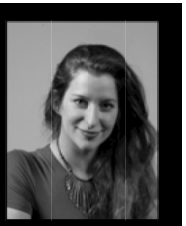
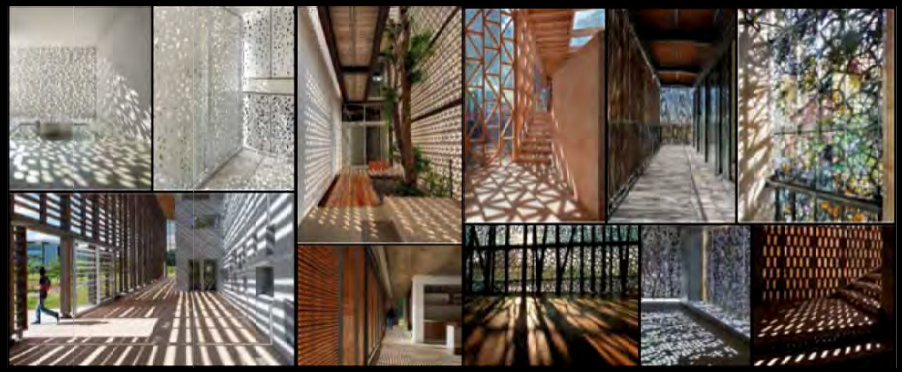
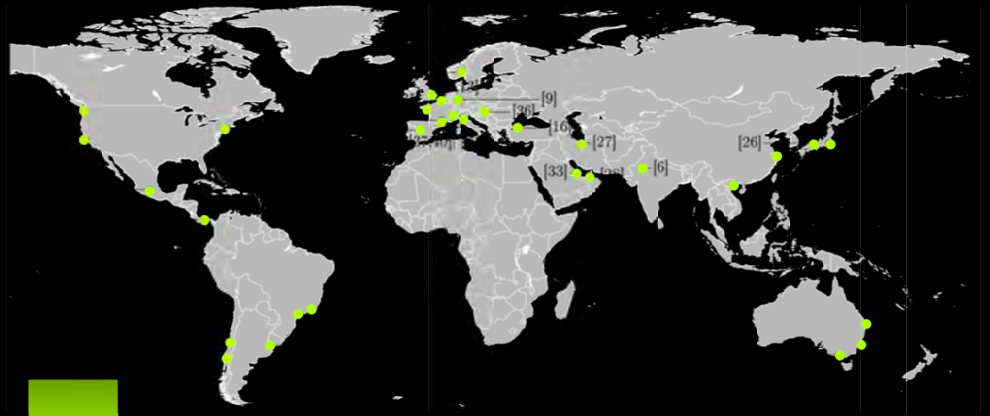
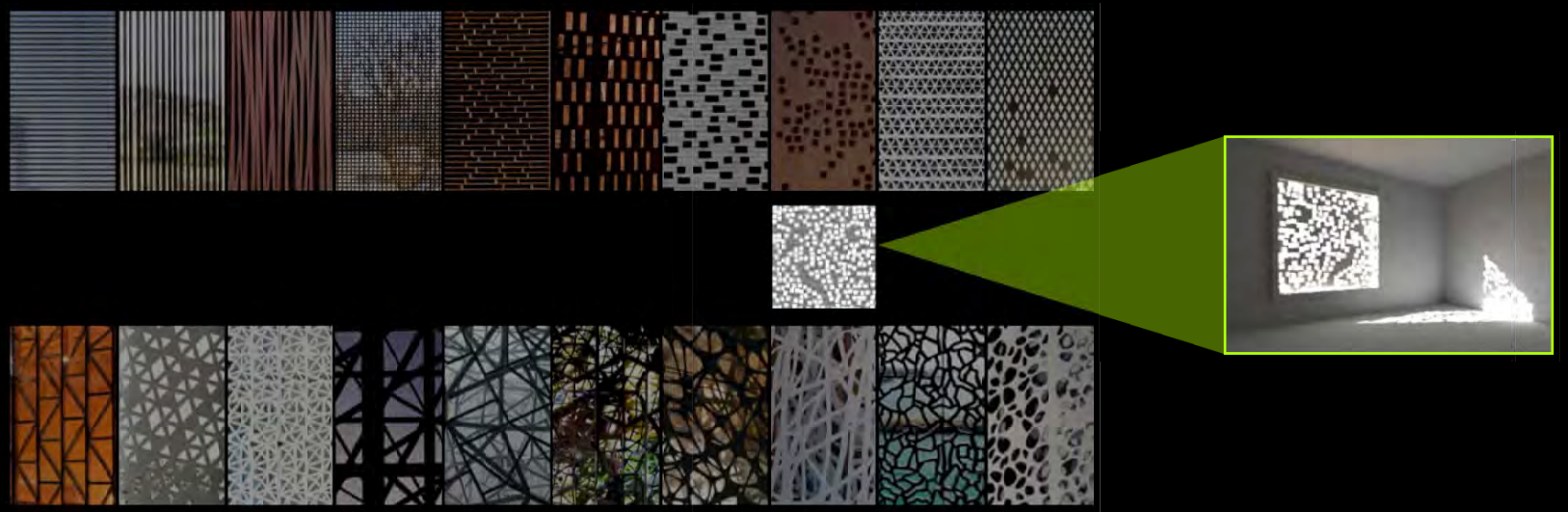
façade patterns

inspiration from worldwide architecture





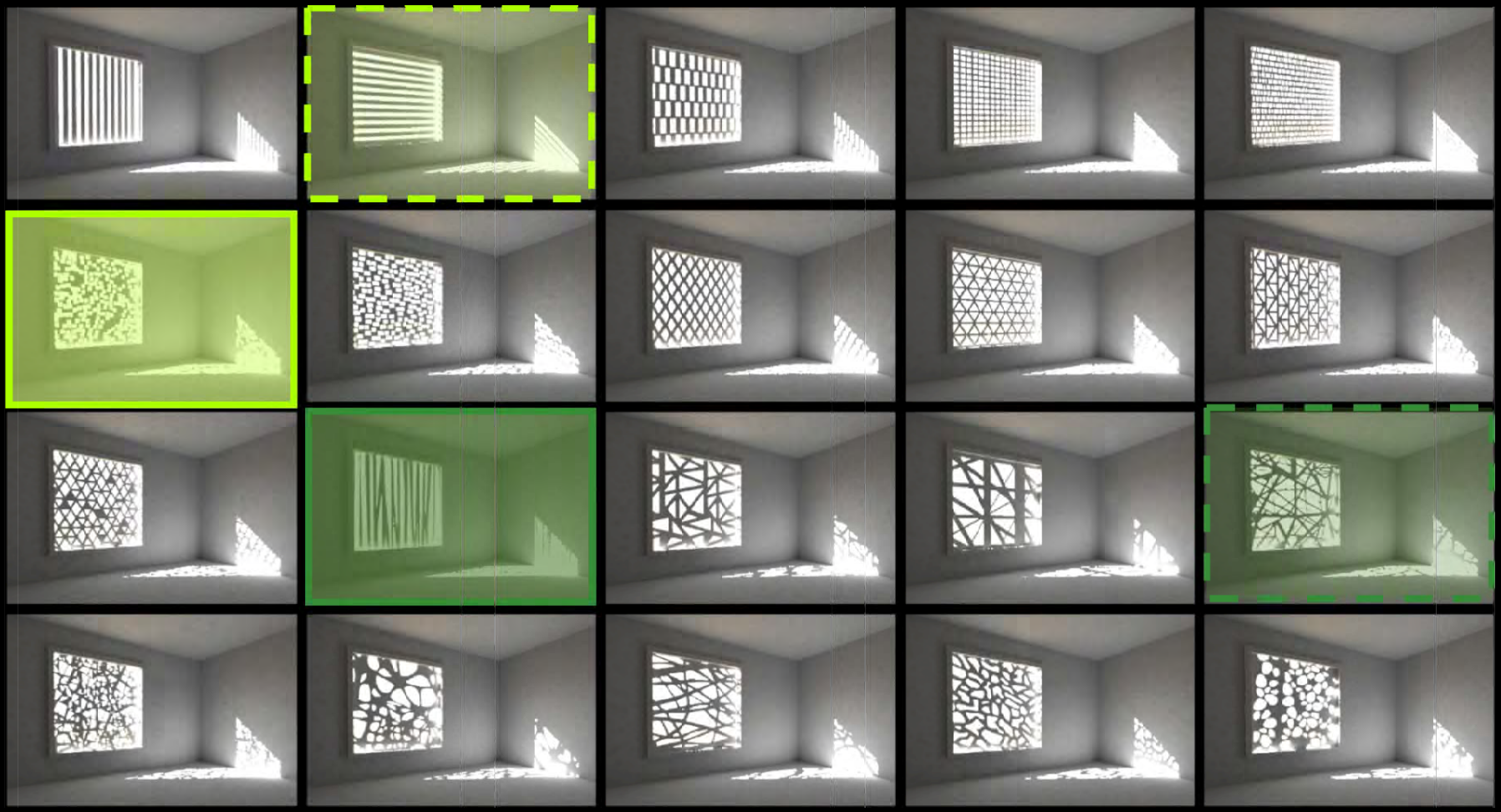




EPFL

façade patterns and daylight composition

consensus on pattern attributes (from designers)



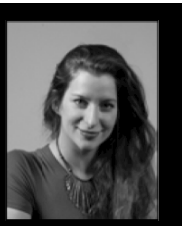
most exciting
least exciting

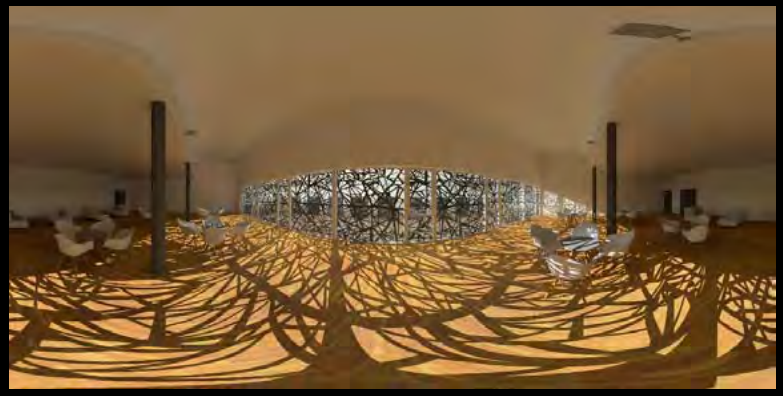
most calming
least calming

EPFL

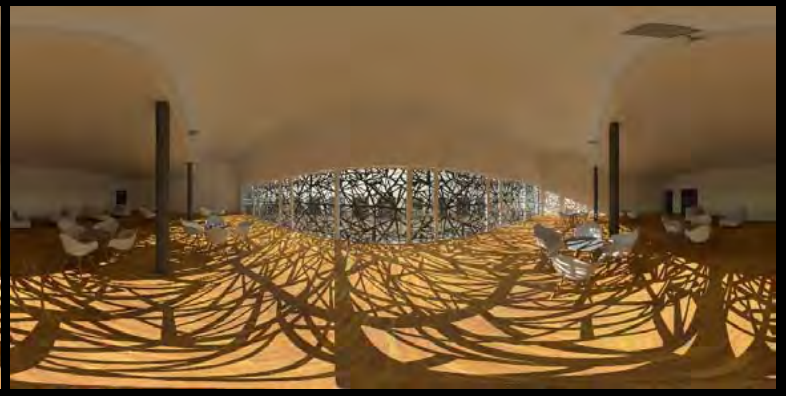
assessing human response to daylight patterns

