…..
- relax and to activate (short term health effects)…..
- optimize working conditions (> performance, alertness)
- etc.

Most effects of light are unconscious and not perceivable !

Visual perception

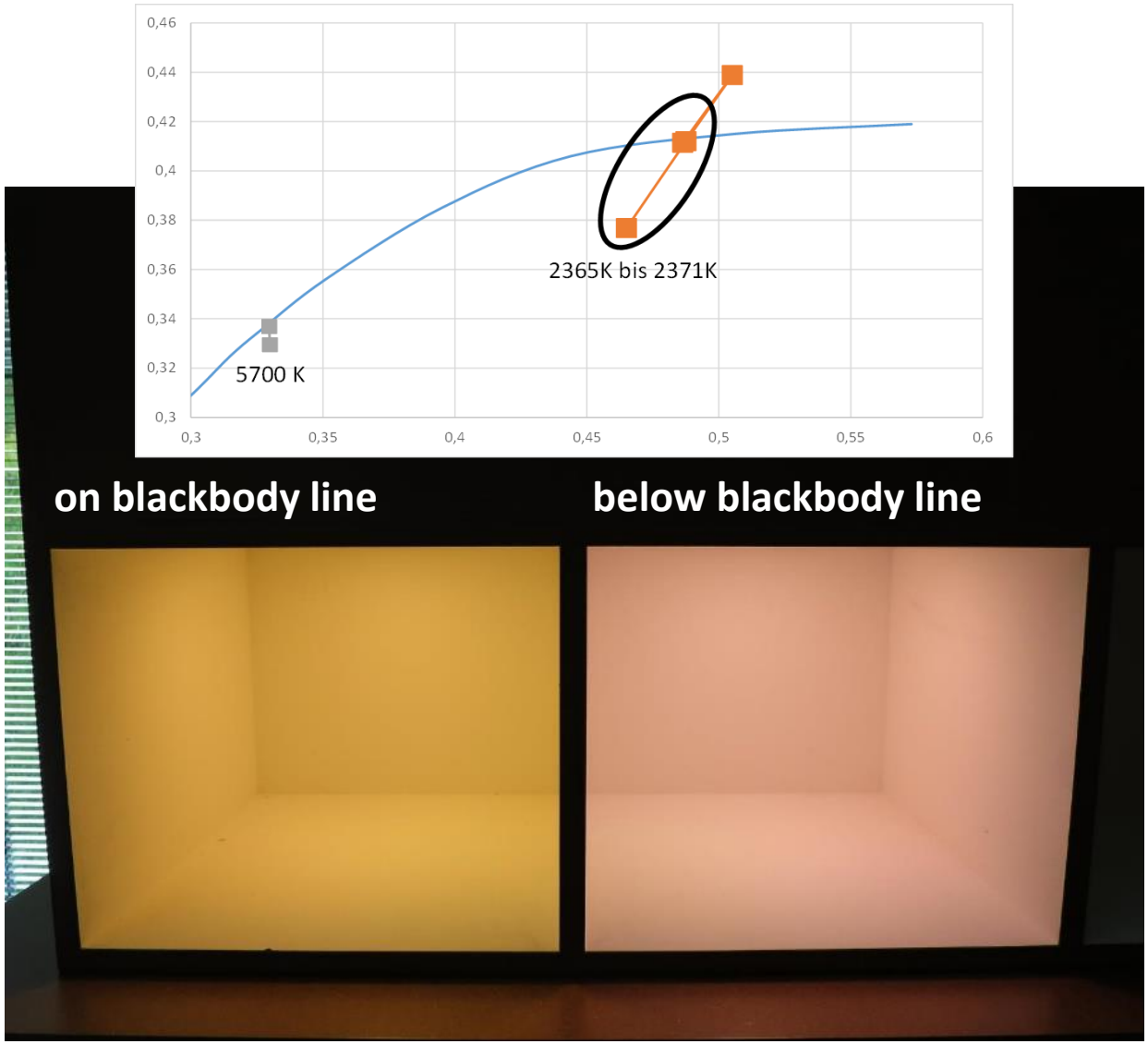
Seeing is a mental process



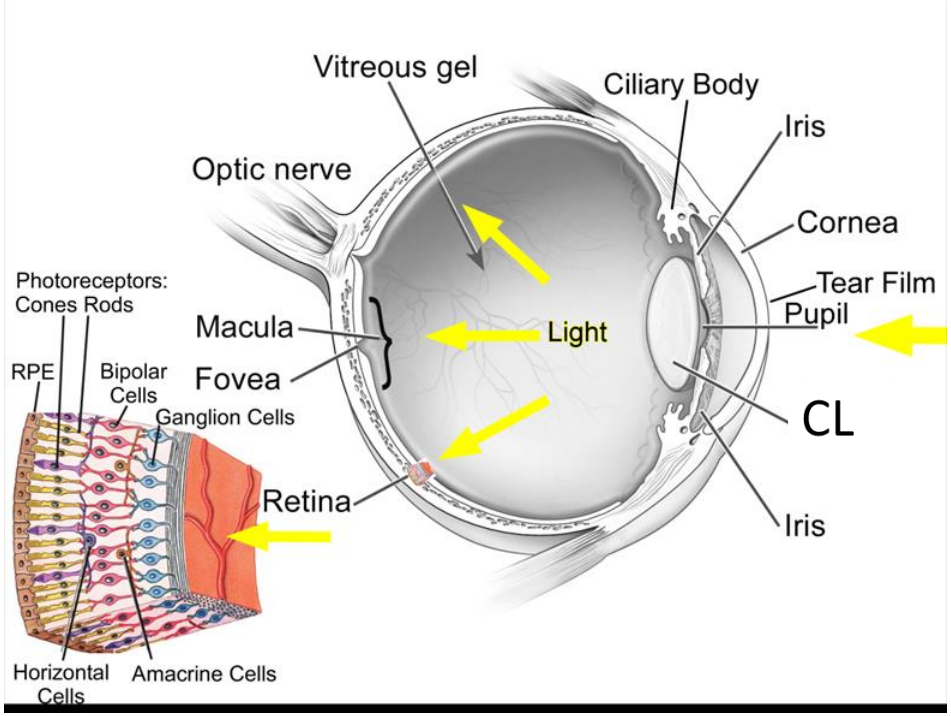
Physics

