


TUNE INTO YOUR BIOLOGICAL RHYTHMS

IS LIGHT A DRUG?

April 2016 / Helen Loomes /





Over millions of years, people have conducted their
life according to natural daylight.

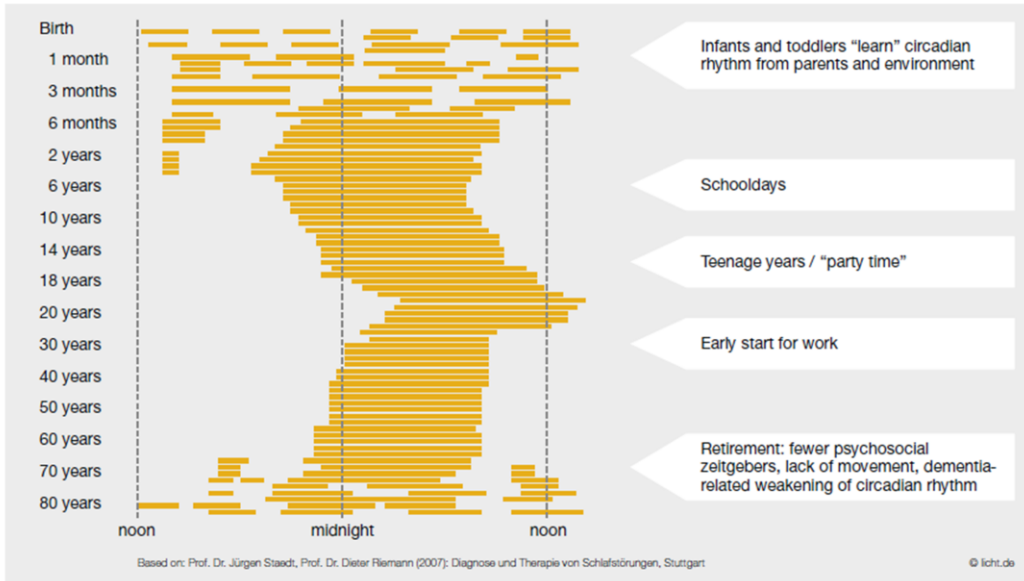
We have become accustomed to sunlight and the
natural day/night rhythm through our evolution.

DYNAMIC LIGHT

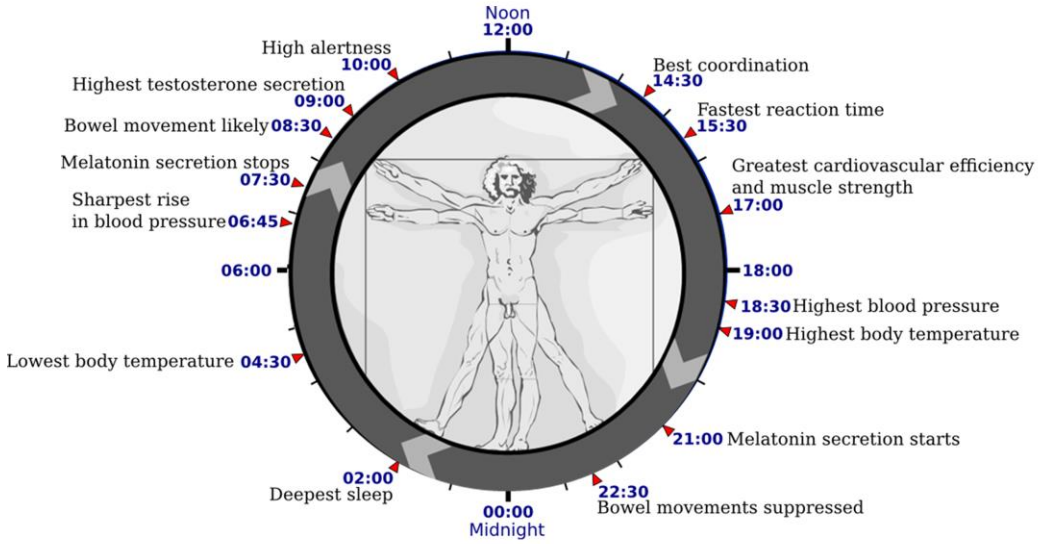
Natural light changes in intensity, colour temperature and direction...