VR immersion





left eye



right eye

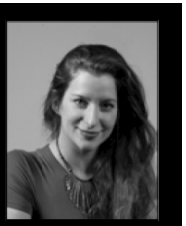
EPFL

daylight patterns and environmental context

overcast conditions

daylight patterns and environmental context

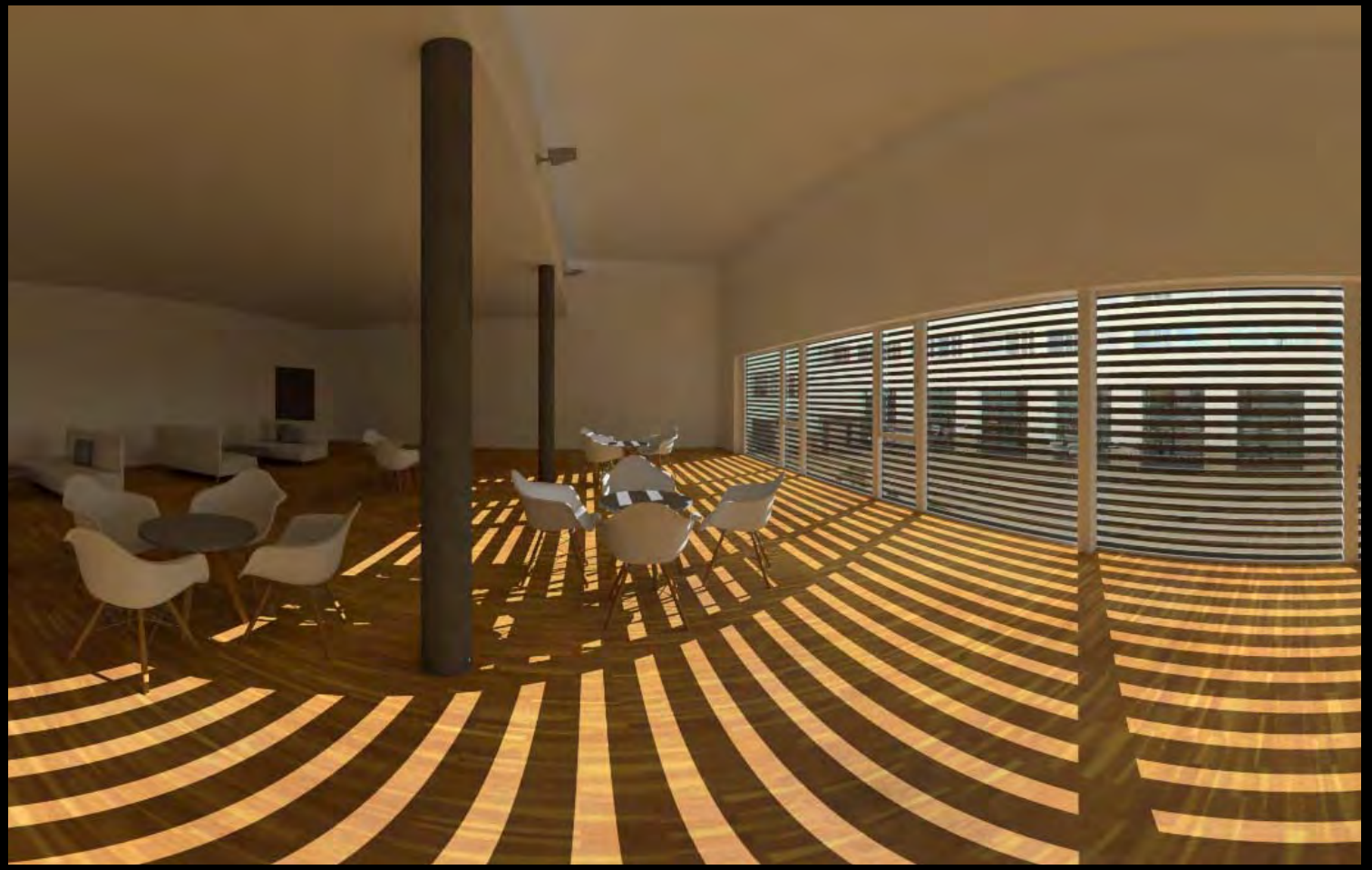
clear sky



EPFL

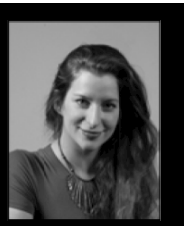
daylight patterns and environmental context

clear sky, low sun angle



daylight patterns and space use context

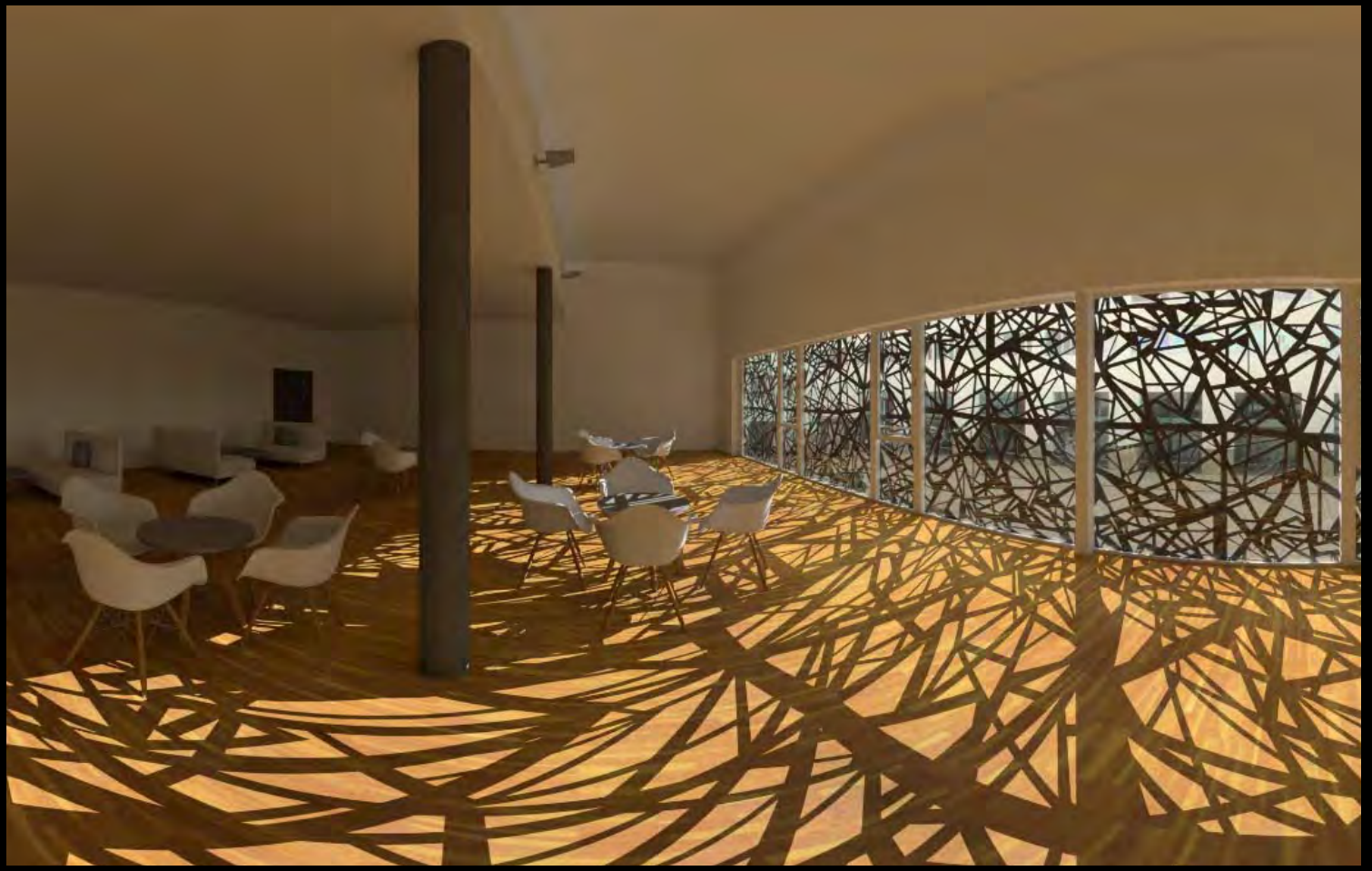
openspace environment



EPFL

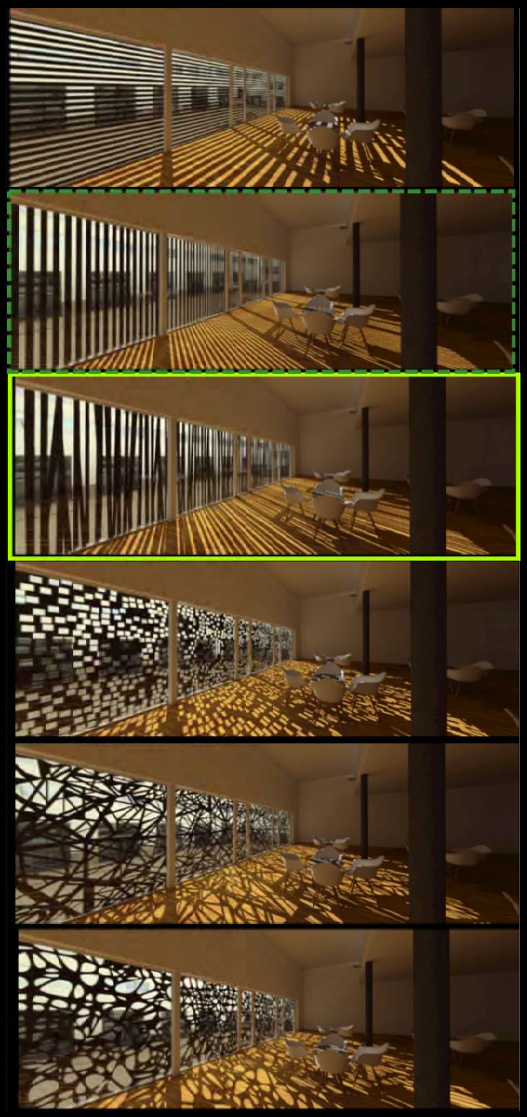
daylight patterns and complexity

irregular pattern

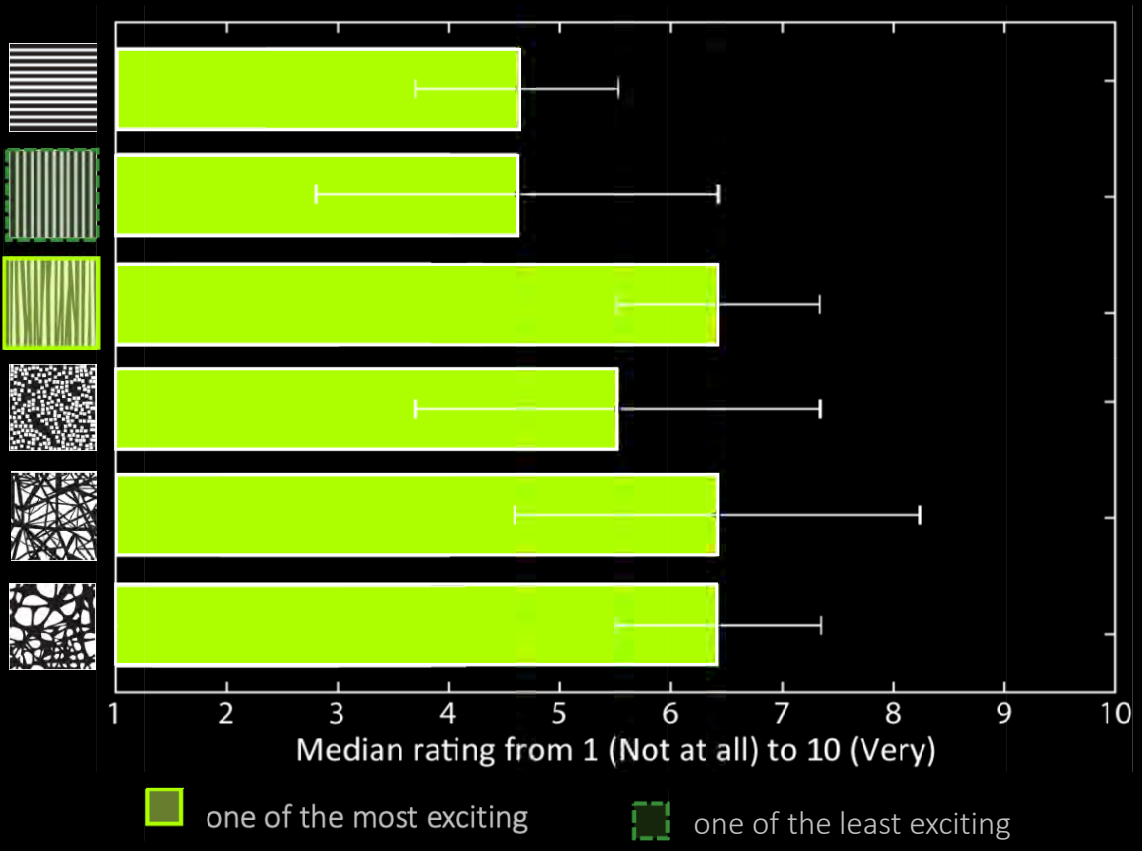


daylight patterns and psycho-physiological human response

how exciting is this space?



Appraisal from 415 participants from 3 locations in Europe
(138 in Greece, 127 in Switzerland, 150 in Norway)



significant effect of pattern **independently**
of sky/sun, context, size or location!