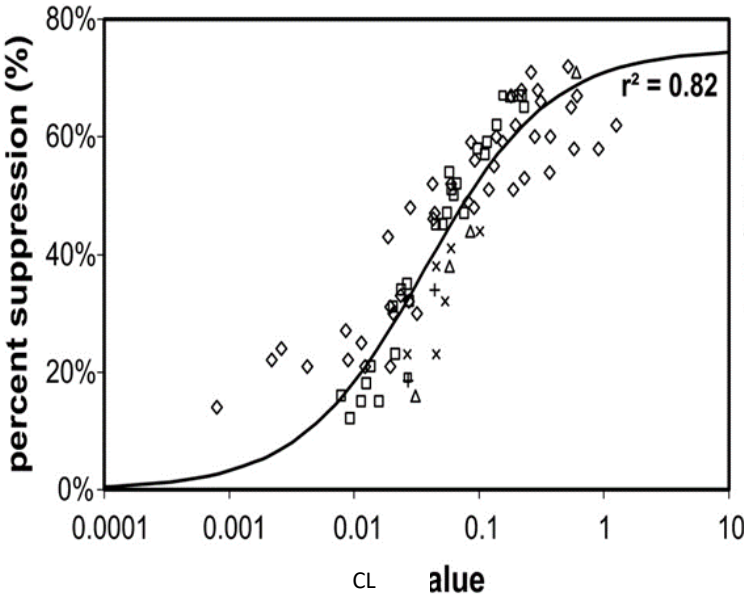
Psychology

Spectral Quality



Third receptor





intrinsically photosensitive retinal ganglion cells (ipRGCs)

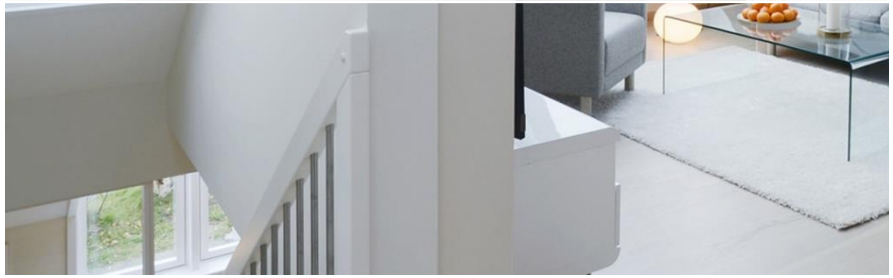
Explanation of Terms

http://business.transworld.net/news/how-to-balance-your-work-and-personal-life/#PtrCgCMCueFeSUGS.97

