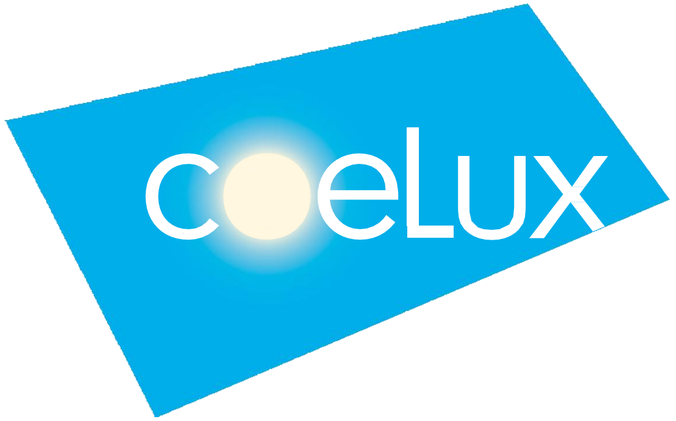


Experience the Sky

2026 09 10

Research and effects of CoeLux on Humans

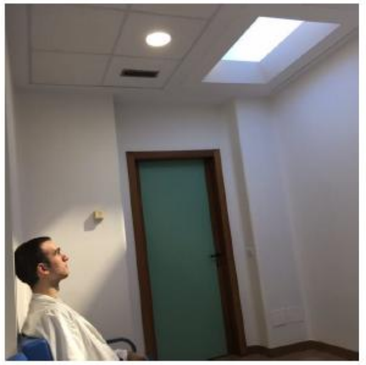
CoeLux Mission

To experience the sky everywhere and at any time, like never before

The “Camera degli Sposi” by Andrea Mantegna in Mantova

Bright Light Therapy for mood disorders - case 1

the case of a «comfortable» BLT with CoeLux



Method:

The synergy between light therapy and drug was studied on a sample of 76 depressed inpatients.

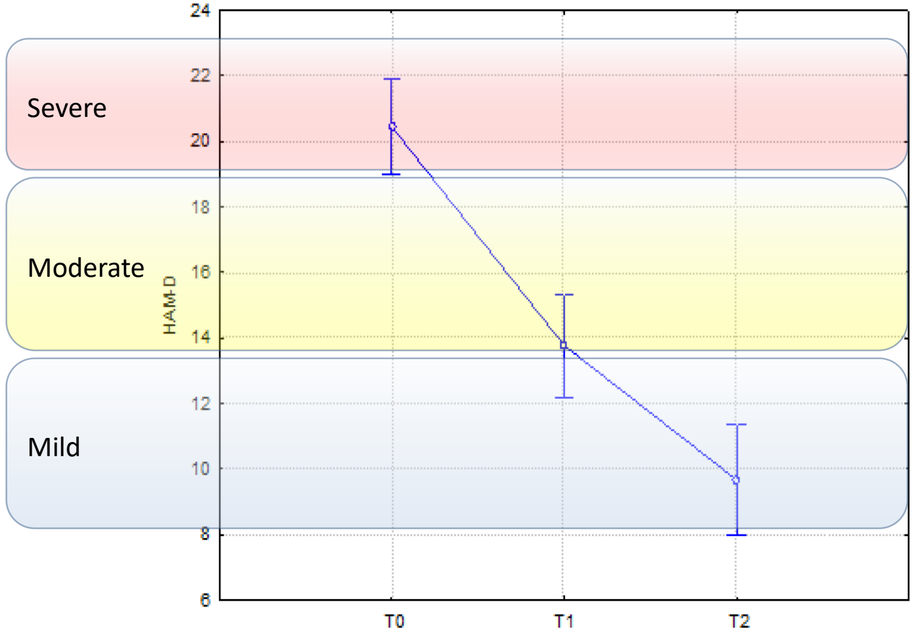
Main results:

A ***significant antidepressant effect was measured in the first week of treatment***, both in unipolar and bipolar patients, **without side effects**. No difference has been found when considering gender, the type of antidepressant used and a positive history for “treatment resistant depression”.

The *patients valued dispensing Light Therapy in a condition of adequate comfort* and suitable environment.

The ***sleep quality of inpatients improved significantly.***

INDICATION OF DEPRESSION. Efficacy of Light Therapy with CoeLux versus weeks of treatment



The change in HAM-D score over time shows the significant antidepressant effect also in the first week of treatment (T0-T1).

Reference:

Poster: «Exposure to Light therapy during the treatment of depression can improve quality of sleep» Prestifilippo D, Brioschi S, Fregna L, Seghi F,Locatelli C, Barbini B, Franchini L, Colombo C

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Bright Light Therapy for mood disorders - case 2

Impact of adjunct BLT on subjective sleep quality

Method:

A randomized controlled trial was undertaken with **100 MDD** (Major Depressive Disorder) inpatients: **Group A**, received **pharmacotherapy augmented with BLT**, Group B, received pharmacotherapy alone. The Pittsburgh Sleep Quality Index (PSQI) evaluated subjective sleep quality.