EPFL

vitality

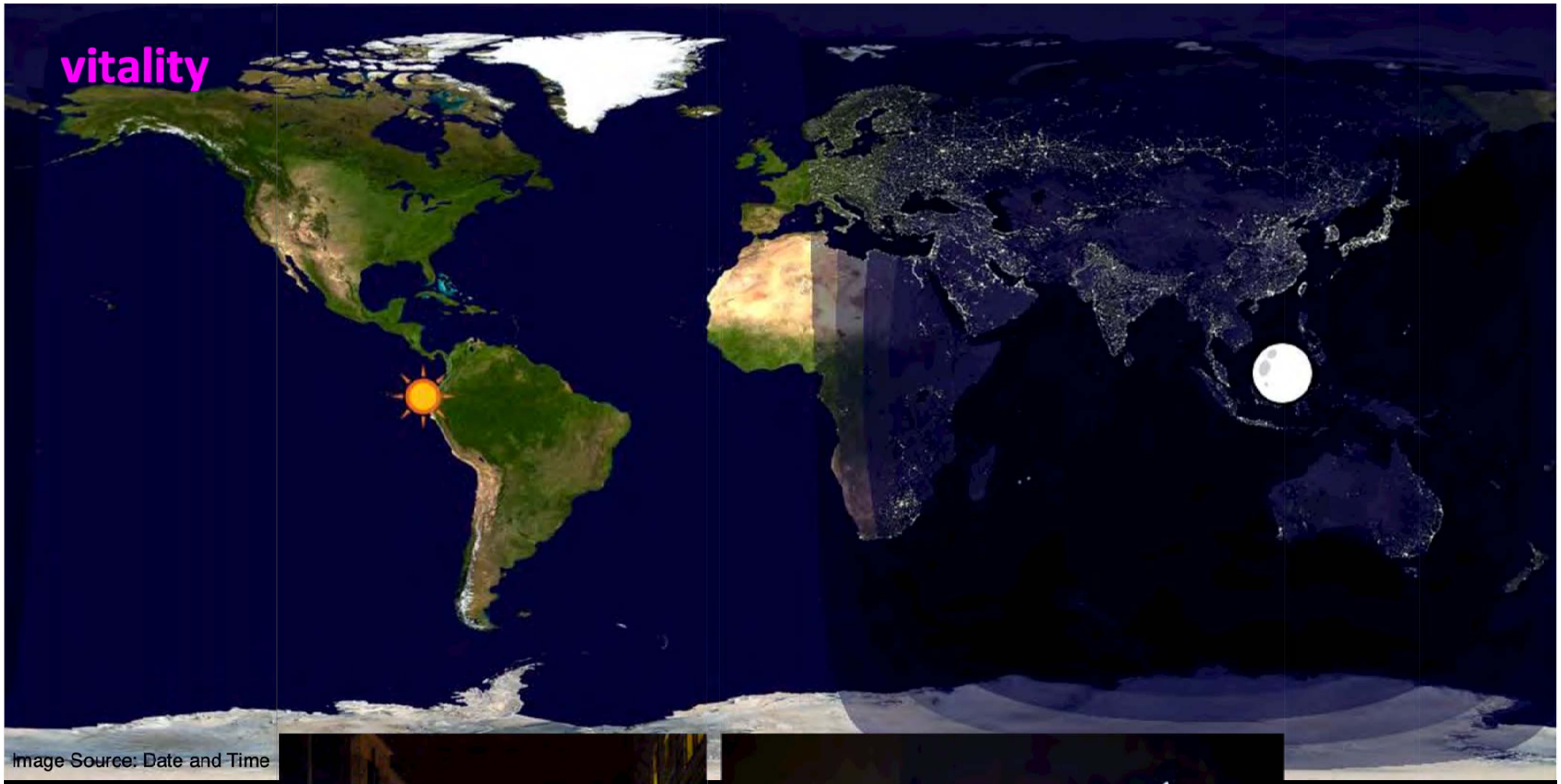
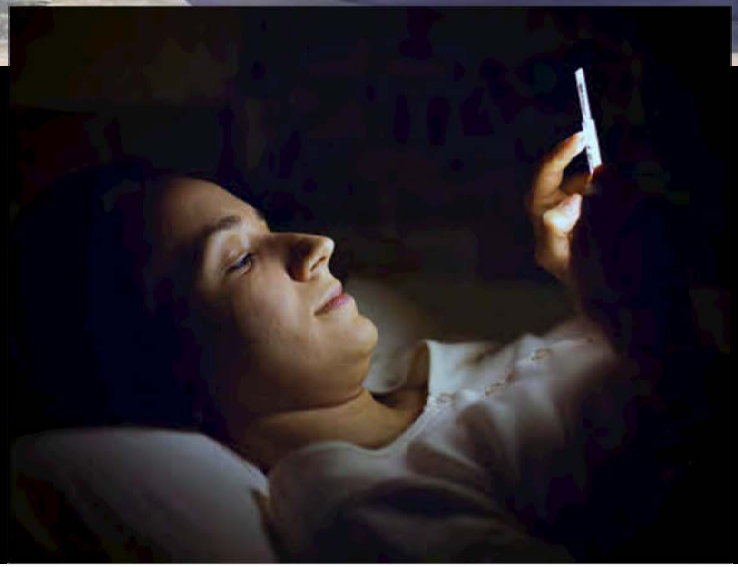


Image Source: Date and Time

Environmental impact

Image Source: Web Urbanist; Harvard Health



Behavioral/Lifestyle impact

EPFL

non-visual system

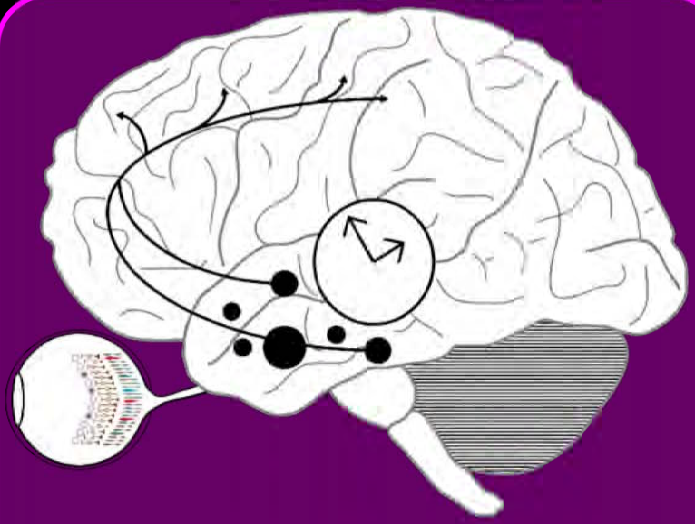
effects of ocular light exposure on human health

Dr. Maria Amundadottir
LIPID PhD alumnus
Co-Founder of OCULIGHT – Entrepreneur,, Iceland

INPUT

vertical illuminance

factors
intensity
wavelength
duration
timing
history



dynamic model
thresholds
spectral sensitivity
integration
circadian rhythms
adaptation

OUTPUT

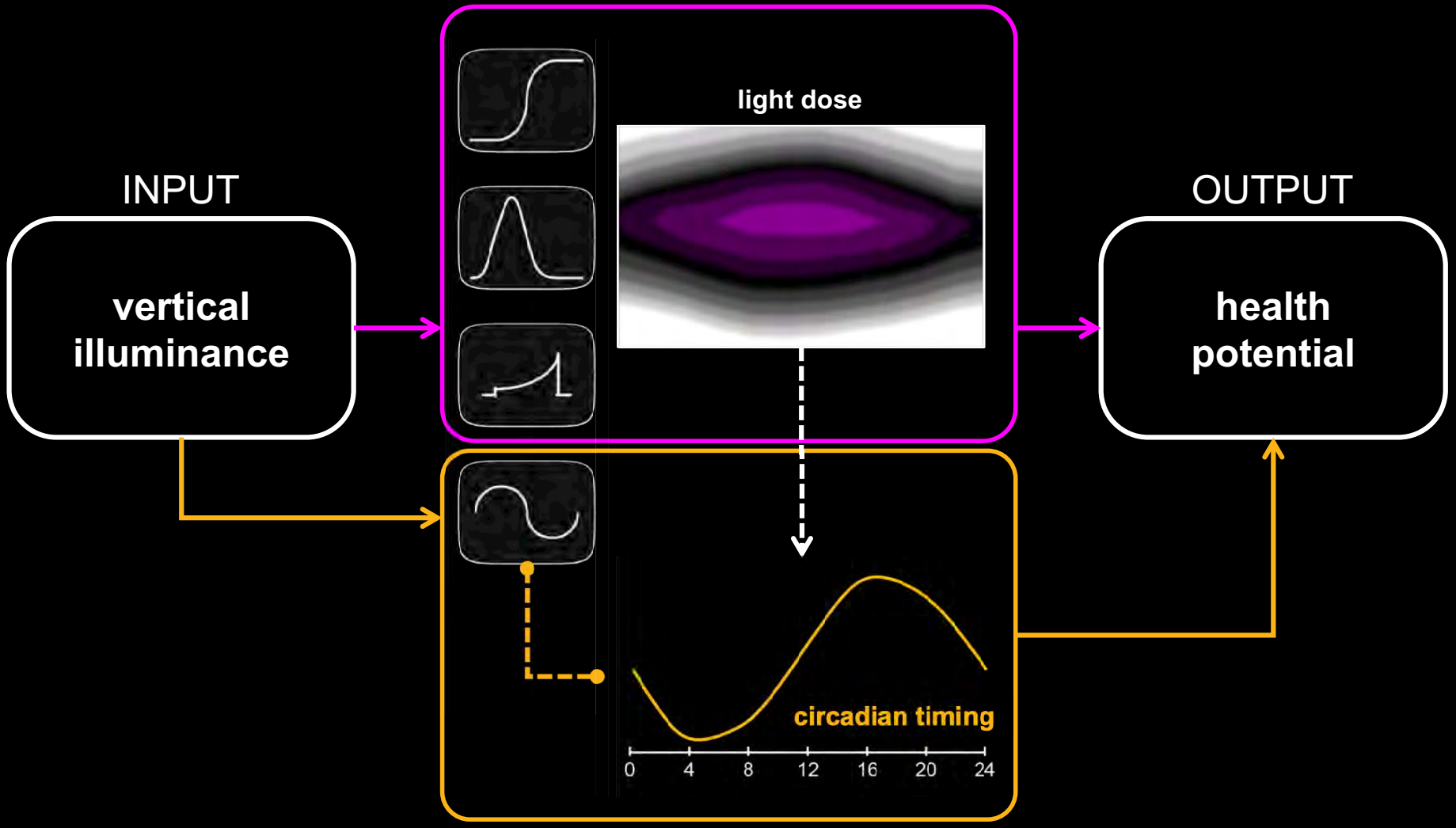
health potential

health benefits
alertness
performance
wellbeing
sleep quality
mood

EPFL

dynamic model

maximize the daily light dose without disturbing circadian timing

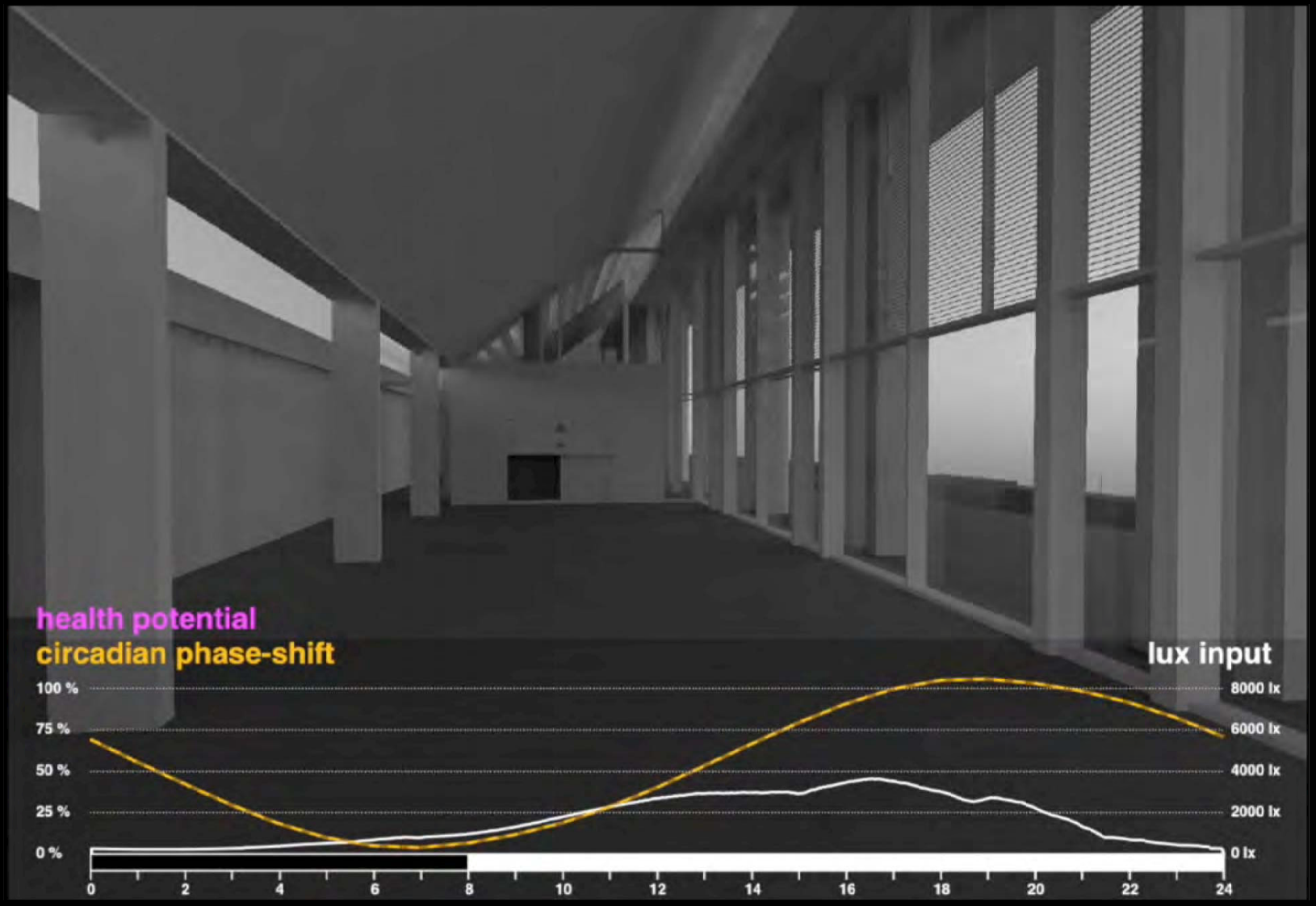


EPFL

dynamic model

cumulative dose and daily cycle

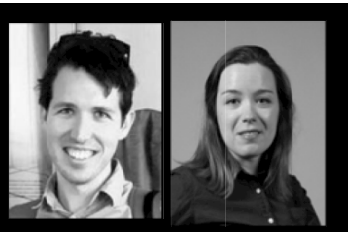
Dr. Maria Amundadottir
LIPID PhD alumnus
Co-Founder of OCULIGHT dynamics, Iceland