Integration

Daylight utilisation

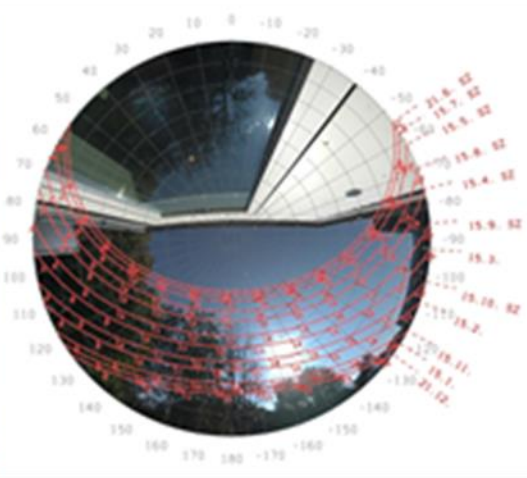
Utilisation of daylight for optimal illumination, supplement with artificial light
Predective control

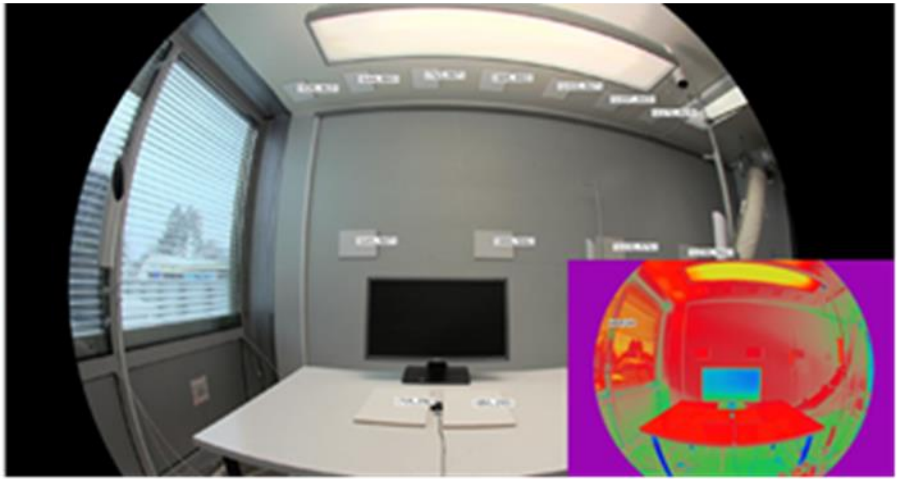


Energy efficiency

Efficient and energy saving solutions by clever control (e.g. occupancy sensors)

Integrated lighting control scheme





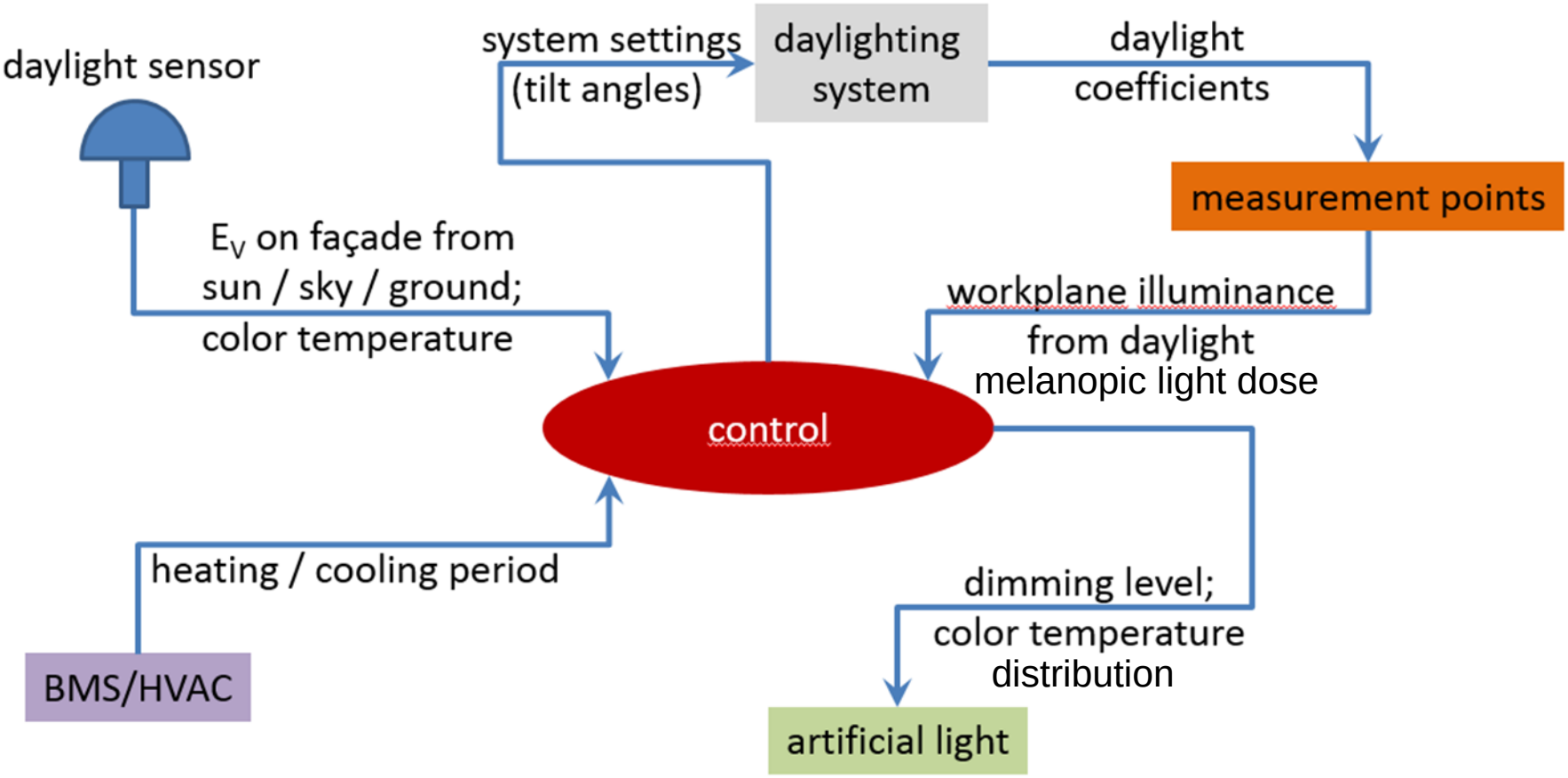
Need for an integral control for day- and artificial light

