

LIGHTSYMPOSIUM
WISMAR 2020/21

THE FUTURE OF DAYLIGHT
AND ARTIFICIAL LIGHTING
IN HEALTHY
BUILT ENVIRONMENTS

MARCH 10—12

The Quest for Natural Light - Then, Now and Tomorrow

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From
Deity
to be
worshipped
to
Green
Architecture

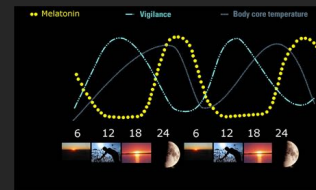
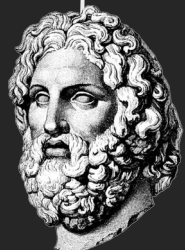
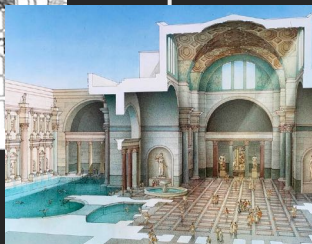
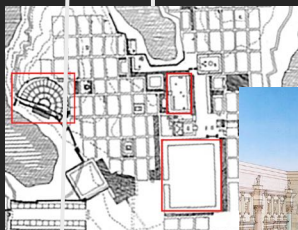
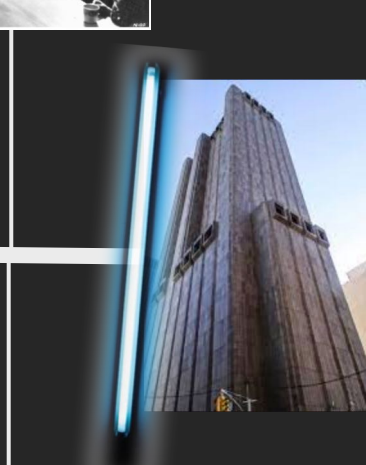
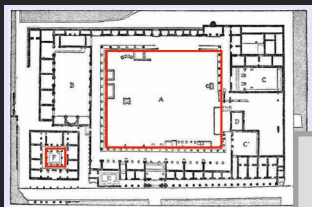
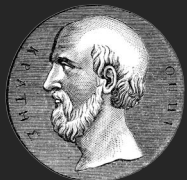


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- Sun in the Temple
 - Sun & The City – Agora, Forum
 - Sun & The House – Atrium
 - Healing Sun – Solarium
 - Darkening the Sun – Solarium
 - Darkening the City – Industrial Revolution
 - Sun & The Tenement – Let the Sun Shine in
 - The Scientific Sun
 - Let the Sunshine out
 - Sun & Green Buildings
 - Sun & Biological Rhythms

