

Human Centric Lighting: Myth, Magic, or Metaphor?

Exploring the Potential and Hype of Lighting for Health

November 21, 2024 | Lighting Days | Stockholm, Sweden

Presenter

Kevin Houser, PhD, PE (NE), FIES, LC, LEED AP

Professor

School of Civil & Construction Engineering

Oregon State University

kevin.houser@oregonstate.edu



Brief Biography

Kevin Houser (PhD, PE, FIES, LC, LEED AP) is a Professor of Architectural Engineering at Oregon State University with a joint appointment as Chief Engineer at Pacific Northwest National Laboratory. He has published more than 125 articles about light and lighting and has delivered more than 125 presentations on 6 continents. He's won the CIBSE Leon Gaster and Walsh Weston Awards, IES Taylor Technical Talent Award three times, the IES Presidential Award, is a Fellow of IES, and a recipient of a 2022 Edison Report Lifetime Achievement Award. He was the editor of LEUKOS, the journal of IES, for a decade, and one of the four editors of the 10th edition IES Lighting Handbook. His work focuses on human perceptual and biological responses to light in a context that balances human needs with planetary health.

Presentation Abstract

Is Human-Centric Lighting merely a new phrase for old concepts, or does it encapsulate transformative ideas and technologies that have the potential to reframe lighting practice? This talk will provide guidance about how one might approach human-centric lighting given both the credible potential and implausible hype.

Learning outcomes

After this presentation, participants will be able to:

1. Appreciate ways in which thoughtful lighting design balances requirements for vision and health.
2. Appreciate that Human-Centric Lighting is not a single idea with a well-defined meaning, but a spectrum of concepts that vary with user and intent.
3. Be aware of lighting recommendations that are intended to support photobiological health for day-active people.
4. Be empowered to immediately apply the core concepts to support your own photobiological and circadian health.



Human-Centric Lighting: Myth, Magic, or Metaphor?

Exploring the Potential and Hype of Lighting for Health

LIGHTING DAYS | November 20 – 22, 2024 | Stockholm, Sweden

Kevin Houser, PhD, PE (NE), FIES, LC, LEED AP

Professor | Oregon State University (w/ joint appointment at Pacific Northwest National Laboratory)
kevin.houser@oregonstate.edu

Co-Founder | Lyr Lux, Inc
kevin.houser@lyralux.com

Copyright © 2024 Kevin Houser. All rights reserved.



Oregon State
University

COLLEGE OF ENGINEERING

School of Civil and
Construction Engineering

On average, adults spend about 90% of the time indoors*



**Design, construction, and maintenance of buildings
strongly influences **quality of life****

(and productivity, absenteeism, recruitment, retention, and profitability)

* Klepeis NE, Nelson WC, Ott WR, Robinson JP, Tsang AM, Switzer P, Behar JV, Hern SC, Engelmann WH. 2001. The National Human Activity Pattern Survey (NHAPS): a resource for assessing exposure to environmental pollutants. *Journal of Exposure Science & Environmental Epidemiology*. 11(3):231-52. <https://doi.org/10.1038/sj.jea.7500165>

Human-Centric Lighting is a **pseudo-scientific phrase.**

Integrative Lighting [CIE E-ILV Definition 17-29-028]*

Lighting specifically integrating both visual and non-visual effects, and producing physiological and/or psychological benefits upon humans.

Note 1: The term “integrative lighting” applies only to humans.

Note 2: Lighting primarily for therapeutic purposes (light therapy) is not included.

Note 3: The term “human centric lighting” is used with a similar meaning.

* See also: [CIE] 2019. CIE Position Statement on Non-Visual Effects of Light: Recommending Proper Light and the Proper Time. 2nd Edition. Vienna (Austria): CIE. 4 pgs.
<http://www.cie.co.at/publications/position-statement-non-visual-effects-light-recommending-proper-light-proper-time-2nd>

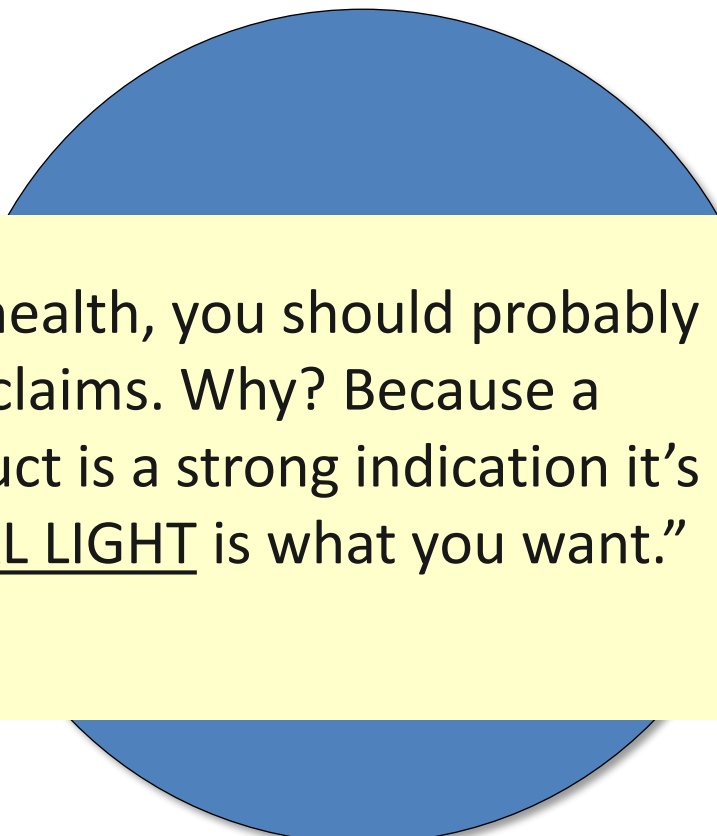
Human-Centric Lighting is a **marketing phrase**.

“If you’re concerned about your health, you should probably avoid products that make health claims. Why? Because a health claim on a food product is a strong indication it’s not really food, and food is what you want to eat.”

— **Michael Pollan, In Defense of Food: An Eater's Manifesto**

Pollan M. 2008. In Defense of Food: An Eater’s Manifesto. New York (NY): Penguin Press. 256 p.