Main results:

Impact of BLT on subjective sleep quality is still underexplored. This study investigates the effect of adjunct BLT on the subjective experience of sleep quality of Major Depressive Disorder (MDD) inpatients.

Only group A (receiving BLT) reported a significant enhancement in their PSQI scores, whereas group B (treated exclusively with pharmacotherapy) did not demonstrate any significant improvements in PSQI throughout the study period.

Reference:

Fregna, Lorenzo et al. "Evaluating the impact of adjunct bright light therapy on subjective sleep quality in major depressive disorder." Journal of affective disorders vol. 348 (2024): 175-178.

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Depressive Symptoms | Subjective sleep quality | Sleep disturbancie

Comparative analysis of HDRS, PSQI and HDRS-S scores between Group A and Group B at baseline (T0) and at the study conclusion (T1).

	T0	T1	p-Value	Effect size
Group A				
HDRS (mean ± SD)	20.25 ± 5.87	5.08 ± 3.[illegible]	<0.001[a]	η^2 0.884
PSQI (mean ± SD)	8.05 ± 5.07	5.64 ± 3.64	<0.001[b]	Kendall's W 0.256
HDRS-S (mean ± SD)	3.51 ± 1.33	0.89 ± 1.46	<0.001[b]	Kendall's W 0.733
Group B				
HDRS (mean ± SD)	19.93 ± 5.16	6.68 ± 3.13	<0.001[a]	η^2 0.912
PSQI (mean ± SD)	7.11 ± 3.17	6.50 ± 3.04	0.072[b]	Kendall's W 0.116
HDRS-S (mean ± SD)	3.68 ± 1.49	1.88 ± 1.09	<0.001[b]	Kendall's W 0.529

[a] Repeated Measures ANOVA.
[b] Friedman's Test.

Bright Light Therapy for mood disorders - case 3

Impact of BLT + Sleep Deprivation on Bipolar Depression

Method:

Eleven **bipolar** depressed (BD) inpatients received 3 cycles of **Total Sleep Deprivation, followed by daily light therapy** sessions for one week. Polysomnography was performed before and after the treatment.

Main results:

Depressive symptoms significantly reduced (HDRS score was 20.27 at baseline and 4.909 one week) and sleep architecture changed with significant differences in N2% and N3% and REM density. ***Change in N3% was positively correlated to depressive symptoms reduction*** (HDRS variation). Other sleep parameters did not show such corrlation. Although, previous studies reported sleep architecture changes after chronoterapeutics in unipolar depression, ***this is the first study to demonstrate changes also in bipolar depressed subjects***.

		Baseline		End of the study	
	N	Mean	SD	Mean	SD
TST	11	423.773	71.438	426.864	56.658
Wake%	11	14.009	7.899	12.364	7.961
N1%	11	20.636	12.073	16.464	12.435
N2%	11	46.995	7.736	59.091	11.398
N3%	11	16.545	6.634	10.091	8.775
REM%	11	15.855	5.440	14.336	7.646
N1 latency	11	35.500	26.549	31.773	24.553
N2 latency	11	66.045	55.413	36.818	27.398
N3 latency	11	75.545	52.498	72.091	58.897
REM latency	11	185.500	104.391	247.091	115.046
N awakenings	11	9.091	3.936	9.091	6.580
Wake after sleep onset	11	67.636	34.212	60.364	42.994
SE	11	76.782	10.413	79.726	7.818
REM density – first REM stage	8	6.369	2.936	7.680	4.825
REM density – last REM stage	11	13.576	6.900	8.350	5.361

Reference:

Sarzetto, Alessandro et al. “Sleep architecture modifications after double chronotherapy: A case series of bipolar depressed inpatients.” Psychiatry research vol. 316 (2022): 114781.

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Bright Light Therapy for mood disorders - case 4

Impact of adjunct BLT on irritability in bipolar depression

Method:

180 bipolar depressed inpatients were randomly assigned to: **Group A** - **pharmacotherapy +30mn morning BLT** daily, or Group B - pharmacotherapy only. A qualitative assessment of irritability was performed after a 4-week program.

Main results:

A potent effect BLT in reducing irritability during a depressive episode: **Group A showed about one-third fewer cases of irritability** compared to Group B, **not related to the overall remission of depressive symptoms**.

