ET LUX FUIT – les apports de l'éclairage naturel au bien-être des habitants

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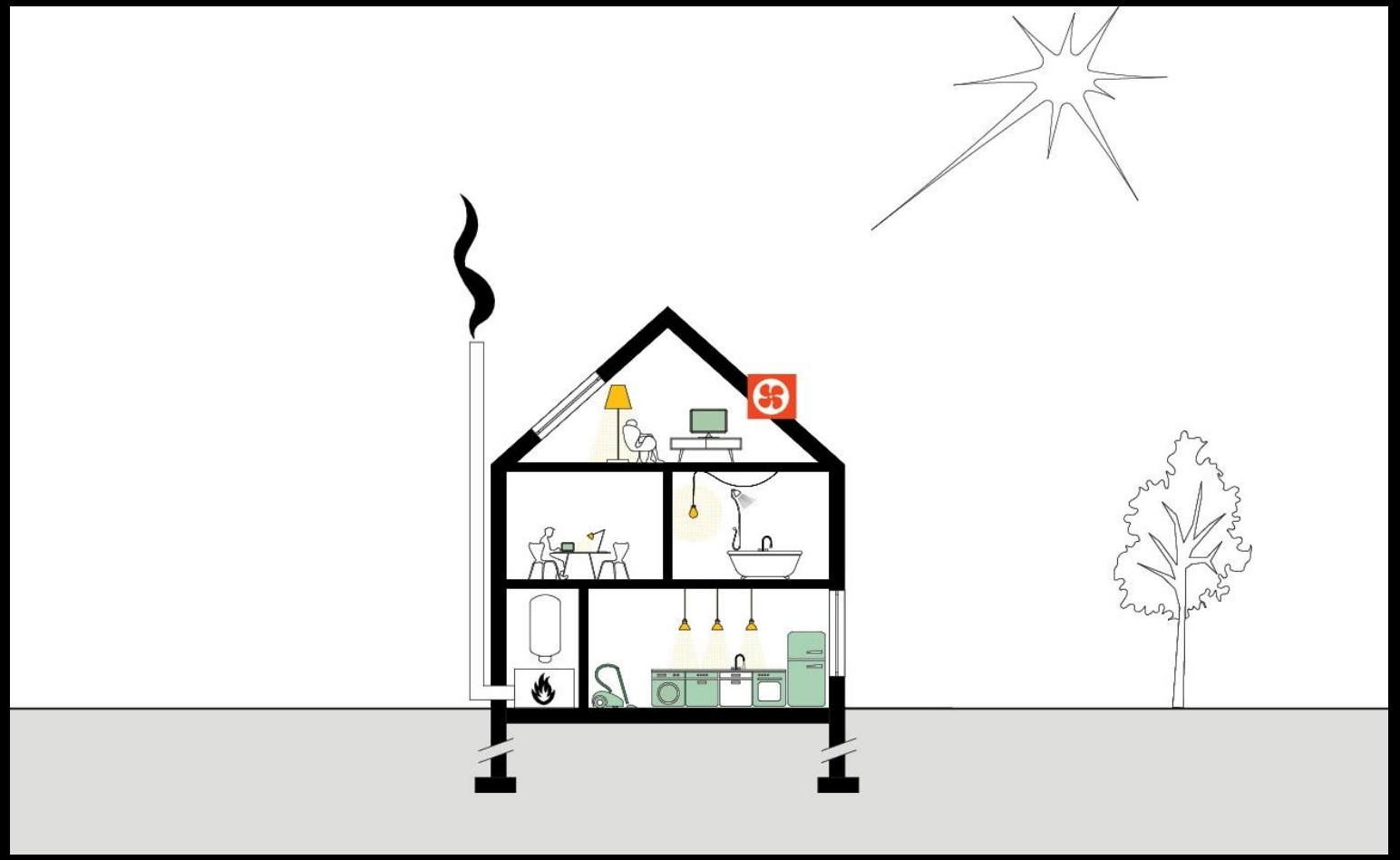
lighting in a sustainability context: a multifaceted challenge

multi-scale – from urban to human



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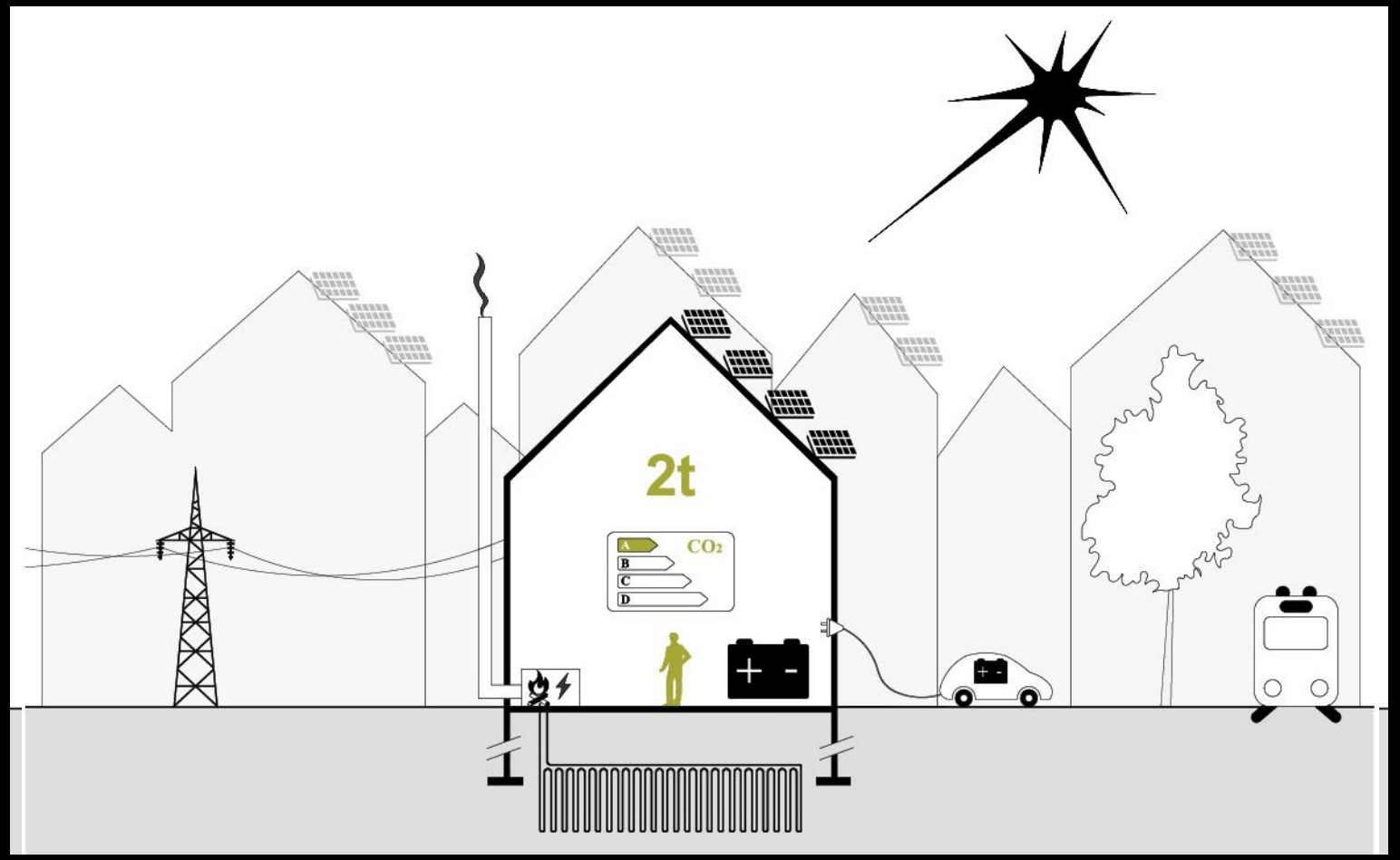
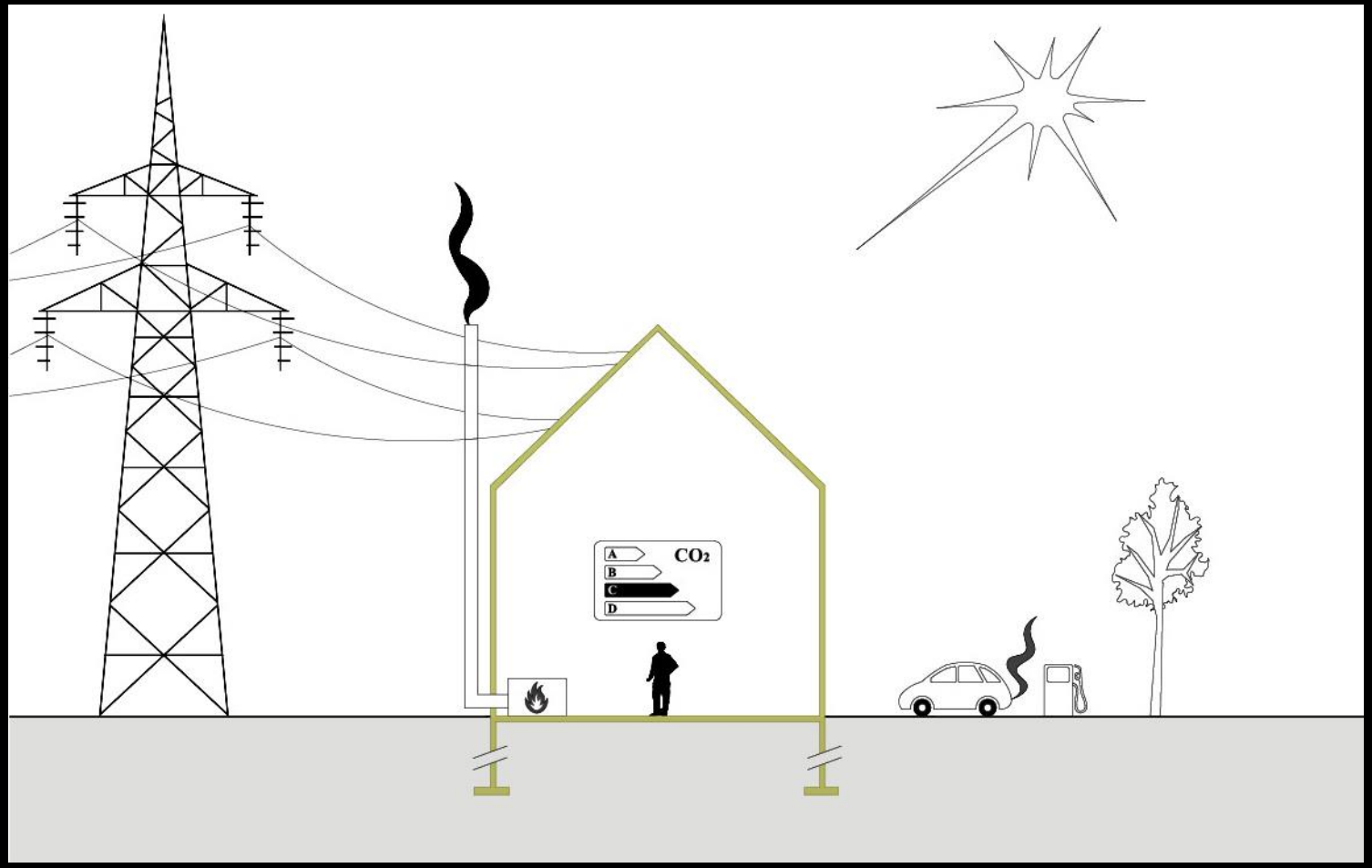
integrated design approach: set sustainability goals

construction, technology, mobility, comfort…



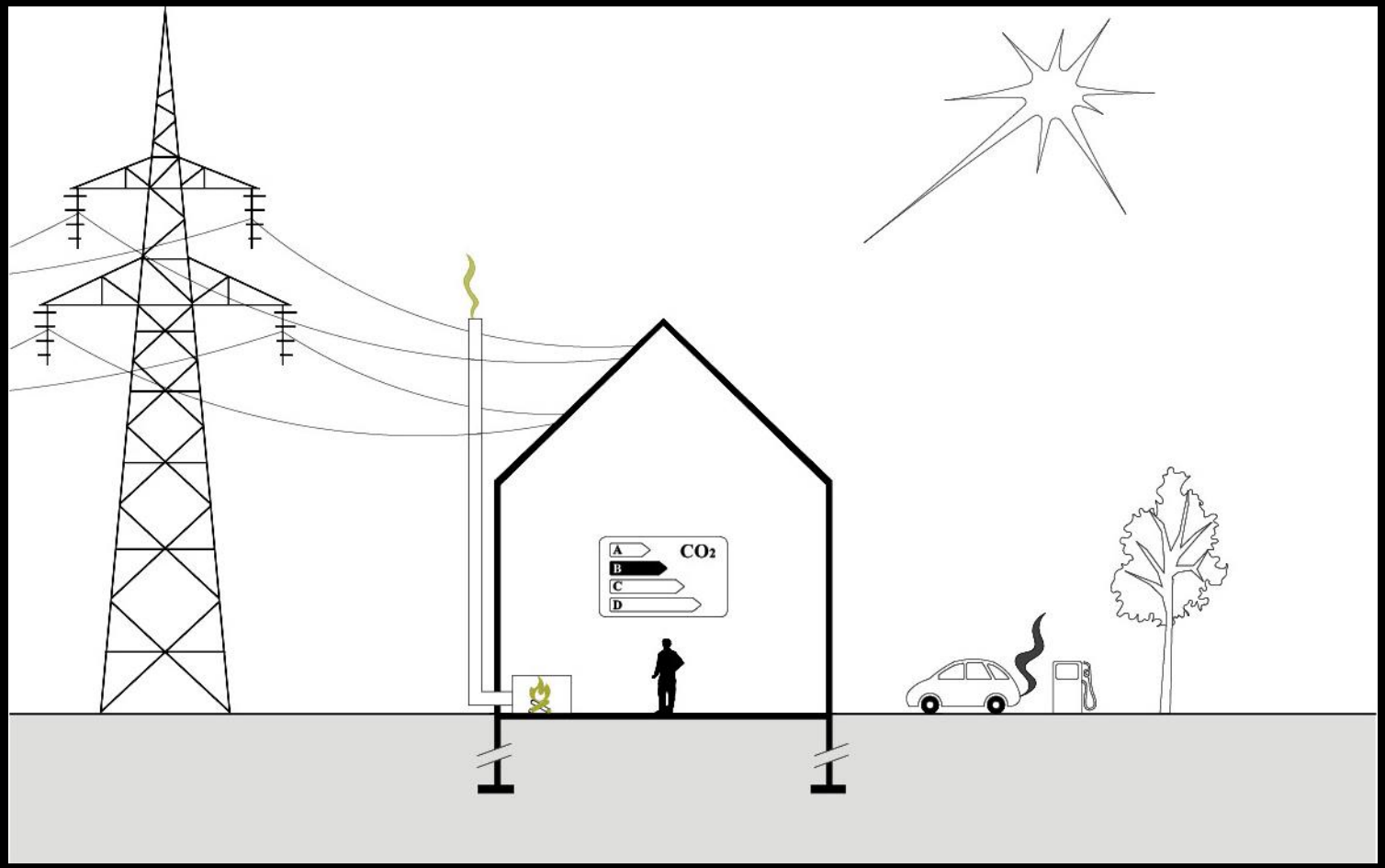
we often start with specific design choices…