Consideration of

- Visual and melanopic needs
- Intelligent sensor technology
- Interface human – machine

- Energy demands

Integrated lighting control scheme



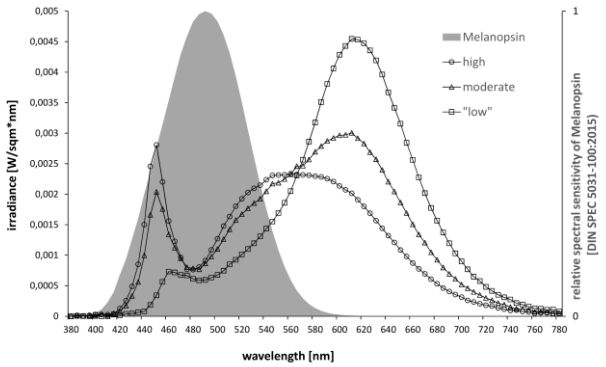
Current Research projects – shift work study

- **Aim:**

Investigation of acute cognitive, subjective, visual, and physiological nighttime effects of different white light spectra with varied portions of short wavelengths, fulfilling current lighting standards

- **Methods:**

N=31 healthy subjects, cross-over design, simulated night-shift paradigm, three light spectra with attenuated portions of blue light



Current Research projects – clinic study

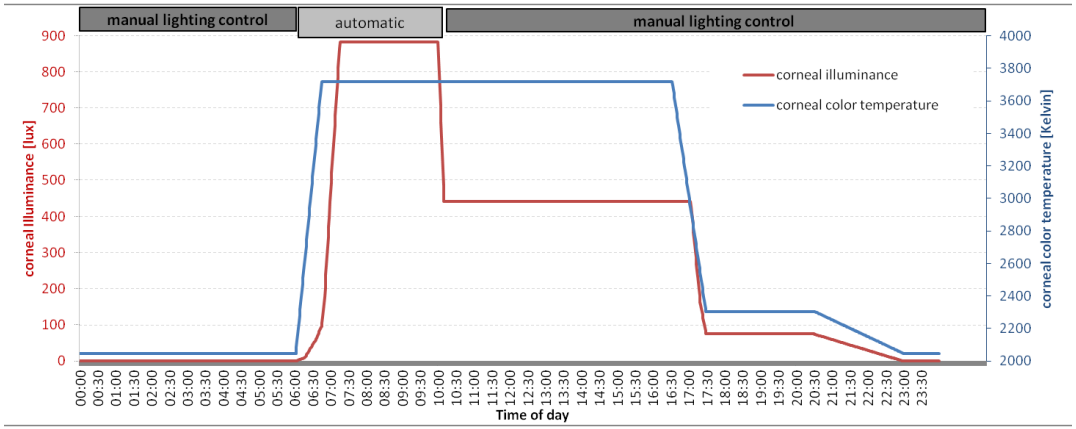
❑ Aim:

Investigation of potential effects of a dynamic ambient illumination on neonates

❑ Methods:

- ❑ randomized, controlled clinical trial;
- ❑ n=46 (dynamic light), n=45 (standard light);
- ❑ delivery mode: elective cesarian section;
- ❑ primary outcome measure: accelerometry (neonates and mothers);
- ❑ 24 hour light control scheme;

www.daqtix.com



Current Research projects

Dynamic illumination of a hospital ward and a domestic dining room

During the day

In the evening

At night

Research Initiative – LightⒷHealth

Mission:

- ❑ generate and consolidate knowledge on biodynamic light effects
- ❑ derive objective and application-driven lighting design recommendations

Participants:

research institutes, end users, lighting industry, lighting designers

current partners: PHILIPS ZUMTOBEL CREELUX Projektleuchten UNI GRAZ tirol kliniken

Output:

- ❑ Applied research in different application areas (clinics, offices)
- ❑ White papers summarizing state of science & biannual workshops
- ❑ Handbook of basic lighting design principles for biodynamic lighting

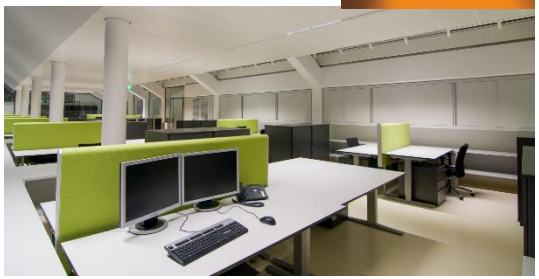
Bartenbach R&D Office, Aldrans, AT

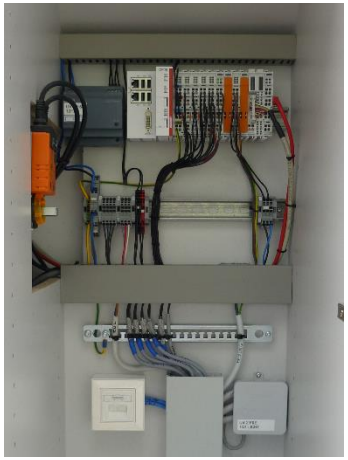
Comprehensive retrofit of office: daylight solution, artificial lighting solution, control, interior redesign

Bartenbach R&D Office, Aldrans, AT

Daylight solution: exterior louvers with varying distance between slats optimized for location, additional screen for luminance control

Artificial lighting solution: architecture integrated, max. 1250lx, 14W/m^2 installed, @ 500lx < 6W/m^2 , CCT 2200K – 5000K





Control: sensors for occupancy, workplane and exterior illuminance, wind speed, temperature

Interior design: redesign of interior surfaces, acoustical ceiling, acoustical panels

Lighting Design projects

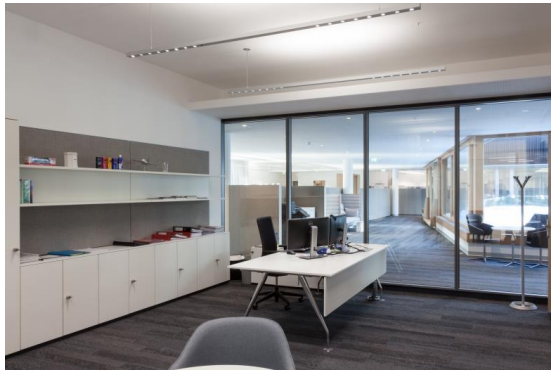
- hospitals

Psychiatric clinic Slagelse, Denmark
(190 beds; initiated: 2015)

Clinic Lichtenfels, Germany
(254 beds; finishing: 2017)

- offices

R&D department Bartenbach, Austria



Distribution Center Wörgl, Austria

- hotels, shops, private homes

Current limitations

- **complex system architecture** which require a high background knowledge
- existence of **equivocal lighting control schemes** for lighting designers, and electrical engineers
- **communication gap** between lighting designer and programmer (control handbook)
- **restricted interoperability** of mostly proprietary lighting control hard- and software
- high investment and installation **costs**
- **confusing user interfaces** and troublesome user-lighting interactions
- sophisticated **maintenance** and high service costs (contracts?)