EPFL

impact of spectrum and brightness on alertness

Forrest Webler & Victoria Soto Magan
PhD students

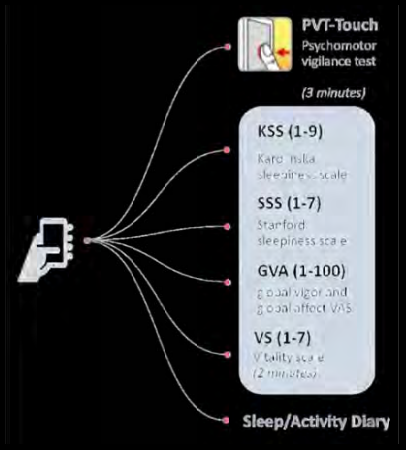


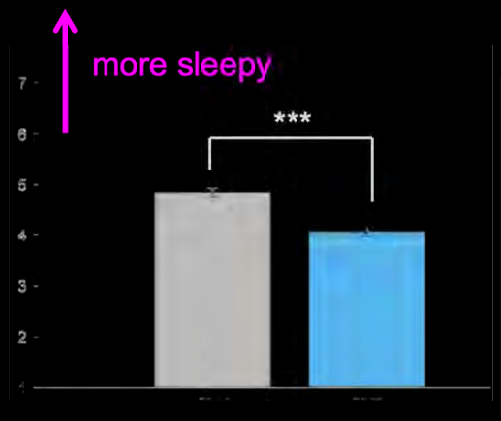
1 effect of spectrum
'bluer' vs neutral in **dim** light

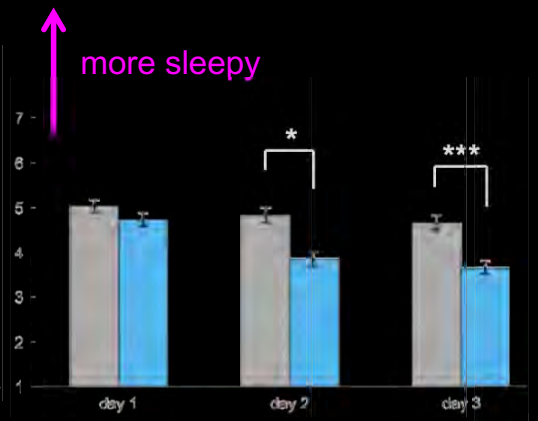
2 effect of intensity
bright vs dim in **neutral** light

3 intensity+spectrum
bright 'blue 1' vs dim 'blue 2'