envelopes using low-carbon materials, light and flexible



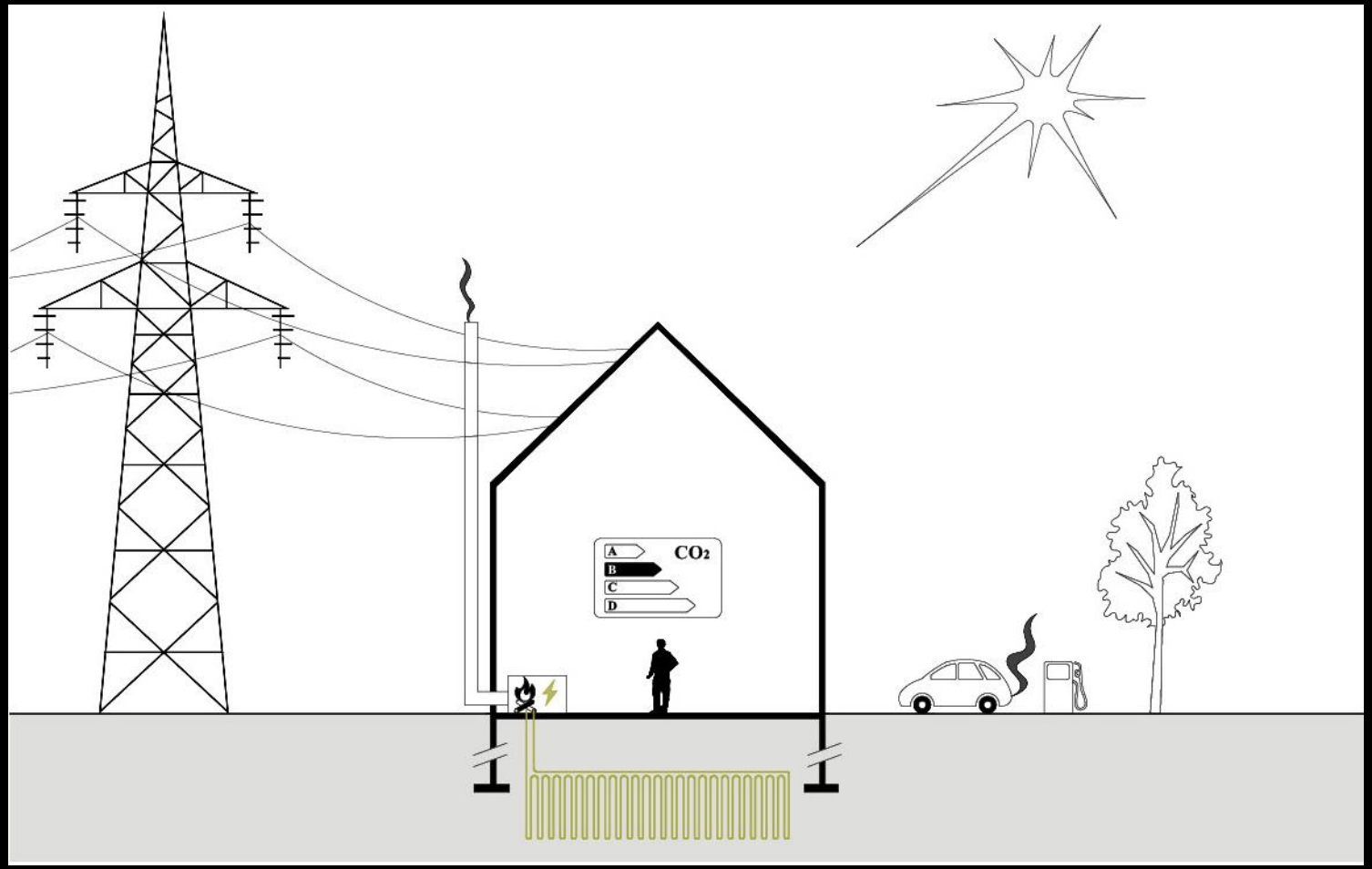
…energy supply alternatives…

reliance on carbon free energy (e.g. wood)