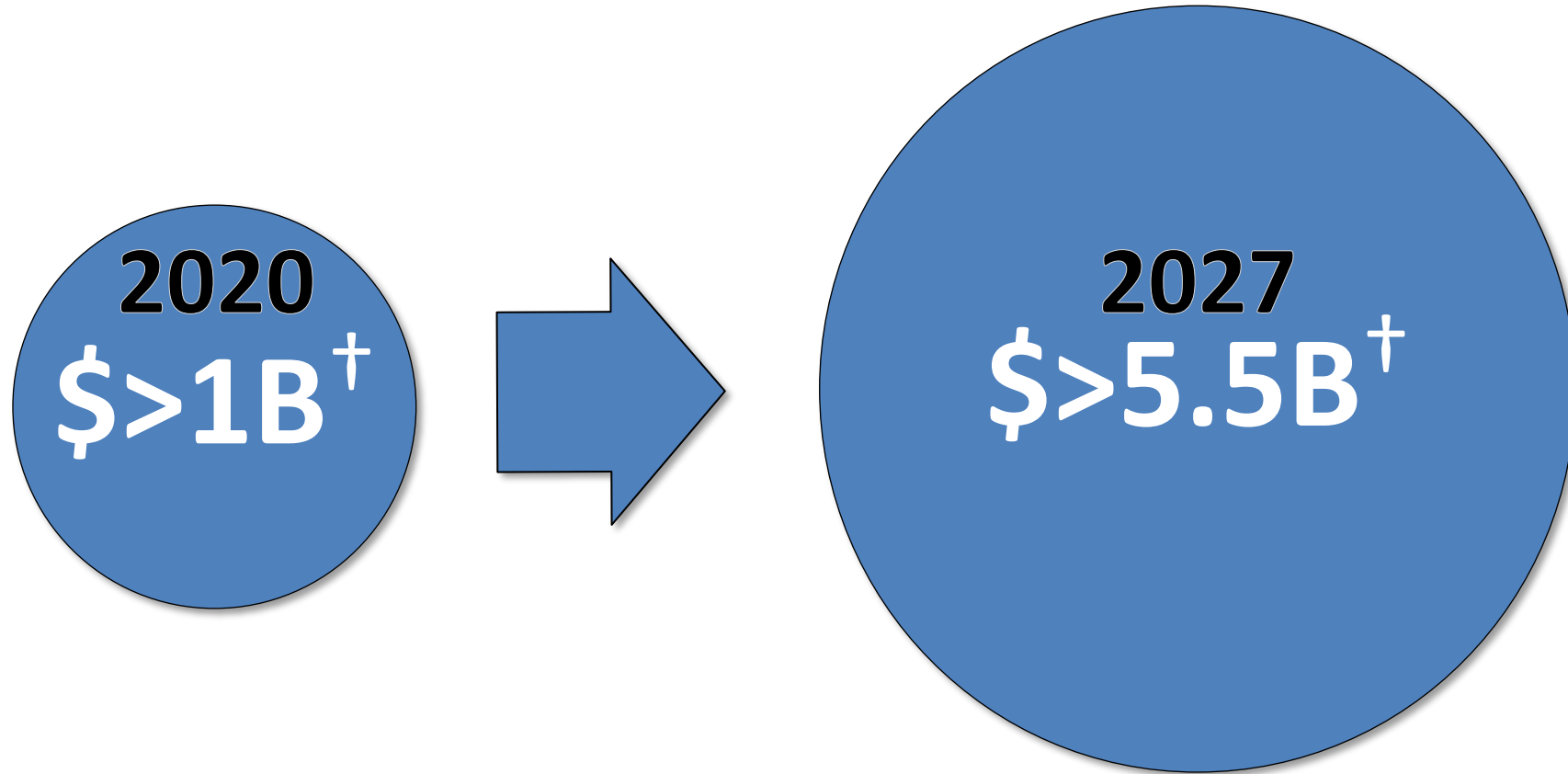
Human-Centric Lighting is a **marketing phrase**.



“If you’re concerned about your health, you should probably avoid products that make health claims. Why? Because a health claim on a LIGHTING product is a strong indication it’s not NATURAL LIGHT, and NATURAL LIGHT is what you want.”
— **Inspired by Michael Pollan**

Pollan M. 2008. In Defense of Food: An Eater’s Manifesto. New York (NY): Penguin Press. 256 p.

Human-Centric Lighting is a **marketing phrase**.



†Global Market Insights. 2021. Human Centric Lighting. <https://www.gminsights.com/industry-analysis/human-centric-lighting-market>

See also: AT Kearney. 2013. Market Study. Human Centric Lighting Going Beyond Energy Efficiency. Lighting Europe / ZVEI. 19 pgs.
https://www.lightingeurope.org/images/publications/general/Market_Study-Human_Centric_Lighting_Final_July_2013.pdf

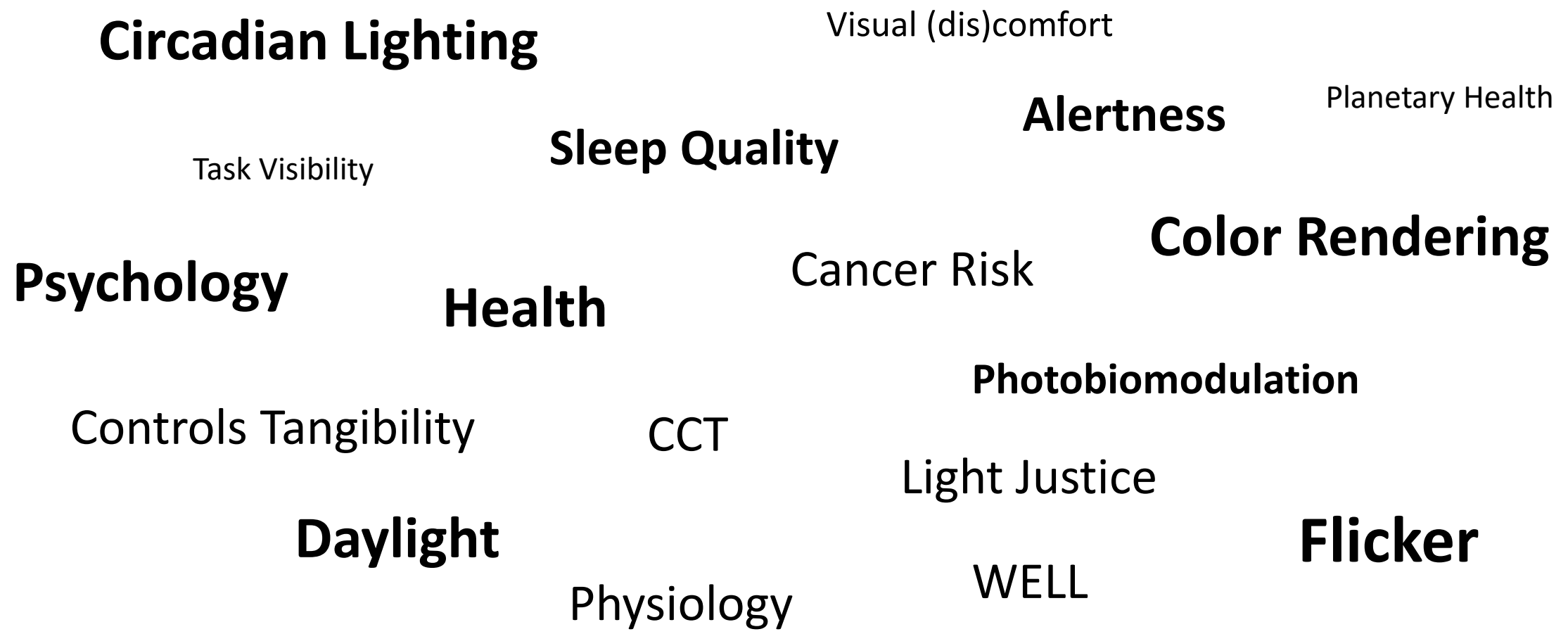
Human-Centric Lighting may be **misguided**.

- With lighting, especially anthropogenic light at night (ALAN), human-centricity may come with ***collateral damage***.
- ALAN exerts
 - ***Direct negative effects*** on people through circadian disruption.
 - ***Indirect negative effects*** on people by damaging earth's ecosystems.
- Holistic considerations of HCL should look ***beyond the short-term***. It is in our self-interest to persevere the ecosystems and biodiversity that support human life.

Houser KW. 2021. Ethics and Fallacies of Human-Centric Lighting and Artificial Light at Night. LEUKOS. 17(4):319-320.