subjective + cognitive evaluation

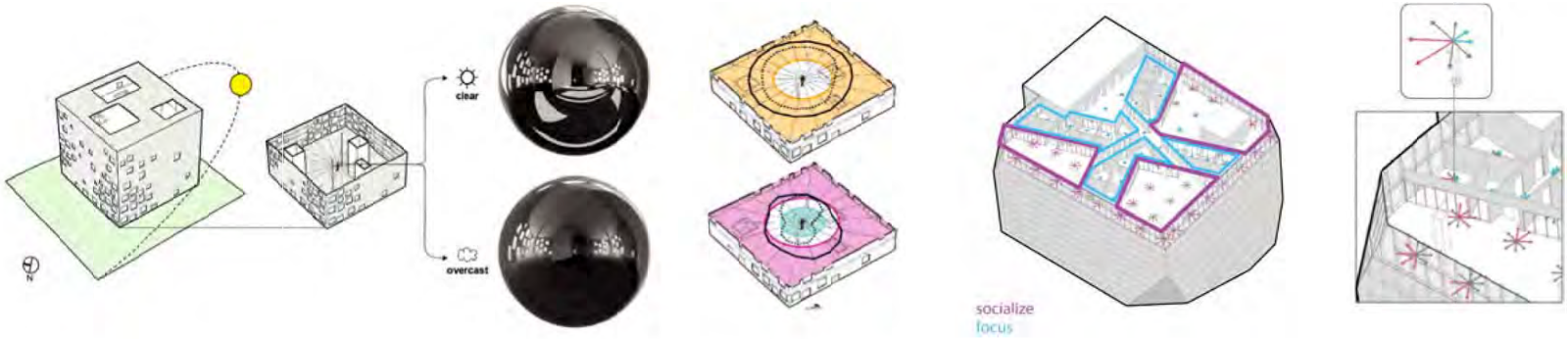


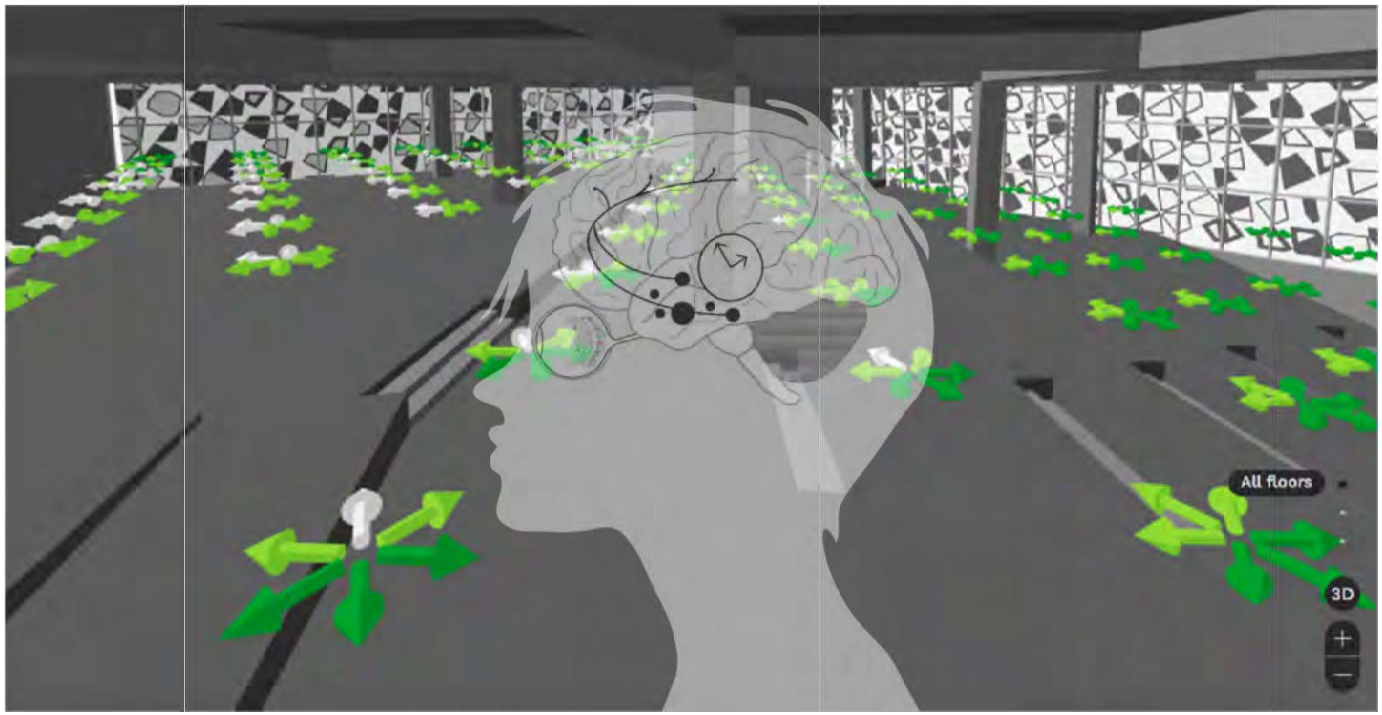




EPFL

TAKING THE **OCCUPANT'S** PERSPECTIVE IN **DESIGN**

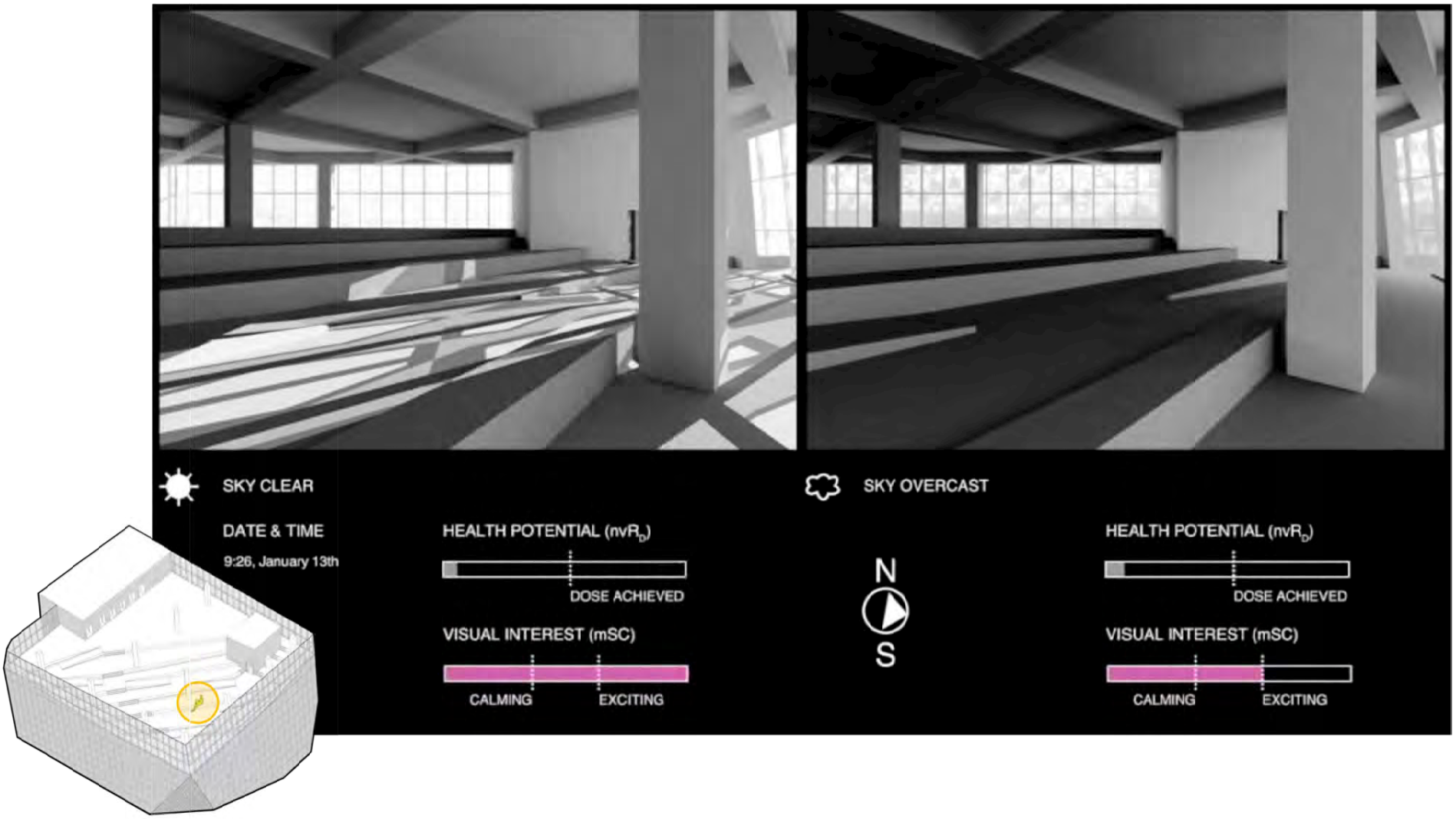




OCULIGHT dynamics

EPFL

THE **OCULIGHT** APPROACH

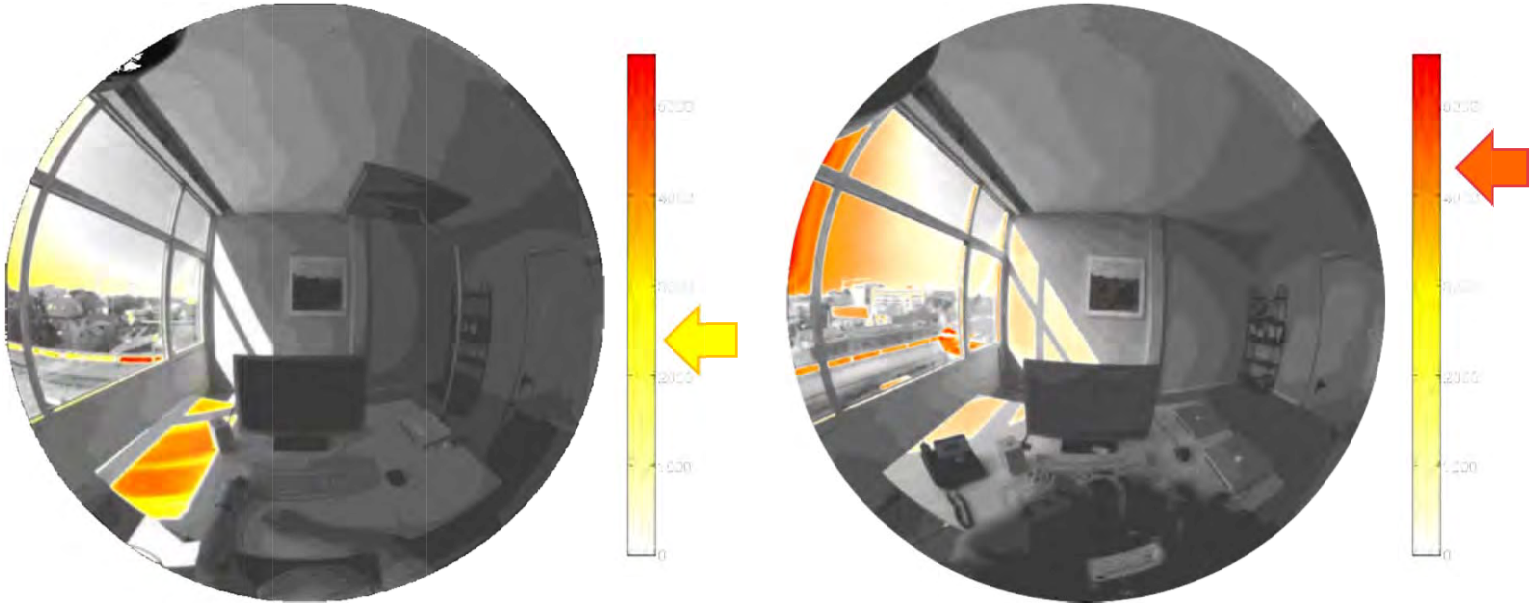


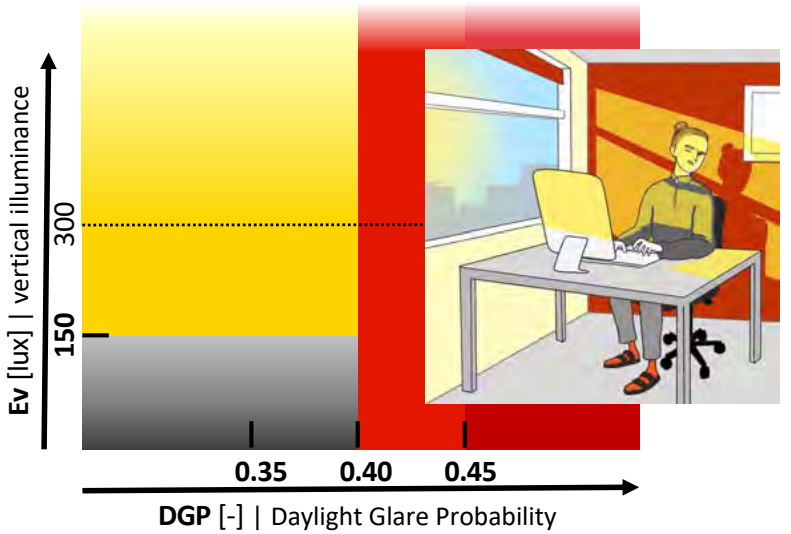
OCULIGHT dynamics

Ryerson Student Learning Center

Toronto, CA | Snøhetta & Zeidler Partnership

COMFORT

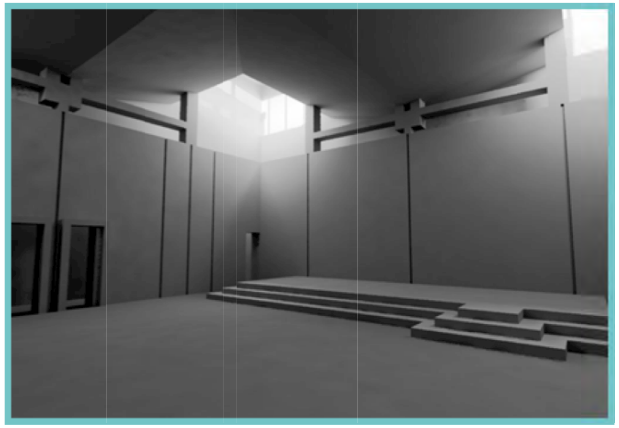




OCULIGHT dynamics

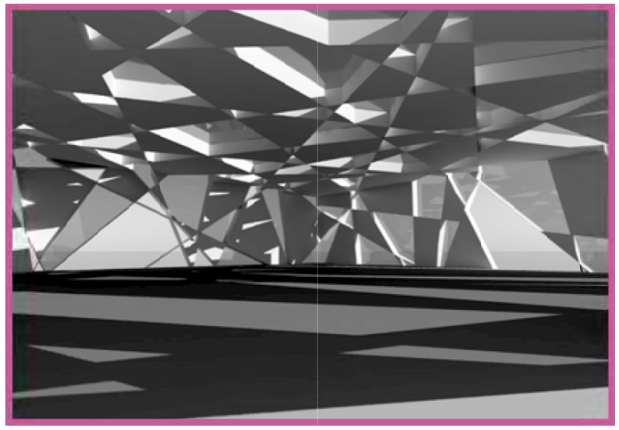
EMOTION

calming?

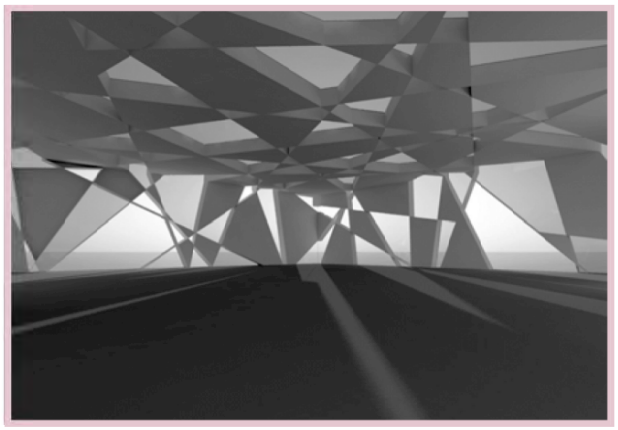


first unitarian church

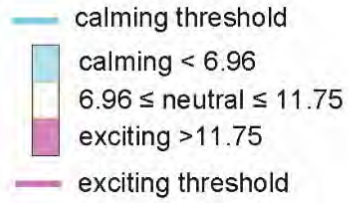
exciting?

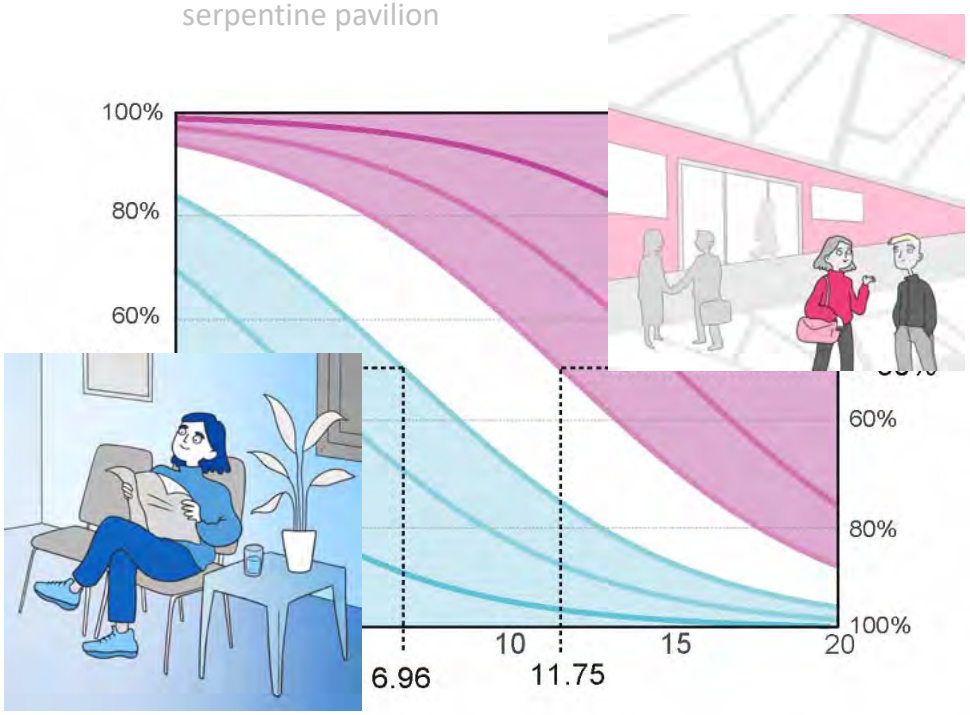


less exciting?