Control handbook

Actual procedure

Hallo [redacted]

Wuerde die aktivierende Szenen wie folgt waehlen:

1) 4000K, max. Ev am Auge (750 lux)
2) 6500K, max. Ev am Auge (750 lux)

Interessant waere dabei die folgende zeitliche Dynamik:

A) Hochdimmen in kurzer Zeit (ca. 15 Sekunden), so dass Versuchsperson dies bemerkt & halten der hohen Intensitaet ueber die Zeitdauer des Tests fuer Studie

B) Hochdimmen wie unter A) jedoch langsam ueber mehrere Minuten wieder herunterdimmen auf 0 um dann wieder das schnelle Hochdimmen analog zu A) zu wiederholen

➔ Insgesamt ergeben sich daraus 4 aktivierende Szenen!

Wuerde fuer die beruhigenden Szenen wie folgt auswaehlen:

1) 2700K & Minimierung des Ev-Anteils am Auge unter 100 lux horizontal im Fuss-/Oberschenkelbereich (zonale direkte Beleuchtung mit minimalem Eintrag ins Auge)

Fully defined control algorithms

- Lage Pläne mit:
  - Leuchten Adressen (Nummern)
  - Gruppenzugehörigkeit
- **Kompletter** Ablauf der Automatik-steuerung
- **Komplettes** Vorgehen bei Manuellem Übersteuern
- Art des Manuellen Übersteuern
- Angabe in Dimmlevel oder %-Lichtstrom
- Tages und Jahresabhängig