<https://doi.org/10.1080/15502724.2021.1951021>

Human-Centric Lighting is **different things to different people.**



Light is a complex stimulus that can be manipulated to affect people.

Time

The temporal pattern (timing and duration) of exposure to light, including photic history.

Pattern

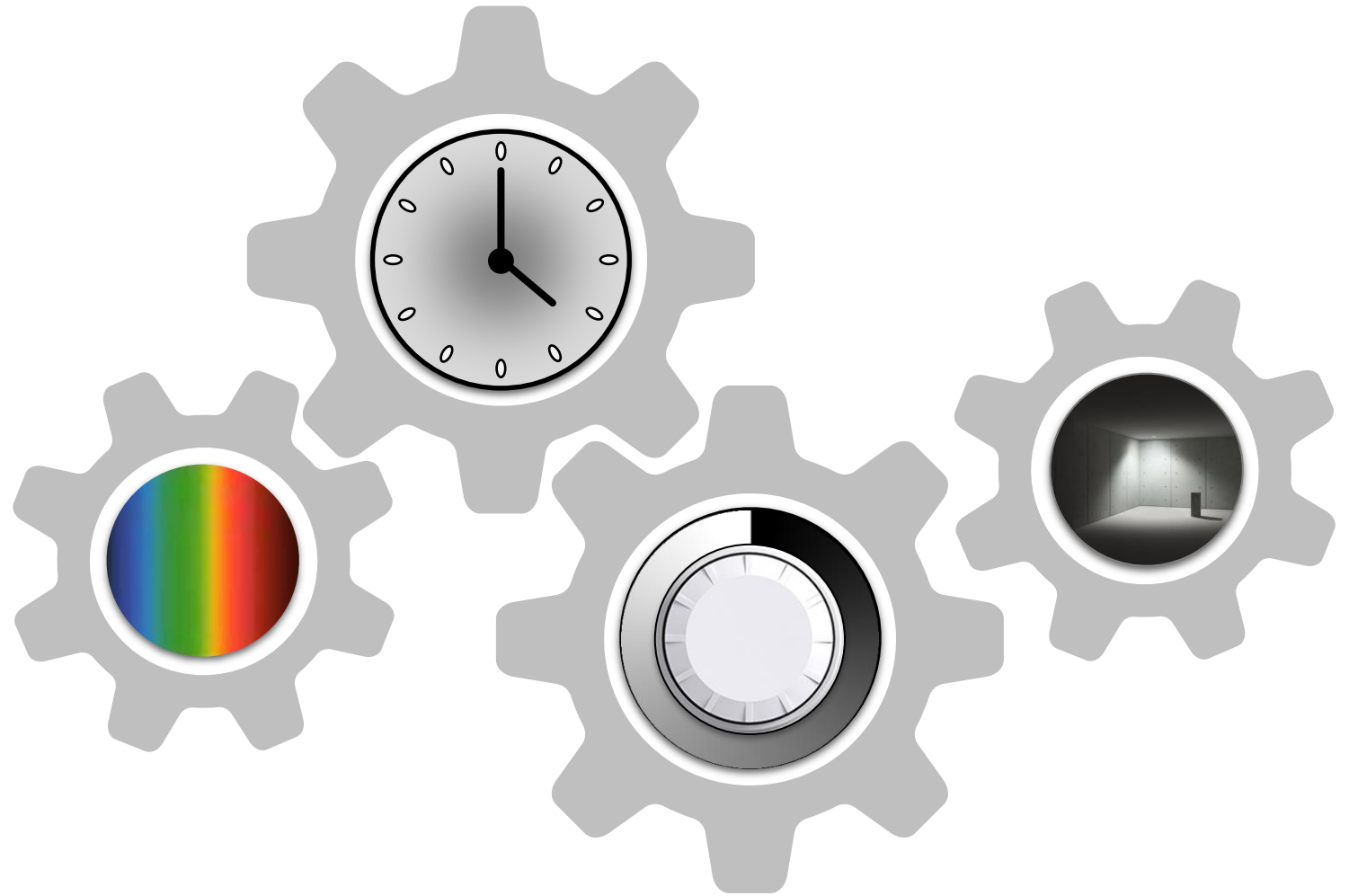
Spatial distribution of the three-dimensional light field.

Spectrum

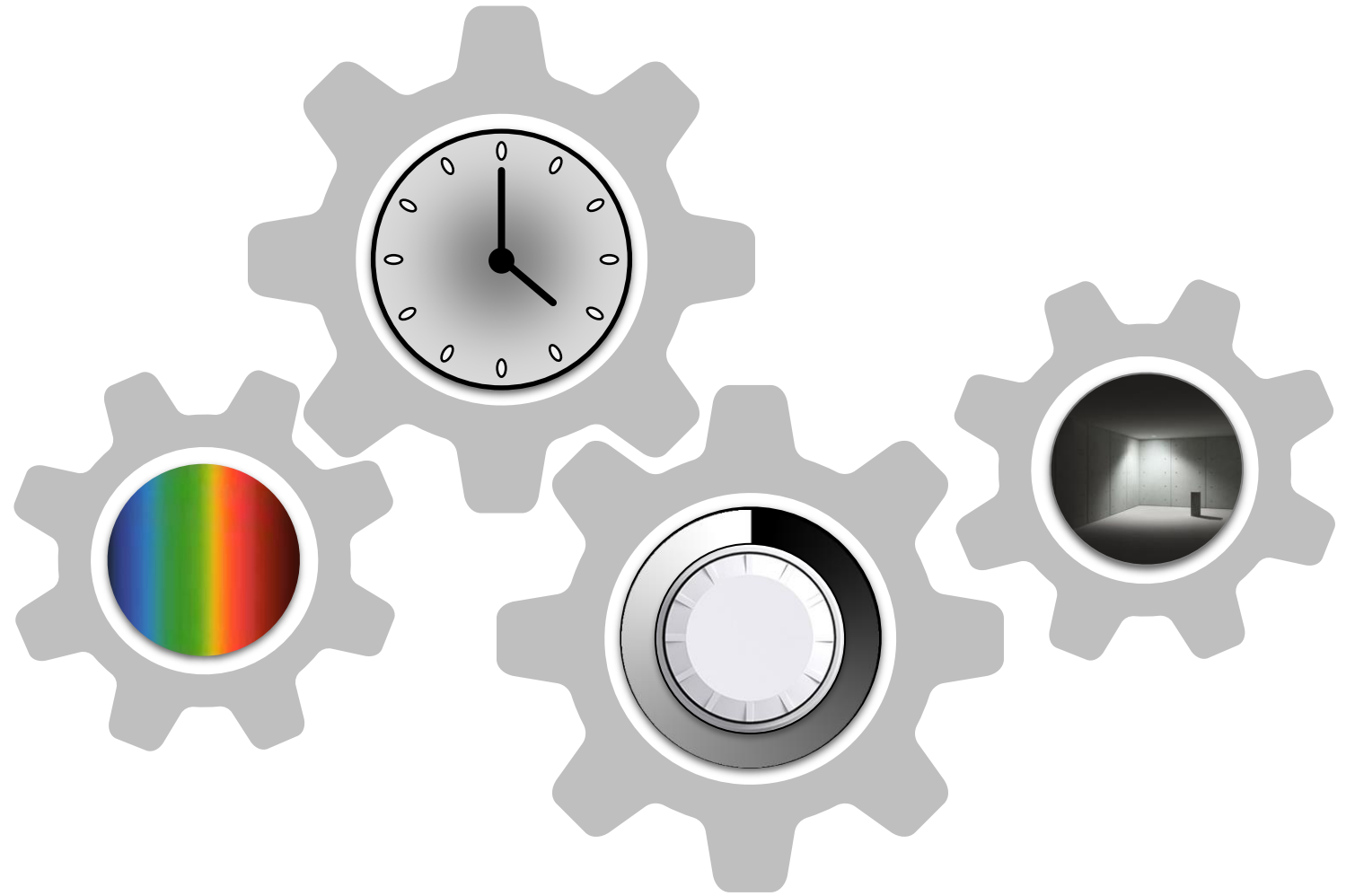
Power as a function of wavelength—the SPD of the light stimulus.