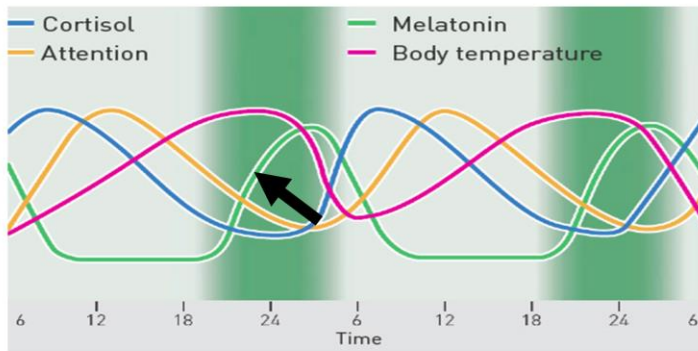
DEVELOPMENT AND SYNCHRONISATION OF SLEEPING BEHAVIOUR



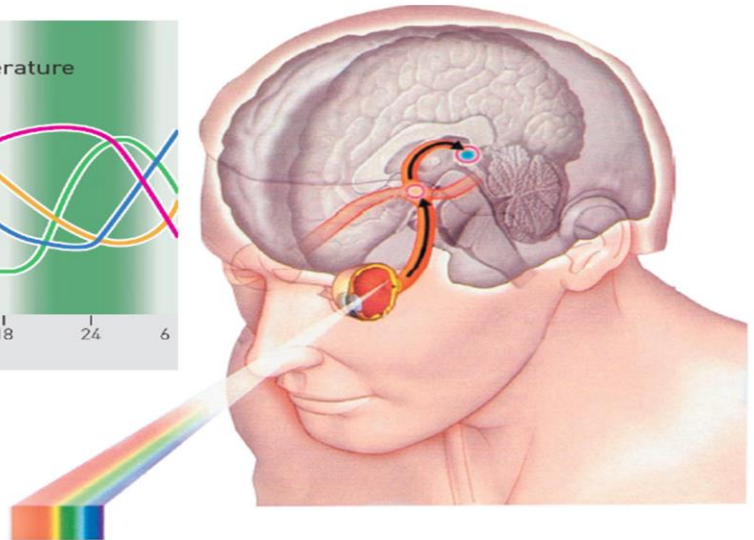
TUNE INTO YOUR BIOLOGICAL RHYTHMS



CYCLE OF DIFFERENT CIRCADIAN RHYTHMS



- The biological clock is triggered daily via specific receptors in the retina



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Since 2002 scientists have found new photo biological receptors. These receptors aren't responsible for visual responses like the rods (Stäbchen) and cones (Zapfen Farbe). Their function is to set your internal biological clock and control your release of hormones. These hormones control your biological rhythm, for example so that you become tired at night. In this diagram you can see that the sleeping hormone melatonin increases at 6 pm and decreases at 6 am.

Therefore the performance and attention curve decrease without the corresponding daylight. Here you see that dynamic lighting can support the biological rhythm.

The biological rhythms of human beings can be modified by light, bluish light, around 450 nm especially, has the largest impact.

Saliva = Speichel = Messung Melatonin

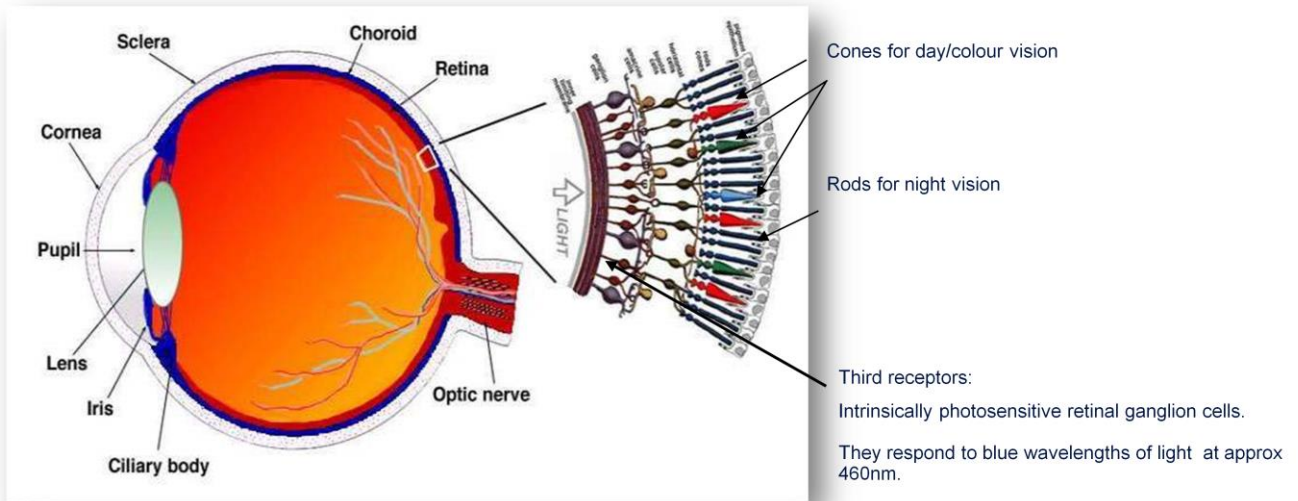
Discovery of Melatonin in 1958.

Discovery of the biological clock in people in 1972.

Pineal gland = Epiphysis releases melatonin and serotonin (happy hormones).

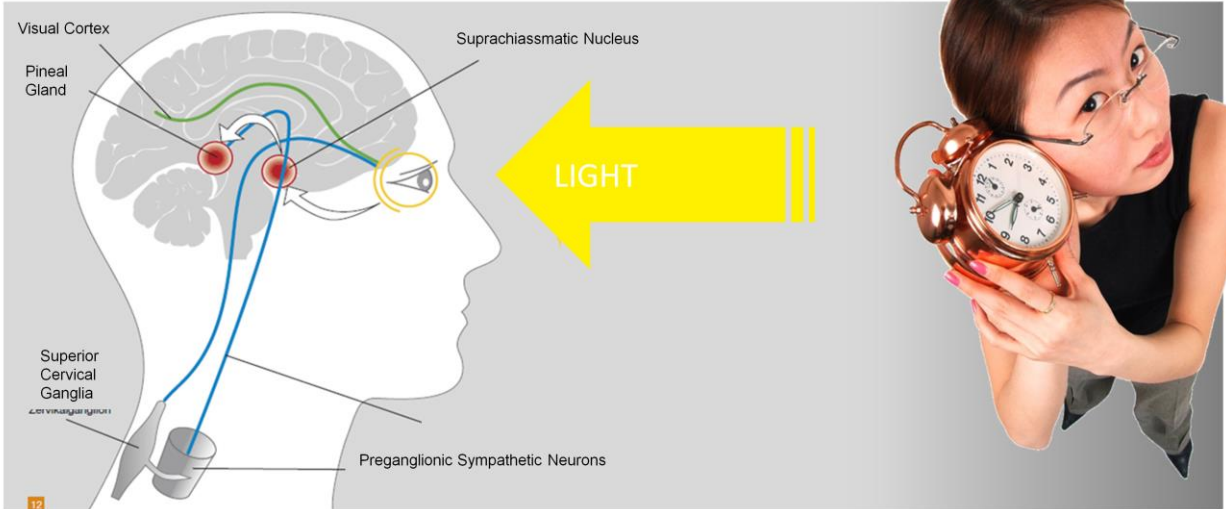
Melatonin suppression = incidence of light in an eye curbs the release of melatonin

Increasing light levels signal the body to begin its active cycle. It responds by producing serotonin, adrenalin and cortisol. Hormone levels rise, along with temperature and metabolism and by mid-afternoon, the body has reached its peak metabolism. Two important hormones are cortisol that rises in the morning and make us feel more alert and melatonin that rises in the evening and make us feel more sleepy. Metabolism converts the fuel in the food we eat into the energy needed to power everything we do, from moving to thinking to growing.