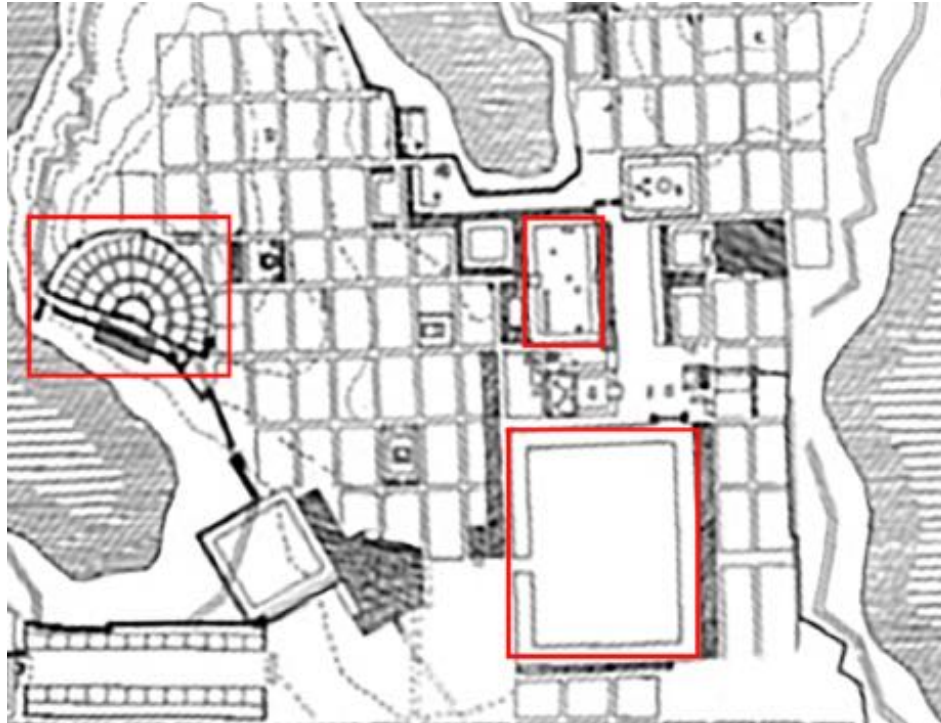




Open Space for Daily Use – Miletus by Hippodamus, 5th Century B.C.



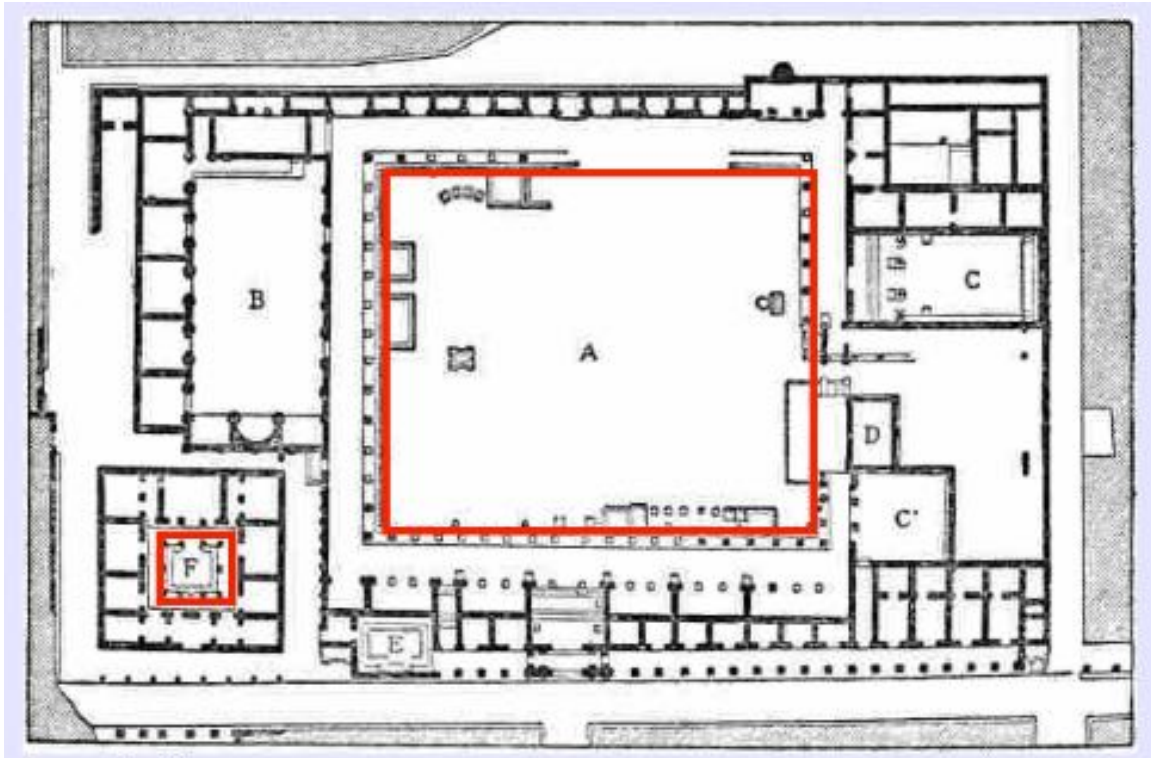
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Open Space for Daily Use – Forum and Atrium in a Greek Setting



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Open Space for Daily Use— The Place They Called Therapia



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Open Space for Daily Use – Piazza del Campo, Siena, 1169 A.D.