Intensity

Quantity of light in radiometric or photometric units.



Light is a complex stimulus **that can be manipulated to affect people.**



Context

Defining HCL

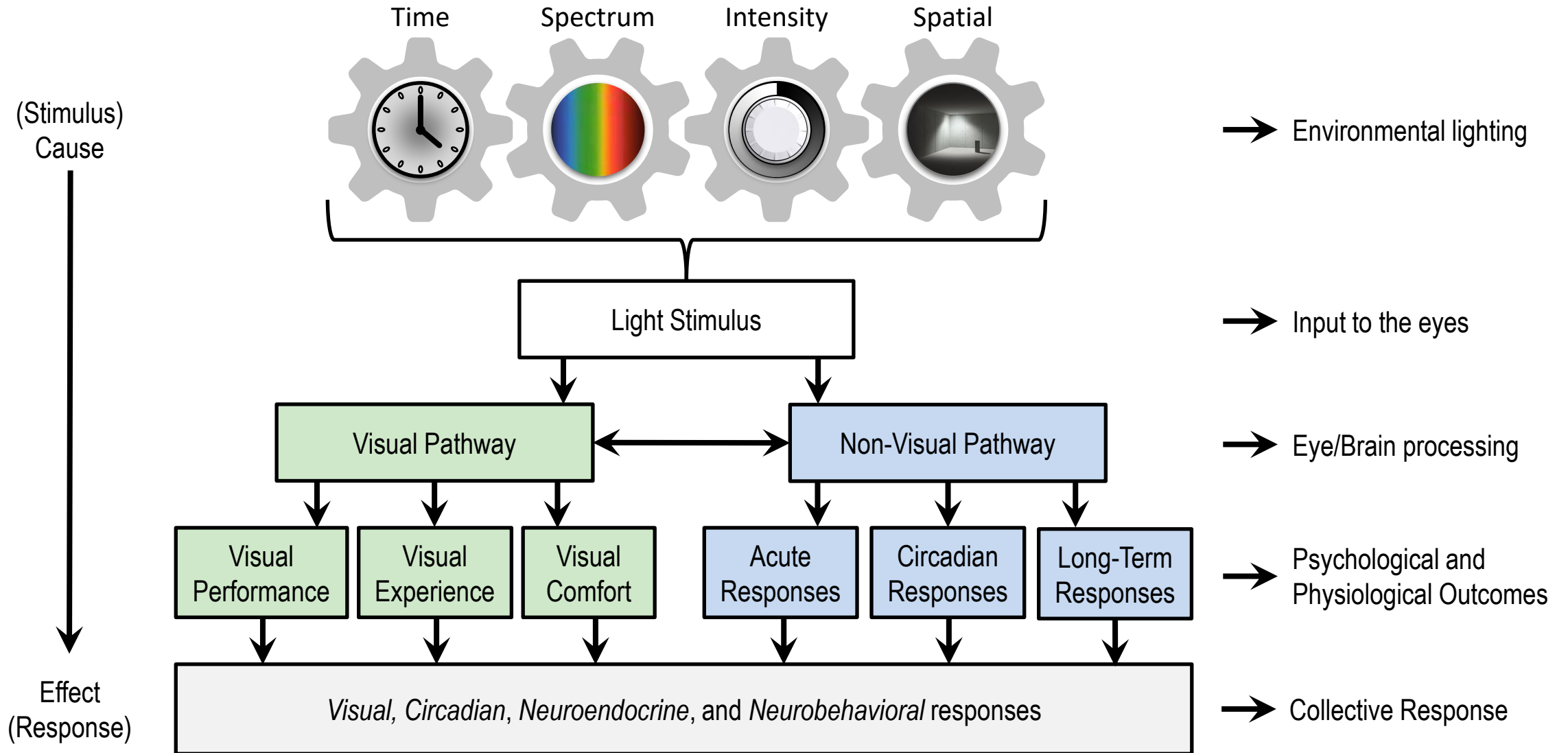
Variables

Priorities

Guidance

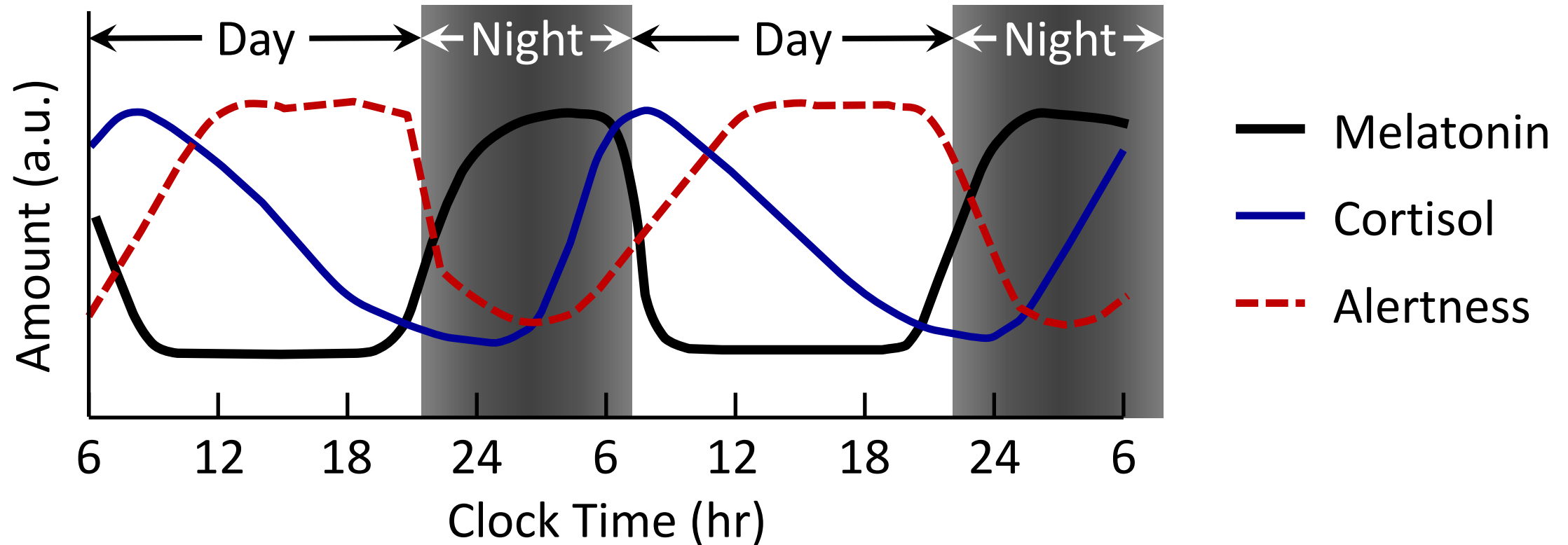
M, M, or M?