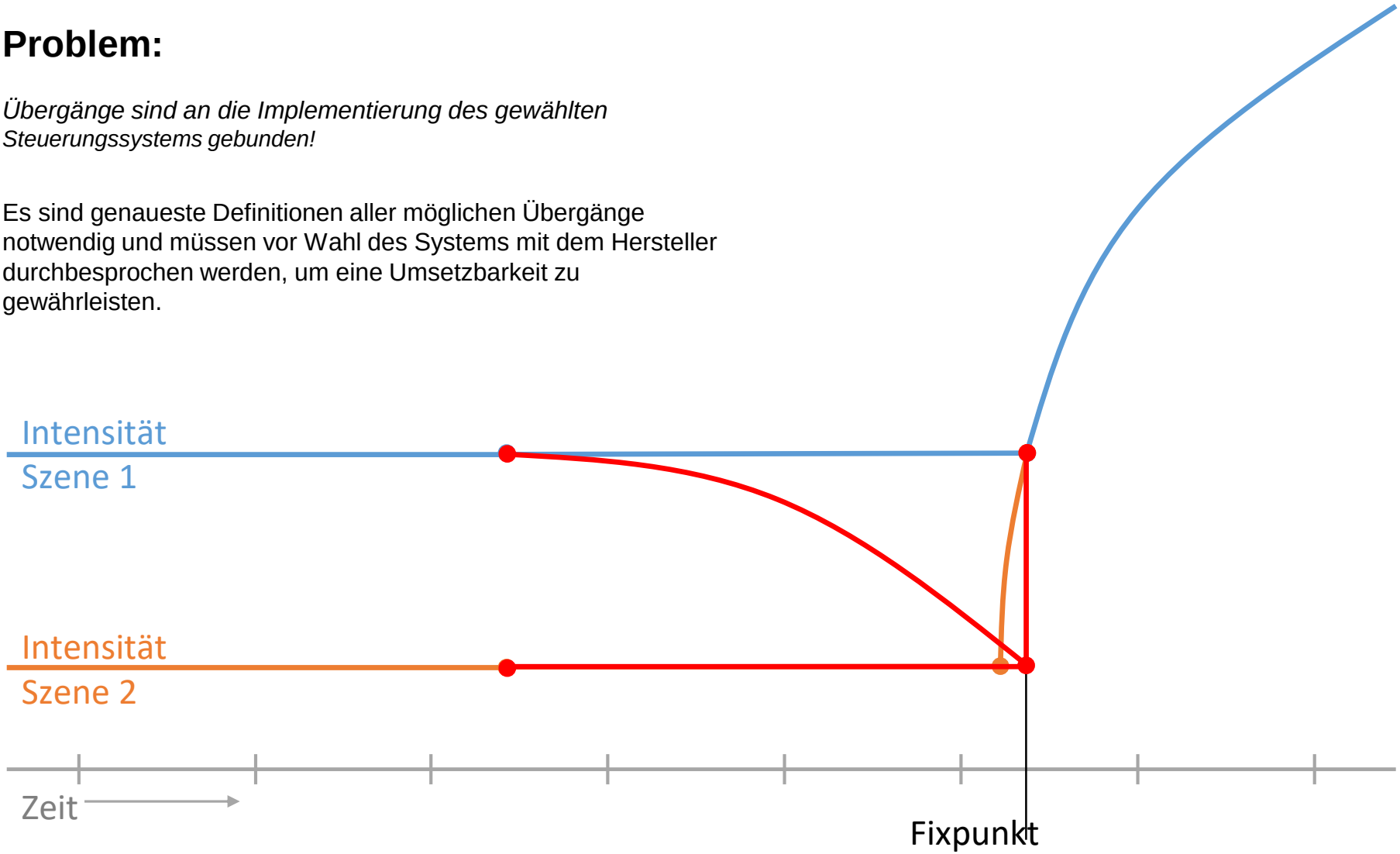
Uhrzeit	00:00	00:15	00:30	00:45	01:00	01:15	01:30	01:45	02:00	02:15	02:30	02:45	03:00	03:15	03:30	03:45	04:00	04:15	04:30	04:45
Gruppe 1: Leuchten 1-2; Stützpunkt „Fensternah" - Helligkeit	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
Gruppe 2: Leuchten 3-4: Stützpunkt „Raummitte" - Helligkeit	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
Gruppe 3: Leuchten 7-9: Stützpunkt „Eingang" - Helligkeit	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
Lichtfarbe (siehe Sheet 3 "Natural Dimming (ND)_Nacht")	(ND)	(ND)	(ND)	(ND)	(ND)	(ND)	(ND)	(ND)	(ND)	(ND)	(ND)	(ND)	(ND)	(ND)	(ND)	(ND)	(ND)	(ND)	(ND)	(ND)
Dimmbereich (xxx - xxx)	0-500	0-500	0-500	0-500	0-500	0-500	0-500	0-500	0-500	0-500	0-500	0-500	0-500	0-500	0-500	0-500	0-500	0-500	0-500	0-500
Dimmbar (D)	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Dimmer auf Stützpunkt																				
Gruppe 4: Leuchten 10-16: Flur „Tag" - Helligkeit	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus
Gruppe 5: Leuchten 10-13; Flur „Nacht" - Helligkeit	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Lichtfarbe	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200
Dimmbereich (xxx- xxx)	0-max.	0-max.	0-max.	0-max.	0-max.	0-max.	0-max.	0-max.	0-max.	0-max.	0-max.	0-max.	0-max.	0-max.	0-max.	0-max.	0-max.	0-max.	0-max.	0-max.
Dimmbar (D) oder fixe Einstellung	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Dimmer auf Stützpunkt																				
Gruppe 6: Leuchten 17-20; „Lichttherapie-Ecke" - Helligkeit	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus
Lichtfarbe																				
fixe Einstellung																				
Gruppe 7: Leuchten 21-26: Essbereich „Nacht" - Helligkeit	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Gruppe 8: Leuchten 21-40: Essbereich „Tag" - Helligkeit	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus
Lichtfarbe	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200
Dimmbereich (xxx - xxx)	0-max.	0-max.	0-max.	0-max.	0-max.	0-max.	0-max.	0-max.	0-max.	0-max.	0-max.	0-max.	0-max.	0-max.	0-max.	0-max.	0-max.	0-max.	0-max.	0-max.
Dimmbar (D) oder fixe Einstellung	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Dimmer auf Stützpunkt																				
Gruppe 9: Leuchte 41; Eingangslicht, Zimmer 12 - Helligkeit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gruppe 10: Leuchten 42-48; Ceiling Washer, Zimmer 12 - Helligkeit	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus
Gruppe 11: Leuchte 49; Badlicht allgemein, Zimmer 12 - Helligkeit	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus	aus
Gruppe 12: Leuchten 50-51; Badlicht Spiegel, Zimmer 12 - Helligkeit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lichtfarbe	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200
Helligkeit Schaltbar (xxx oder xxx)	0 v 20	0 v 20	0 v 20	0 v 20	0 v 20	0 v 20	0 v 20	0 v 20	0 v 20	0 v 20	0 v 20	0 v 20	0 v 20	0 v 20	0 v 20	0 v 20	0 v 20	0 v 20	0 v 20	0 v 20
Schaltbar (S) oder fixe Einstellung	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S

Control handbook

Problem:

Übergänge sind an die Implementierung des gewählten Steuerungssystems gebunden!