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Open Space for Daily Use – Piyasa, Sariyer, Istanbul, 1930



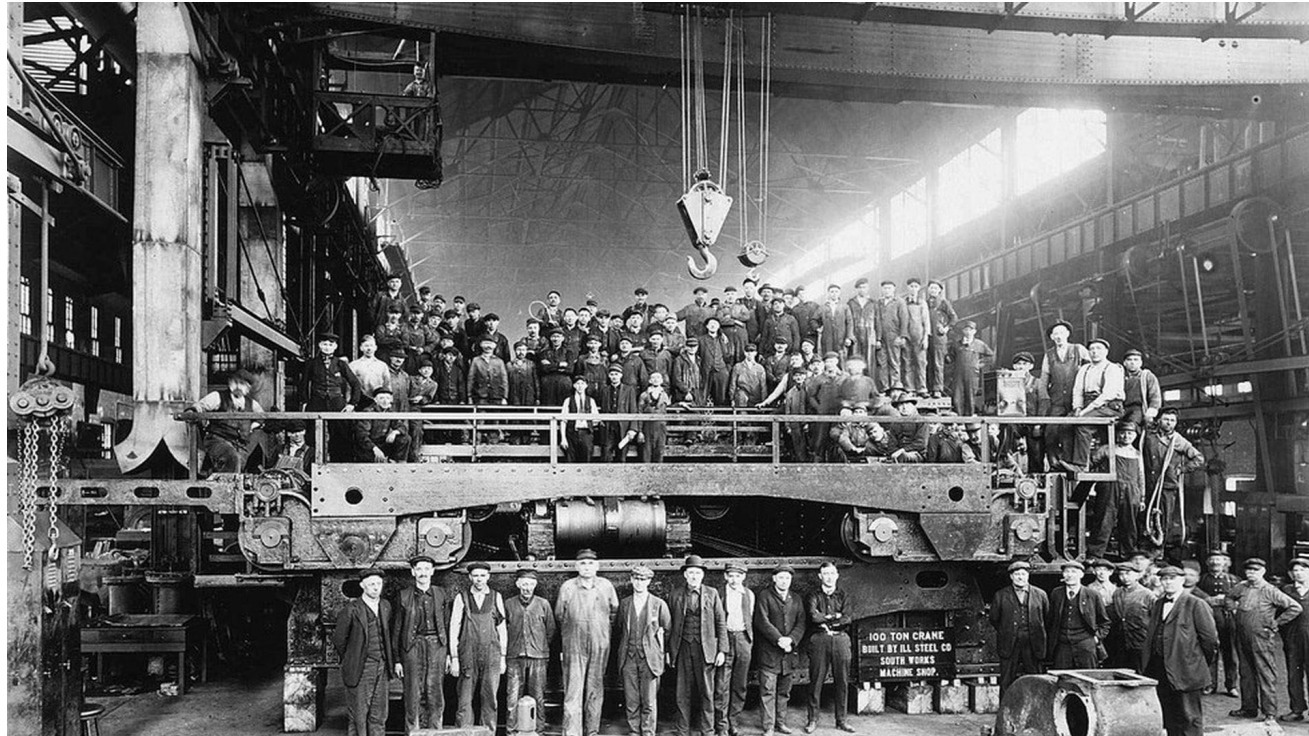
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Industrial Revolution – When the Skies Came out of Reach



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Industrial Revolution – How the English Disease was Born



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A perfect place for Homo Diurnus?

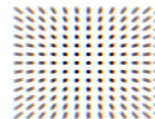
Industrial Revolution – When the Cities Kept Darkening



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A perfect place for Homo Diurnus?