First we have to understand how this works. Light enters via the lens into the eye and reaches the retina at the back of our eye-ball. When the light reaches the retina, it passes a layer of ganglion cells, bipolar cells and then the layer of where the cones and rods are. With the cones (red, blue, green) we can see colours, the rods are for low lux level vision (no colour recognition).

In 2002, "Hattar et al" described in the layer of ganglion cells, the 3rd receptors in addition to the known rods and cones.



Circadian Oscillator

DYNAMIC LIGHT

Natural light changes in intensity, colour temperature and direction...



DYNAMIC LIGHT

... and so we should try to reproduce it with flexible artificial light



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Natural light changes over the day in intensity, colour temperature and angle.

Dynamic light can affect concentration or well-being...

in a
meeting room

Here you see a dynamic light control in one of our meeting rooms.

From the welcome at the morning (with activate light/ blue light)

Over a conference till lunch with normal light and a short activate time after lunch with blue light

To the end of the conference with discussions in the evening with warm light.

EDUCATION



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JOINT RESEARCH IN HAMBURG SCHOOLS 2011-2012

- TRILUX was involved in several research projects at schools in Hamburg, Dresden and Berlin.
- For the research project in Hamburg, 39 schools were modified with dynamic light from TRILUX and Philips.
- The modified schools had the opportunity to switch their lighting to suit the situation.

300 lux	4.000 K (traditional light),
1.000 lux	6.000 K (concentration),
650 lux	12.000 K (activate)
300 lux	2.700 K (calm).



TRILUX
SIMPLIFY YOUR LIGHT.

PHILIPS



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Cold colour temperature light can push you in the morning or after lunch to get a better performance.
But before you go to sleep, a warm colour temperature is preferable to aid beauty sleep.

The effects of dynamic light are not completely explored **just** the basic statements.

Trilux is involved in some research projects in grammar schools.
The schools have good experience with the dynamic light.

CASE STUDY: HAMBURG-EPPENDORF

The study comprised of 166 students and 18 teachers over the course of 1 year.

The students were between 7 and 16 years of age.

Conducted by the Hamburg UKE Clinical Centre for Child and Youth Psychosomatic Research.

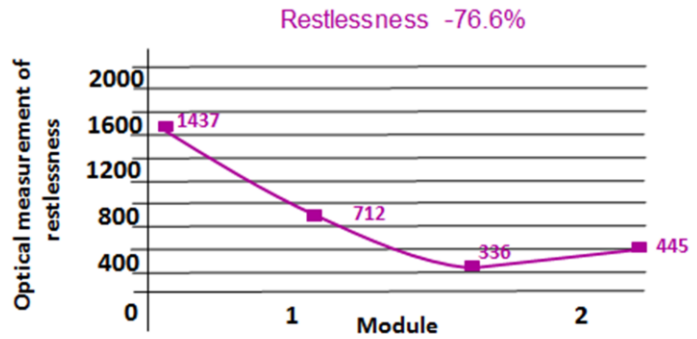
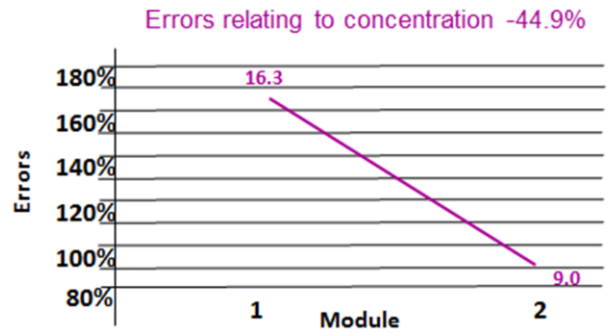
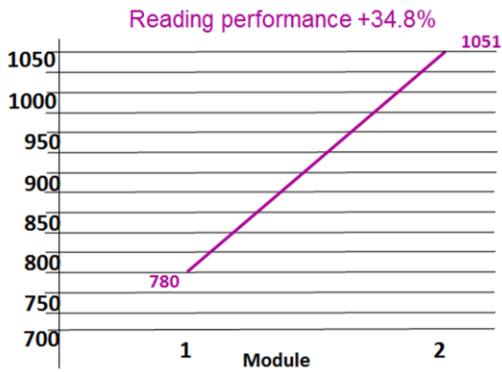


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This is a study where different lighting scenes were available to teachers to use according to the activity.

CASE STUDY: HAMBURG-EPPENDORF



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The reading speed rose by almost 35% when pupils were working under Dynamic Lighting Classroom System. On average, pupils read 1,051 words in a set time compared with 780 words in the baseline measurement under conventional lighting.

