

Biological Rhythm Aware Office Lighting Control

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Chara Papatsimpa is a current a post-doc researcher at TU/e. Her work is concerned with mathematical optimizations for human-centric lighting. Specifically how our existing knowledge on the circadian effects of light can be translated to formal lighting control optimizations.

Biological Rhythm Aware Office Lighting Control

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What is
the problem?

We spend
90%
of our time
indoors

Evening light
exposure
is high
(smartphones, TV)

Indoor light
levels are low

85%
of people
use an alarm

Resulting in

“Social jet-lag”
Misalignment of biological and
social time

We translate insights from
chronobiology to practical
lighting recipes to enhance
health and well-being
through offering
personalized light “nutrition”

Our solution



Methods

- We use quantatified models of the effects of light on human pacemaker

$$\dot{x} = \frac{\pi}{12} \left[y + \mu \left(\frac{1}{3}x + \frac{4}{3}x^3 - \frac{256}{105}x^7 \right) + B \right]$$

$$\dot{y} = \frac{\pi}{12} \left\{ qBy - \left[\left(\frac{24}{\tau 0.99729} \right)^2 + kB \right] x \right\}$$

- We formulated the system as a formal mathematical optimization problem
- Inroduced a novel algorithm to solve the highly non-linear problem

Personalized lighting pattern
for every employee

Light profile depends on history
of light exposure, user habits and
preferences