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Natural light at a school in Chicago, 1938

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National Museum of American
History, Smithsonian Institution

The Quest for Healthy Light in Buildings – The Birth of the Scientific Sun aka **Integrative Lighting**



This for health

+



This for sight

Dual – purpose light



Daniel Freund, American Sunshine

The Quest for Healthy Light in Buildings – Let the Sun Shine in



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Children at the Smethwick School, aged nine to eleven, took their studies in Vita Glass classrooms. According to the company, boys gained an average of 2.83 pounds and 1.22 inches more than their compatriots in regularly glazed rooms. They also made more red blood cells. Girls faired even better, 6.11 pounds and 1.86 inches.

Daniel Freund

Daniel Freund, American
Sunshine

The Quest for Healthy Light – Sun & The City

First International Conference on Light, Paris, 1927
proclaims

*From Heliotherapy to Heliohygiene

**A healthy outdoor life
as the ultimate goal**

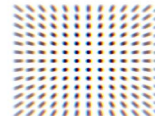
*Saleeby C.W. 1928 in Sunlight 1(7)
Rollier, A. 1923, Heliotherapy

The Quest for Healthy Light in Buildings – Or: The Scientific Sun



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Light therapy at a school in New York, 1940

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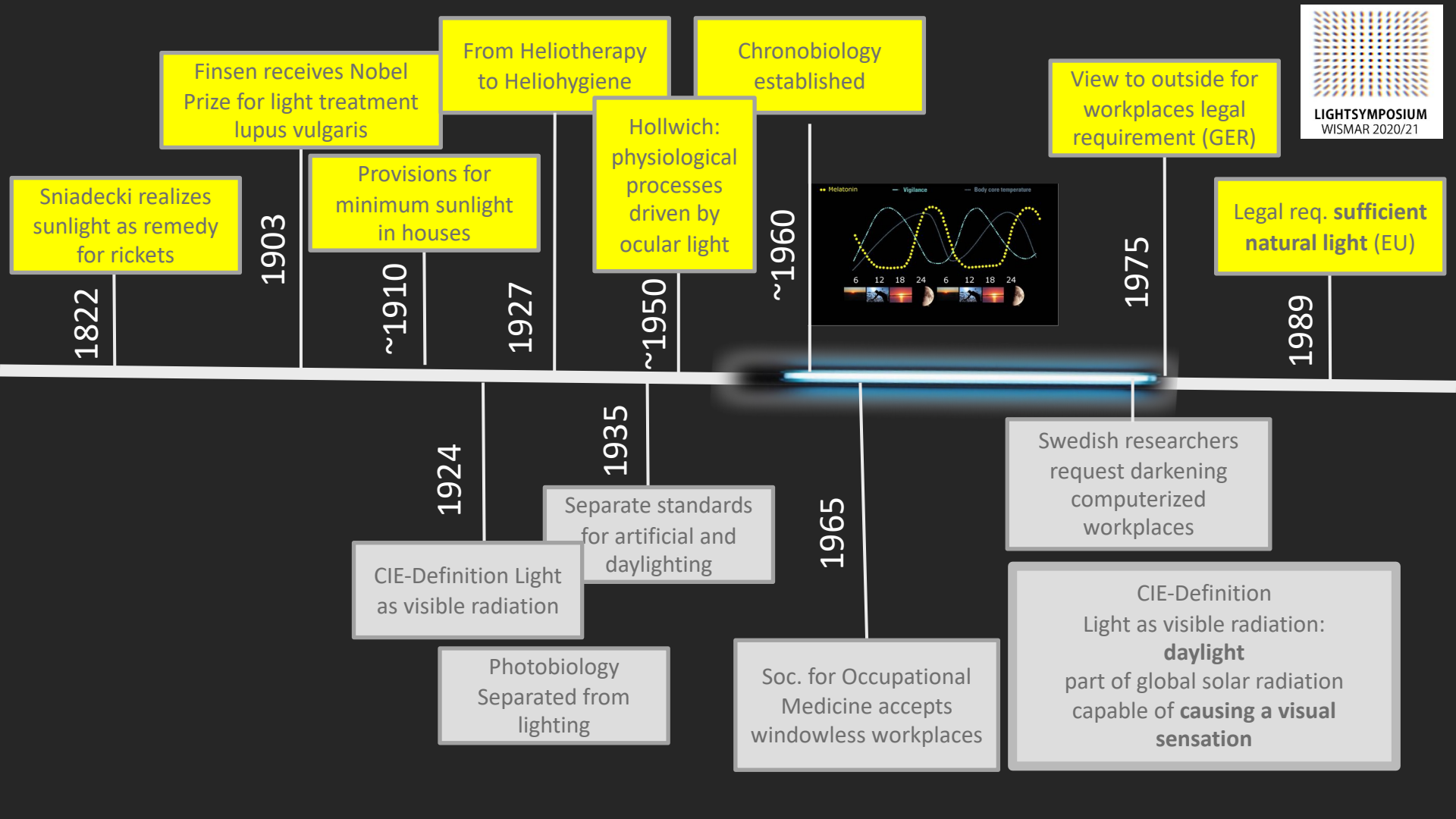
National Museum of American
History, Smithsonian Institution