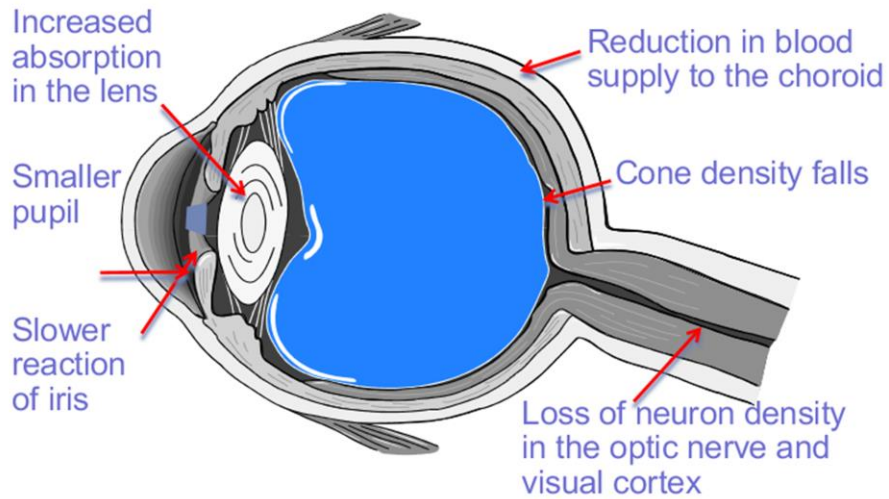
HEALTH



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The ageing eye



THE AGEING EYE



25 years



47 years



60 years



70 years



82 years



91 years

As the eye ages so it yellows, this means older people see less light from the blue end of the spectrum than younger people.

A DARKER, MORE HAZY WORLD

Older people experience

- A reduction in vividness of the colours of images e.g. reds begin to look like pinks
- A reduced ability to discriminate blues



PEOPLE WITH DEMENTIA SUFFER FROM

- frequent **sleep disturbances**
- including **night wandering** and **confusion**



Source: wikimedia

drugs can lead to further confusion and increase the risk of falls

ARCHITECTURE

- Adapting the architecture to the patients requirements can increase their well-being
- Provide orientation and security



clearly arranged
rooms



straight
corridors



handrails



Colour concept



Good quality
lighting



Quellen:

http://www.focus.de/immobilien/wohnen/bauen-gestaltung-gegen-das-vergessen-architektur-fuer-demenzranke_aid_902272.html

http://www.spathstoecker.de/images/spath-architekturbuero/einzelartikel/spath_Demenz_Architektur.pdf

DEMENTIA FRIENDLY LIGHTING

Primary elements

Use daylight wherever possible

Choose the right light source and high light levels

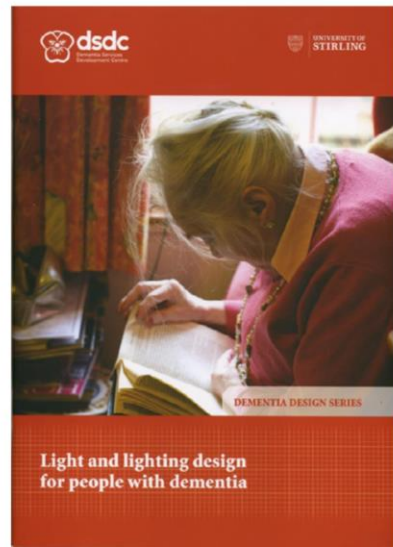
Use sufficient 'domestic' style fittings

Expose people to the 24-hour cycle of light and dark.

RESEARCH

Dementia Services Development Centre
Sterling University

Thanks to
Kristina Allison BA (Hons), MA, MSL, MILP
Lighting Enterprises Consultancy & Associates Ltd.



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Best of breed demonstration ward and bedroom at Sterling. Uses Livity, Sanesca, Inpera Ligra Plus, Acruro, Arkon and Ambiella night light.

Recommended light levels

(sample page from the DSDC lighting book)

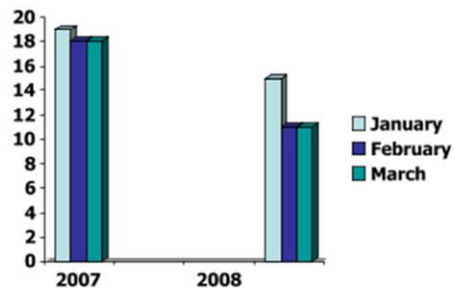
Area	Maintained average horizontal illuminance (in lux) not less than	Minimum overall colour rendering index (R _a)	Minimum lamp colour rendering index (R _c)
Living rooms	300	85	80
Ensure high lighting levels at activity tables and seats for reading by positioning lights nearby			
Recreation	300 supplemented by 300	85	80
Provide 300 lux from artificial lighting. Supplement by 300 lux daylight when available and 300 lux from free-standing units when daylight is not available			
Kitchens	600	85	80
Ensure high lighting levels at worktops, sinks and server counters by positioning lights nearby			
Bathrooms and toilets	300	85	80
Ensure high lighting levels at wash-hand basins and WCs by positioning lights nearby			
Bedrooms	200	85	80
Ensure high lighting levels at headboards and dressing tables by positioning lights nearby			
Dining rooms	300	85	80
Ensure high lighting levels at dining tables by positioning lights directly above them			
Other areas			
Corridors – at night	No activity	20-50	85
	Activity	100-150	
Corridors - daytime	No activity	50	85
	Activity	150	
Corridors – mid point of relevant doors ¹	200 (vertical)		85
Offices	500	¹ A relevant door is one that is meant to be identified and operated by people with dementia	
Lifts	175		





Why should we bother?

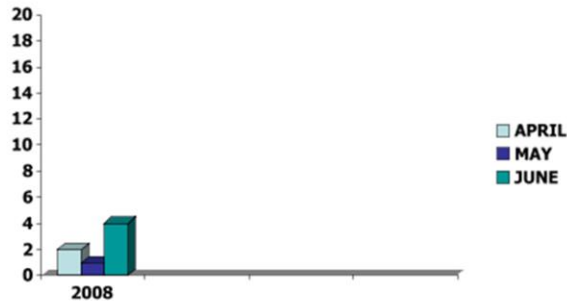
- We all fall down – or do we?



