

Press release
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Well-being and social activities thanks to beneficial lighting Zumtobel studies conducted in St. Katharina and Caritas Socialis care homes



B1 | Two studies conducted by Zumtobel were able to provide evidence that the circadian rhythm of individuals is also influenced by the intensity and colour temperature of light.

Does better light result in improved quality of life? Does a higher, dynamically controlled light input result in enhanced well-being and increased social activities in older people? These questions were examined in the course of a study conducted by Zumtobel, in collaboration with the Lighting Competence Centre and other partners, in the dementia care ward of the St. Katharina residential care home in Vienna over a period of 15 months.

People's quality of life strongly depends also on their visual capabilities. In old age, the quantity of light required for any type of activity incre-

ases dramatically, because of clouding of the eye's lens. Up to 1,500 lx are then required for activities such as handicraft work or reading. In comparison, standards applying to offices provide for a mean illuminance level of 500 lx. However, light is not only essential for perception, but also has a biological component. Thus, light has an effect on people's day/night rhythm via retinal receptors. Sufficient daylight suppresses melatonin production, while the hormone melatonin produces sleepiness at night. Too little light by day has negative effects on people's well-being and may cause sleep disorders and depressive moods, among others.



B2 | Elderly people need significantly larger quantities of light for any type of activity. Sufficiently bright lighting improves their social activities, resulting in a balanced circadian rhythm.

What other factors can be positively affected by light? In a care home for patients suffering from dementia, various dynamic daytime lighting scenarios were examined. The main result: large quantities of light can improve the circadian rhythm of older people, especially of people needing care, if they do not have regular access to natural daylight.

The main goal of the investigation carried out at the St. Katharina residential care home in Vienna was to examine which factors – illuminance level or spectral composition of light and its dynamic sequence – have a positive impact on the home's residents. With daytime melatonin production suppressed by providing appropriate lighting, chances are that residents will have a better night's sleep on the one hand and be more active in the course of the day on the other, so that they should be more inclined and motivated to take part in social and/or household activities. By stabilising the residents' circadian rhythm, a positive spiral can be triggered, which results in an improvement of their cognitive orientation and have a positive influence on their emotional state so that, as a whole, their well-being should be enhanced by providing restful sleep at night and activation by day.

In the course of refurbishment measures carried out at the St. Katharina care home in Vienna, the opportunity arose to install an appropriate lighting system – luminous ceilings which could produce a variety of lighting situations – at the newly fitted dementia care ward and to examine its effects on the residents. In order to guarantee the biological effects of light also indoors, it is necessary for artificial lighting to be similar to daylight. At present, this is not possible using conventional lighting. In the case of warm or intermediate light sources – which are usually used indoors –, biological efficacy could only be achieved with dramatically increased levels of illuminance and thus considerably higher energy costs. Therefore, a new fluorescent lamp with a colour temperature of 8000 K at a colour rendering index of $R_a \geq 80$ was used for the luminous ceilings, in combination with the previously known fluorescent lamp colour temperatures of 3000 K and 6500 K. This allows a very wide range of colour temperatures and illuminance levels to be selected and dynamically controlled. The biological effects of the SKY-WHITE fluorescent lamp with a colour temperature of 8000 K, a larger blue component, and its light colour that is more similar to a sunny day at comparable illuminance and comparable energy efficiency, are 2 to 2.5 times higher



than those of conventional fluorescent lamps. CIELOS luminaires were used for the luminous ceiling. They contain twelve lamps (four of each light colour).

Within the scope of the study, the effects of a standard situation were compared to those resulting from three different lighting situations:

- Higher intensity
- Modified spectrum
- In addition, simulation of a dynamic lighting sequence corresponding to the course of natural daylight by means of artificial lighting

For this purpose, the residents' behaviour, in particular with a view to communication and interaction with each other and with care personnel, was observed, documented and evaluated. In total, data from 15 residents were collected during the observation period. The residents, most of them women, were very advanced in years (with an average age of over 88) and suffered from some degree of dementia which did not allow them to live on their own any more (Alzheimer's dementia, vascular dementia, dementia as a secondary symptom).

The results:

- Residents' communication with care personnel has increased, especially in the afternoon.
- An increase in communication has been observed in all three lighting situations.
- Residents have participated in household

activities such as baking cakes, preparing meals etc. more often, especially when exposed to biologically effective lighting situations.

- Social activities such as handicraft work, singing etc. have been increasingly frequented in lighting situations providing high levels of illuminance.

This increase in social activities indicates an improvement of the dementia care ward residents' quality of life.

Moreover, the data concerning effects on movement behaviour – i.e. time spent at the ward, places of stay, and changes of location within the ward – could not be related unequivocally to the lighting situations. Differential aspects (personality structure, chronotype) seem to play a role as well. Further investigations are required in this respect.

In the research project, valuable references are given to further studies which can improve older people's quality of life, especially those who suffer from dementia:

- According to the observations made, improved daytime communication results in less unrest at night: the resident's sleep behaviour based on their movements in bed may indicate an improvement of their circadian rhythm.
- Improved sleep may result in lower doses of medication and less effort for care staff: the higher costs required for the lighting system



amount to 1.45 € per resident and day (calculated over a period of ten years). Savings on medication costs must be set off against these costs.

- The lighting system has to be controlled in a targeted manner. Too high levels of illuminance and colour temperatures may result in complaints (especially where care personnel moves to areas with lower levels of illuminance).

The scientific studies conducted at St. Katharina's have been intensified and extended by a second research project carried out at the Caritas Socialis care home in Vienna.

Data from a reference group living with a stan-

dard lighting system were compared with a second group. The second group was exposed to dynamic lighting, using Cielos luminous ceilings and colour temperatures ranging from 3000 K to 8000 K as well as illuminance levels of up to 1,200 lx. In this group, an increase in daytime activities and a decrease in daytime unrest, combined with better sleep, could be observed.

Zumtobel will continue to conduct research in these areas to improve the well-being of people who are sick, ageing or requiring care. In this respect, scientific research is focussing especially on the effects of light on sleep behaviour.

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