The Evolution of Electrical Lighting Design: From utility to health

"An Old Woman Dozing" Nicolas Maes 1655

Before electricity…meager or expensive…

"The Potato Eaters" van Gogh 1885
"Concert de Flutes" Menzel
"The Bedroom" de Hooch 1660

Before electricity…the preferred light was daylight…

Salle de Lecture, LaBrouste, 1857
"Hide and Seek" Tissot 1877
Steven Mark House, Chase Hill Farm, RI
We’ll start with incandescents.

Note: Moscow, ID was founded in 1879 as was the incandescent lamp.
Pressure on designers...

...to the point of diminishing returns...~20 fl

Remember Weber's Law!
Post Oil Embargo Requirements—
Illuminance & Energy

Green Building Movement pressure:
LEED points for daylighting

GE ads—1960s and 1930s
Indianapolis Power & Light

...before and after 1960s remodel...

Electric light dominated vs. daylighted

An HID lamp for every window

Elevator lobby transformation

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...not just a 1960s thing...
light = power...

...fixtures for judicious night illumination...

...but, the notion persists...

...or dumb and dumber?...
The city now...

...but if you turn off the light,
the lamp doesn’t last as long...
to be debunked, stay tuned!

Please turn off the lights before you leave the building.

...but if you turn off the light,
the lamp doesn’t last as long...
to be debunked, stay tuned!

...occupancy sensors
Light and Performance

"In addition to its effect on the timing of circadian rhythms…blue light exposure can result in melatonin suppression, elevation of body temperature, and also increases in alertness and improvements in night performance.” However, if you want to sleep at night, avoid blue light…
Why light therapy offers an opportunity to cope with the problems of a modern, 24-hour society:

--S.H.A. Begemann

• Breakthrough
  • Separate non-visual detection of light
• Curative Applications
  • Winter depression and blues
  • Treat jet lag and shift work symptoms
• Preventative Applications
  • Reduce absenteeism & increase productivity
  • Treat symptoms in home-bound elderly
• Disclaimer
  • Most promising for office and elderly

In light treatment for SAD and non-seasonal depression, some degree of improvement occurs within the first hour (although full treatment may take several weeks).

In light treatment for SAD and non-seasonal depression, light in the blue end of the spectrum has proven to be most effective...

Why? Supresses melatonin.
Application of Healthy Lighting in the Workplace  
Laurens Zonneveldt

- What is healthy office lighting?
  - ~1000 lux needed for psycho-biological stimulation
  - Traditional lighting design
    - Illuminate the task
    - Avoid glare
  - Biological lighting design
    - Consider light falling on eye

Light & Health 2002  
Eindhoven University  
20 November 2002

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Richard Rogers fully subscribes to LRC’s findings.

Left: Pompidou Center  
Below: RSH Office in London’s Leadenhall Bldg (Cheese Grater)
In the daytime, performance and well-being

Daytime daylight is the economical light source that offer illuminances above 2000 lux with ideal spectral distribution
- Preferred light at work
- Survey respondents' choice
- For human health more than energy savings
- Cost equal to 1 hour's work/person/year

Circadian rhythm is also keyed to color temperature…

Warm light
- Cool light

Midday vs. Night

The color temperature of the hallways is modulated throughout the day to mimic the effects of changing sunlight. The LEDs temperature ranges from 3400 K at night to 6000 K at midday.
Discover CIRCADIAN technology!

- It’s the technology that best imitates sunlight.
- It affects the suppression and stimulation of melatonin release.
- It eliminates the negative effects of continuous exposure to artificial lighting, such as drowsiness, fatigue, and anxiety.
- Its flexible lighting control is made possible using a mobile app.

Examples of luminaires featuring CIRCADIAN technology:

- HAU
- TRANSFORM
- EVO IRX
- BRACKET C
- ROOSTER
- SYSTEM 2000
Daylight is a bit more effective per lux.

LRC calculator is web-based and gives rapid results…

https://www.lrc.rpi.edu/cscalculator
To be alert on the night shift, use blue light to suppress melatonin.

Which is the opposite of what you’d do to sleep well (suppress cortisol).
## Consideration for Healthy Lighting for Multiple Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Human and Bird Physiological Perception &amp; Chromatopilus A.U. Scale</th>
<th>Stimulus in Nanometers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humans</td>
<td><img src="image1.png" alt="Human Perception Scale" /></td>
<td>450-700 nm</td>
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<tr>
<td>Hamsters</td>
<td><img src="image2.png" alt="Hamster Perception Scale" /></td>
<td>400-600 nm</td>
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<tr>
<td>Dogs</td>
<td><img src="image3.png" alt="Dog Perception Scale" /></td>
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<td>Birds</td>
<td><img src="image4.png" alt="Bird Perception Scale" /></td>
<td>370-700 nm</td>
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<tr>
<td>Plants</td>
<td><img src="image5.png" alt="Plant Perception Scale" /></td>
<td>400-700 nm</td>
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</tbody>
</table>

Black indicates colors not sensed.

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...daylight fades...

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