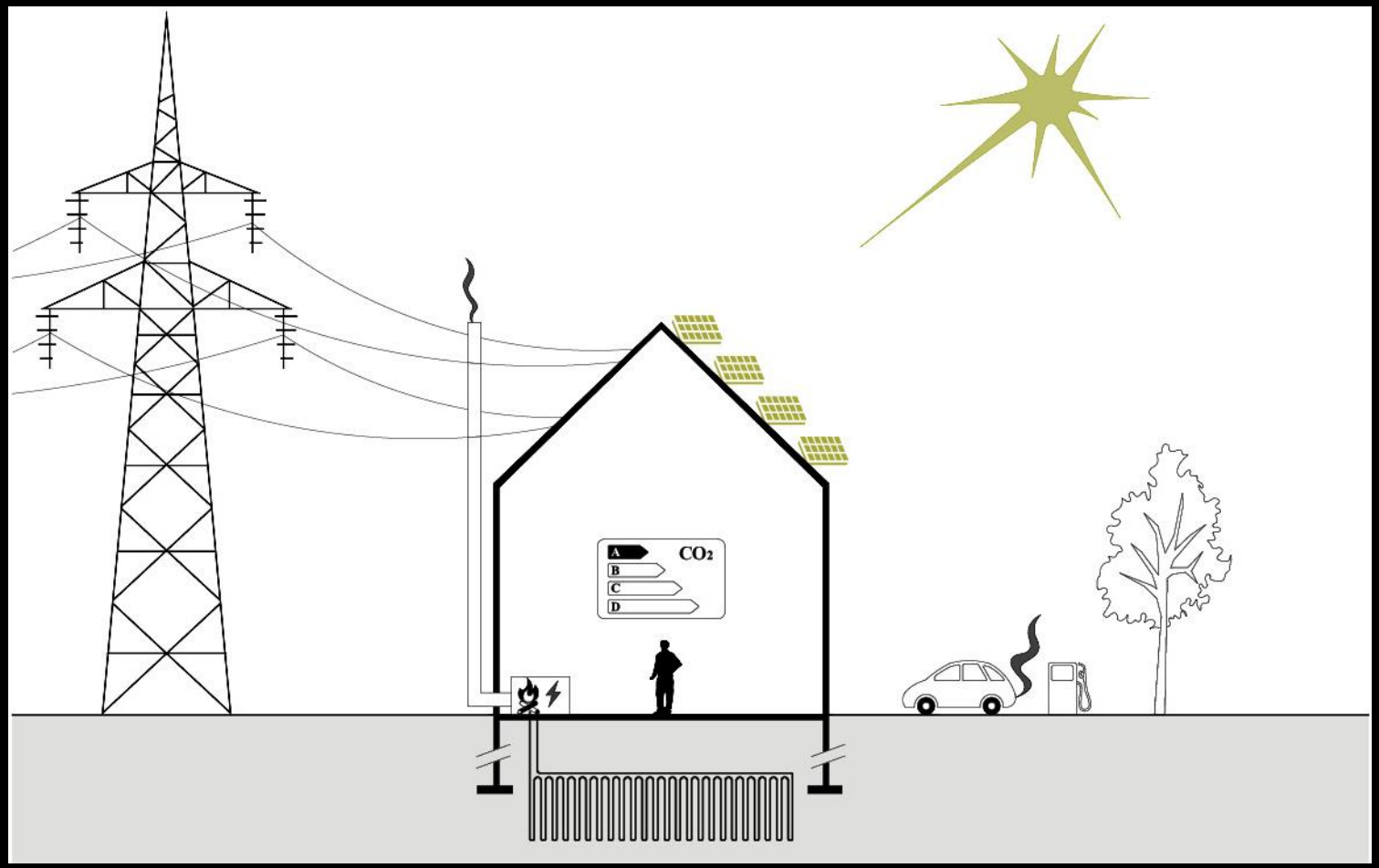
…selection of active systems…

heat pump with electricity



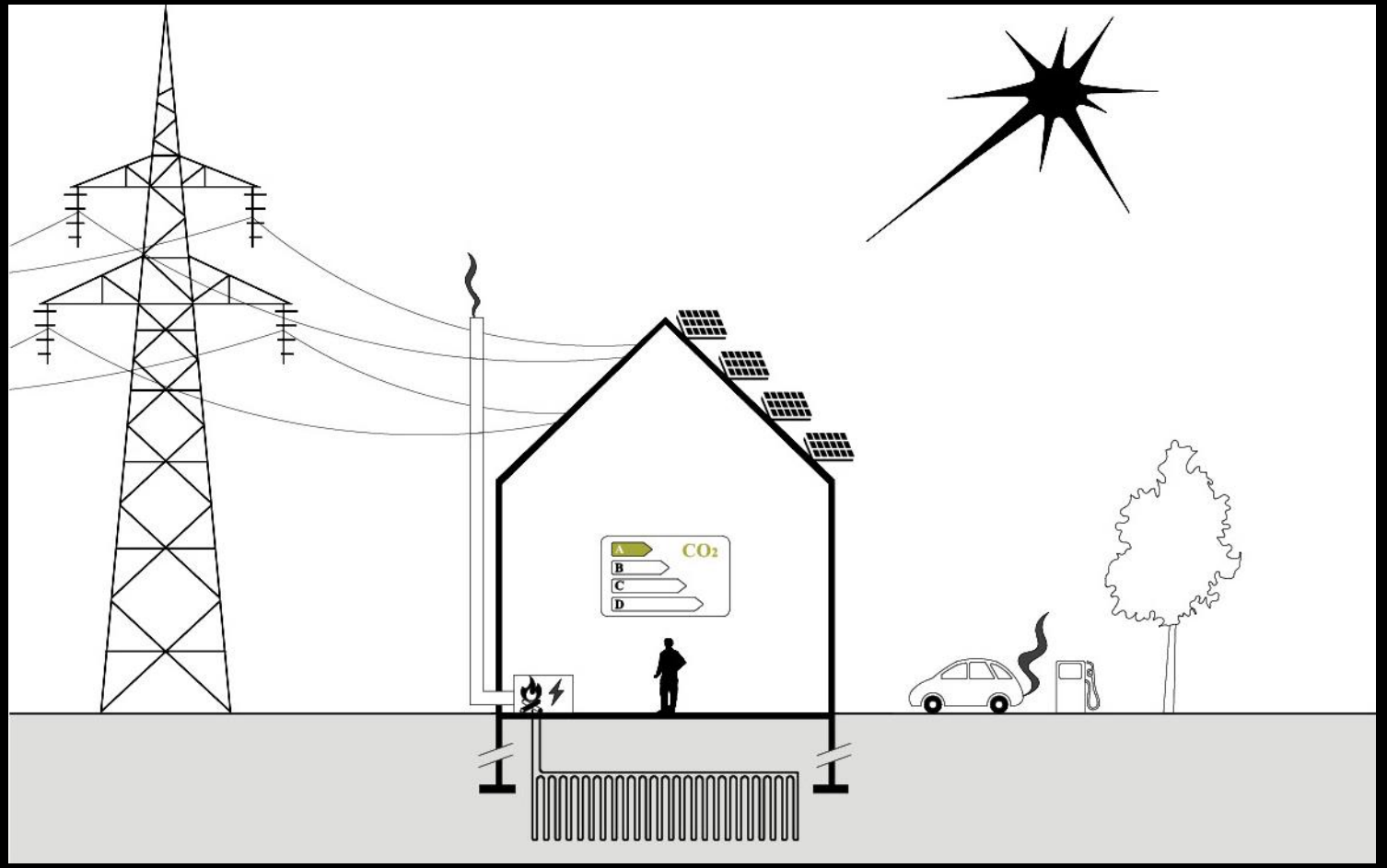
…integration of solar technology…

locally-generated renewable energy



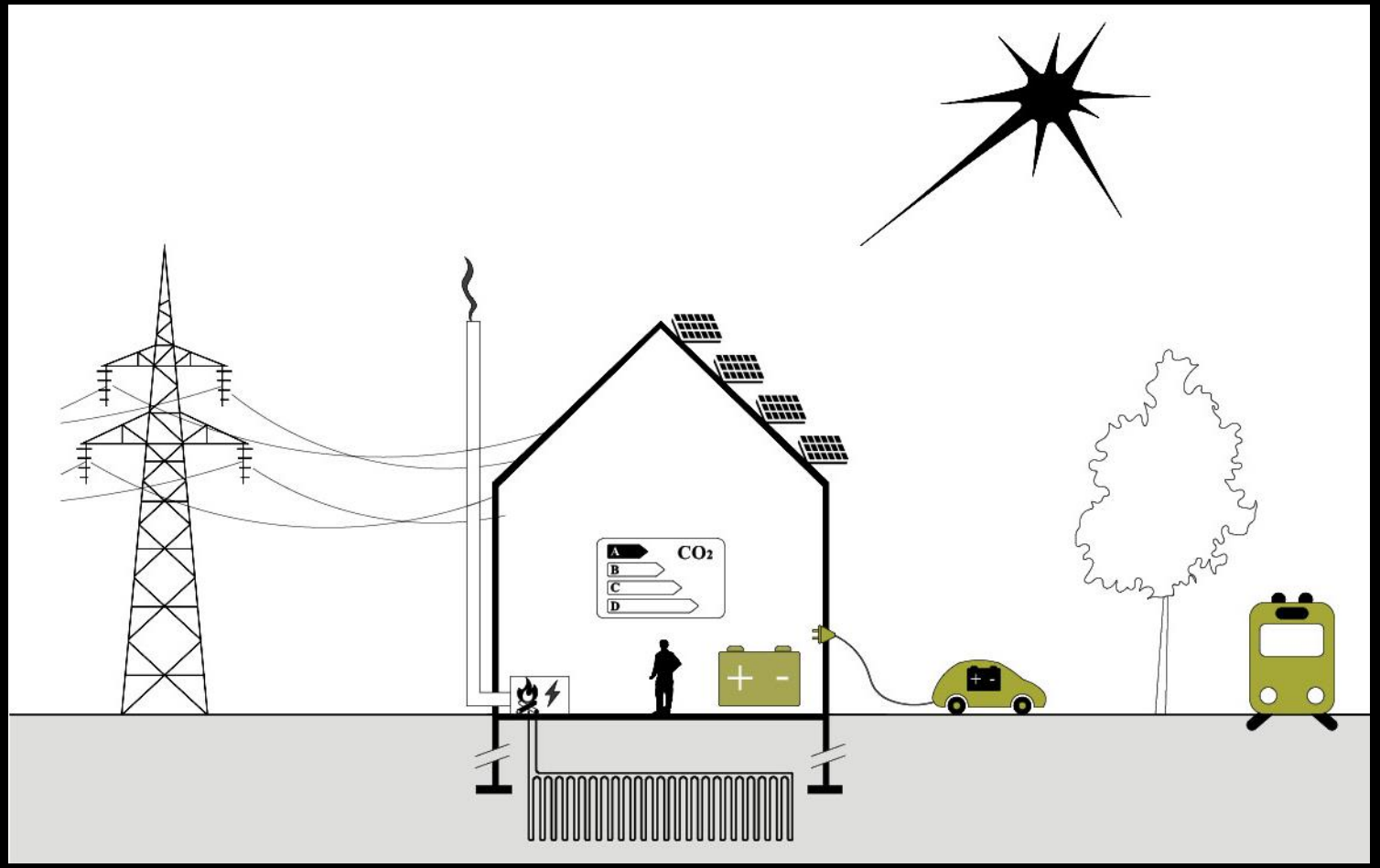
…local choice of materials…

reduced CO2 emissions



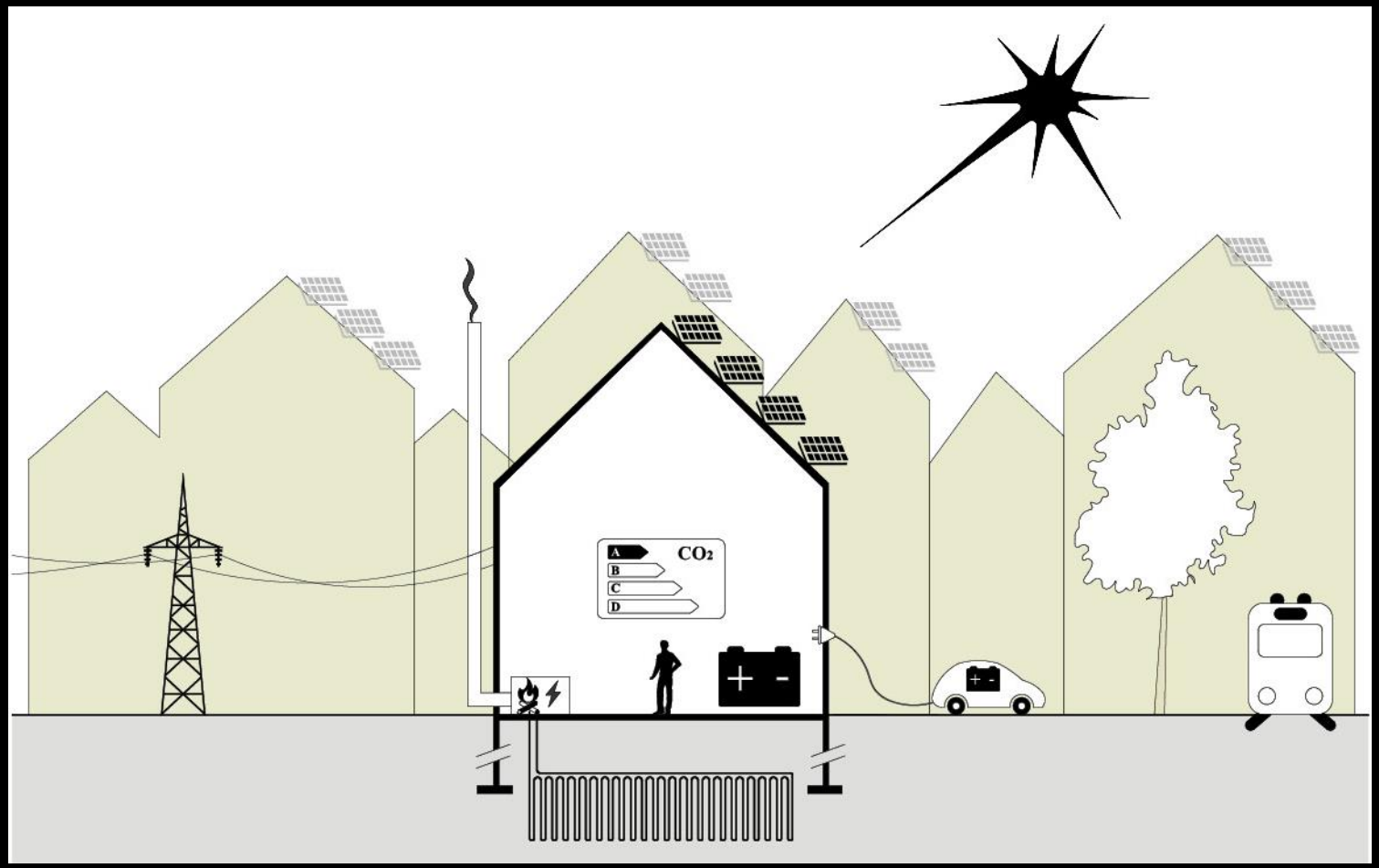
…diversify storage options…

building and mobility coupled for improved energy efficiency…



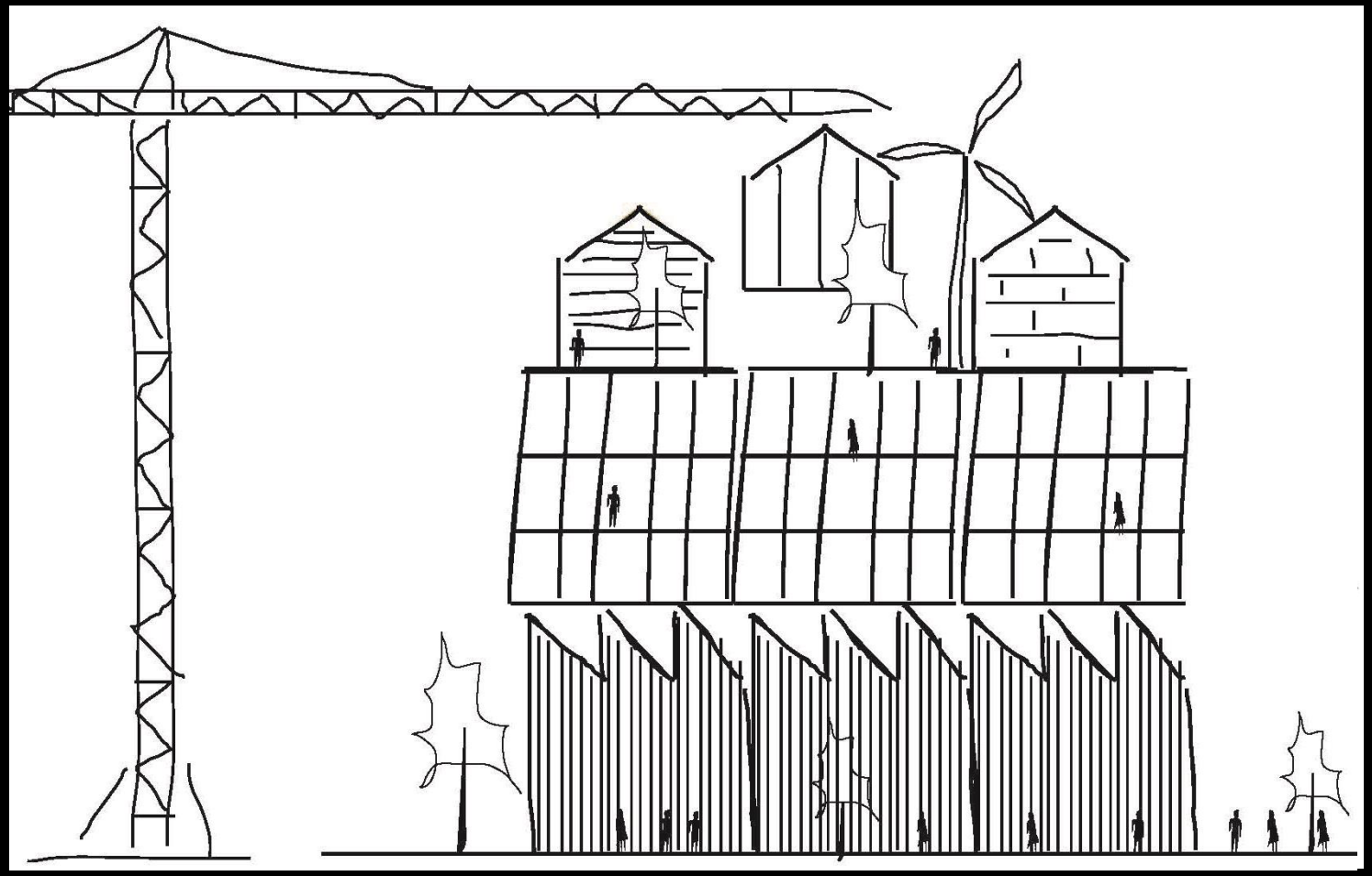
…and contribute to urban quality…

higher density of urban areas instead of increased urban sprawl



enough ingredients to build for the future? the SMART LIVING LAB as a case study

the challenge of integration



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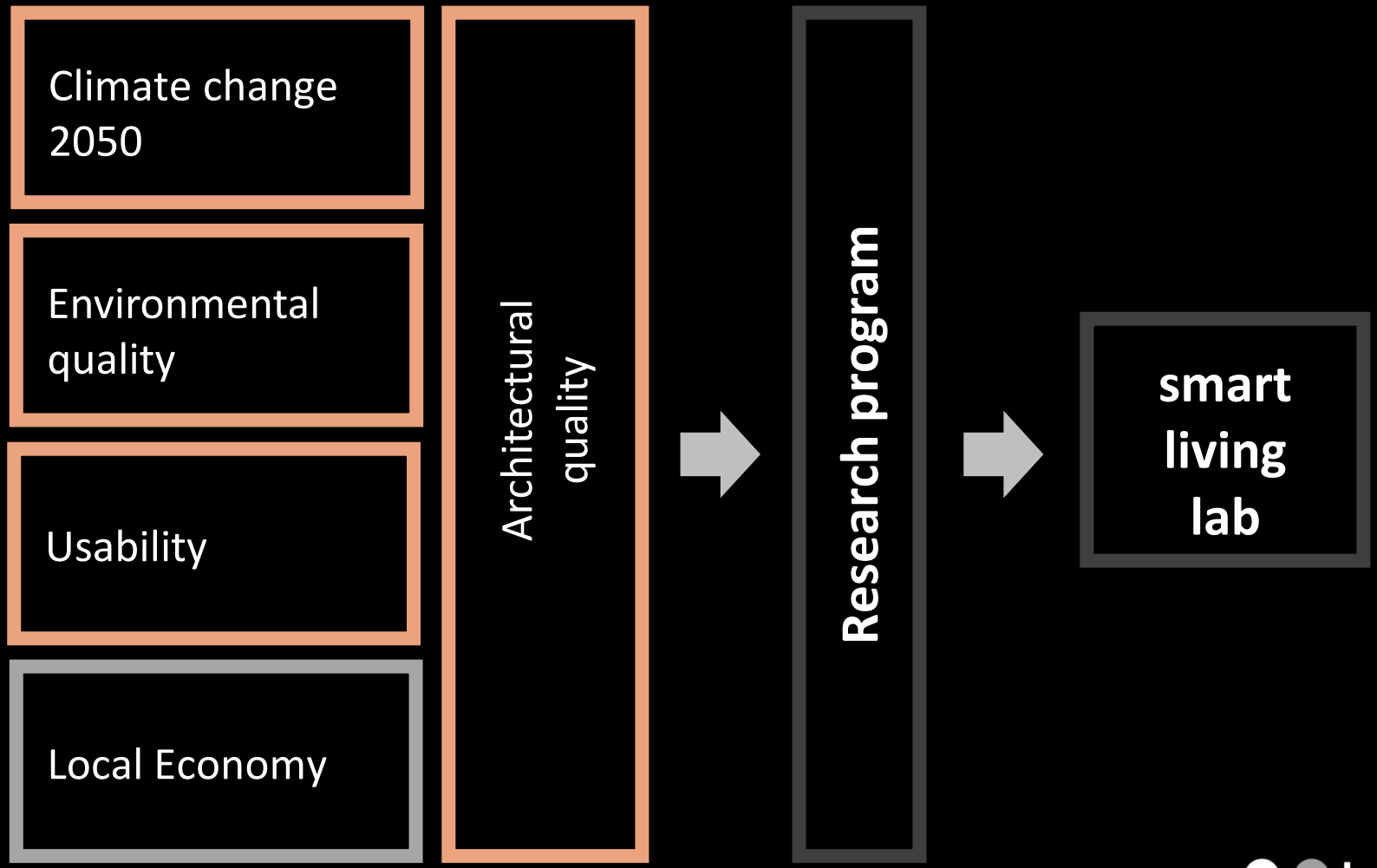
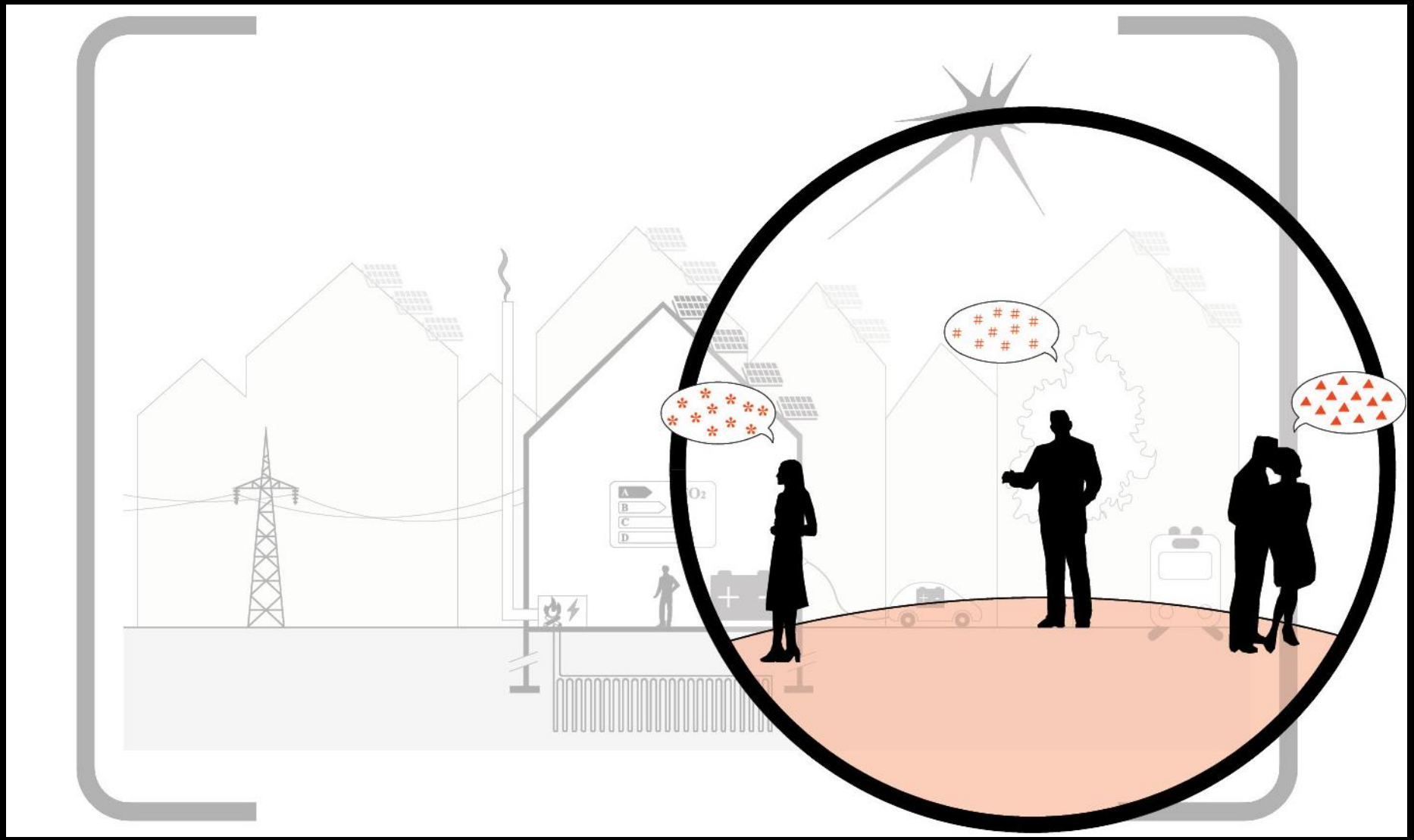
need for a methodology / priorities