Irritability is a major source of distress in depressed patients and their carers, linked it to social and family dysfunction, treatment non-adherence, suicide attempts, violence, depressive recurrences, and poor quality of life. **The present is the 1st study demonstrating a positive impact of BLT in reducing irritability in bipolar depression.**

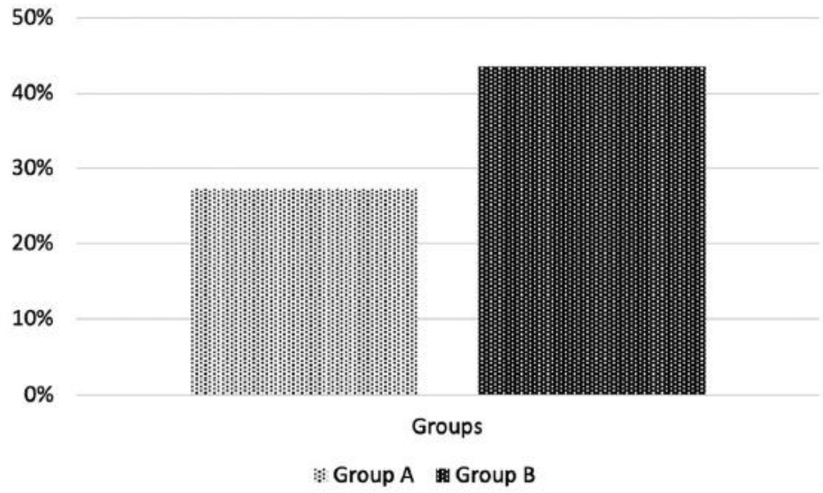

Figure 1. Prevalence of irritability between groups after 4-week BLT exposure protocol.

Reference:

Łorenzo Fregna , Francesco Attanasio and Cristina Colombo, ”The effect of bright light therapy on irritability in bipolar depression: a single-blind randomised control trial”, Int J Psychiatry Clin Pract . 2023 Nov;27(4):416-418.

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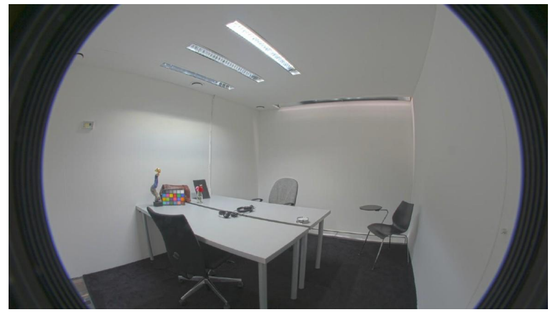
Perceived ambient quality

How do you perceive the room?



Method:

Randomized controlled trial in two identical rooms, **with CoeLux and with standard illumnation,** involving 100 subjects. Evaluation by means of questionnaires.

Main results:

Both CoeLux® skylight and the resulting room atmosphere were perceived as ***very natural*** *and* ***attractive*****.** For all the associations, CoeLux® outperformed the standard (effect size >0,8). For most of the cases, high significance ($p < 0.001$) was obtained.

Reference:

Room- and illumination-related effects of an artificial skylight, Canazei et al. *Lighting Res. Technol.* (2015) 0:1-20

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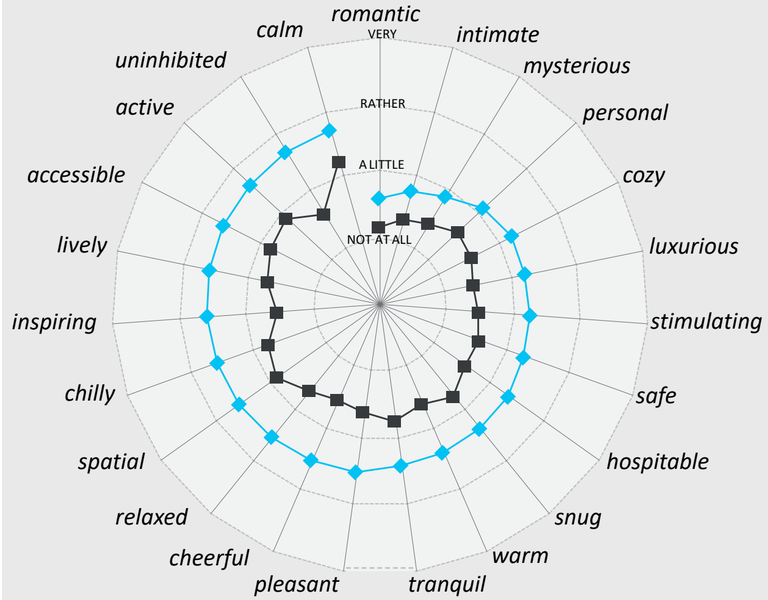
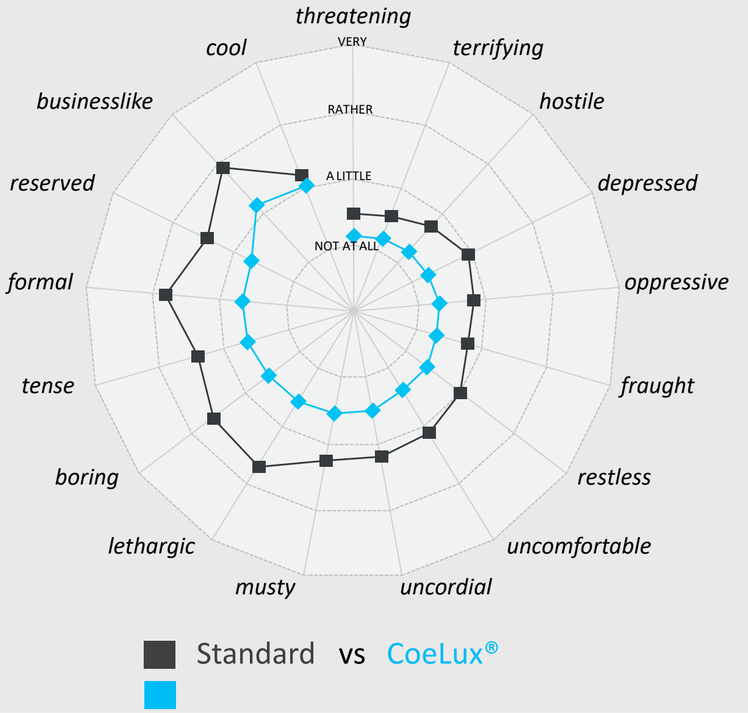
POSITIVE ASSOCIATIONS