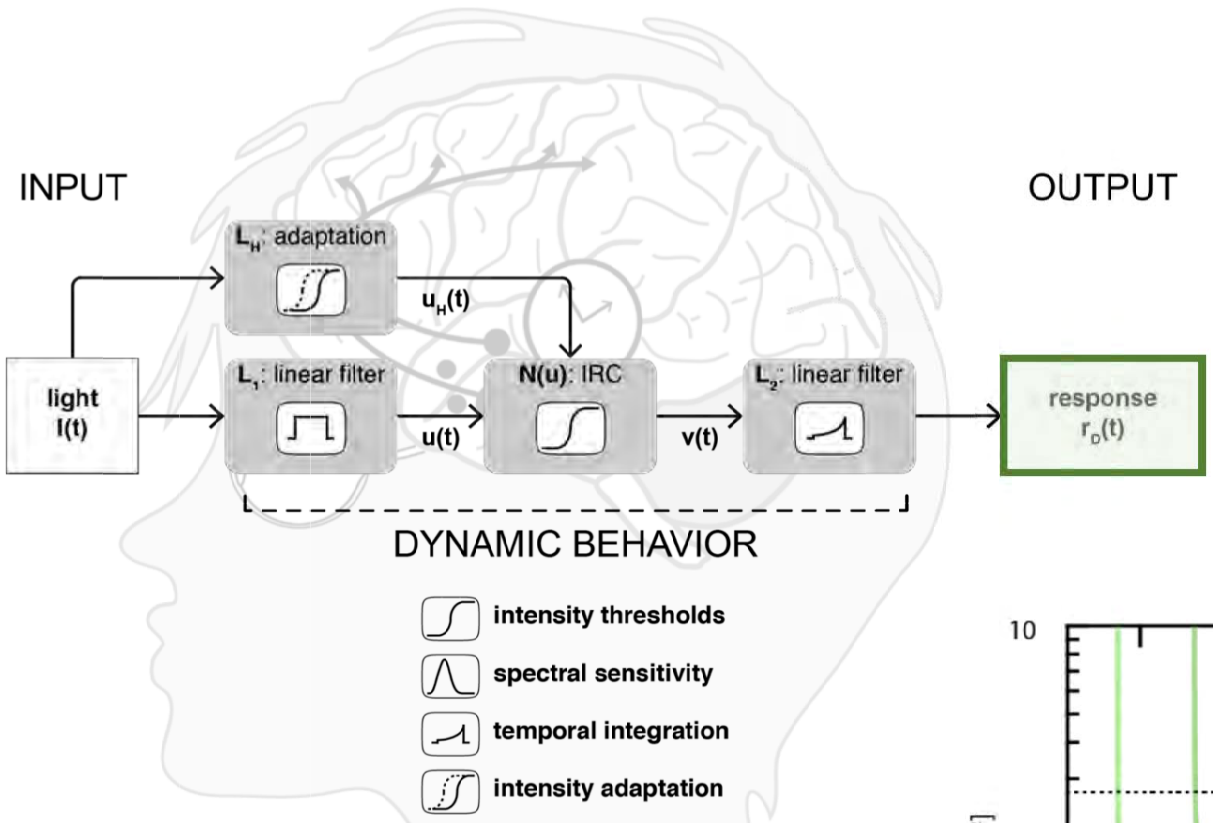
serpentine pavilion





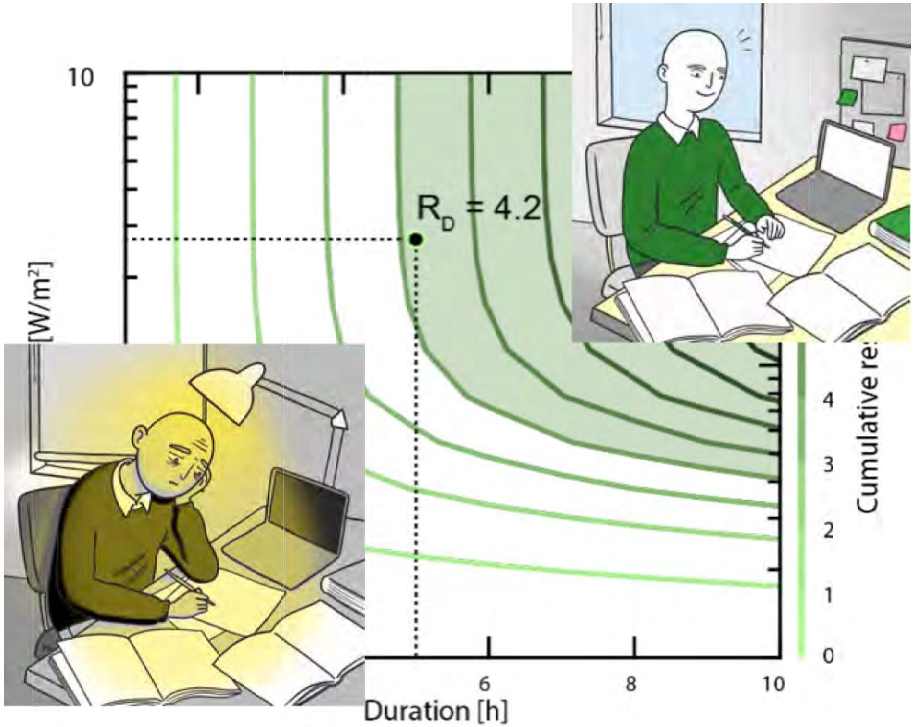
OCULIGHT dynamics

VITALITY



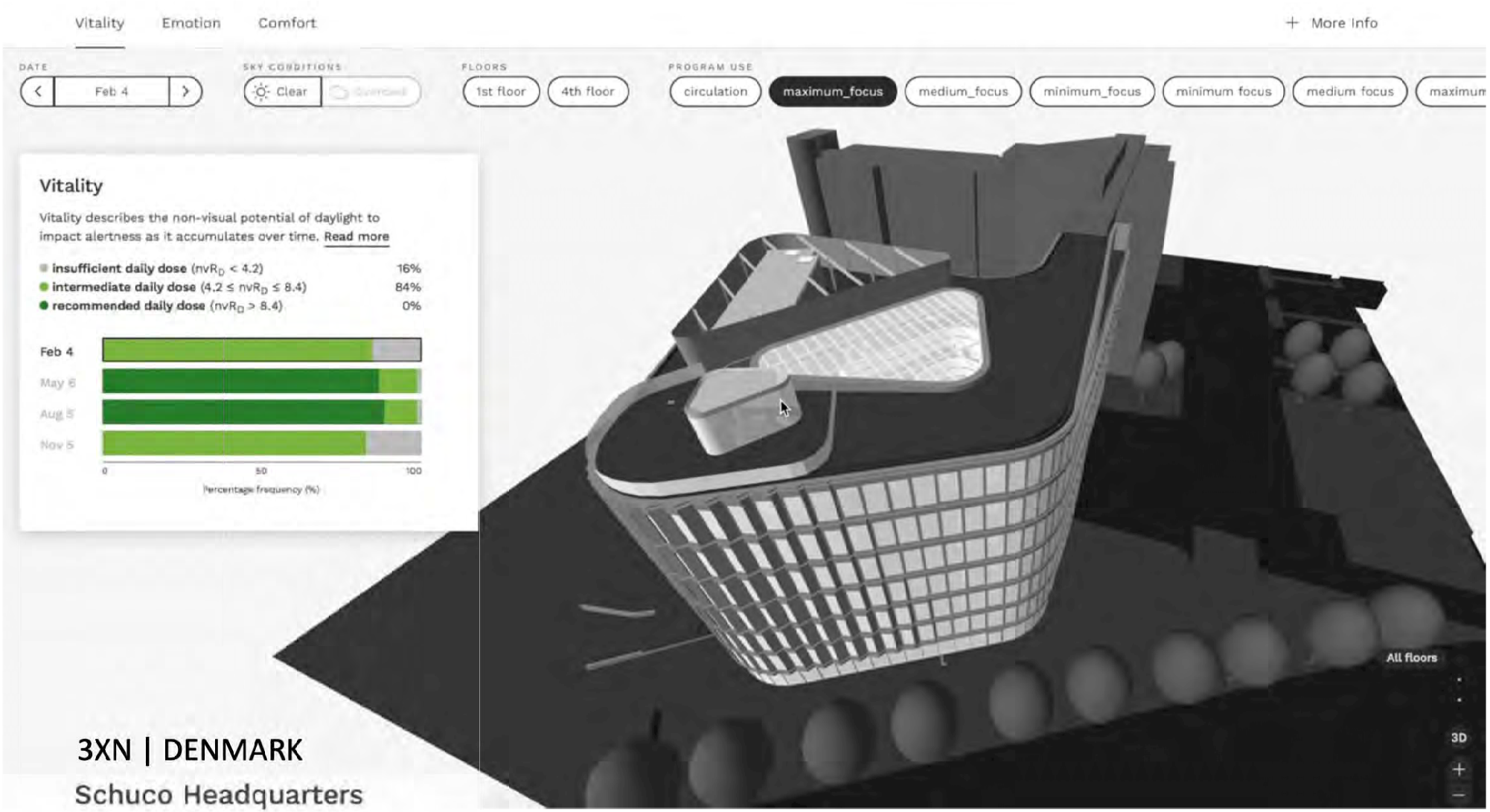
dose achieved < 4.2

Non-visual health potential
$R_D > 4.2$



OCULIGHT dynamics

INTERACTIVE VISUALIZATION



3XN | DENMARK

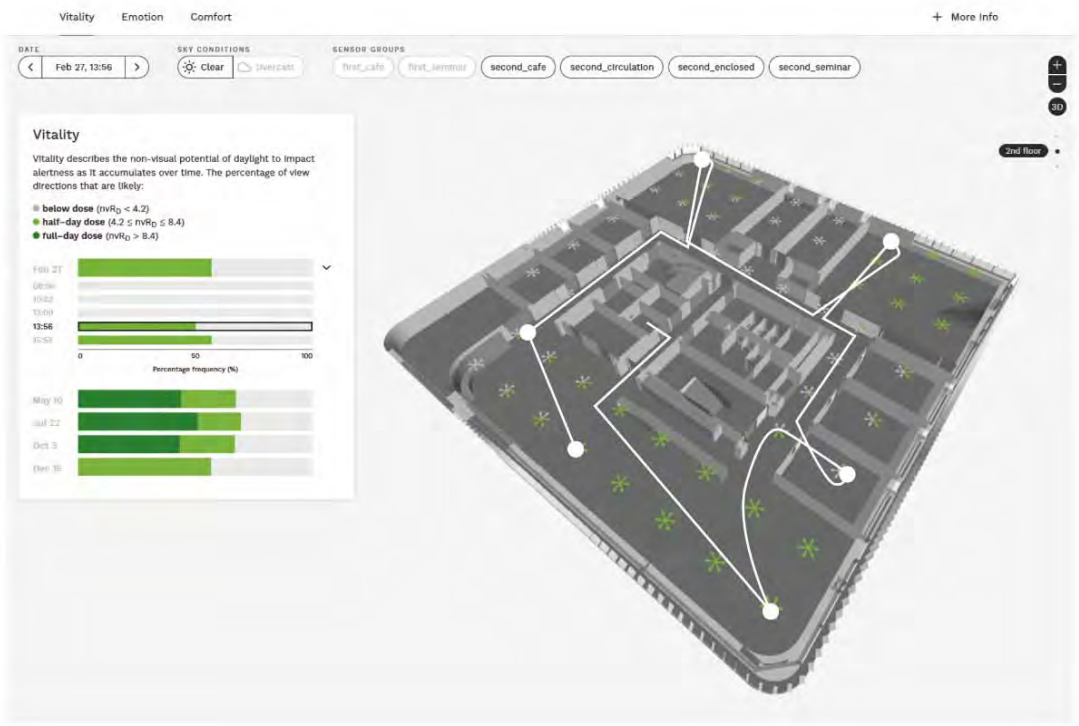
Schuco Headquarters

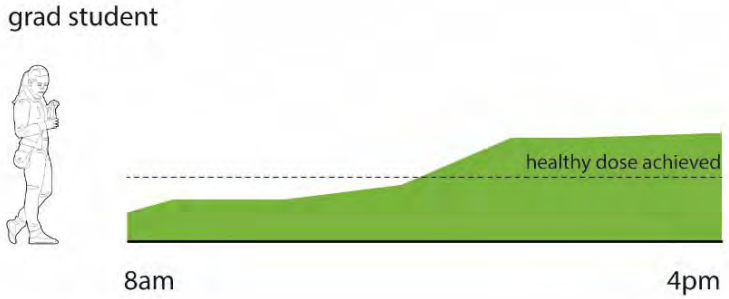
OCULIGHT dynamics

FUTURE DEVELOPMENTS

spatio-temporal population analytics

from building performance to ***occupant performance*** in buildings…



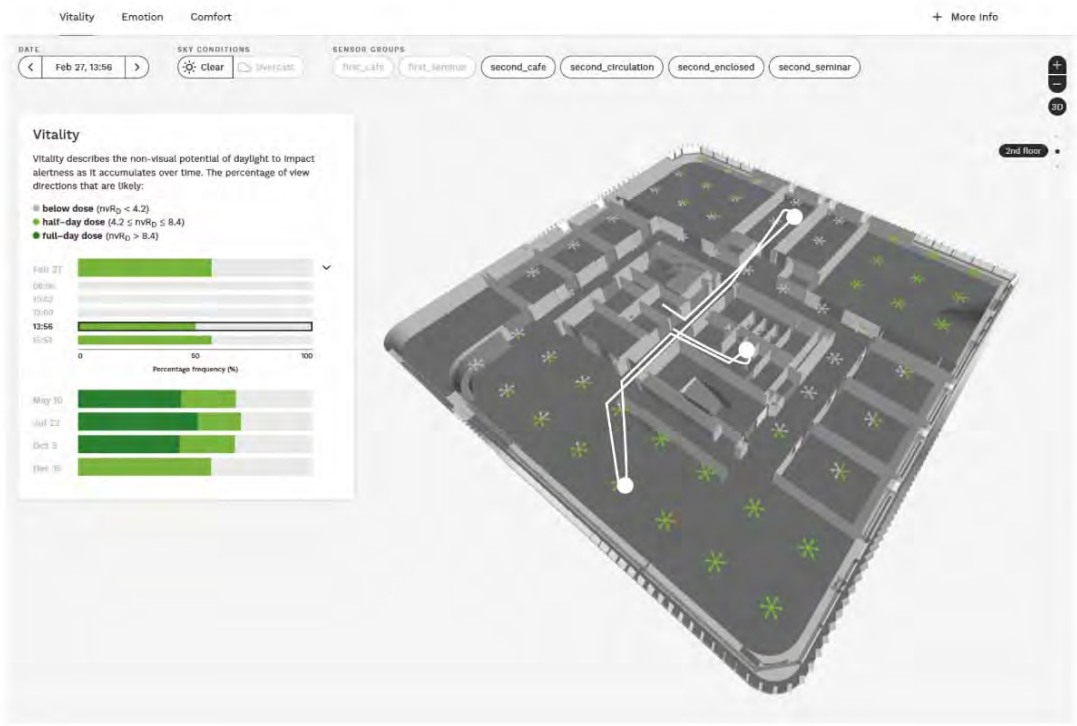


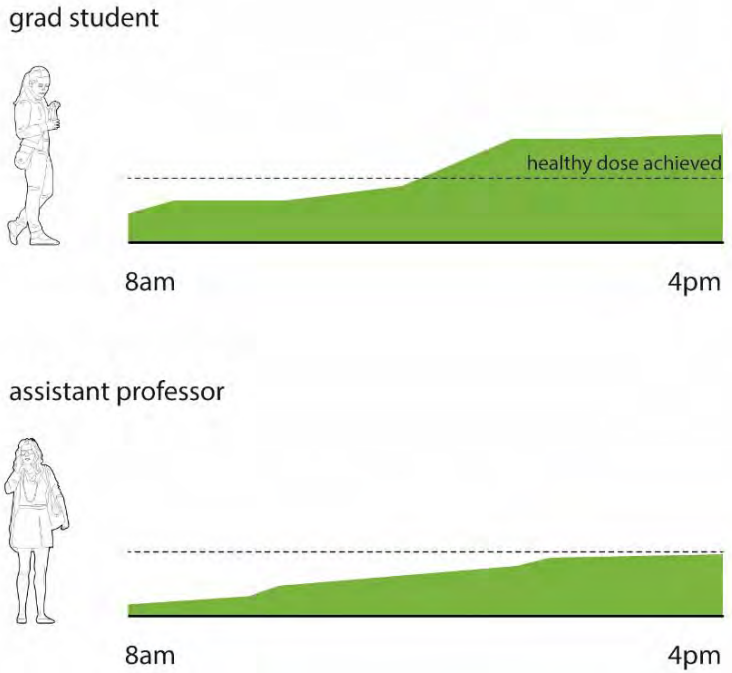
OCULIGHT dynamics

FUTURE DEVELOPMENTS

spatio-temporal population analytics

from building performance to ***occupant performance*** in buildings…





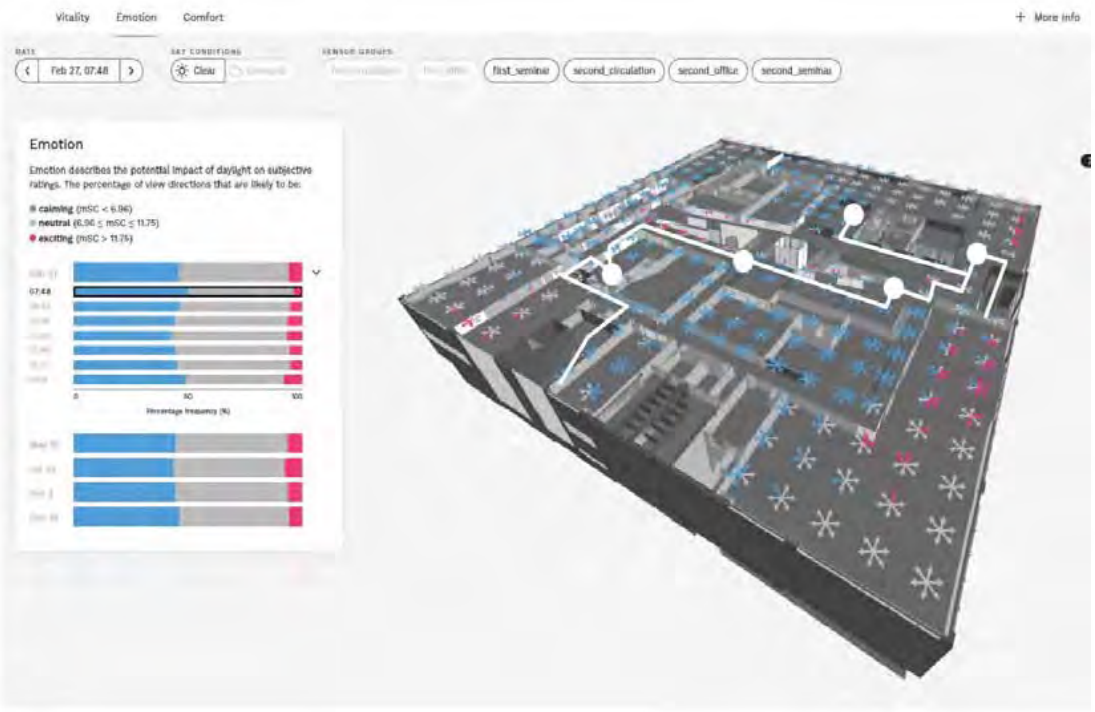
… with in-situ monitoring using **wearable** technology