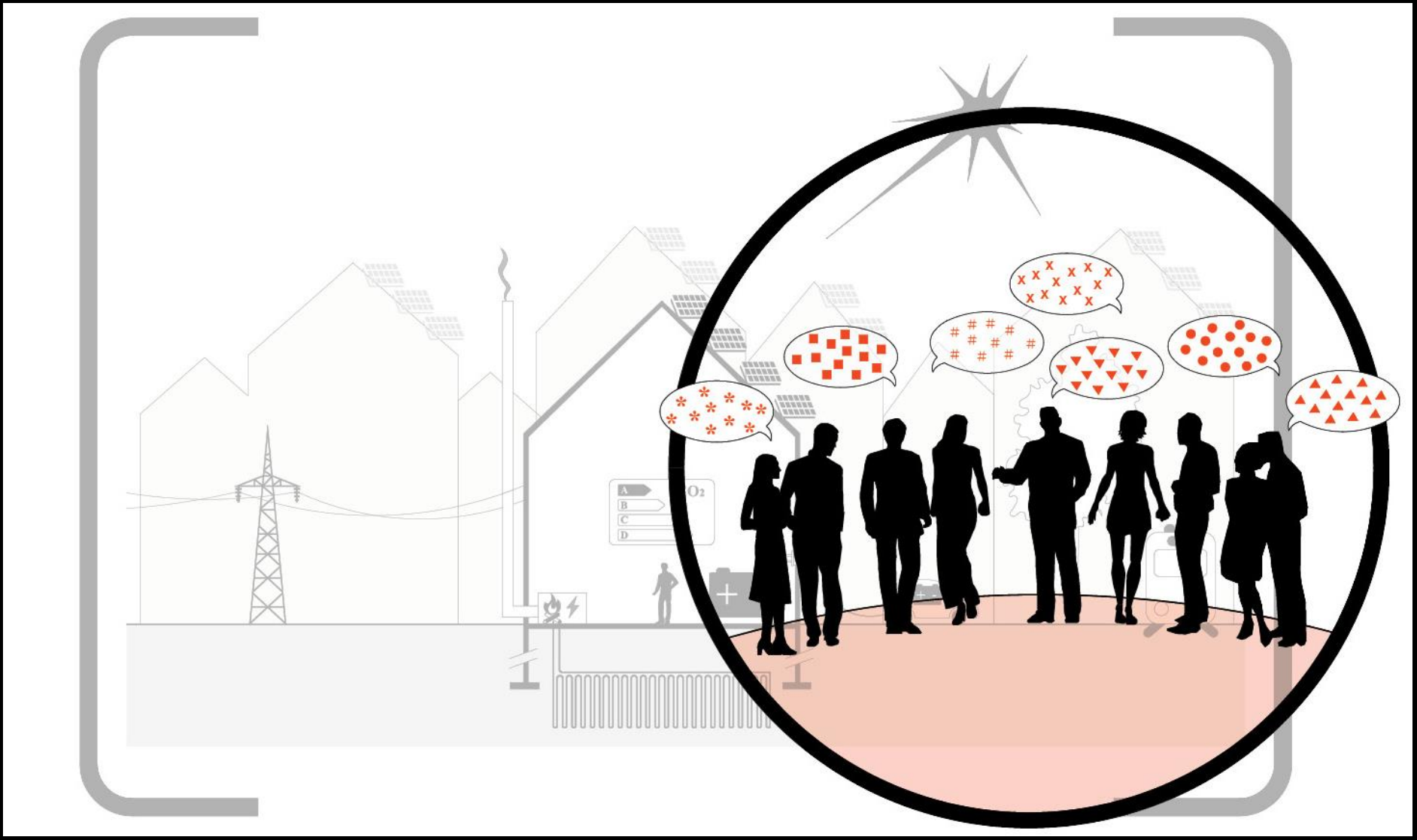
always a compromise: remarkable performance for chosen focus, acceptable for other aspects



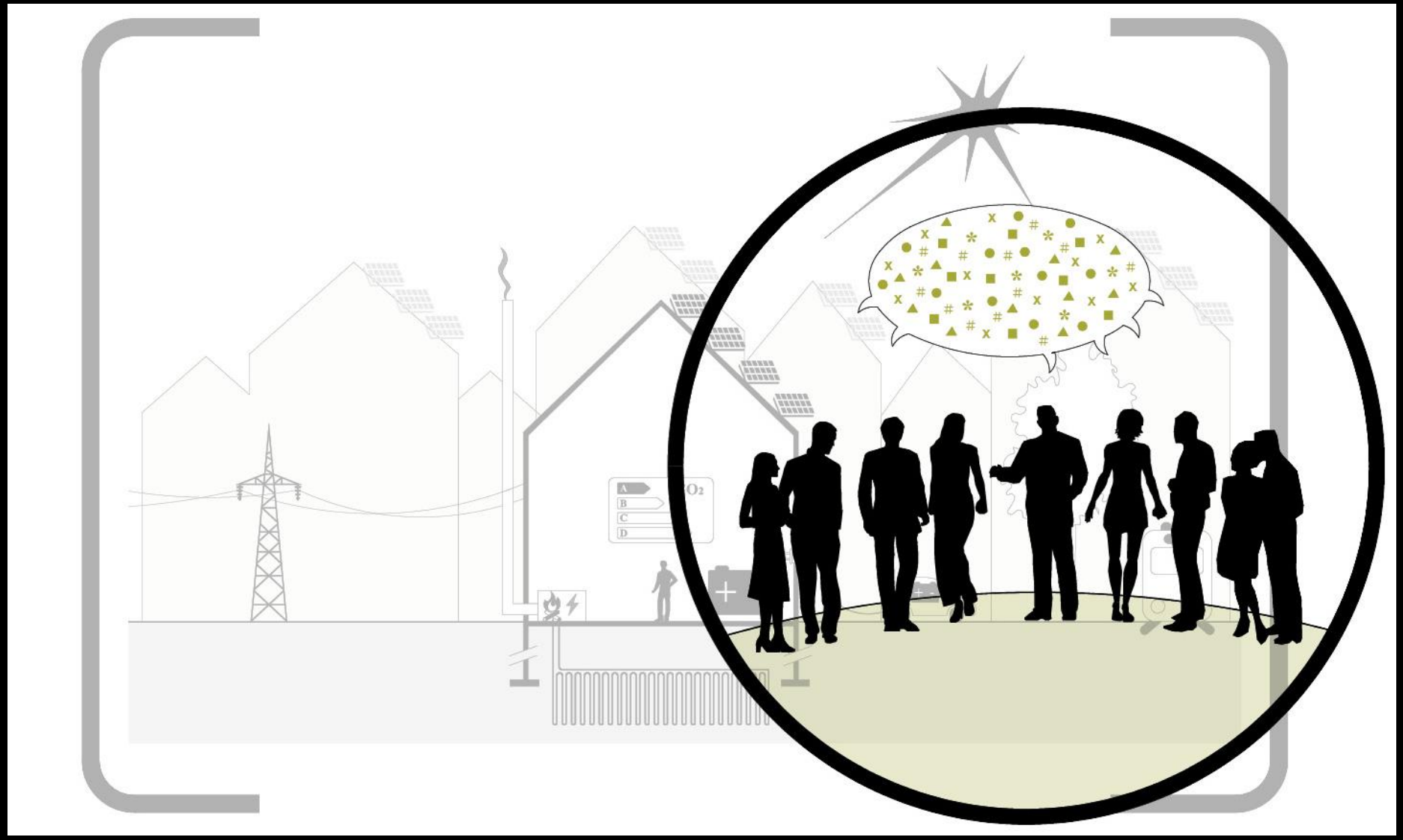
several actors involved, speaking different languages



more and more disciplines, more and more actors



main challenge: sharing a common language



smart living lab's chosen areas of focus (for which remarkable performance should be achieved)

CO2 emissions

skin

user environment

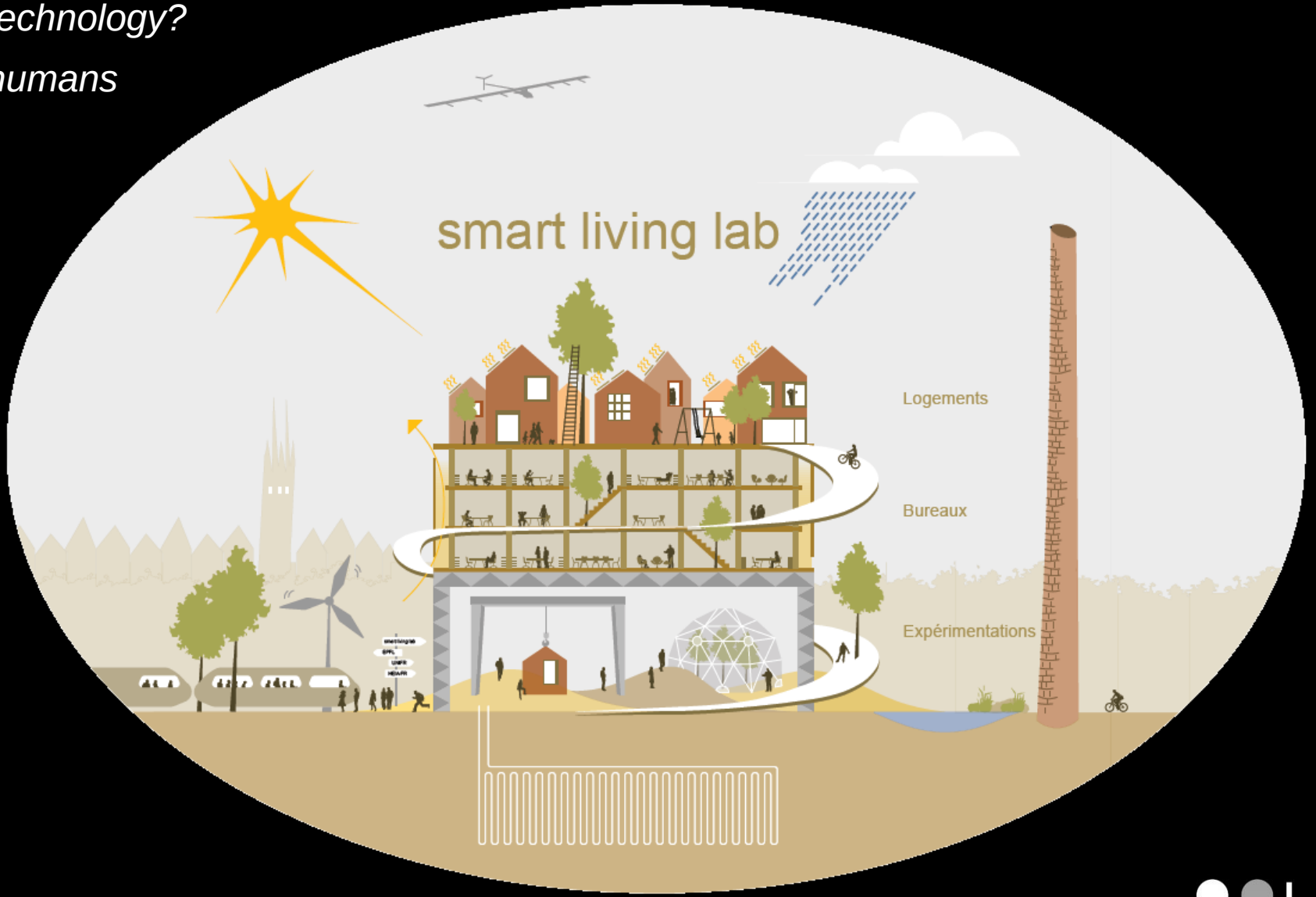
storage & mobility

active systems

towards a 2020 building for a 2050 vision

obsolete technology?

focus on humans



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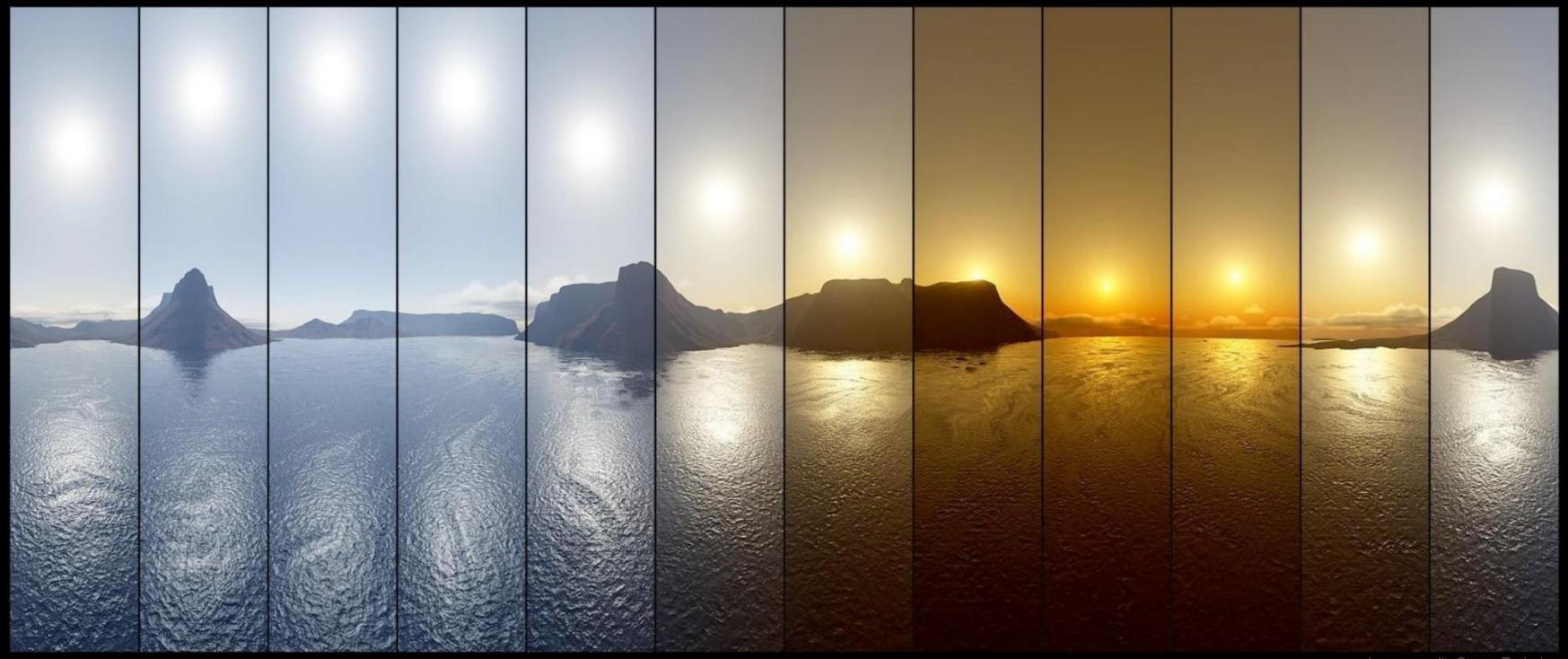

Image credit: StevenRutledge

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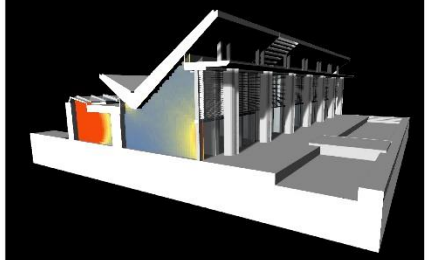
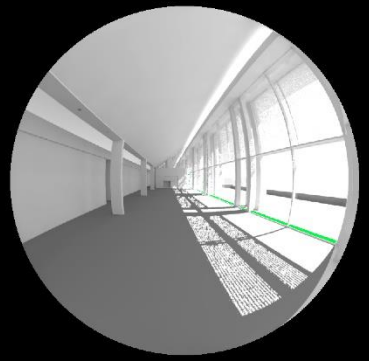
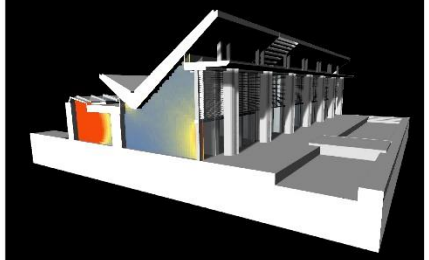
mainstream performance metrics

task performance	visual comfort	energy
		
illumination	glare risk	solar gains

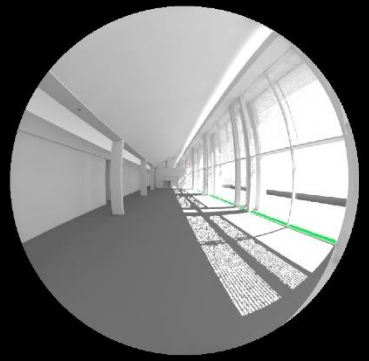
mainstream performance metrics

task performance



illumination

visual comfort



glare risk

energy

solar gains

human factors

health?