NEGATIVE ASSOCIATIONS



Immediate (<1h) person-related effects – case 1 - summary

How do you perceive yourself?

Method:

Immediate and medium-term (1h) **mood-related and neurocognitive effects** where evaluated in two identical rooms, **with CoeLux and with standard illumnation,** over a sample of 100 persons, by means of a **questionnaires** and **two decision-making tests**.

Main results:

CoeLux® outperformed standard lighting both for positive and negative associations. Scores of CoeLux ® lighting were quite stable along the duration of the test, whereas those for ***standard lighting got significantly worse after one hour*** (e.g. Claustrophobia).
Subjects made riskier, faster as well as more selfish decisions under CoeLux®

Reference:

Artificial skylight effects in a windowless office environment
Canazei et al. *Building and Environment* (2017) 124:69-77

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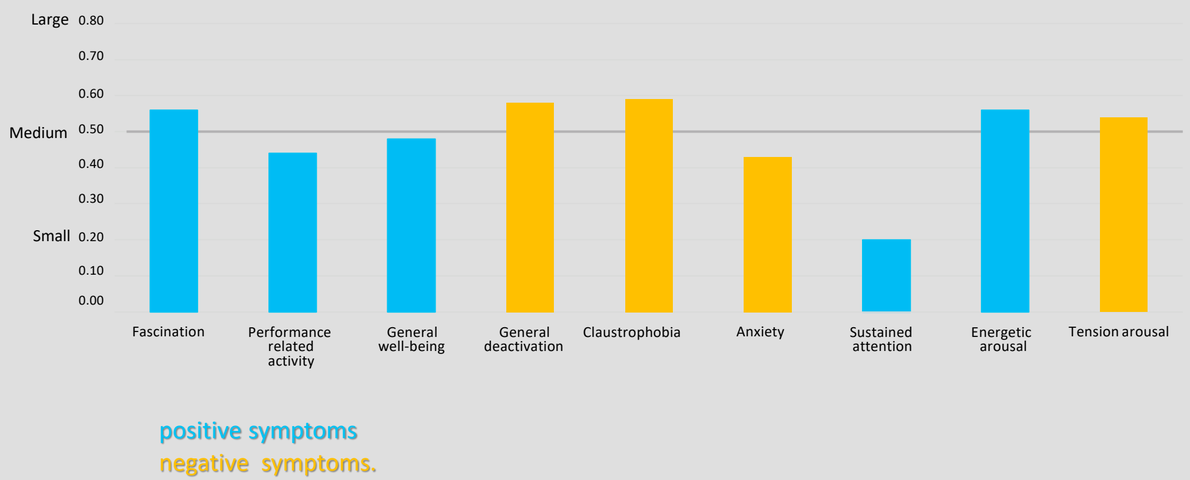
MEASURED DIFFERENCE (COHEN'S «d» EFFECT SIZE) BETWEEN COELUX AND CONVENTIONAL LIGHTING SYSTEM, FOR POSITIVE AND NEGATIVE SYMPTOMS