Courtesy of Morningside Care Homes

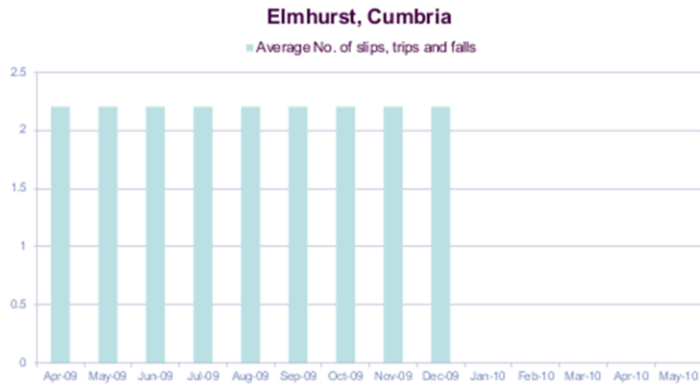
Why should we bother?

- Things appear to be improving!



Courtesy of Morningside Care Homes

Why should we bother?



THE KINGS FUND

The King's Fund is an English health charity that shapes healthcare policy and practice through research and analysis.

TheKingsFund>

Improving the patient experience

Developing Supportive Design for People with Dementia

The King's Fund's Enhancing the Healing Environment Programme 2009-2012



IPSWICH HOSPITAL

- Ipswich Hospital was chosen to create a pioneering care environment in conjunction with the Kings Fund.

Ipswich Hospital NHS Trust



'If we could only change three things, these would be:

- *Signposting using accent colours*
- *Creating a central social space*
- *Improving the lighting'*

Senior nurse,
Dementia care and adult safeguarding



MARIA-HILF HOSPITAL, BRILON, GERMANY

New lighting has been installed in all patient rooms and corridors of the geriatric department.

A light management system controls the light level and the colour temperature.



ILLUMINATION LEVELS

Between 600 to 1500 lux during the day in patient rooms

300 lux on the floor and 600 lux at eye level in corridors



All LED lighting is controlled via a central management system to give 600 lux at eye level and 300 lux at floor level in corridors and between 600 to 1,500 lux during the day in patient rooms.

THE ENTRANCE AND CORRIDORS

Colour temperature varies between 3,000K and 6,500K



MARIA-HILF HOSPITAL, BRILON, GERMANY



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GENERAL IMPRESSIONS AFTER THE LIGHTING RENOVATION?

After the renovation, the activities of the geriatric patients have **become calmer**.

In detail, after a few days of acclimatisation they have a **more relaxed demeanour** compared to the day of admission and on other wards.

When asked why they felt calmer, some of the patients point directly to **good lighting and a pleasant atmosphere**.

Thomas Pape
Director of Care Service



WHAT IS THE MEDICAL IMPRESSION AFTER THE LIGHTING RENOVATION?

The generally positive reaction of geriatric patients has allowed the medical management to significantly **lower** support in the form of **medication**.

Thomas Pape
Director of Care Service



HOW DO THE STAFF BENEFIT FROM THE NEW LIGHTING?

The therapeutic team is excited by the consistently **positive reactions of their patients** as well as its own positive experience of pleasant illumination.

Thomas Pape
Director of Care Service



**HUMAN CENTRIC LIGHTING CONFERENCE
ROYAL INSTITUTION, LONDON.
22.2.2016**

Professor Debra Skene,
University of Surrey.

Professor Rob Lucas
Manchester University

Luke Price
Public Health England



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

CIE Statement on Non-Visual Effects of Light

RECOMMENDING PROPER LIGHT AT THE PROPER TIME

**CIE TN003 Report on the First International
Workshop on Circadian and
Neurophysiological Photometry, 2013**

www.cie.co.at/index.php/Publications/Technical+Notes



HUMAN CENTRIC LIGHTING CONFERENCE ROYAL INSTITUTION, LONDON. 22.2.2016

- More research is needed.
- Preferably field studies.
- We need to collaborate with the scientists to move forward.
- We will prepare a properly formulated questionnaire without leading questions.
- Provide an accessible platform for all parties to share results.