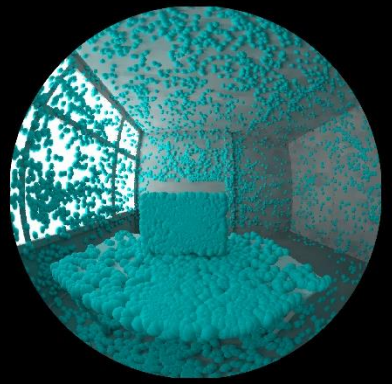
behavior?

perception?

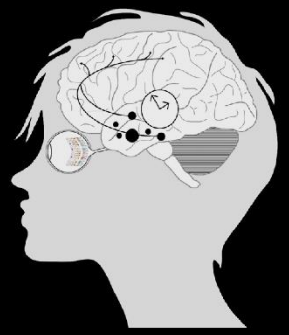
human-centered design factors

visual delight

visual responsive comfort



health potential

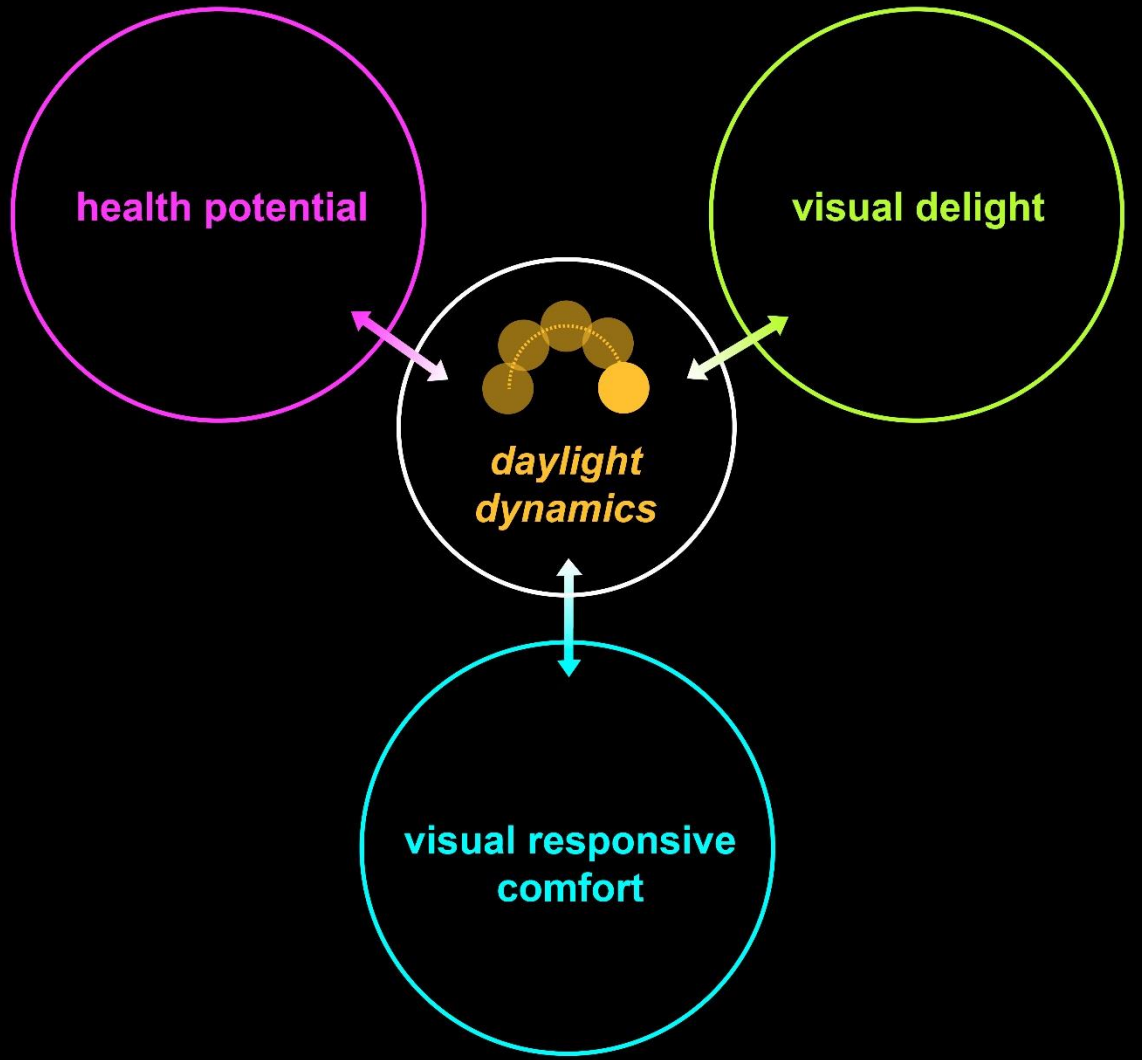


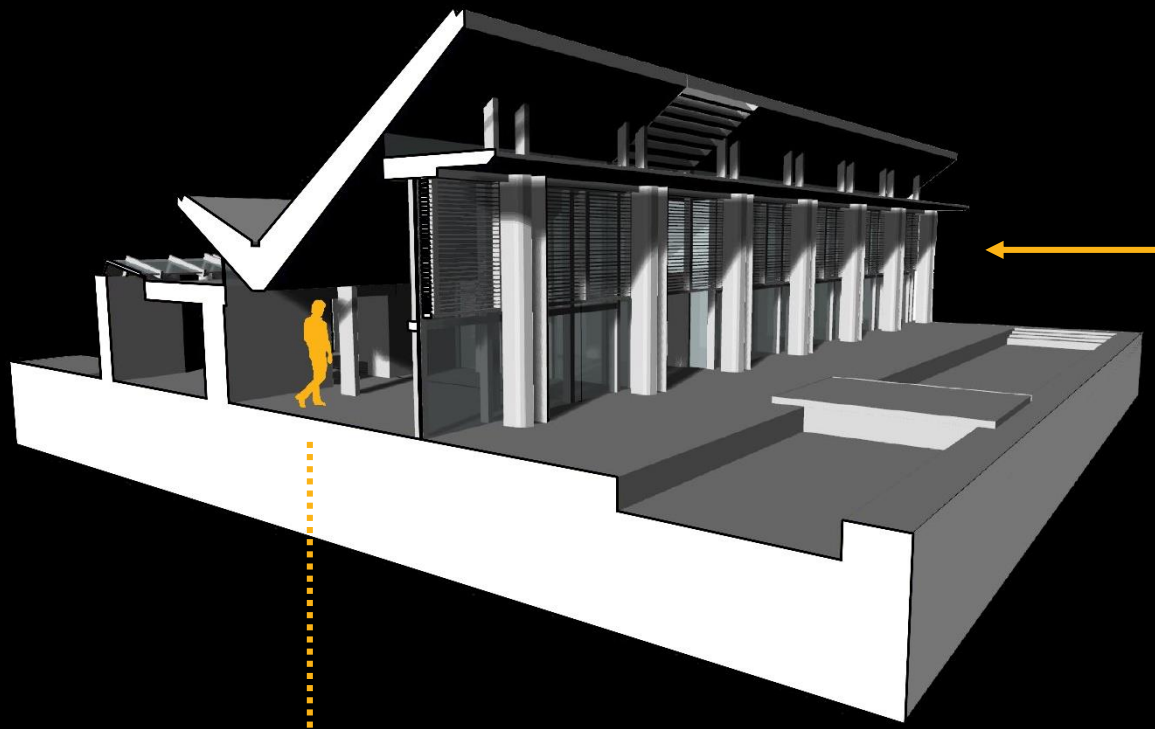
human factors

health?

behavior?

perception?



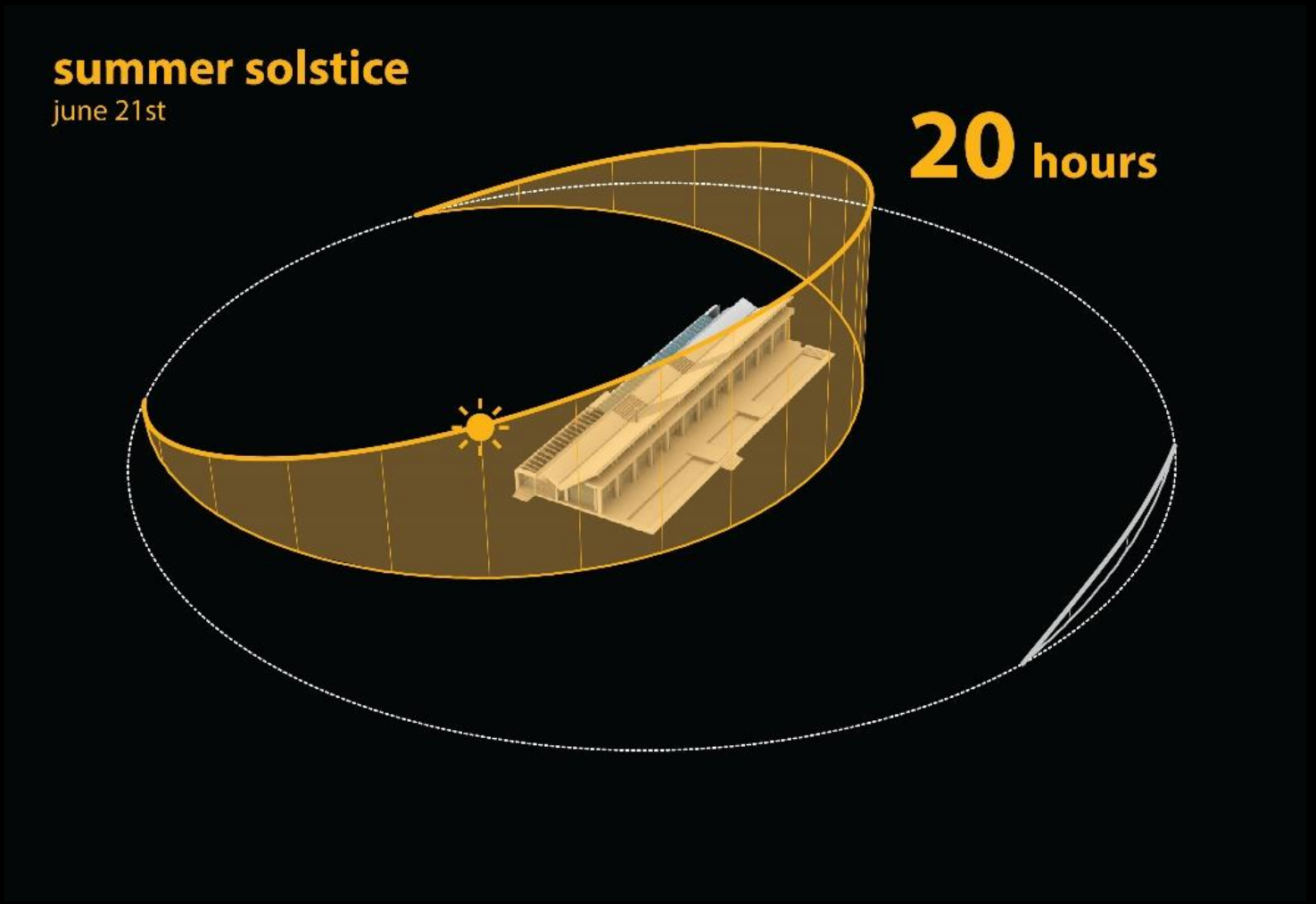


Neugebauer house
Richard Meier & Partners

High dynamic range (HDR) rendering

latitude 64.13° N

latitude 64.13° N

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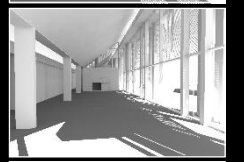
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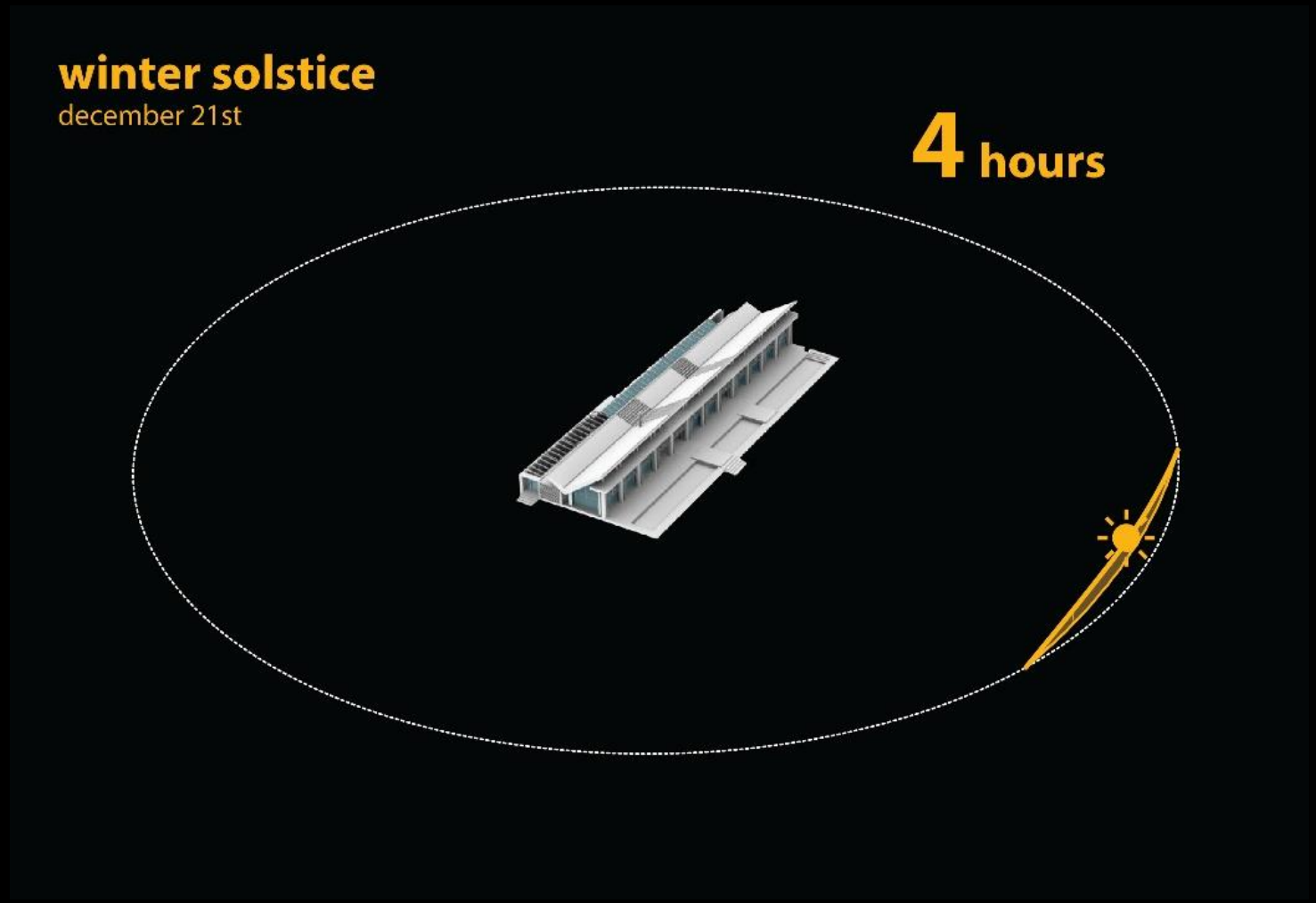
latitude 64.13° N