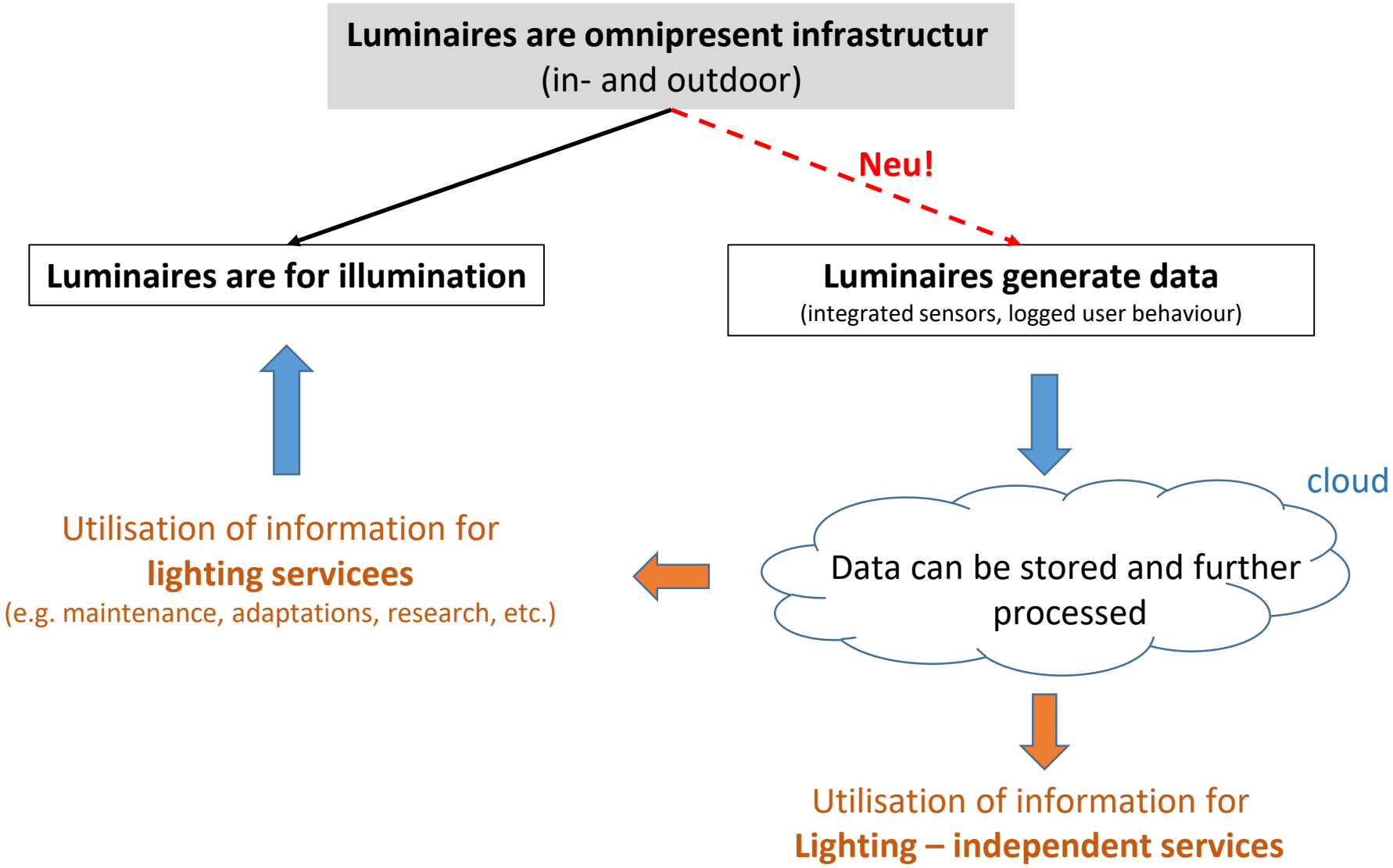
Es sind genaueste Definitionen aller möglichen Übergänge notwendig und müssen vor Wahl des Systems mit dem Hersteller durchbesprochen werden, um eine Umsetzbarkeit zu gewährleisten.



Big Data und IoT

Luminaires are omnipresent infrastructur
(in- and outdoor)

Big Data und IoT



General perspective

Lighting industry was a low tec and low cost branch

Digital lighting (LEDs + ICT)

- changes lighting industry from low > high tec
- opens new technical possibilities not possible until now (breakthrough technology)
- enables high-quality (individual) lighting solutions
- provides the potential to cover the increasing need for light while at the same time reducing energy consumption

> increase efforts to make it a high value and high cost branch by quality and application oriented solutions

Chance

- **scientific evidence** for non-visual light effects is quite weak at the moment

  > more **resilient scientific basis** on non-visual light effects is needed

- By documenting the added value of biodynamic lighting, we will change the value of light from a cheap and thus unimportant issue to a **valuable part of our environment, life quality and life style**