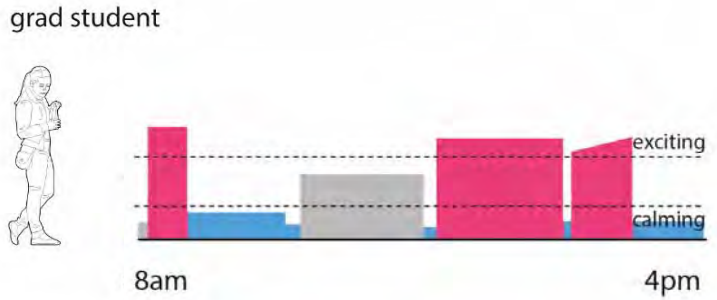
OCULIGHT dynamics

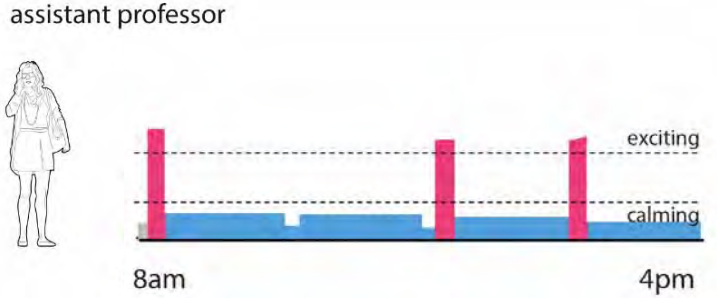
FUTURE DEVELOPMENTS

spatio-temporal population analytics

from building performance to ***occupant performance*** in buildings…

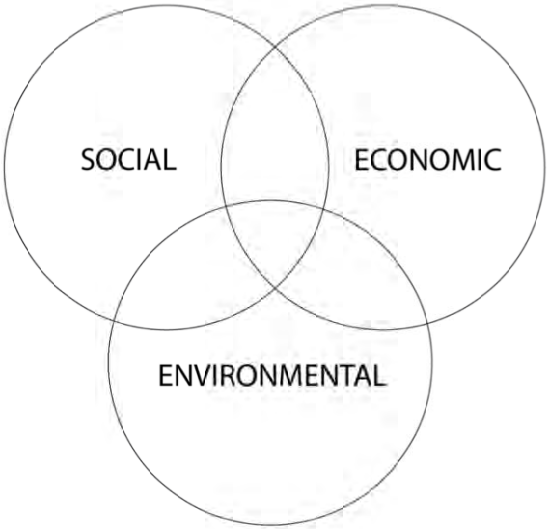


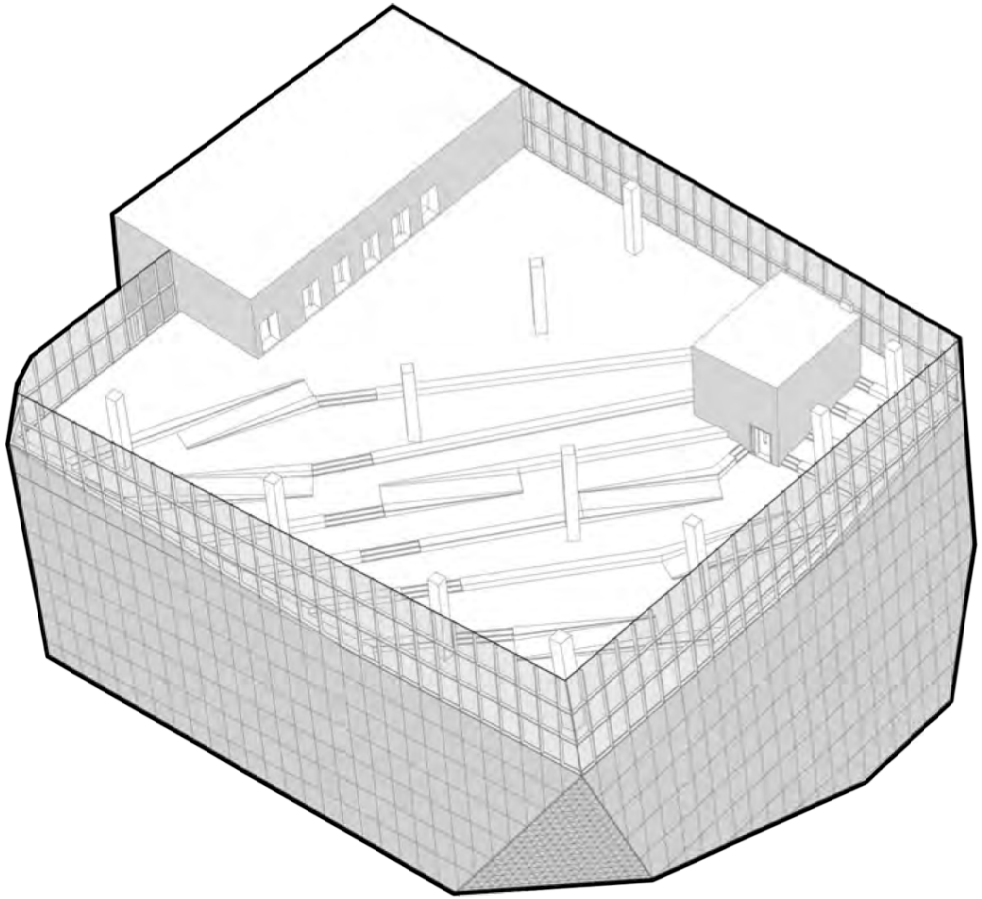




OCULIGHT dynamics

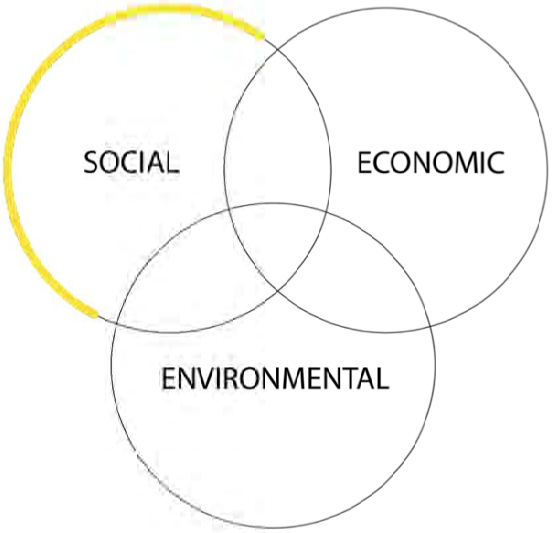
REVISITING **SUSTAINABILITY**…





OCULIGHT dynamics

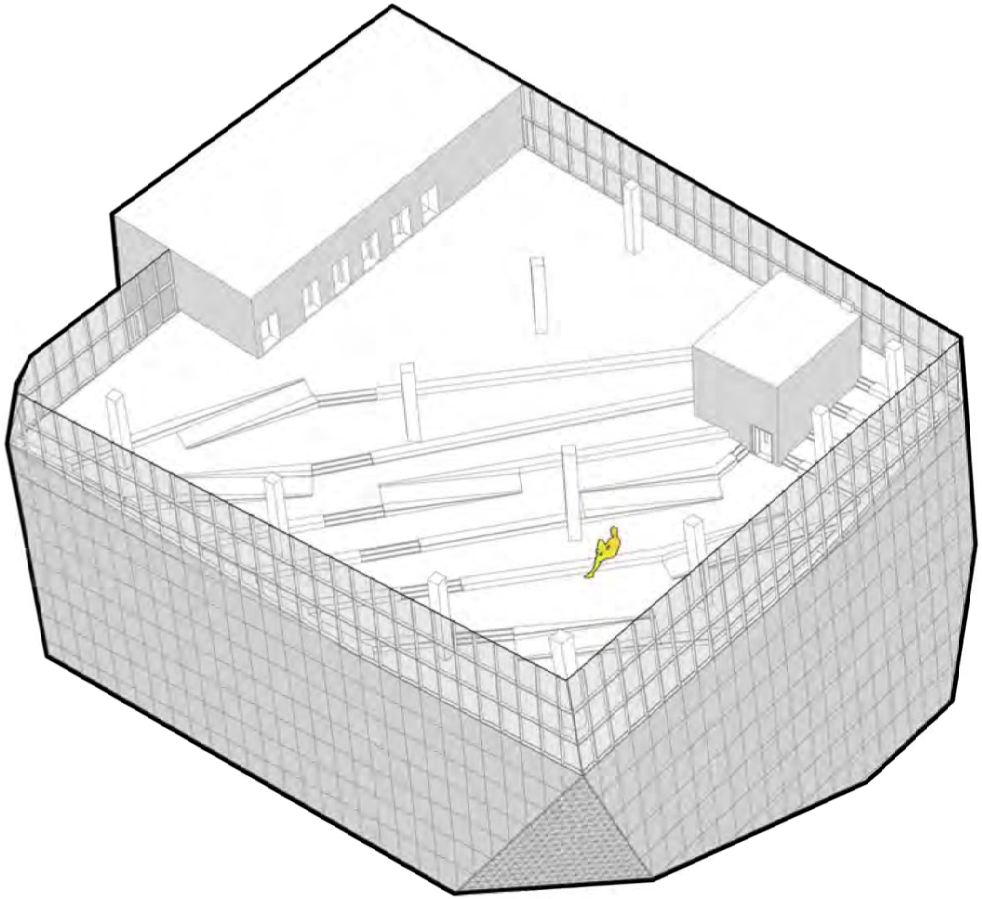
REVISITING **SUSTAINABILITY**…



EMOTION

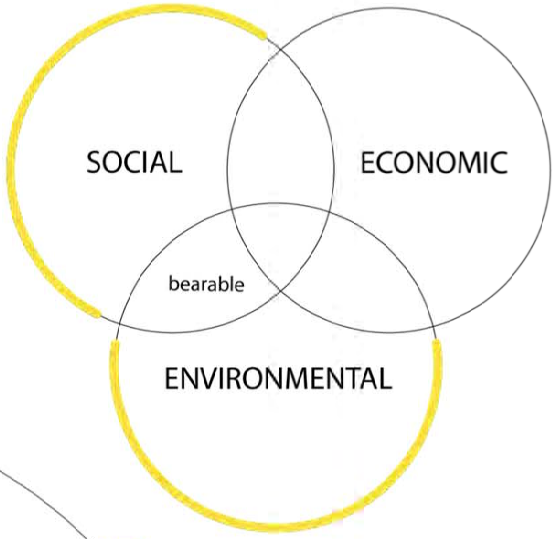
HEALTH

COMFORT



OCULIGHT dynamics

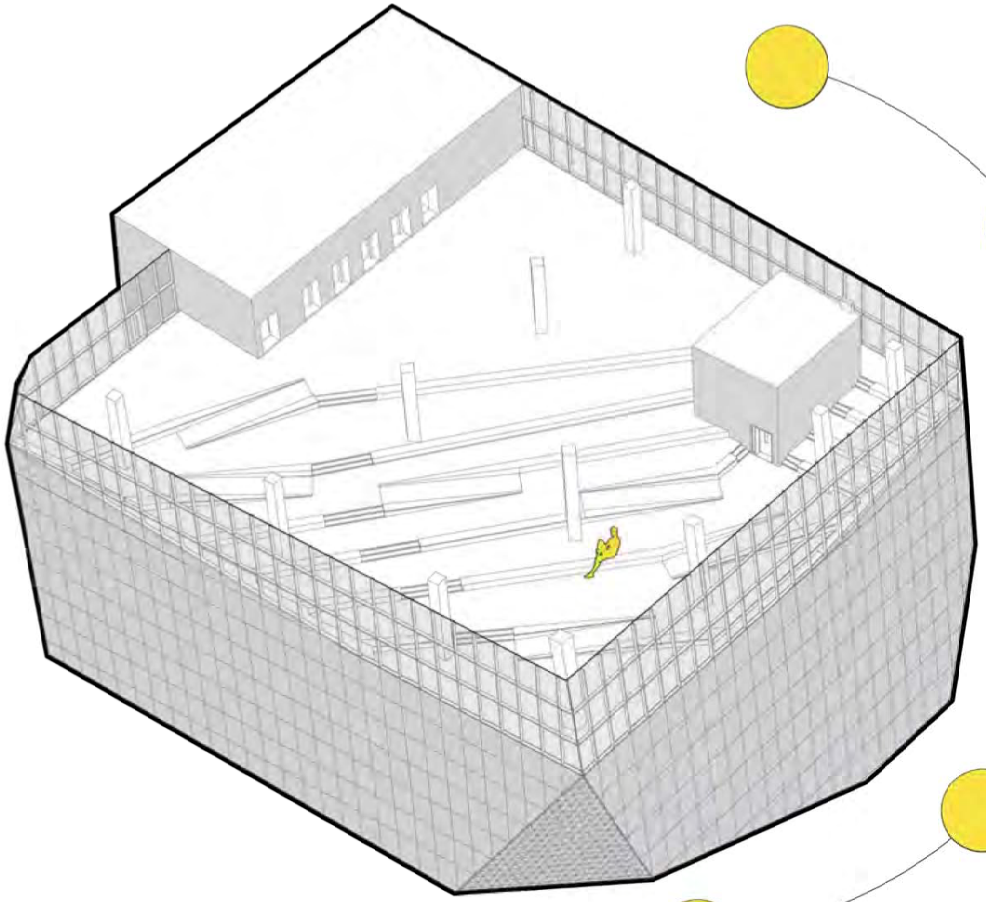
REVISITING **SUSTAINABILITY**…