Light as a stimulus exerts responses in humans.



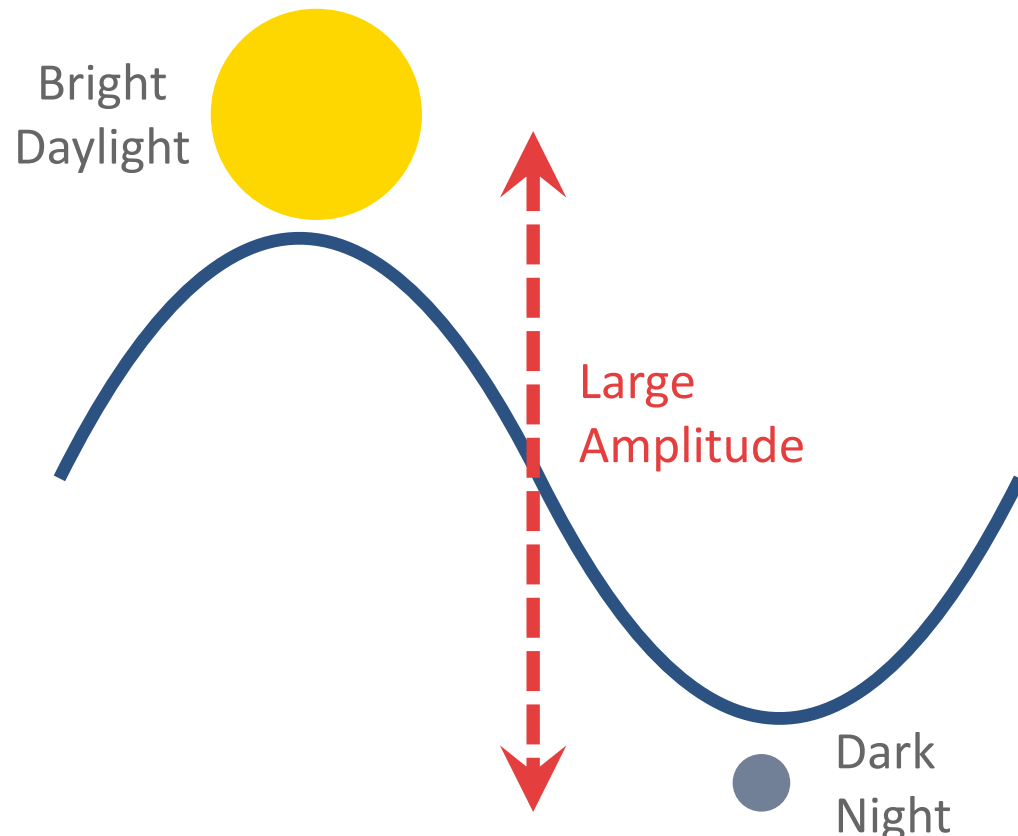
Houser KW, Esposito T. 2021. Human-Centric Lighting: Foundational Considerations and Five-Step Design Process. *Front. Neurol.* 12:630553. <https://doi.org/10.3389/fneur.2021.630553>

Temporal Pattern is the #1 influence on circadian phase shifting.

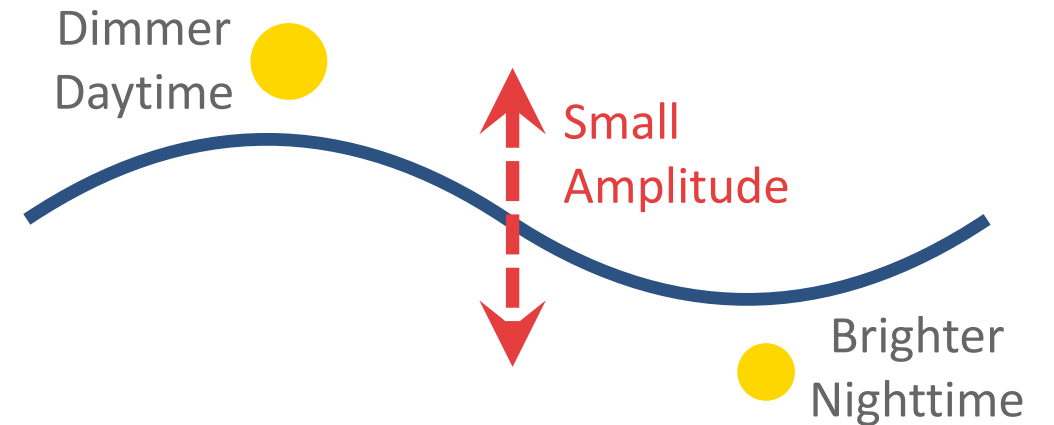


Bright/dark **Amplitude** influences daytime alertness and sleep consolidation.