LIGHT AFFECTS HOW WE FEEL





fresh – stimulating – light – neutral – cool

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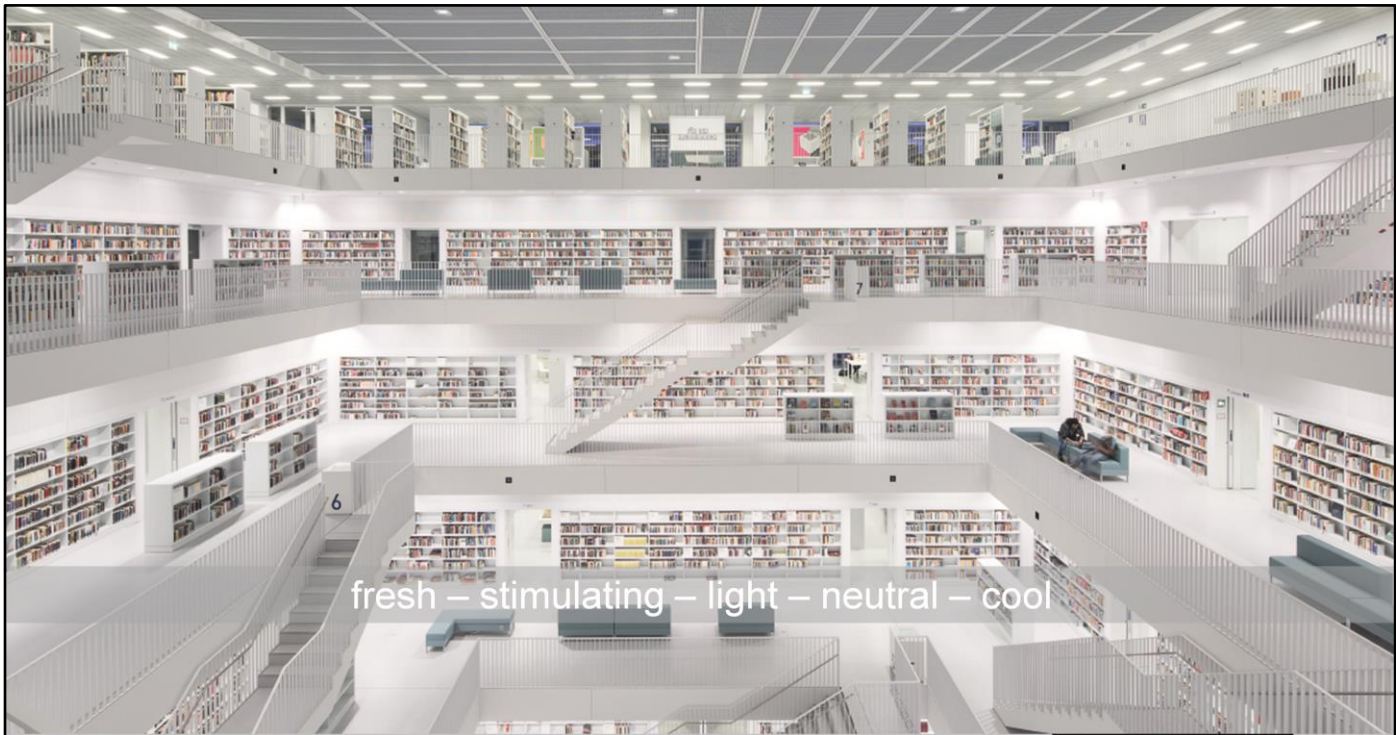
fresh – stimulating – light – neutral – cool



fresh – stimulating – light – neutral – cool

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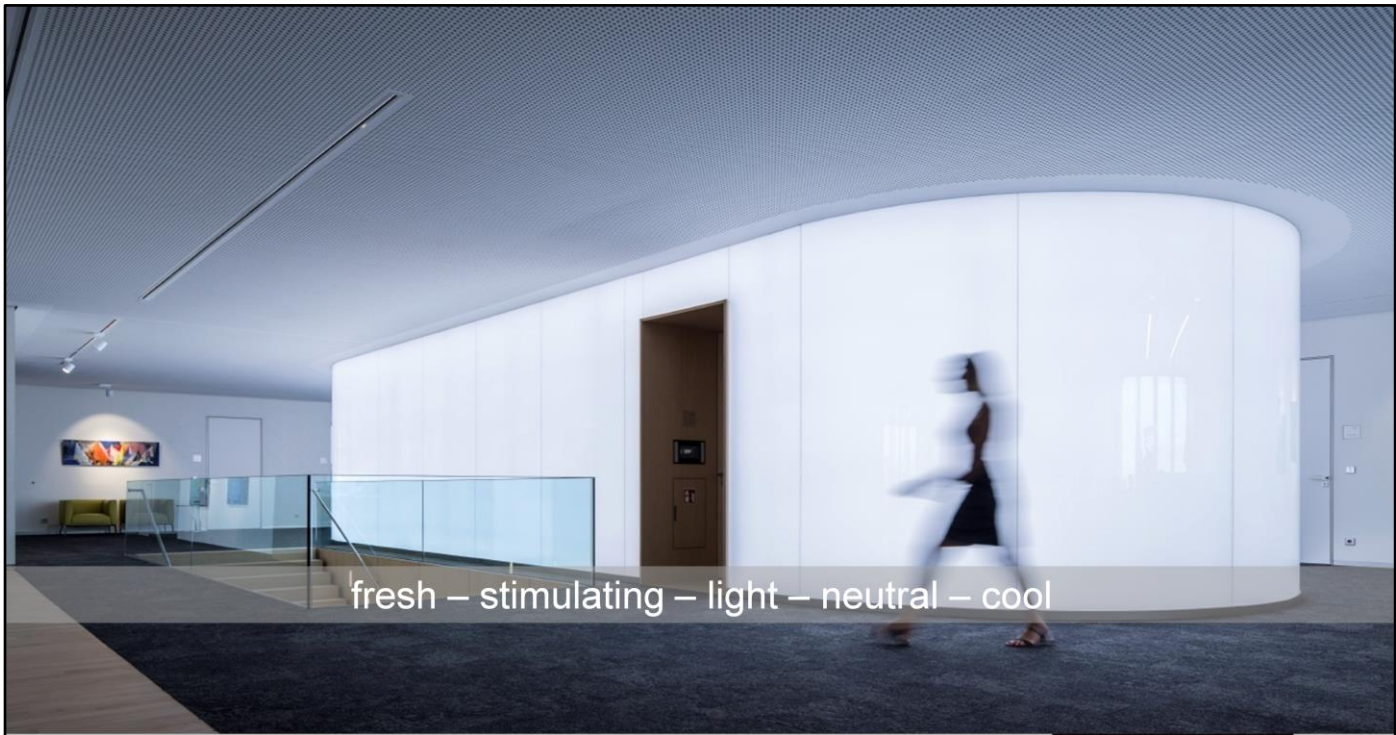