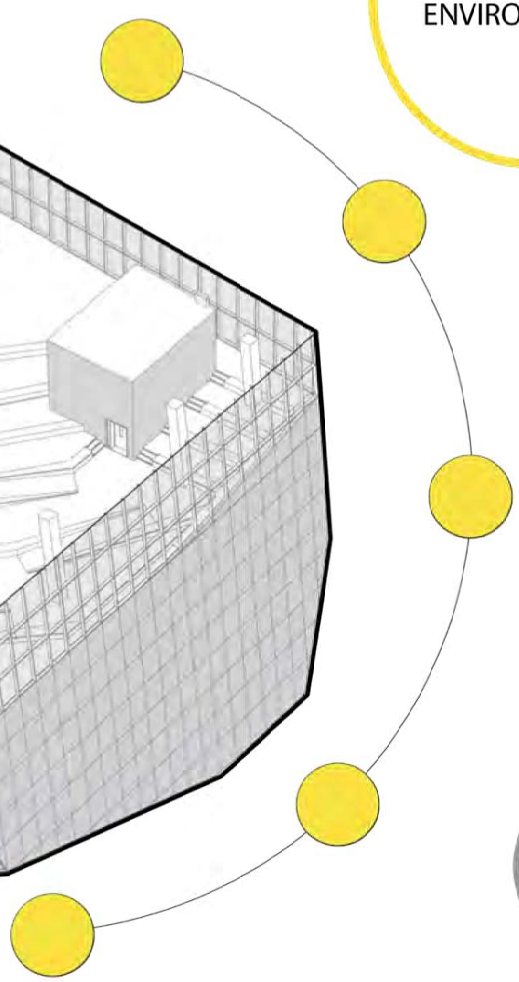


EMOTION

HEALTH

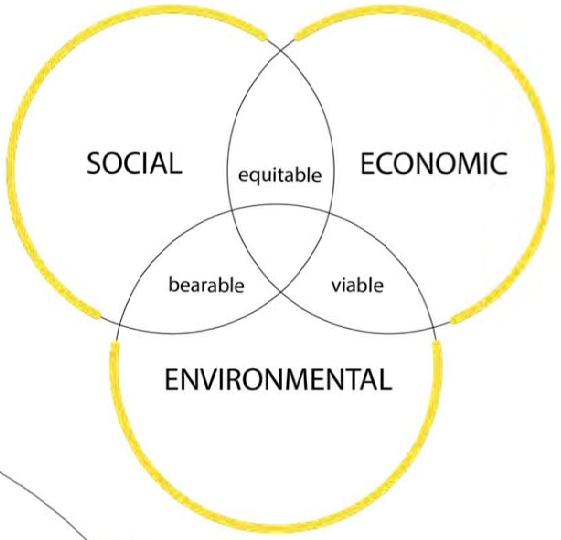
COMFORT





OCULIGHT dynamics

REVISITING **SUSTAINABILITY**…

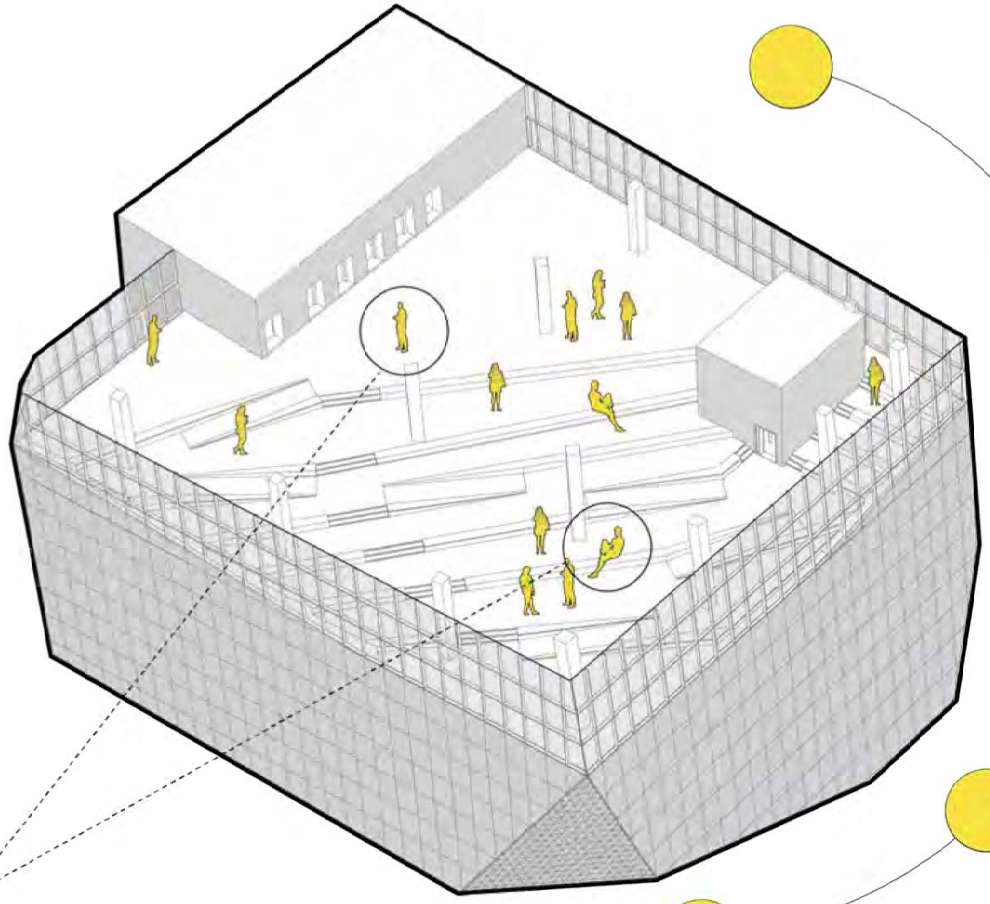


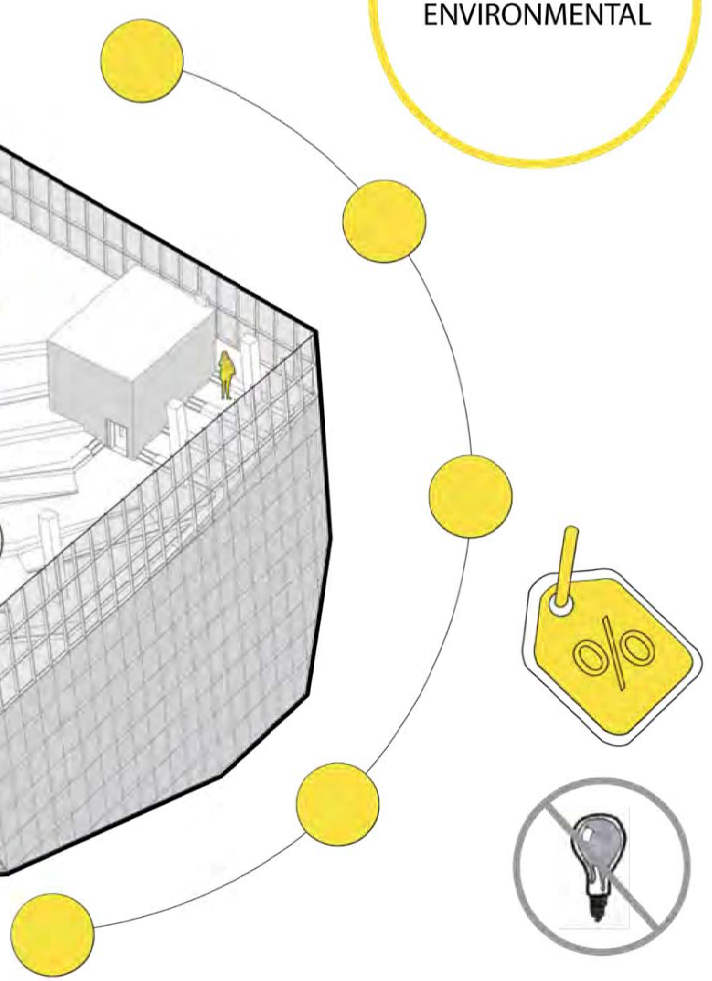
EMOTION

HEALTH

COMFORT

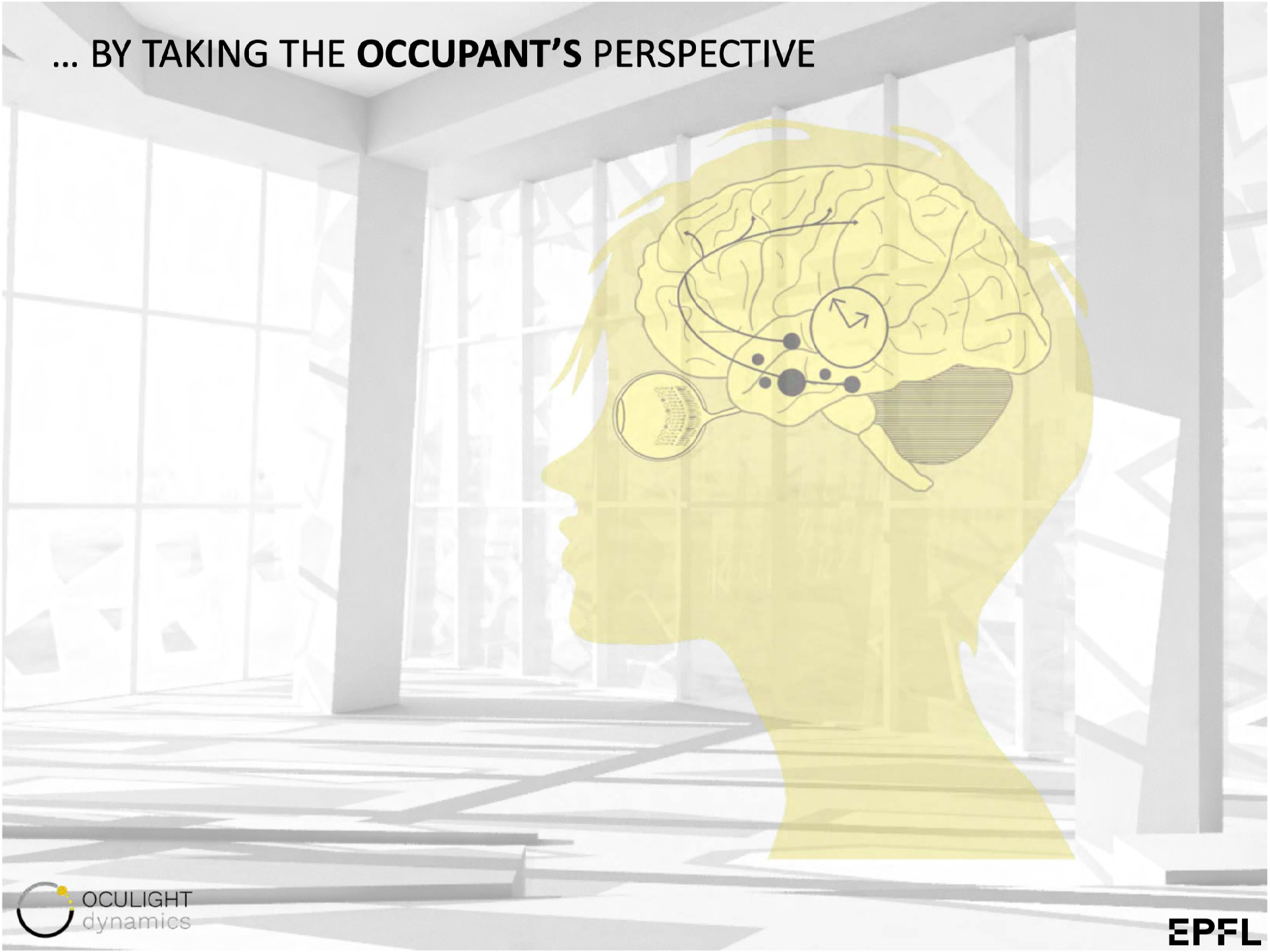
EQUITY





OCULIGHT dynamics

… BY TAKING THE **OCCUPANT'S** PERSPECTIVE



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EPFL – LIPID | Laboratory of Integrated Performance in Design

Prof. Marilyne Andersen
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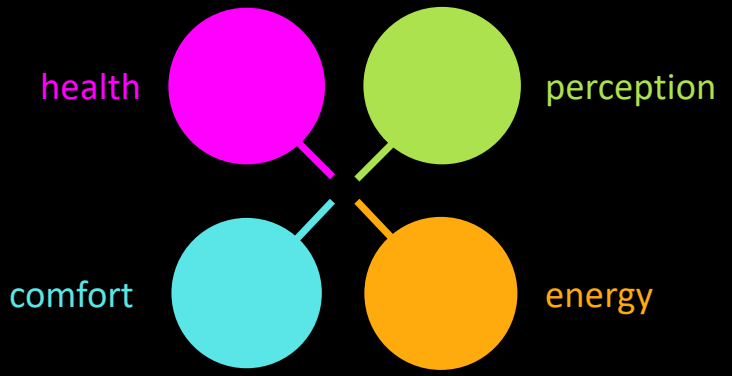
Dr. Jan Wienold
Scientist



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