Dein Kind braucht Sonne!



OSRAM-VITALUX

Scientific Sun
in Action



The Quest for Healthy Light in Buildings and Cities

By about 1960 ...

- *Good lighting* was considered artificial fluorescent lighting.
- Occupational medicine accepted windowless workspace as „healthy“.
- Office landscapes (almost) without windows were created.
- Windowless learning space (schools, lecture rooms) became common.
- Builders were asked to stop constructing skyward altogether, opting instead to tunnel underground habitations.
- With air conditioning and modern illumination, humanity was believed ready to return to the cave.
- Indoors, homes with improved lighting could outdo the sun.

Solarium to Promote Health – And its End

A place exposed to sun

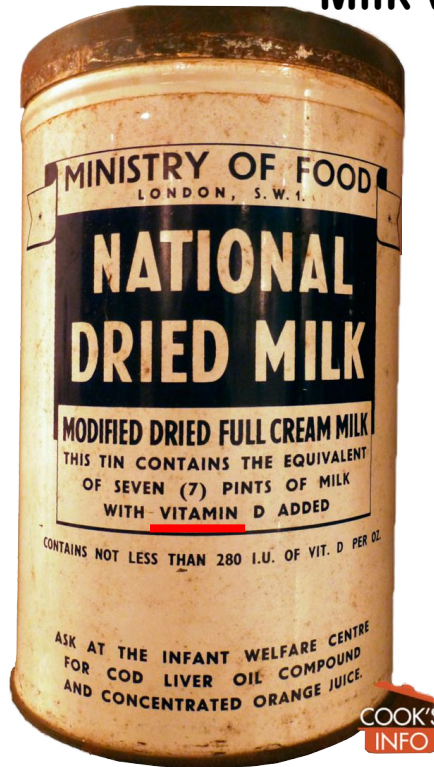


Paganism

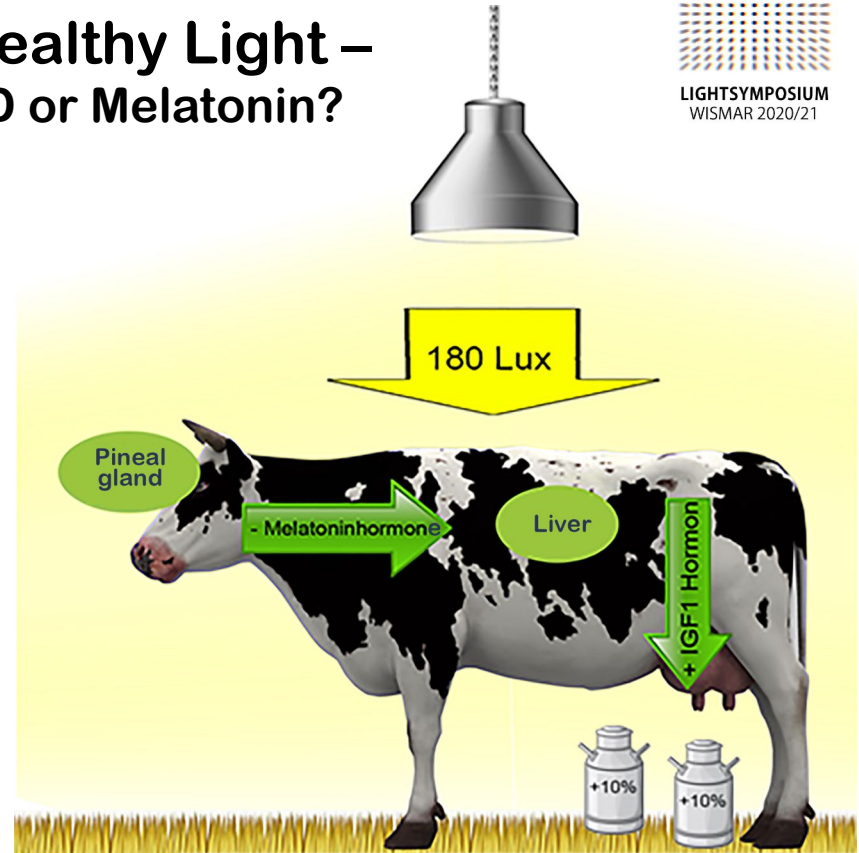


Tanning bank

The Quest for Healthy Light – Milk with Vitamin D or Melatonin?



Radiant health (not) straight from the sun itself or from its replica?





Rationale of Controllability

Keep all under control – Keep them constant

“At present the pro-window forces still lack behavioral data in support of their case and argue on the basis of metaphor and supposition, but their arguments must be weighed against statistics...from the windowless schools...reported to have 40 percent greater efficiency in heating and cooling, **constant light to prevent eye strain**...35 decibels or more noise reduction, and reduced maintenance costs.”

C.T. Larson, 1965

The Effect of Windowless Classrooms
on Elementary School Children

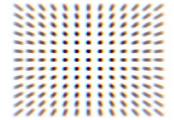


1971



1973

1974



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1988

1991



History of a School Planned to Function without Daylight



Rationale of Controllability

Keep all under control – Keep them constant

Until the year 2004
in Germany
daylight
did not contribute
to lighting
of workplaces

said the
Workplace Ordinance

Rationale of Controllability

Keep all under control – ~~Keep them constant~~

Until the year 2004
in Germany
daylight
did not contribute
to lighting
of workplaces

Workplace Ordinance, 2004

- Daylight is the primary lighting
- All workplaces shall receive sufficient daylight as possible
- Workstations should be placed as near to the windows as possible

Let the Sunshine in Solar Architecture

From about 1980 ...

- The sun as a source of energy
- Energy-saving glazing
- More glass than wall – better communication with the environment
- Light transmission reduced against simple glazing
- In most projects, refurbished buildings receive less light
- „Daylighting“ means: invisible solar radiation cut to nothing
- Inside buildings, you will never see saturated colours