Results summary. Details are in the following slides

Immediate (<1h) person-related effects – case 1 - detail

1. Performance - Related Activity

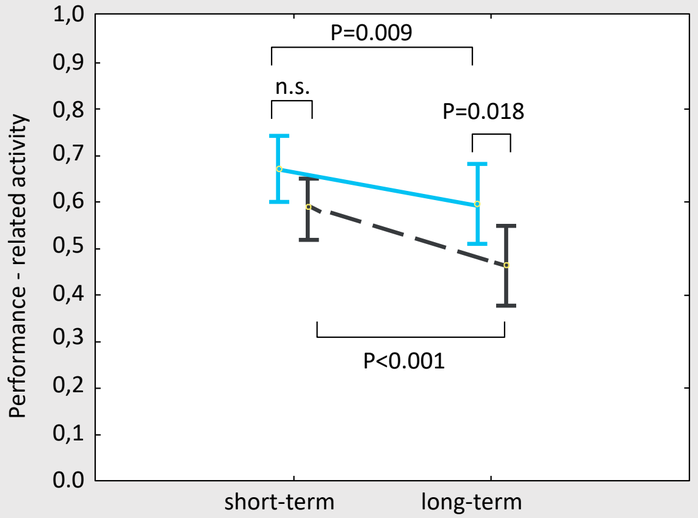
Reference: Artificial skylight effects in a windowless office environment. Canazei et al. *Building and Environment* (2017) 124:69-77

Measures*:
25 items measured, e.g. keen, eager, motivated to work, active, energetic, forthcoming, persistent, concentrated,
...
* Janke, 1978

Rationale:
actual mood state at the beginning (Short-term) and at the end of the data collection period (Long-term)

Key finding 1 - Frequency (%):
CoeLux® Performance-Related Activity Score was rated higher than Standard mean score by **76% of the subjects**

Key finding 2 - Effect Size:
Cohen's d = 0.44



CoeLux®
Standard

Immediate (<1h) person related effects – case 1 - detail

2. General Deactivation

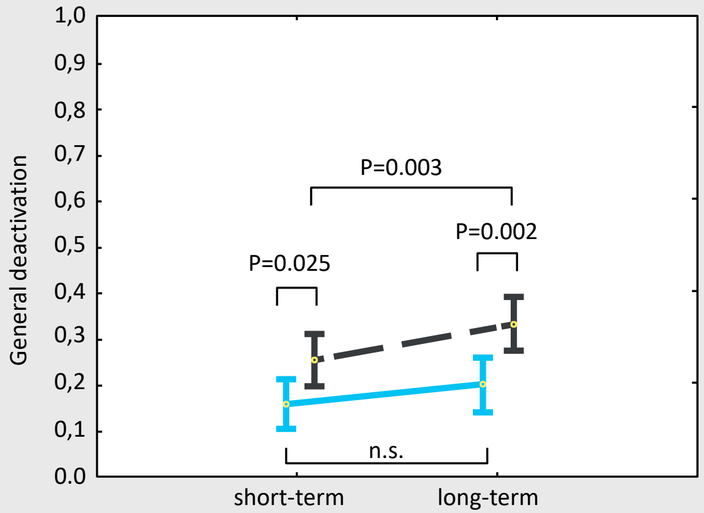
Reference: Artificial skylight effects in a windowless office environment. Canazei et al. *Building and Environment* (2017) 124:69-77

Measures*:
32 items measured, e.g. careless, spiritless, powerless, lazy, passive, slow, sleepy, demoralized, …
* Janke, 1978

Rationale:
actual mood state at the beginning (Short-term) and at the end of the data collection period (Long-term)

Key finding 1- Frequency (%):
CoeLux® Performance-Related Activity Score was rated higher than Standard mean score by **84% of the subjects**

