Circadian Light For Your Health

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Health in Buildings

How do we Shift our Focus from Risk Avoidance to Health Promotion?

“Are You in an Unhealthy Office Relationship?”
Washington Post, June 2014

Risk Avoidance

Health Promotion
We know that daylight can help light our buildings and reduce energy.

Can it also provide circadian health benefits, improving sleep and daytime alertness?
Circadian System

- Plants and animals exhibit patterns of behavioral and physiological changes over an approximately 24-hour cycle that repeat over successive days—these are circadian rhythms

- *circa* = about; *dies* = day
Why is Light So important?

Light reaching the retina has several impacts.
Q: Why are we concerned with circadian light?
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A: There is a disconnect between our biology and our modern lifestyle.
For most of human history, we lived outdoors in a daylight rich world as hunter-gatherers...

"Someday this will all be done by consultants."
We now live and work indoors most of the day under evolutionarily novel light conditions.
We spend about 93% of our time indoors

J. Spengler, Harvard School of Public Health, 1983
What are the consequences of this dramatic lifestyle change?
Later that morning....
Circadian disruption has been associated with:

- Poor sleep
- Higher stress, anxiety and depression
- Increased smoking
- Cardiovascular disease
- Type 2 diabetes
Can we improve employee health through improved indoor daylight?
Study Sites
Phase 1

Buildings designed for max daylight penetration

Typical Federal Buildings
Measurement of light stimulus

- Developed by Lighting Research Center, Rensselaer Polytechnic Institute

- Calibrated meter that measures circadian light (Daysimeter)
  - From that we can calculate circadian stimulus over the waking period
Phase 1 Findings

Greater circadian stimulus exposures in the morning:

- Participants fell asleep faster at night (by almost 30 min)
- Reported decreased depression
- Reported improved sleep quality

Phase 1 Findings

Those exposed to higher **daytime circadian stimulus** reported:

- Sleeping better
- Feeling less depressed

Some Other Observations

1. The benefits of circadian light were slightly better in winter than in summer.

2. Behavior matters - People close shades when it is too bright and leave them closed, reducing indoor daylight.

3. Computers are a key driver of shade use and other daylight reducing behaviors.

4. Federal employees do not sleep a lot... AT ALL

5. Daylighting alone is insufficient for circadian stimulus in most spaces due to interior design choices and the difficulty in achieving daylight penetration.
The Daylight Ecosystem

**Daylight Design** – Windows, Controls, Integration with Electric Light

**Interior Design** – Furniture, Layout, Colors, Finishes, Computer Ergonomics

**Organizational System** – Culture, Occupant Behavior, Nature of Work, Reward Structure, Work Technologies
Who gets the window?

Who operates shades?

How mobile are people?

How do we compensate for low daylight?

Should we use daylight maps for layouts?

Could this be a Lumen Shower space?

Where do we put break areas?

Who gets the window?

How do we bring daylight deeper?
Will adding desktop LEDs yield similar results in workspaces with limited access to daylight?
Creating desktop lighting solutions
Why the desktop?

1. People spend the most time at their desks.
2. When at the desk, they are largely working on their computers – forward vision.
3. Light at the desktop can be designed to have maximum effect – it is more likely to enter the retina and it can be better controlled.
Study Sites
Phase 2

FHWA - Turner Fairbank Highway Research Center, McLean VA

White River Junction VA Medical Center, White River Junction VT
And...

Preliminary results are positive, but analysis still being finalized
Collaboration with U.S. Department of State

• All secure facilities have fully enclosed artificially lit office spaces
  – Varying amounts of solar access based on worldwide locations and geography

• U.S. Embassy in Riga, Latvia and Reykjavik, Iceland
In Summary

• Data shows health benefits associated with increased circadian stimulus during day, especially in the morning
  – Falling asleep faster at night
  – Better sleep quality
  – Better moods

• Daylight penetration not always possible; may need to supplement with additional light sources
  – Must consider the daylight ecosystem
What’s Next?

• Publish Results

• Leverage other research and create expert consensus around the best evidence for links between buildings and health outcomes

• Translate evidence into building design and operational practices

• Work with standards organizations to integrate health promoting practices into existing building standards.
Get Light, Mostly Daylight, Morning Best!

http://www.gsa.gov/circadianlight

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