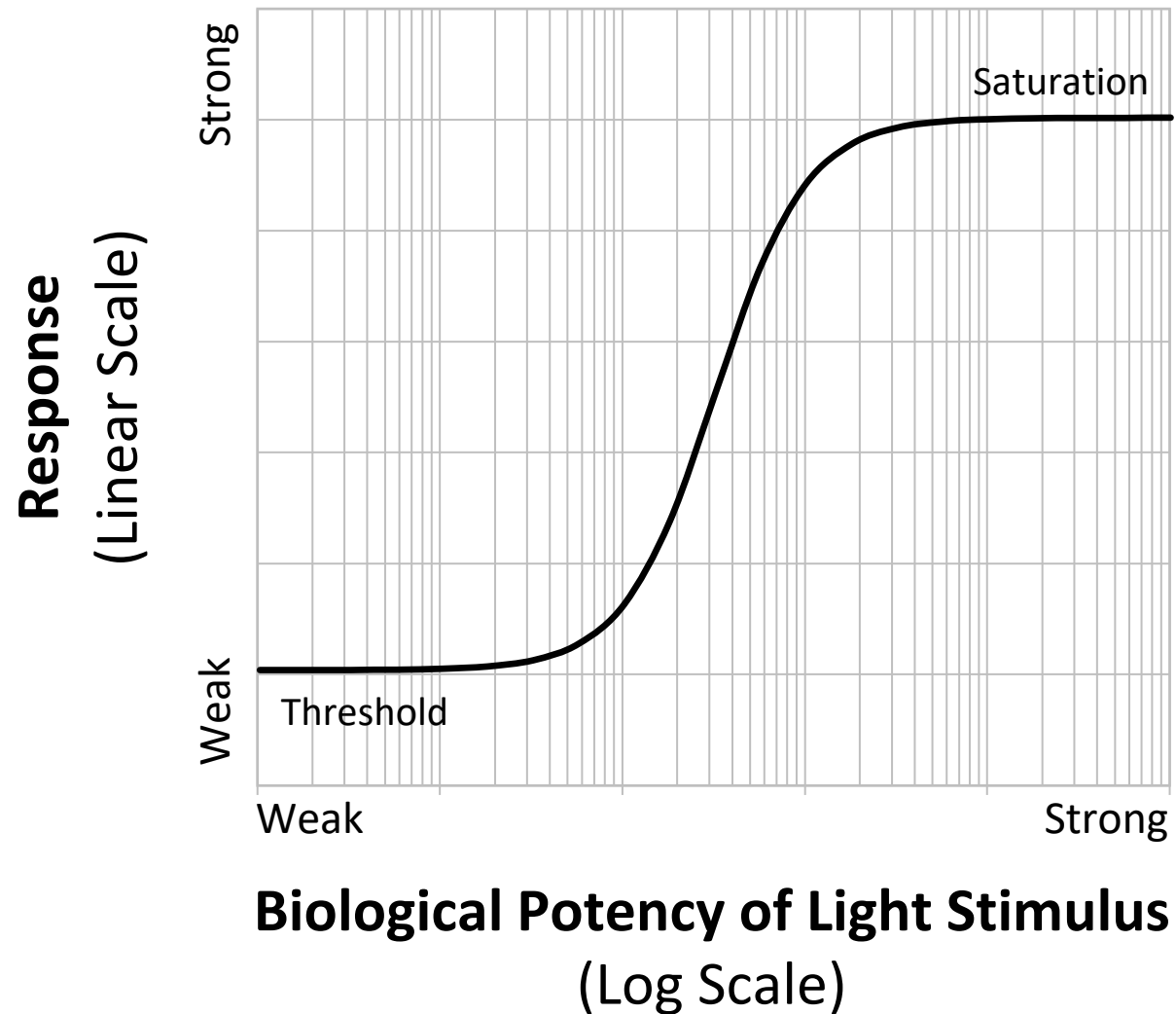
Nature



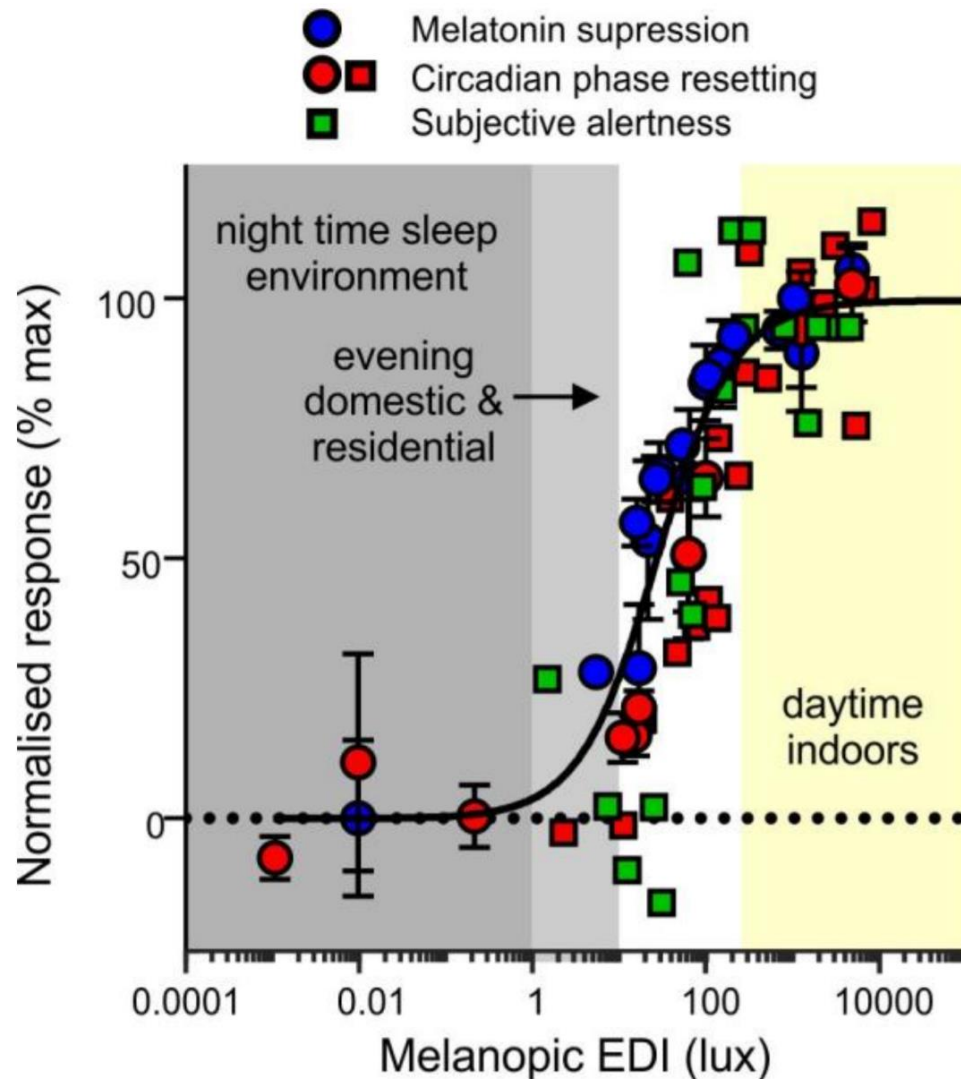
Modern Indoor



To understand the role of **Light Level** and **Spectrum**, it is important to understand a generic **logistic sigmoid function**.



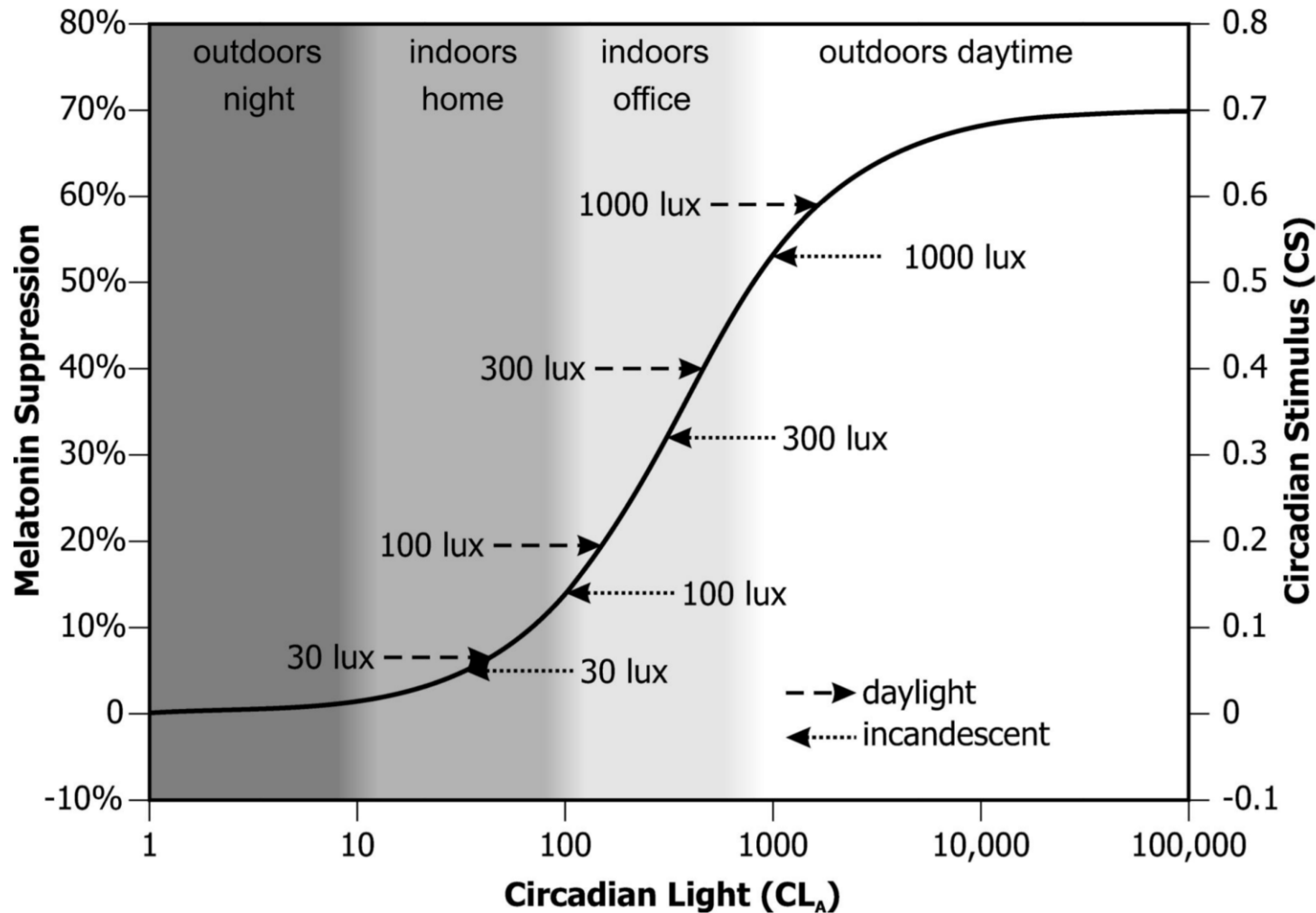
Light Level is the #2 influence.