Key finding 2 - Effect Size:
Cohen's d = 0.58



CoeLux®
Standard

Immediate (<1h) person related effects – case 1 - detail

3. Claustrophobic Symptoms Checklist

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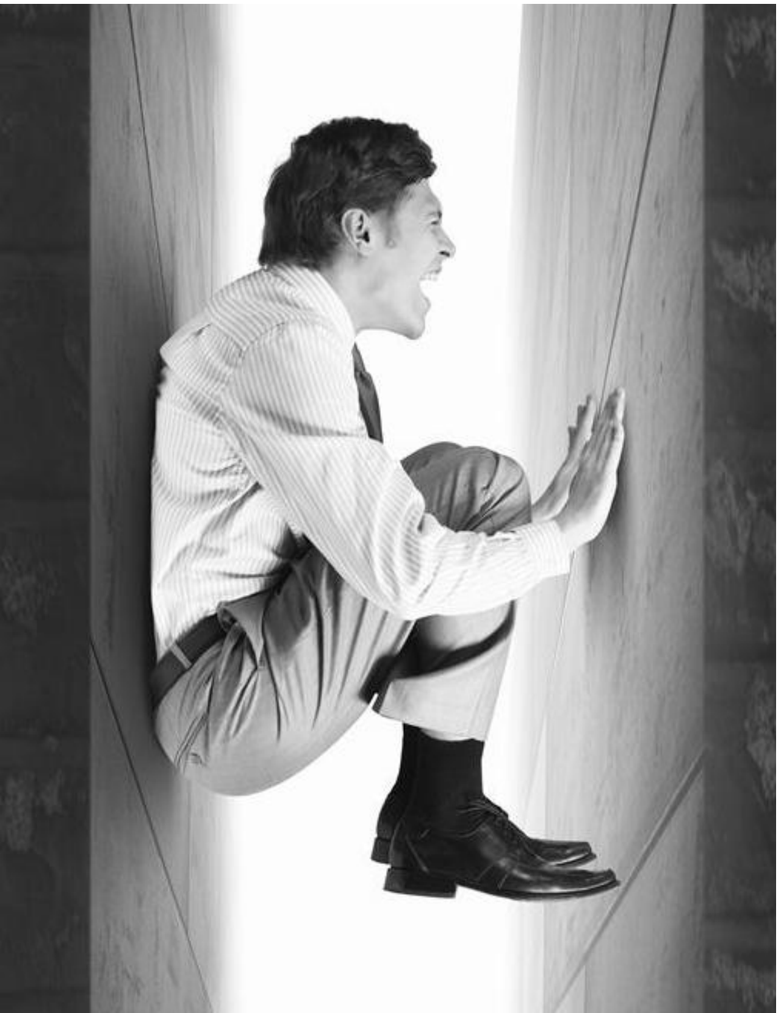
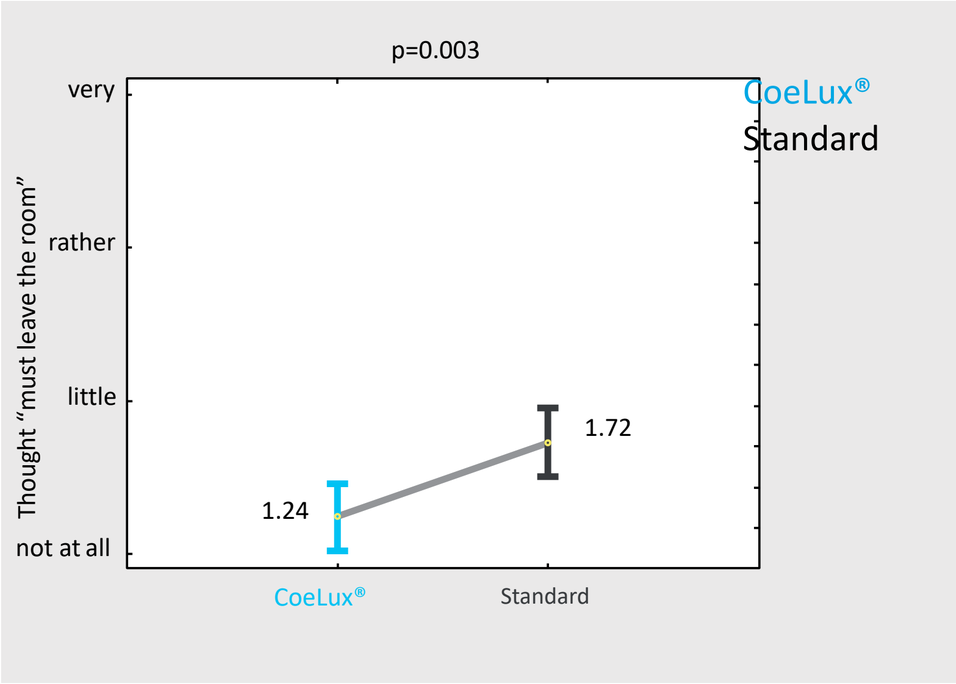


Measures*:
Two out of 6 claustrophobic symptoms were significantly different between the two lighting conditions: item “I feel dizzy” and item “I think that I must leave the room”.

Rationale:
to quantify potential lighting effects on claustrophobic feelings

Key finding 1 – Frequency (%):
The feeling “must leave the room” was rated lower than Standard mean score by **84% of the subjects**

Key finding 2 - Effect Size:
Cohen’s d = 0.59



Reference: Artificial skylight effects in a windowless office environment. Canazei et al. *Building and Environment* (2017) 124:69-77