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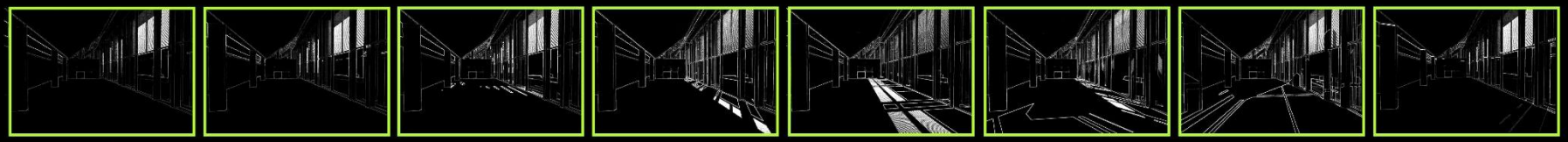
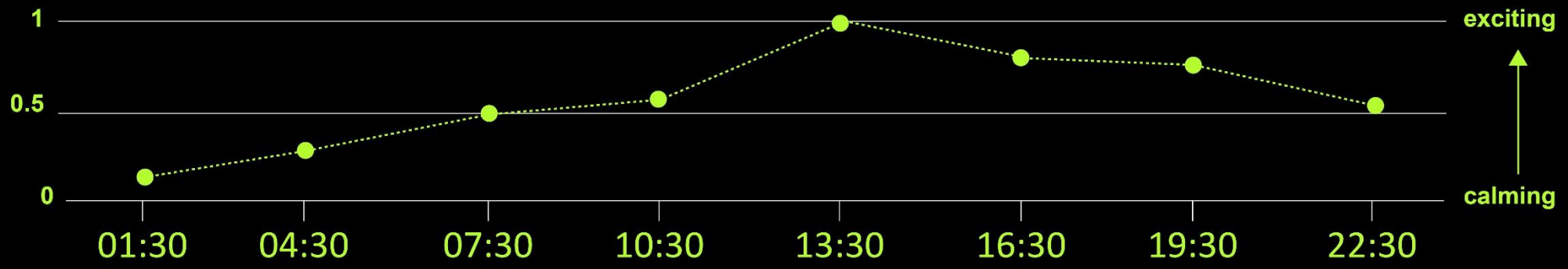
visual delight

dynamic performance

luminance map



spatial contrast



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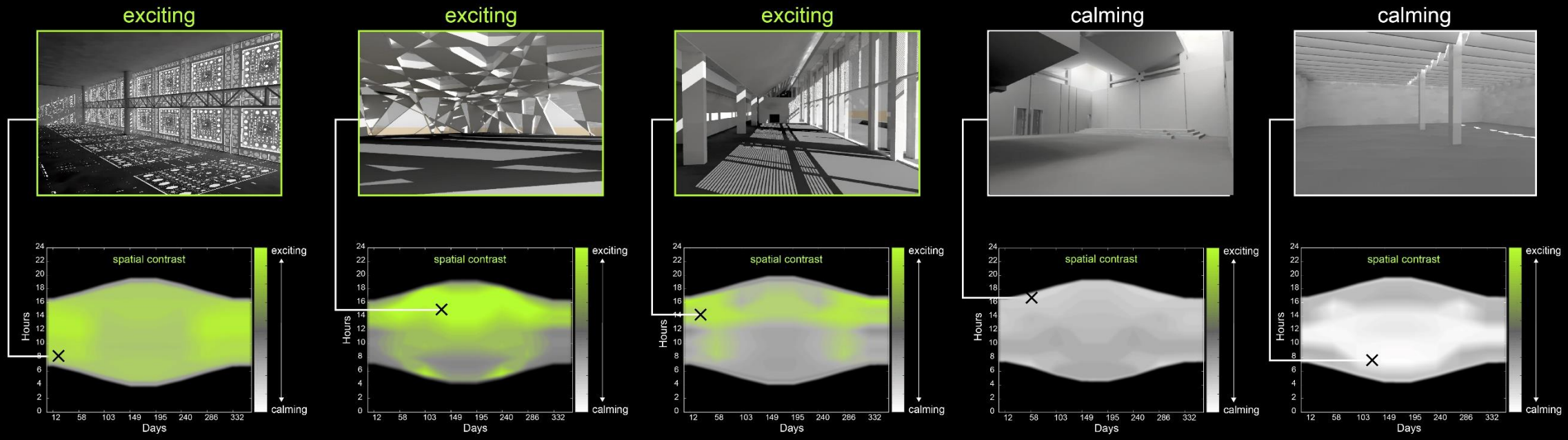
visual delight

dynamic spatial and temporal performance



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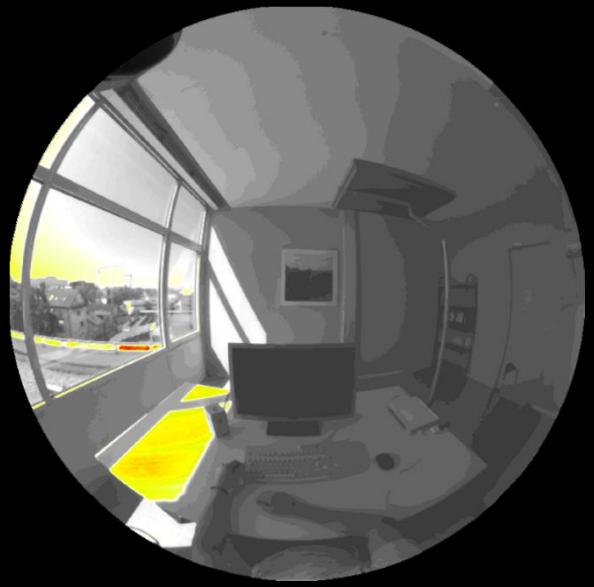
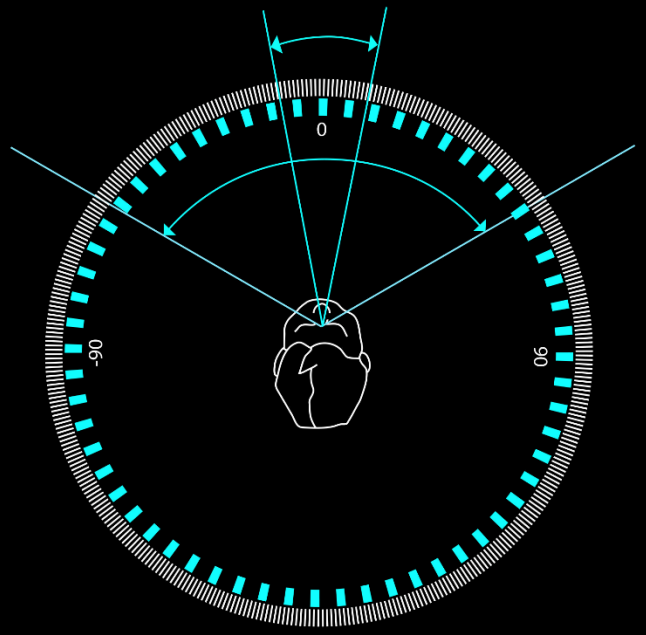
responsive comfort