Brown TM, Brainard GC, Cajochen C, Czeisler CA, Hanifin JP, Lockley SW, Lucas RJ, Munch M, O'Hagan JB, Peirson SN, Price LLA, Roenneberg T, Schlangen LJM, Skene DJ, Spitschan M, Vetter C, Zee PC, Wright KP. 2022. Recommendations for daytime, evening, and nighttime indoor light exposure to best support physiology, sleep, and wakefulness in healthy adults. PLOS Biology. 20(3): e3001571.

<https://doi.org/10.1371/journal.pbio.3001571>

Spectrum is the #3 influence.



Figueiro MG. 2017. Disruption of Circadian Rhythms by Light During Day and Night. *Current Sleep Medicine Reports*. 3(2):76-84. <https://doi.org/10.1007/s40675-017-0069-0>

Spatial Pattern
should be considered
with **Quantity** and
Spectrum.



Context

Defining HCL

Variables

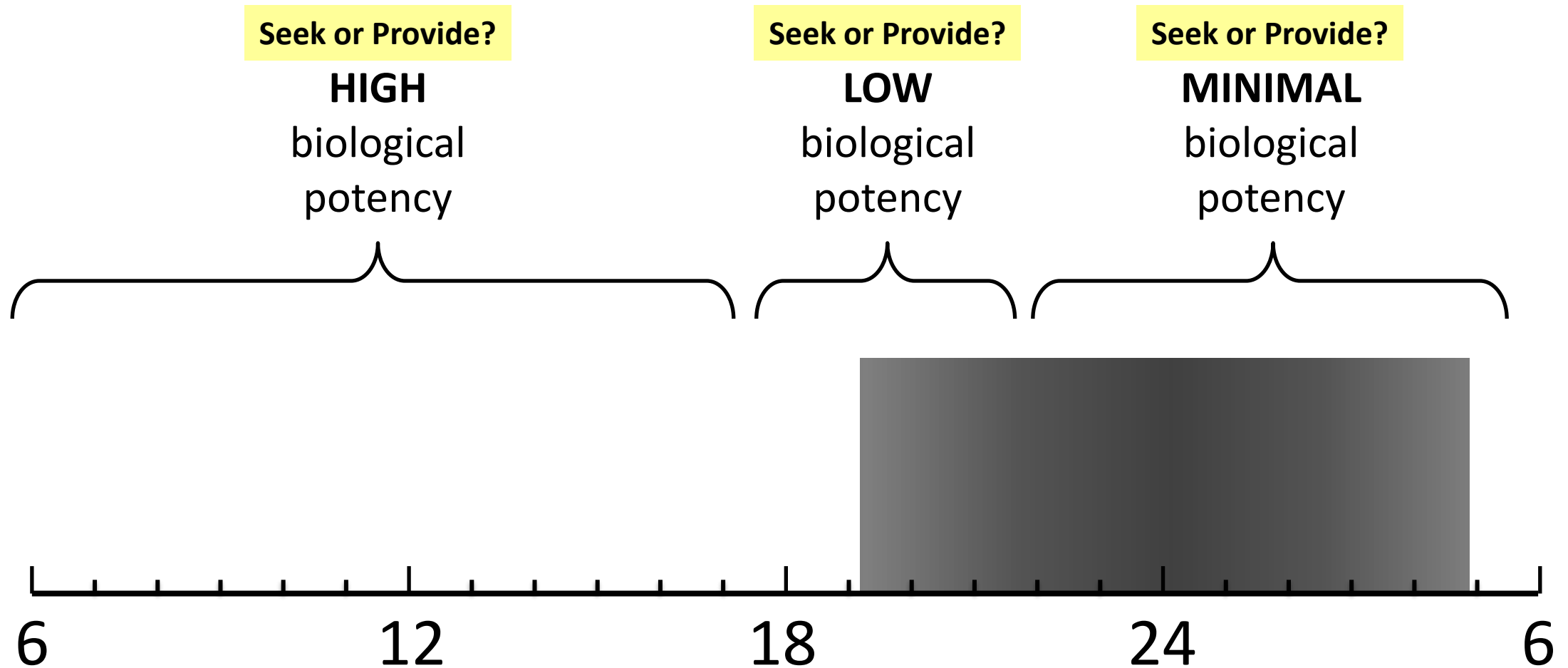
Priorities

Guidance

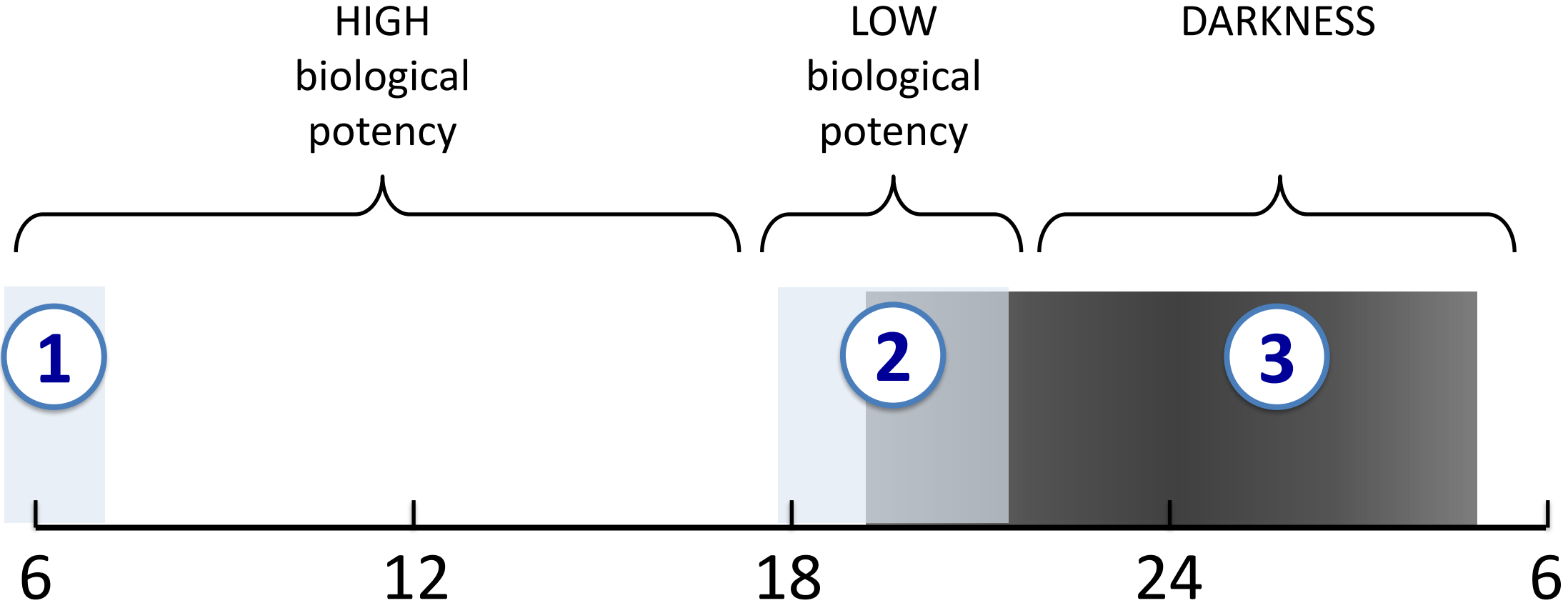
M, M, or M?

What then, is *human-centric lighting* in application? *

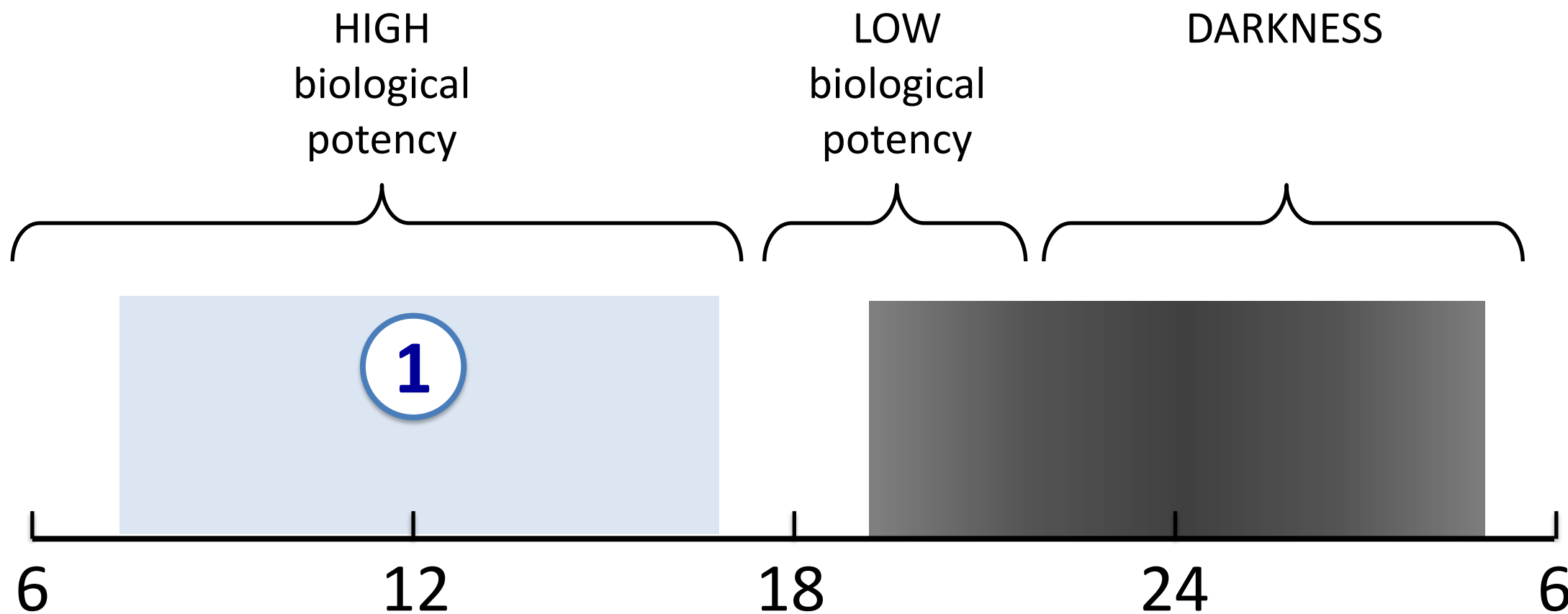
* For day active people!



Buildings where people **sleep** require **three** lighting conditions (for circadian health).



Building where people **work/learn** require **one** static lighting condition (for circadian health).



Myth, Magic, or Metaphor?



Context

Defining HCL

Variables

Priorities

Guidance

M, M, or M?

Myth, Magic, or Metaphor?



Context

Defining HCL

Variables

Priorities

Guidance

M, M, or M?



Oregon State
University



kevin.houser@oregonstate.edu

COLLEGE OF ENGINEERING

School of Civil and
Construction Engineering

Resources

Human Centric Lighting and Semantic Drift

<https://doi.org/10.1080/15502724.2018.1501234> [OPEN ACCESS]

In this LEUKOS editorial I traced the rise of the phrase “Human Centric Lighting” and commented on the lack of clarity about what the phrase could mean and might mean to different people.

Human-Centric Lighting: Myth, Magic, or Metaphor?

<https://doi.org/10.1177/1477153520958448>