fresh – stimulating – light – neutral – cool

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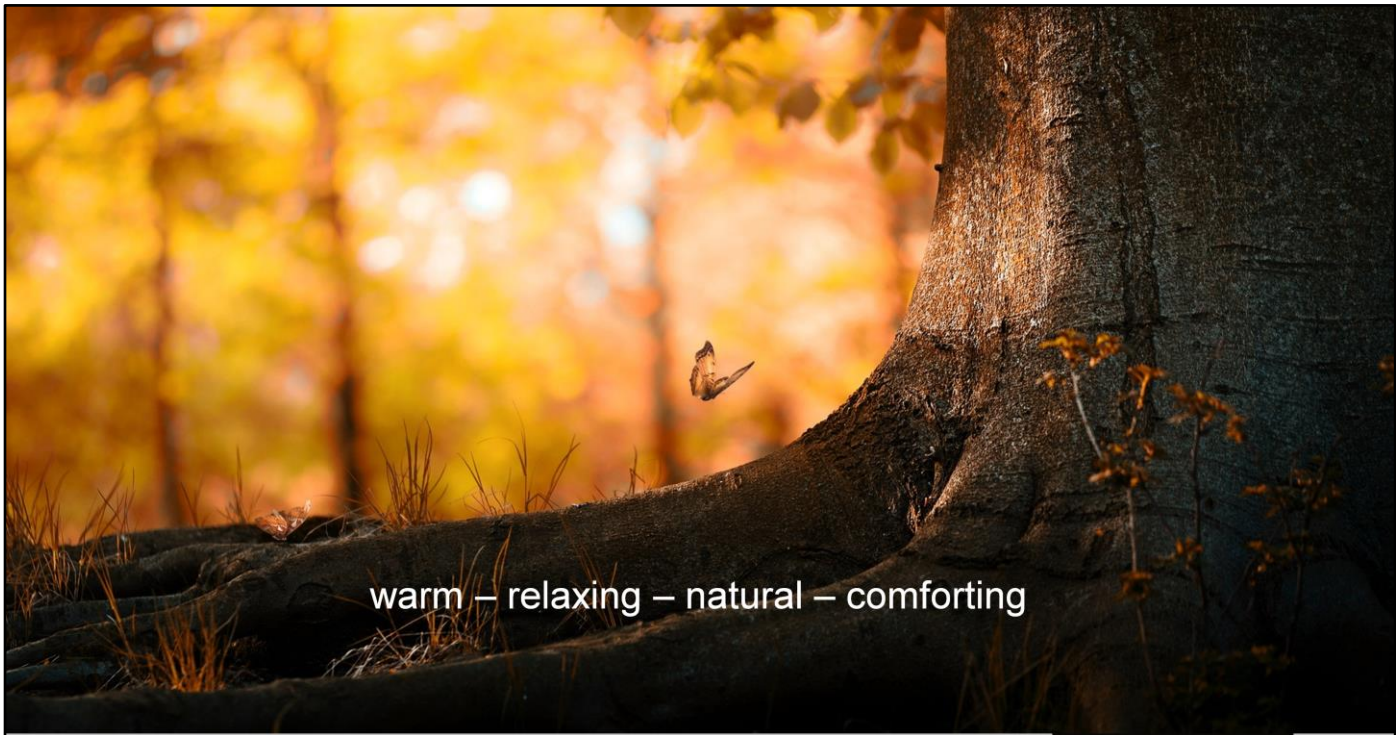




fresh – stimulating – light – neutral – cool

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warm – relaxing – natural – comforting

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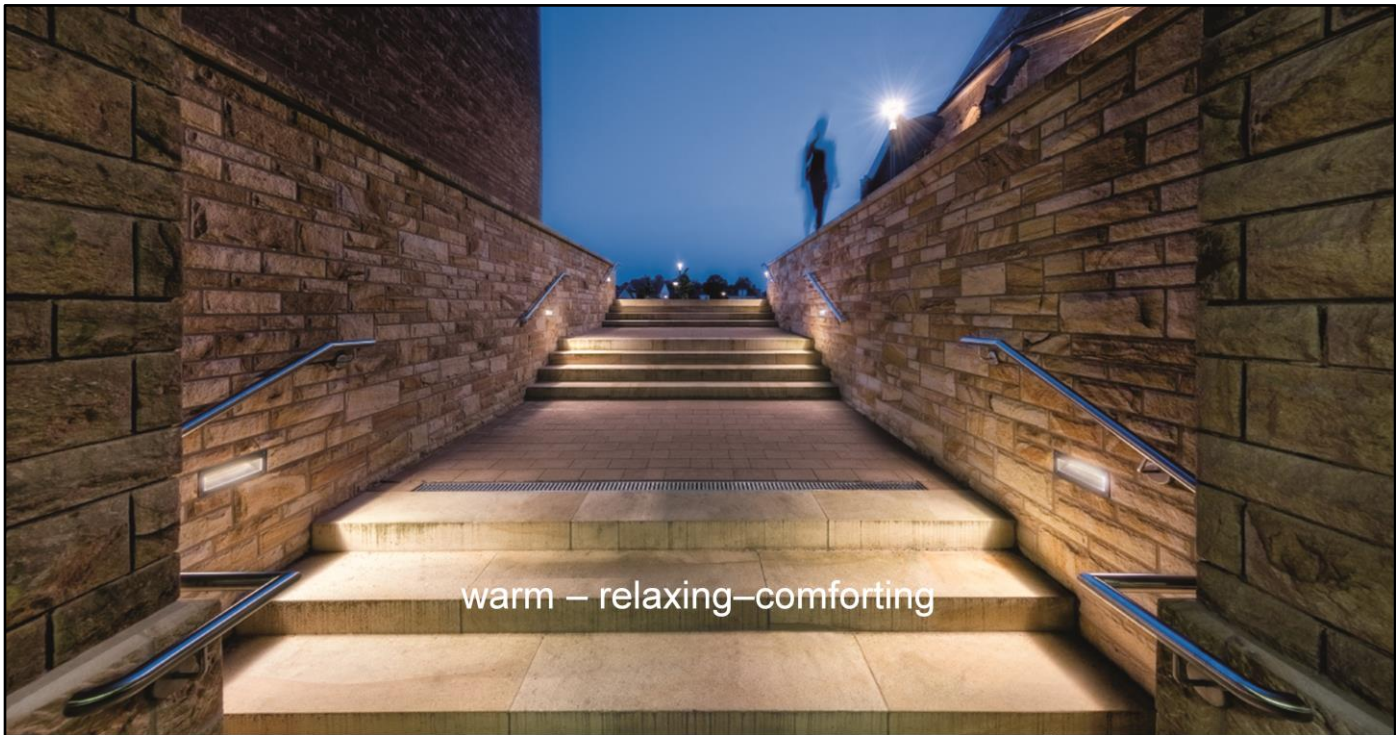
 TRILOX AKADEMIE