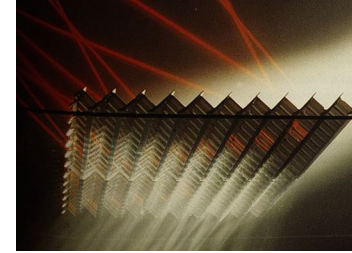


Schneider, Solar Architektur für Europa

Let the Sunshine in Solar Architecture



Let the Sunshine in Solar Architecture

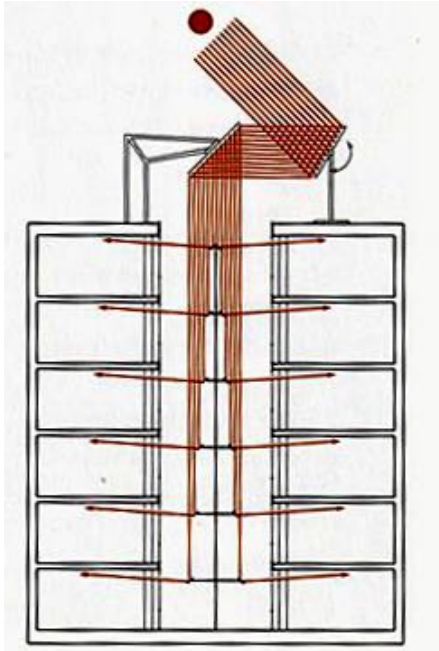


Control over the volume
and intensity of light –
A perfectly engineered future?

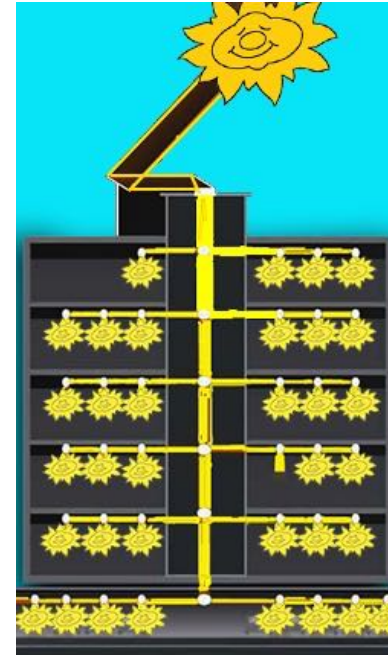
Let the Sun Shine in Lightpipes to bring sunlight into buildings



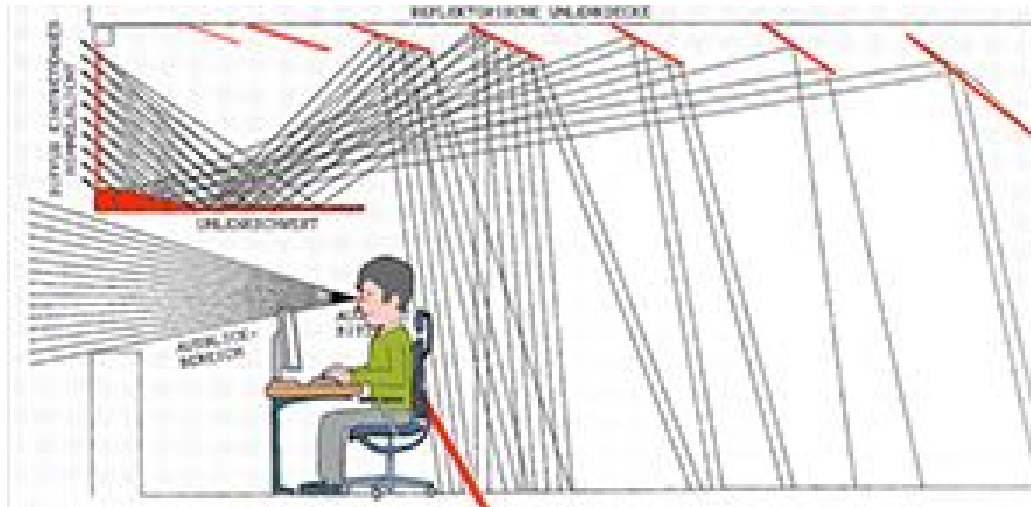
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Nice idea! But ...
What about physics?



Let the Sun Shine in Light shelf to convey light deep into the room



Nice idea! But ...
What about psychology?

Light and Health 1926

Scientific Sun or Simulating Outdoors Inside

Some findings...