In this LR&T article, I am my co-authors unpacked the concept of HCL. What is old? What is new? What is known? What is unknown? What are the varied roles of different constituencies?

A Review of Human Physiological Responses to Light: Implications for the Development of Integrative Lighting Solutions

<https://doi.org/10.1080/15502724.2021.1872383> [OPEN ACCESS]

This LEUKOS article is a comprehensive review intended to be a one-stop scientific article for those that are trying to understand how light influences biology and physiology. It is written for the scientific community as much as it is for the design community. Incredible group of co-authors.

Human-Centric Lighting: Foundational Considerations and a Five-Step Design Process

<https://doi.org/10.3389/fneur.2021.630553> [OPEN ACCESS]

In this Frontiers in Neurology article, I and Tony Esposito endeavored to write with empathy for a specifier. They are the ones that are tasked with designing light for people, yet the information they need to make good decisions is fragmented and inconsistent. We were trying to provide some order to the complexity of information that is out there.

Ethics and Fallacies of Human-Centric Lighting and Artificial Light at Night

<https://doi.org/10.1080/15502724.2021.1951021> [OPEN ACCESS]

In this LEUKOS editorial I comment on the intrinsic problems with human centricity. Lighting causes collateral damage to people and non-human life. Does the lighting community have the collective will to do better?

Melanopsin Vision: Sensation and Perception Through Intrinsically Photosensitive Retinal Ganglion Cells

<https://doi.org/10.1017/9781009029865>

In this Elements in Perception book (Cambridge University Press), we integrate new knowledge from visual neuroscience, psychology, sleep science and architecture to discuss how melanopsin-mediated ipRGC functions can be measured and their circuits manipulated. We discuss how contemporary and emerging lighting technologies can be powerful tools to set mind, brain and behavior.