Immediate (<1h) person related effects – case 1 - detail

4. State-Trait Anxiety Inventory (STAI)

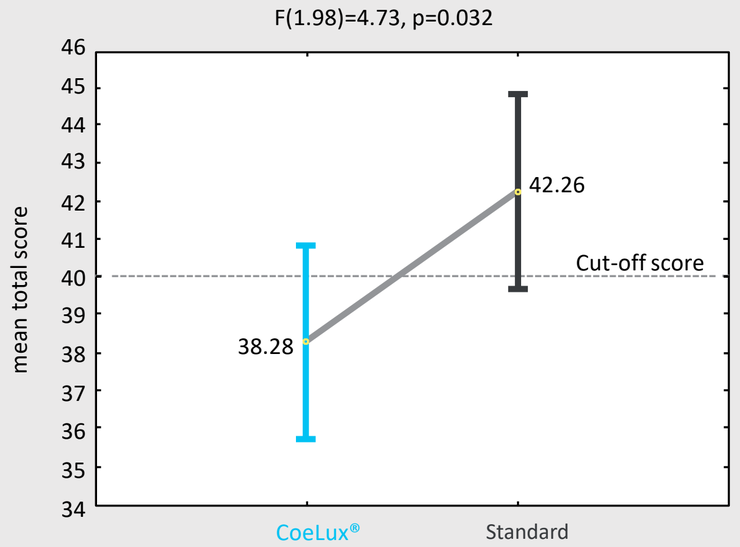
Reference: Artificial skylight effects in a windowless office environment. Canazei et al. *Building and Environment* (2017) 124:69-77

Measures*:
a total anxiety score was derived by adding the ratings (1 to 4) of 20 items, e.g. feel calm, secure, tense, upset, atisfied, frightened, nervous, relaxed, worried, …

Rationale:
room lighting long-term effects on the perceived anxiety state have been measured. A Cut-Point of 40 **detects clinically significant symptoms for S-Anxiety Scale

Key finding 1 – Frequency (%):
Under CoeLux® state anxiety was rated lower than Standard mean score by **70% of the subjects.**

Key finding 2 - Effect Size:
Cohen's d = 0.43



Key findings – Cut-off score:
Standard lighting (but not CoeLux) exceeds the cut-off score of STAI indicating clinically relevant heightened anxiety scores

Immediate (<1h) person related effects – case 2

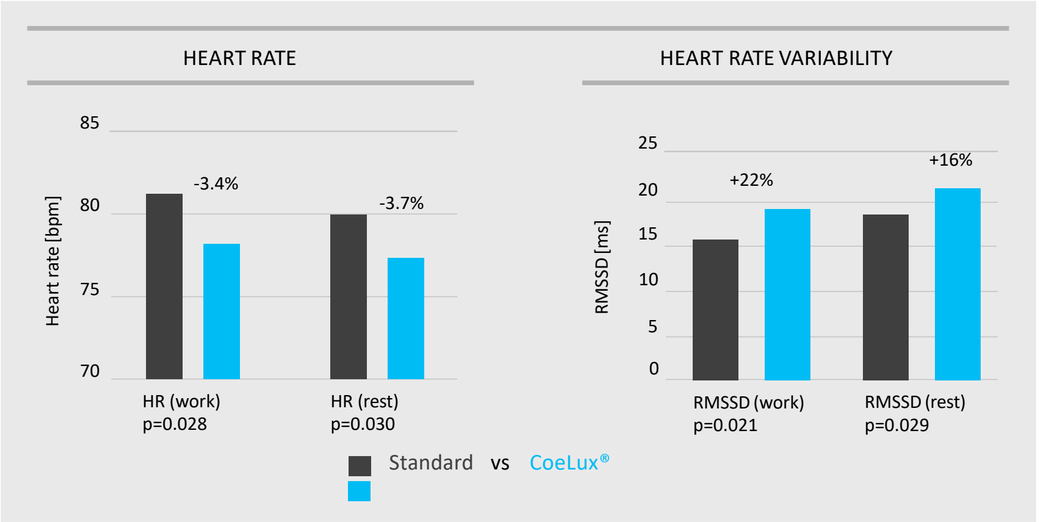
Calming effects on geriatric impatients

Method:

21 **mildly depressed geriatric inpatients** in a balanced cross-over design, over 2 consecutive days for 30 minutes under **either conventional room light or CoeLux® 45 LC** *via* questionnairs and physiological measurements

Main results:

Subjective calmness was found to improve over time under CoeLux® only (p = 0.029). Even though glare was reported, under CoeLux. **patients voluntarily stayed within the area directly lit by the artificial sun** nearly all the time (97%), while keeping their eyes closed for longer time.
Subjective calmness is confirmed **lower hearth rate and larger heart rate variability** (vagal tone) under CoeLux, both under work load and at rest (large effect sizes)



Reference:

Psychophysiological Effects of a Single, Short, and Moderately Bright Room Light Exposure on Mildly Depressed Geriatric Inpatients: A Pilot Study. Canazei et al. *Gerontology* (2017) 63:308-317

In collaboration with

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Non-visual (?) effects on diurnal exposure – case 1

during and after (by night) the exposure

Method:

10 people in **a workplace** were involved for an *all-day long test*. While performing mild activity, their psychological and physiological conditions were measured thanks to questionnaires, EEG, ECG and salivary measurements.