LIGHT AND HEALTH


*A DISCUSSION OF LIGHT AND OTHER RADIATIONS IN
RELATION TO LIFE AND TO HEALTH*

Luckiesh, M., & Pacini, A.

- Evolution has written certain needs into bones, bodies, and eyes
- Coming indoors cannot overcome that in generations
- Natural light is essential in living and work environments

ARTIFICIAL SUNLIGHT
COMBINING RADIATION FOR HEALTH
WITH LIGHT FOR VISION

MATTHEW LUCKIESH



Adapt the indoors to
simulate the out-of-doors

Light and Health 1990

How to Improve Working Conditions?

LIGHT AND HEALTH

Influences of lighting on health and well-being
of office and computerworkers

Ahmet E. Çakir

Çakir & Çakir, 1990

Some findings...

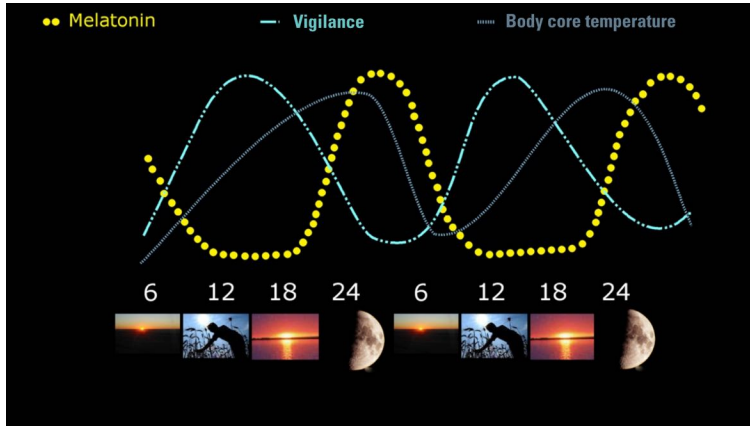
- Daylight in work environments improves self-reported health beyond any expectation
- The negative impact is likely to be caused by circadian interruption and not by the characteristics of the artificial lighting
- Personal control of the visual environment a most powerful factor for health and well-being



Improve daylighting, but
also the artificial lighting

Light and Health 2020

A Century after the Scientific Sun ...



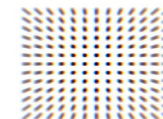
- We have „tens of thousands“ of scientific papers on circadian rhythms
- We know much more about physiology of the eye than in 1990
- We seem to know about the **circadian rhythms**
- But: Even experts suspect a typo when they read **circannual rhythms**
- „Light therapy“ introduced in the 1980s still goes strong, but it is not lighting
- Lighting standards still rely on „illuminance“, a physical quantity defined for laboratory
- Quality of lighting defined in 2021, but we need to define the **human needs**.



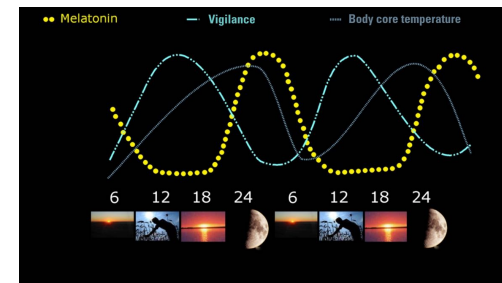
Light and Health 2050

Some thoughts on how to achieve more success ...

- Support human lifestyle (aka work-life-balance) in natural and built environments
- Lighting is not the ultimate goal, that is shaping the space
- Good lighting requires a holistic concept:
User experience BKA Vitruvian Principles of Architecture
 - Firmitas (quality, stability)
 - Utilitas (utility, usefulness)
 - Venustas (beauty, elegance)
- Support „biological“ rhythms, but
 - Light is a powerful zeitgeber, but not the only
 - Social zeitgebers, nutrition, temperature et.al. are of vital importance
 - Light in a „healthy“ environment is not just visible radiation, but also the scenery e.g. nature



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Thank you

Physiology is seldom that simple ...