warm – relaxing – comforting

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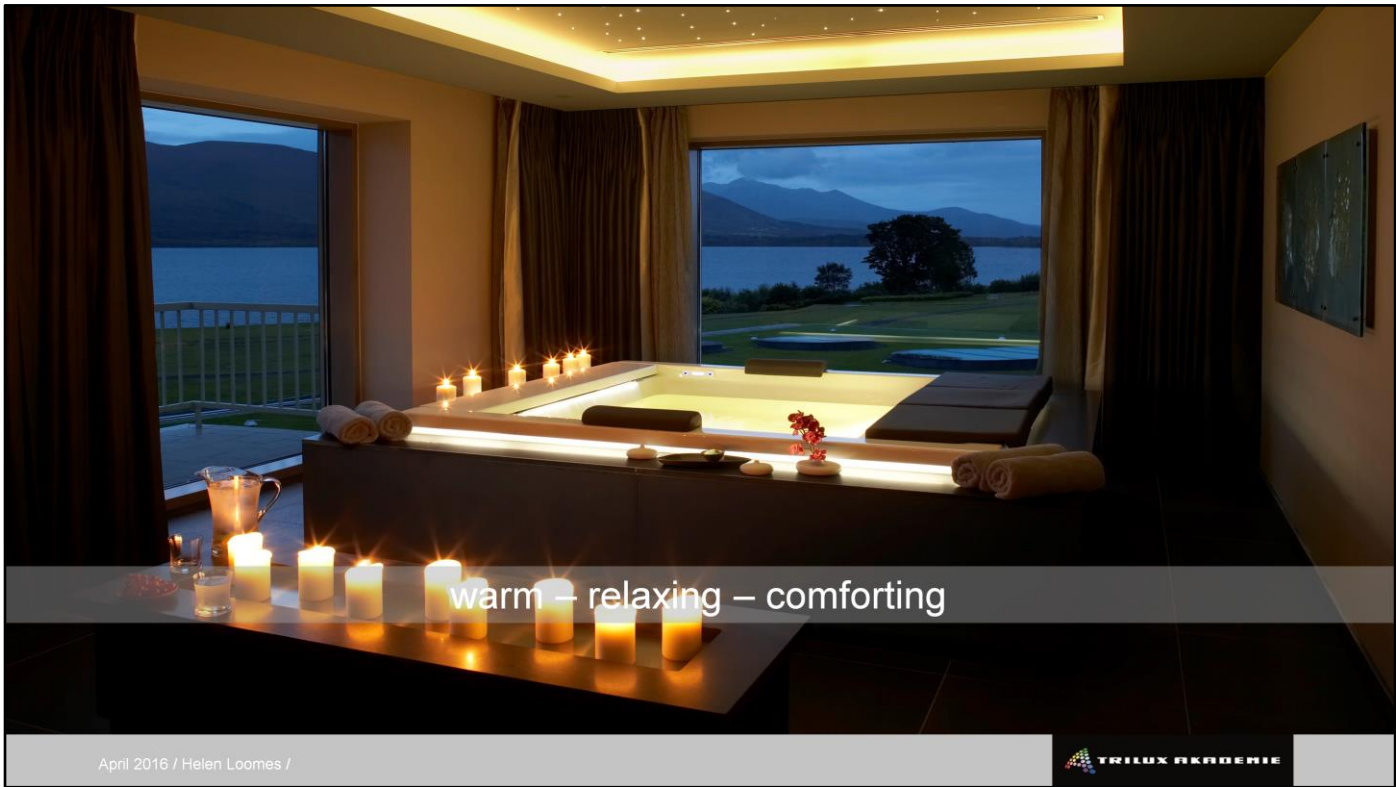
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warm – relaxing – comforting

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 TRIUX AKADEMIE



wow! – spectacular – euphoric – sublime – inspiring

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TRIUX AKADEMIE



wow! – spectacular – euphoric – sublime – inspiring

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TRILUX AKADEMIE



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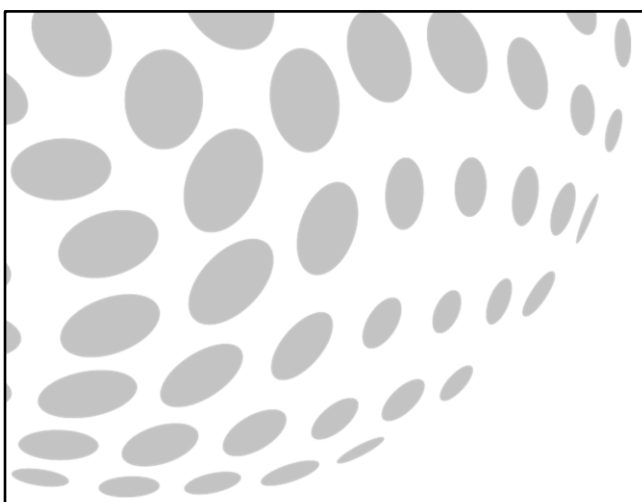




wow! – spectacular – euphoric – sublime – inspiring

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What is your definition of a drug?