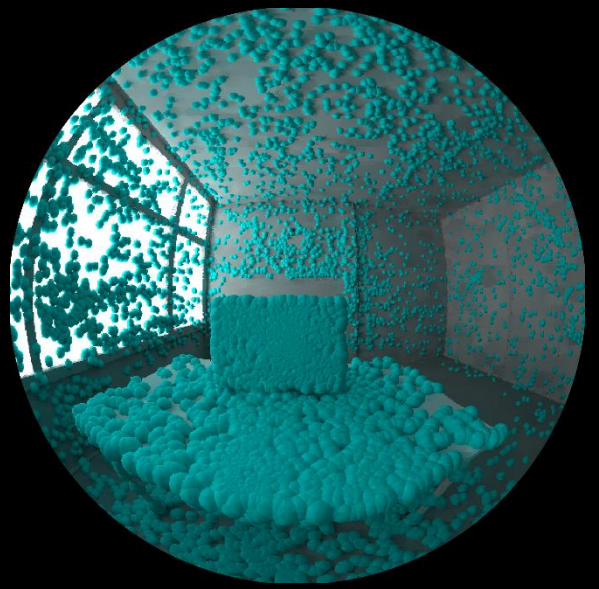
ergorama



perceived light



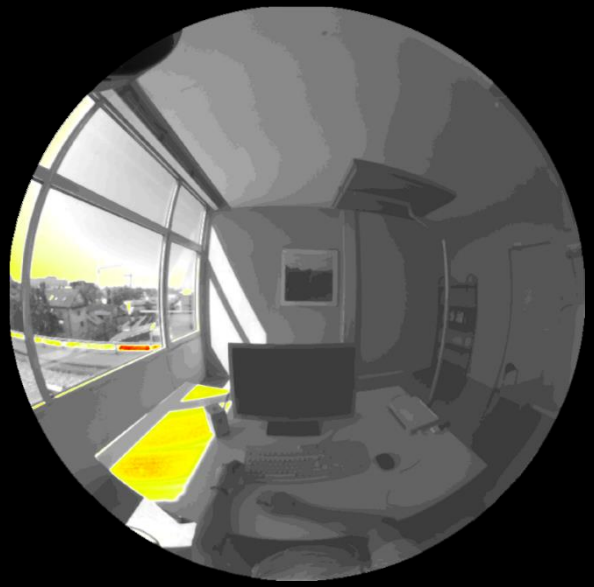
field of view



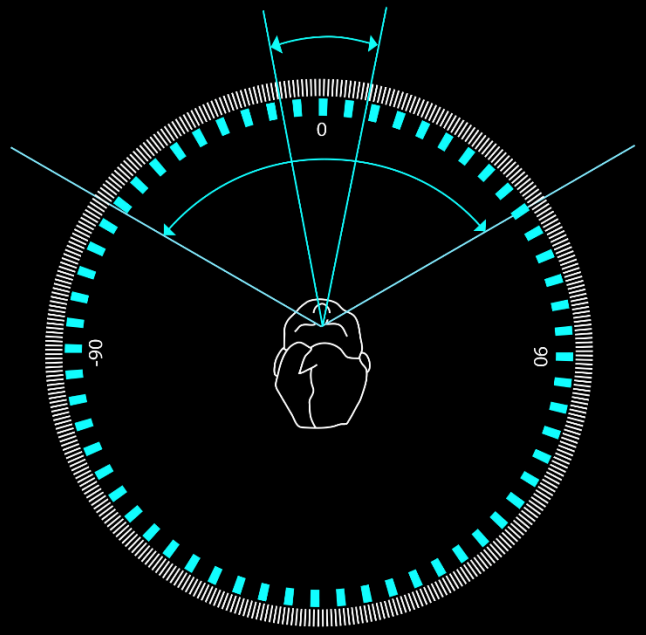
gaze response

responsive comfort

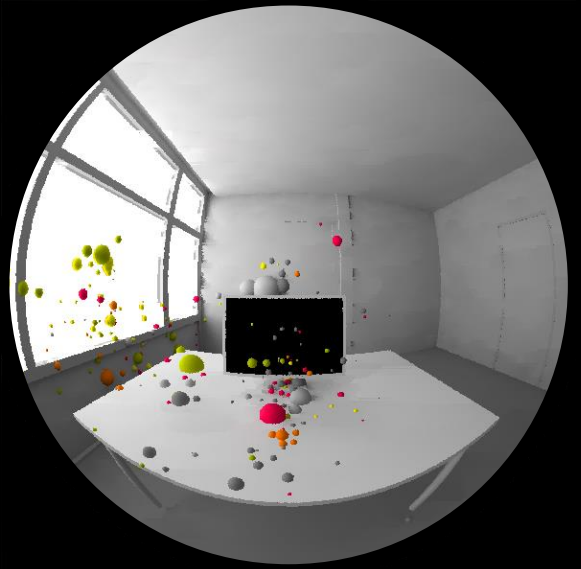
ergorama



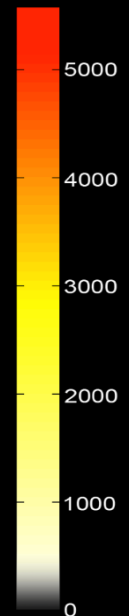
perceived light



field of view



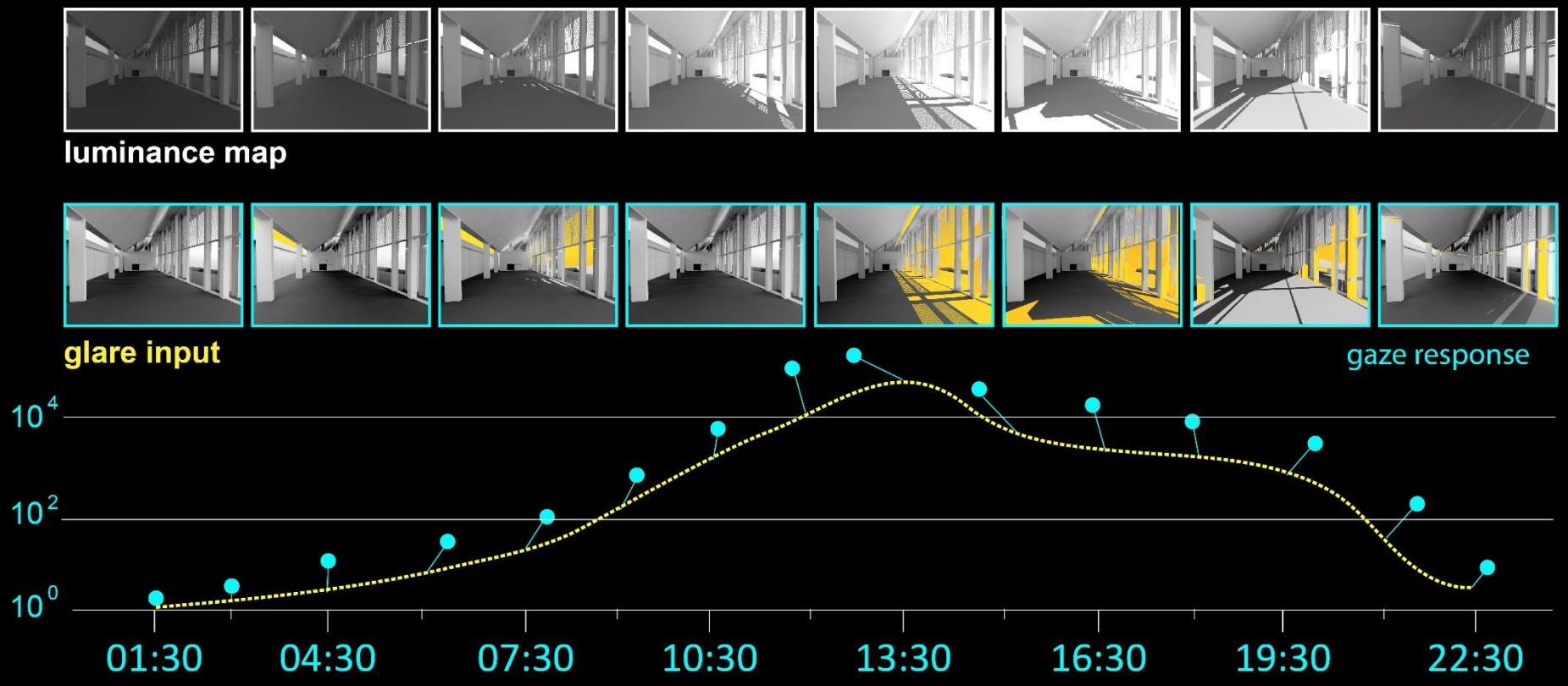
talking [illegible] phone

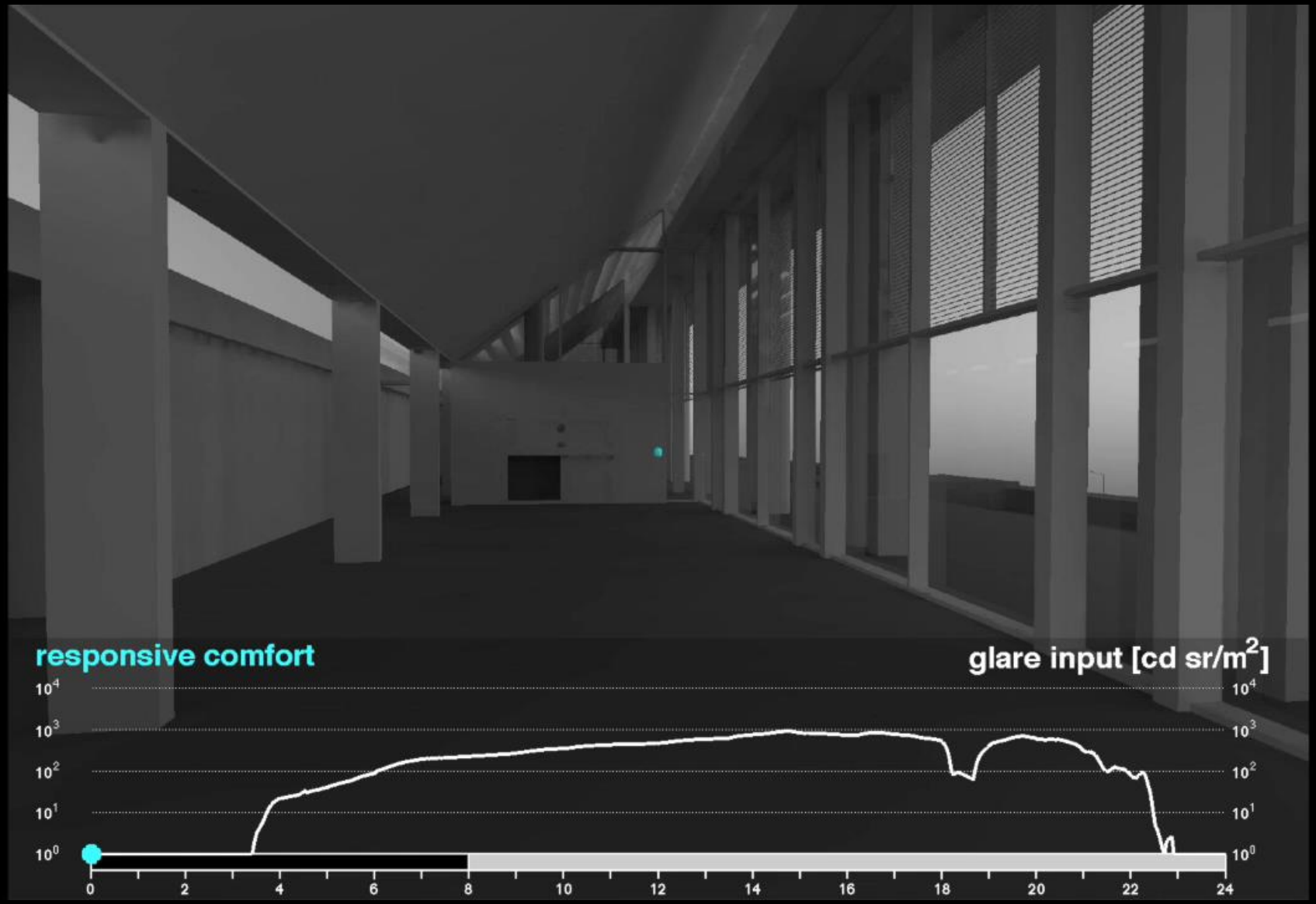


responsive comfort

responsive comfort

- predicting gaze responses (avoidance or attraction) as a function of glare input





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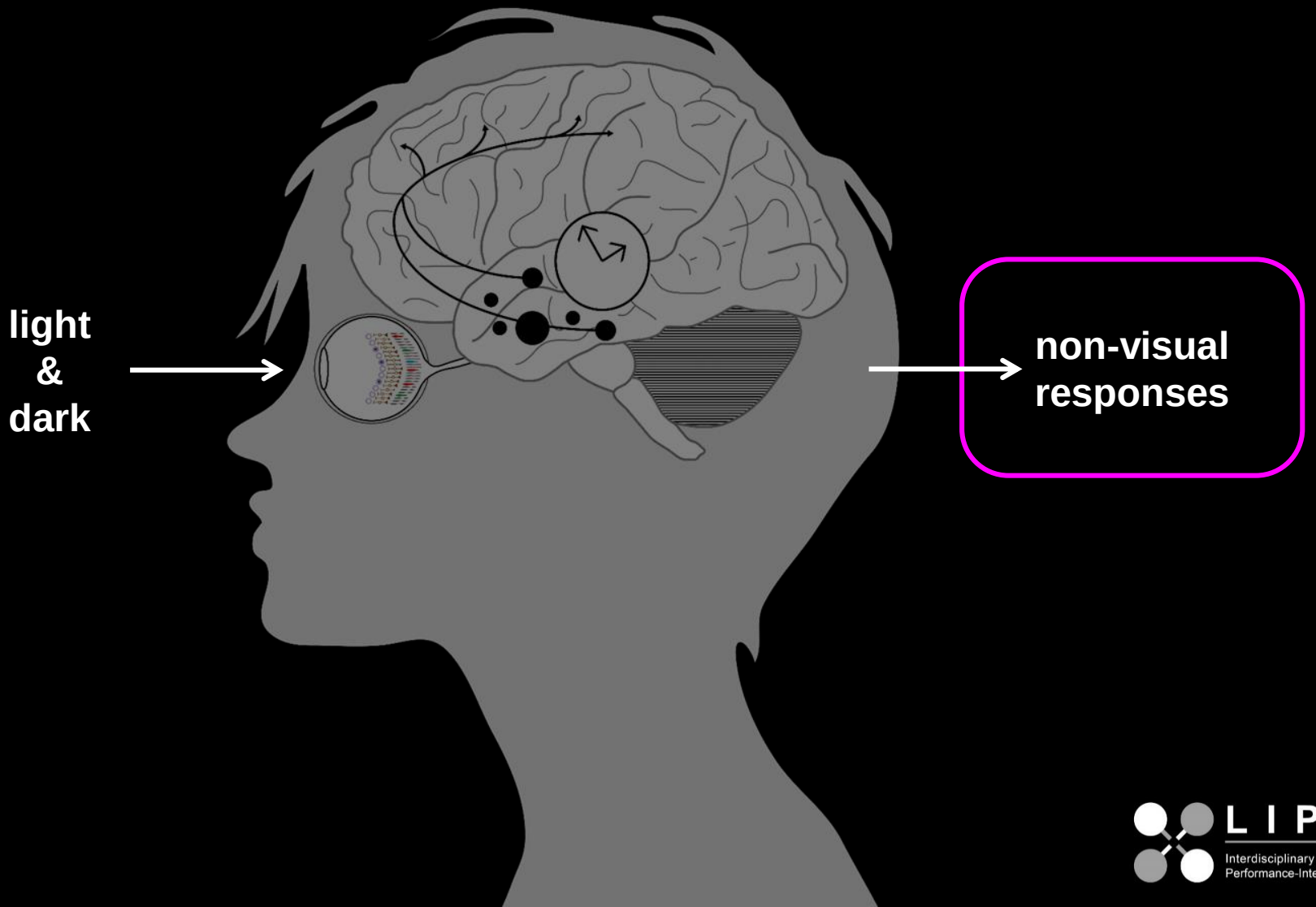
health potential



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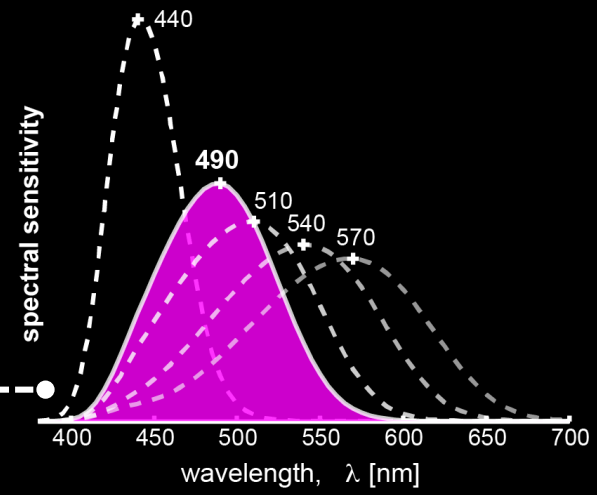
health potential

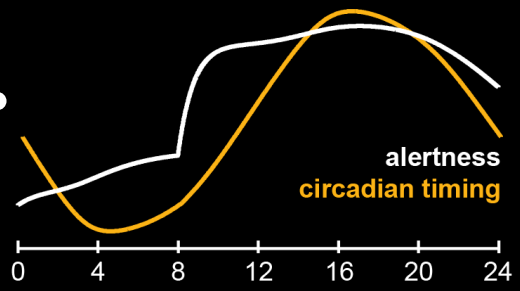
factors

- intensity
- wavelength
- duration
- timing
- history

light & dark

- higher levels are more effective
- blue light is more effective
- brief intermittent pulses are also effective
- timing of circadian rhythm
- adaption to changes in light exposure





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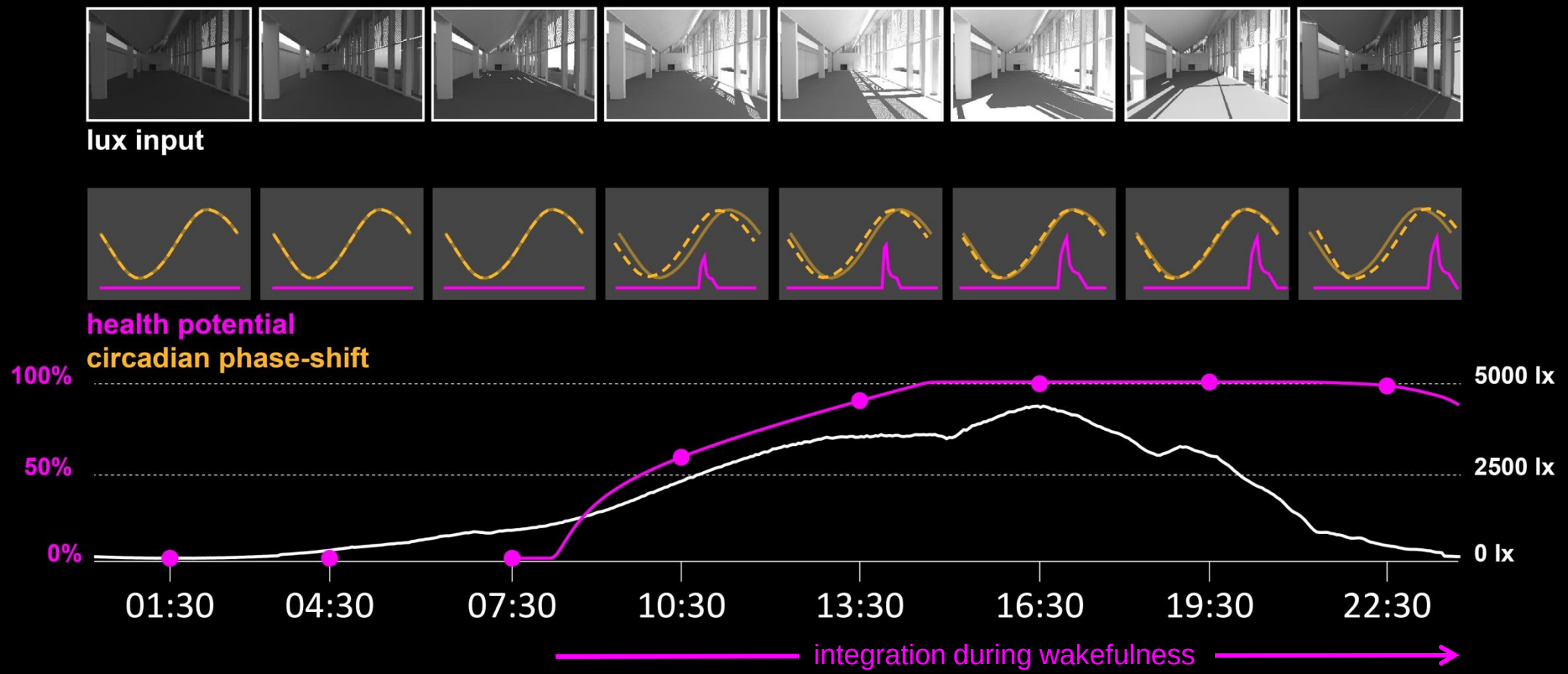
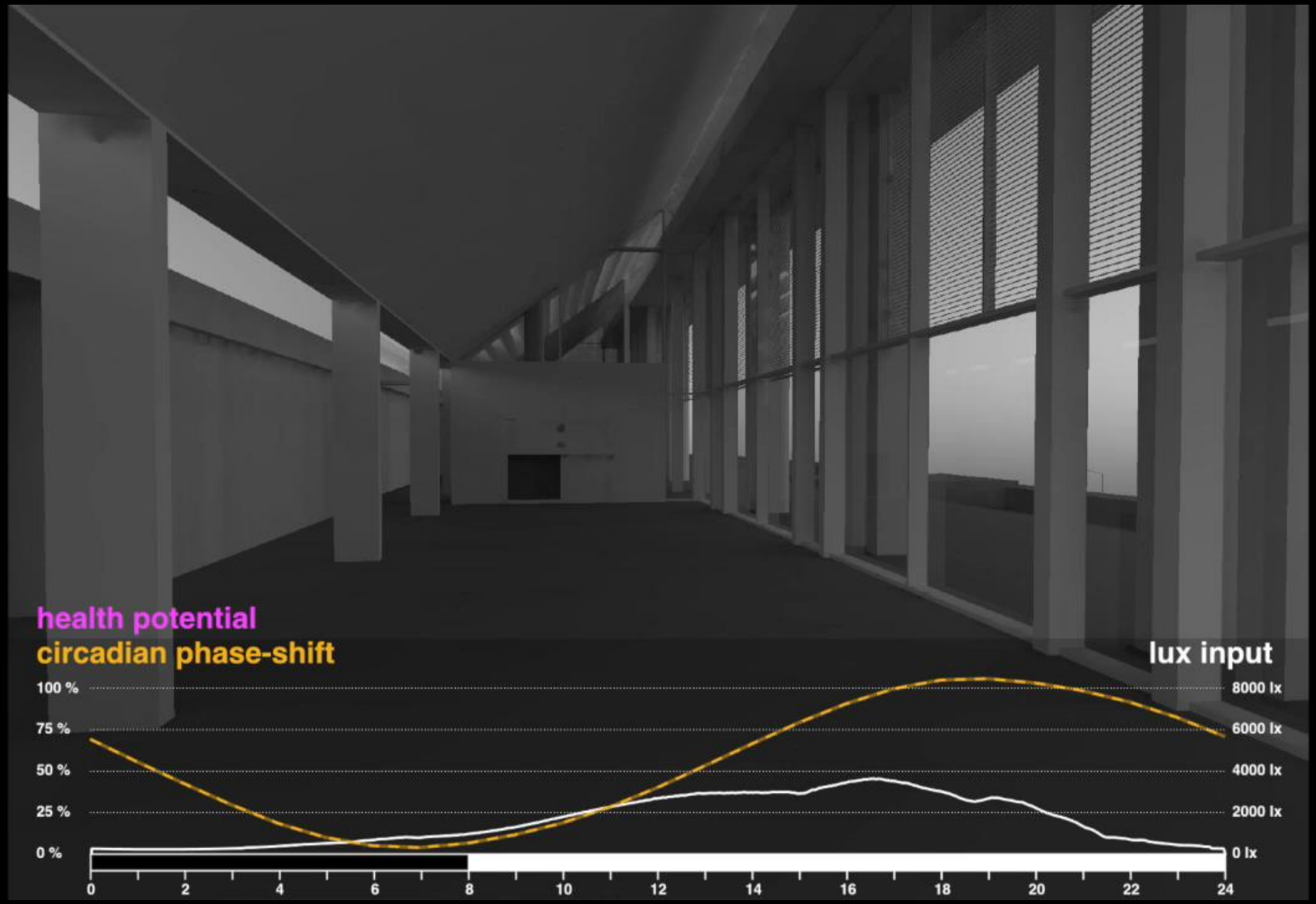
health potential

