Biological Rhythm Aware Office Lighting Control

Biological Rhythm Aware Office Lighting Control

Poster · May 2020

DOI: 10.13140/RG.2.2.13232.58886

2 authors:

Charikleia Papatsimpa
Eindhoven University of Technology
19 PUBLICATIONS **50** CITATIONS

SEE PROFILE

J.-P.M.G. Linnartz
Eindhoven University of Technology
257 PUBLICATIONS **6,428** CITATIONS

SEE PROFILE

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

Charikleia Papatsimpa[1] and Jean-Paul Linnartz[1,2]

[1]Eindhoven University of Technology, Eindhoven, the Netherlands

[2]Signify, Eindhoven, the Netherlands

What is the problem?

We spend **90%** of our time indoors

Evening light exposure **is high** (smartphones, TV)

Indoor light levels are low

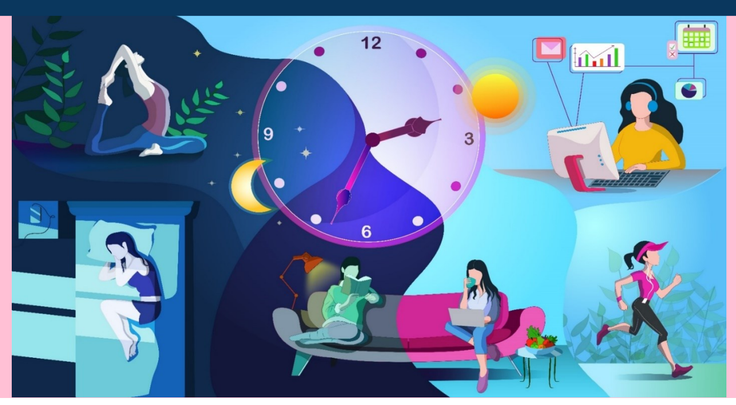
85% of people use an alarm

Resulting in

"Social jet-lag"
Misallignment of biological and social time

Our solution

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



Methods

- We use quantitatified 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