Main results:

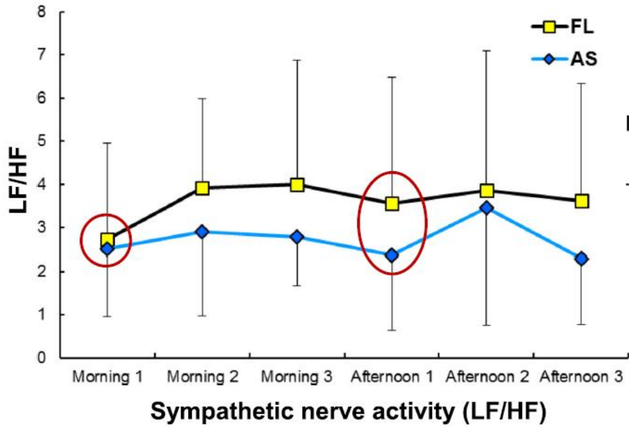
CoeLux is perceived as ***more attractive, more natural and connected to nature than standar lighting***

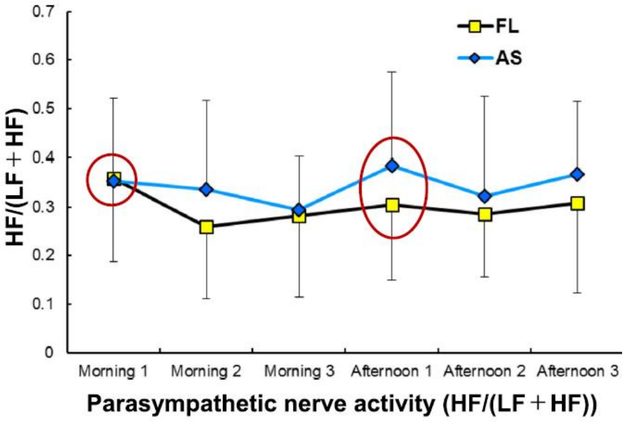
With CoeLux, Cortical arousal levels were significantly lower whereas work performances were similar between the sources.

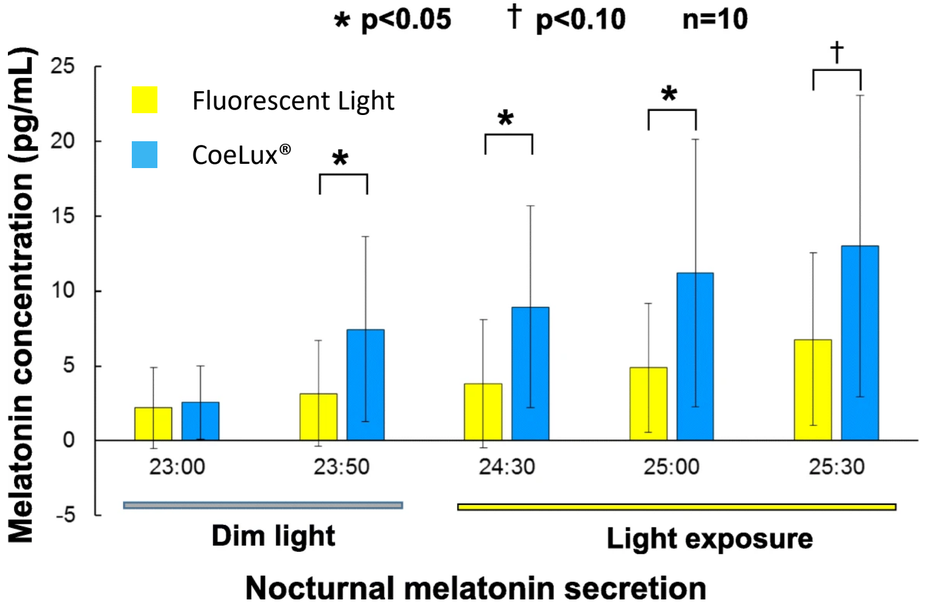
HRV evaluation showed that **sympathetic nerve tone was lower** and **parasympathetic nerve tone was higher**, both significantly.

Ordinary level of arousal is the same, but ***work can be performed with lower stress*** (EEG measurement)

Salivary measurements revealed an ***advanced onset of melatonin secretion***, then a good quality of sleep is expected thanks to the maintainance of circadian rhtyhm.







The advanced onset of melatonin secretion at night due to the exposure, during the day to CoeLux® Lighting (AS) vs Conventional Lighting (FL)

Reference:

Non-visual effects of diurnal exposure to an artificial skylight, including nocturnal melatonin suppression
Yasukouchi et al. *Journal of Physiological Anthropology* (2019) 38:10

Effects on diurnal exposure – case 2

during and after (by night) the exposure

Method:

Two tests in a workplace (a long-duration test involving 8 people and a short-duration test involving 156 people) based on questionnaires.

Main results:

People rated themselves as feeling significantly ***more alert motivated, productive, enthusiastic, chilled, happy, relaxed, energetic, optimistic*** and they found the conditions **easier to work in**.

In the 5-days test, respondents in the test room reported having had a ***longer sleep*** (mean value around 18 minutes) the previous night than those in the control room.

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