dynamic model





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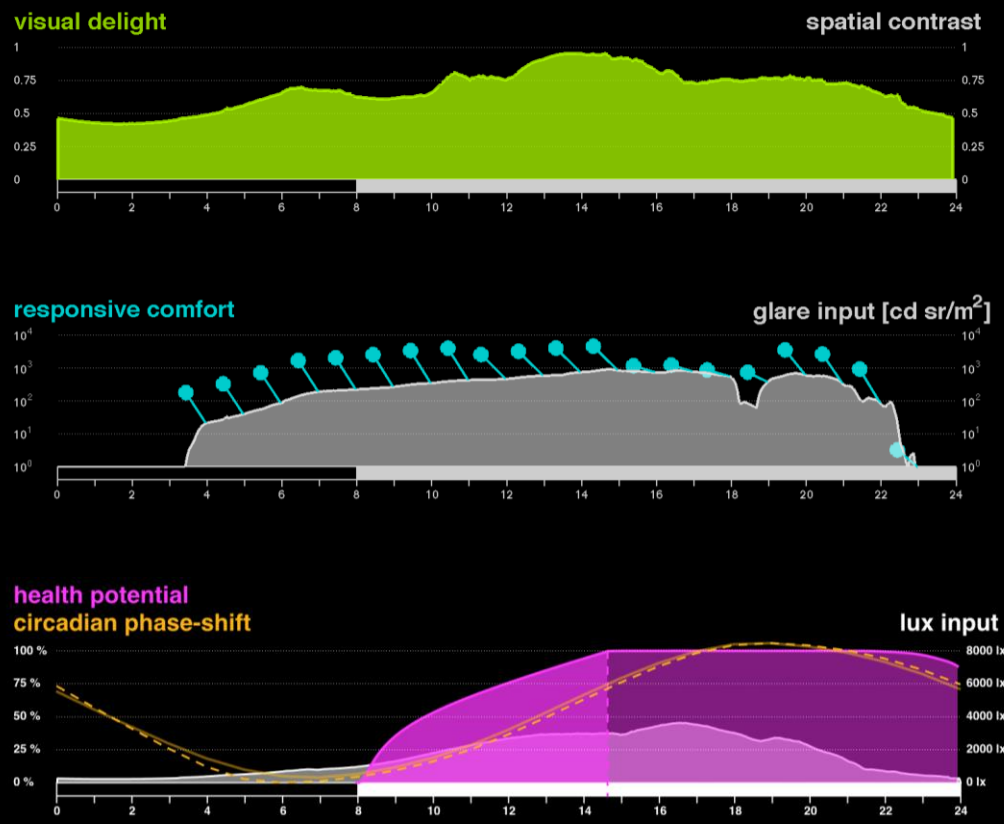
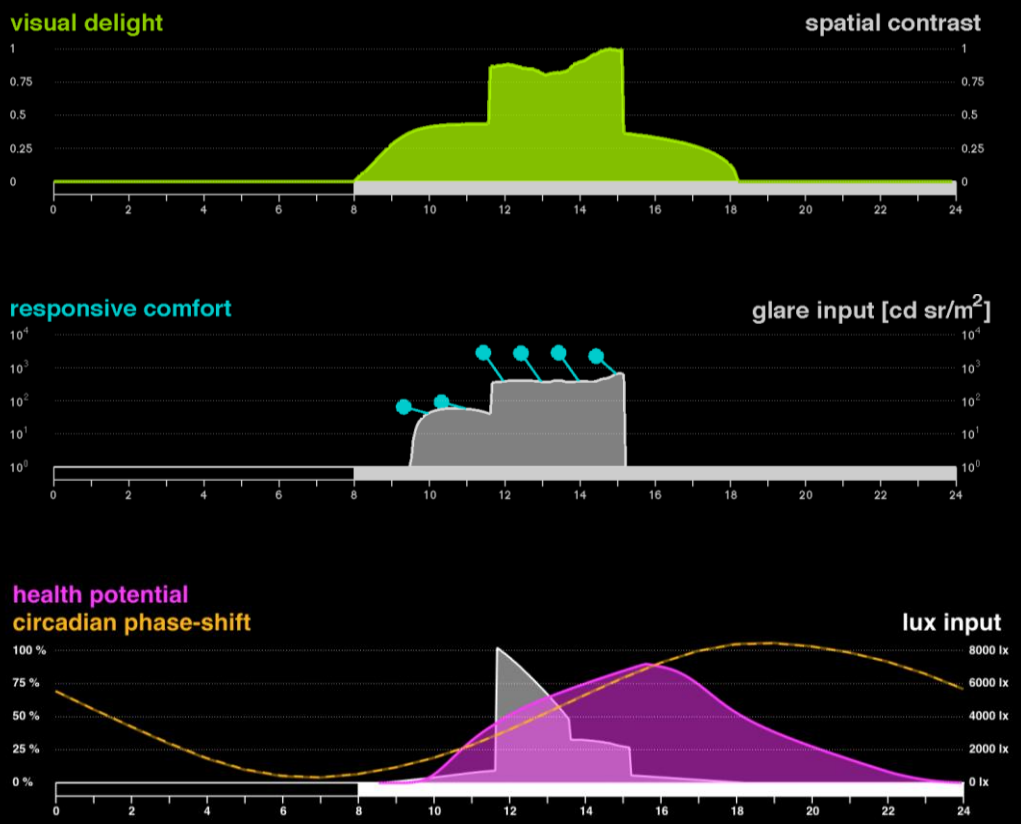
june 21st



december 21st



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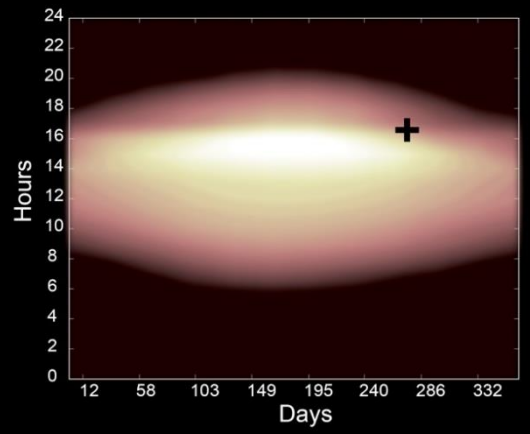
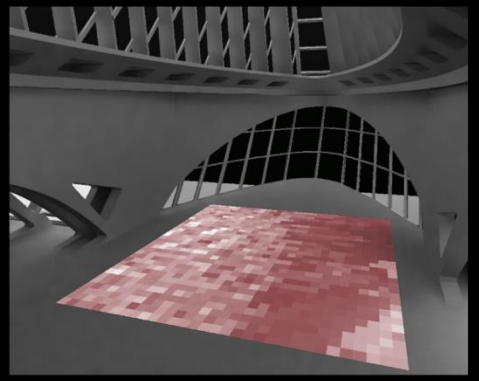
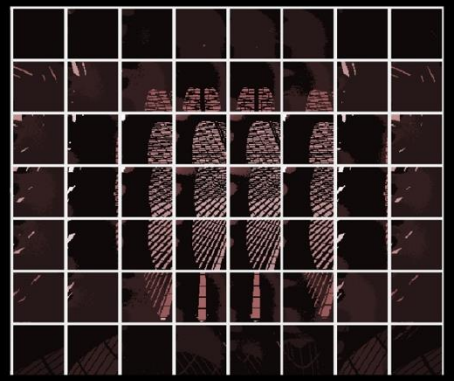
evaluating daylight performance

temporal vs. spatial / annual vs. instantaneous

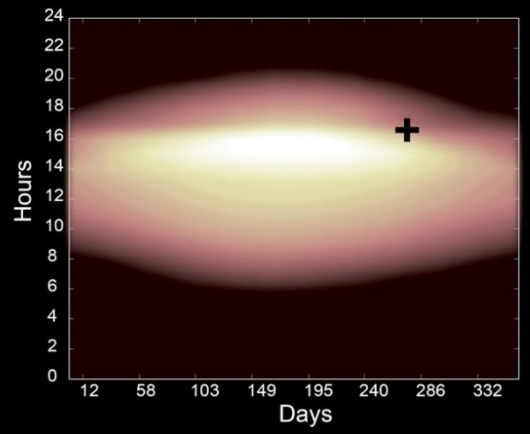


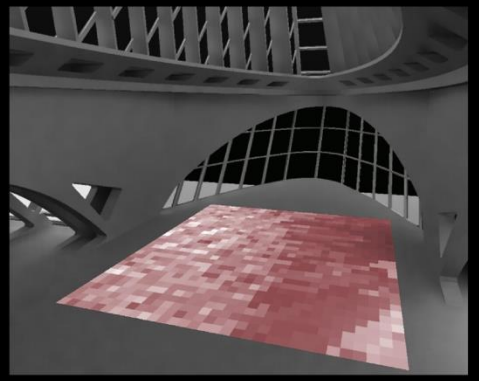


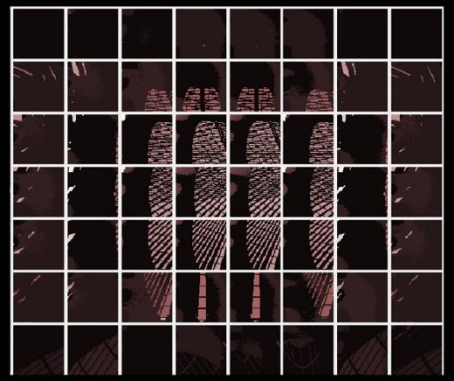


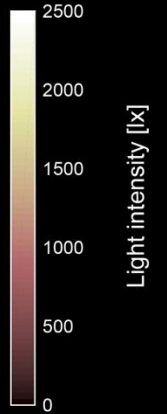
evaluating daylight performance

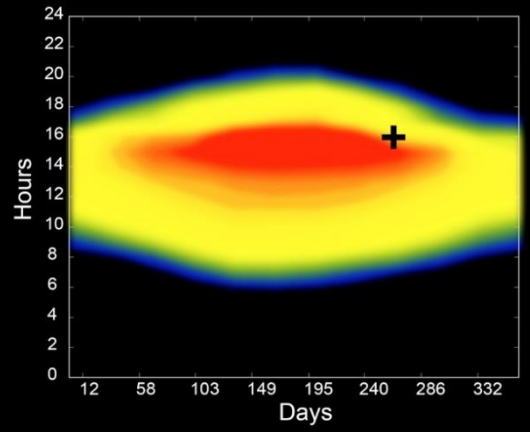
temporal vs. spatial / annual vs. instantaneous / absolute vs. goal-based

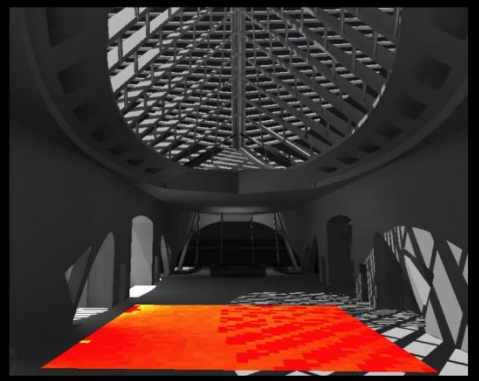


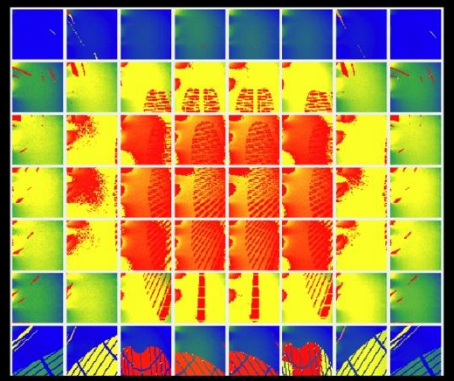












The challenge of sustainable lighting

multi-scale – from what resources we have to what we need as humans

multi-disciplinary – requires to reach out and to share a common language

iterative – requires compromises and is satisfaction-based (not optimization)

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