

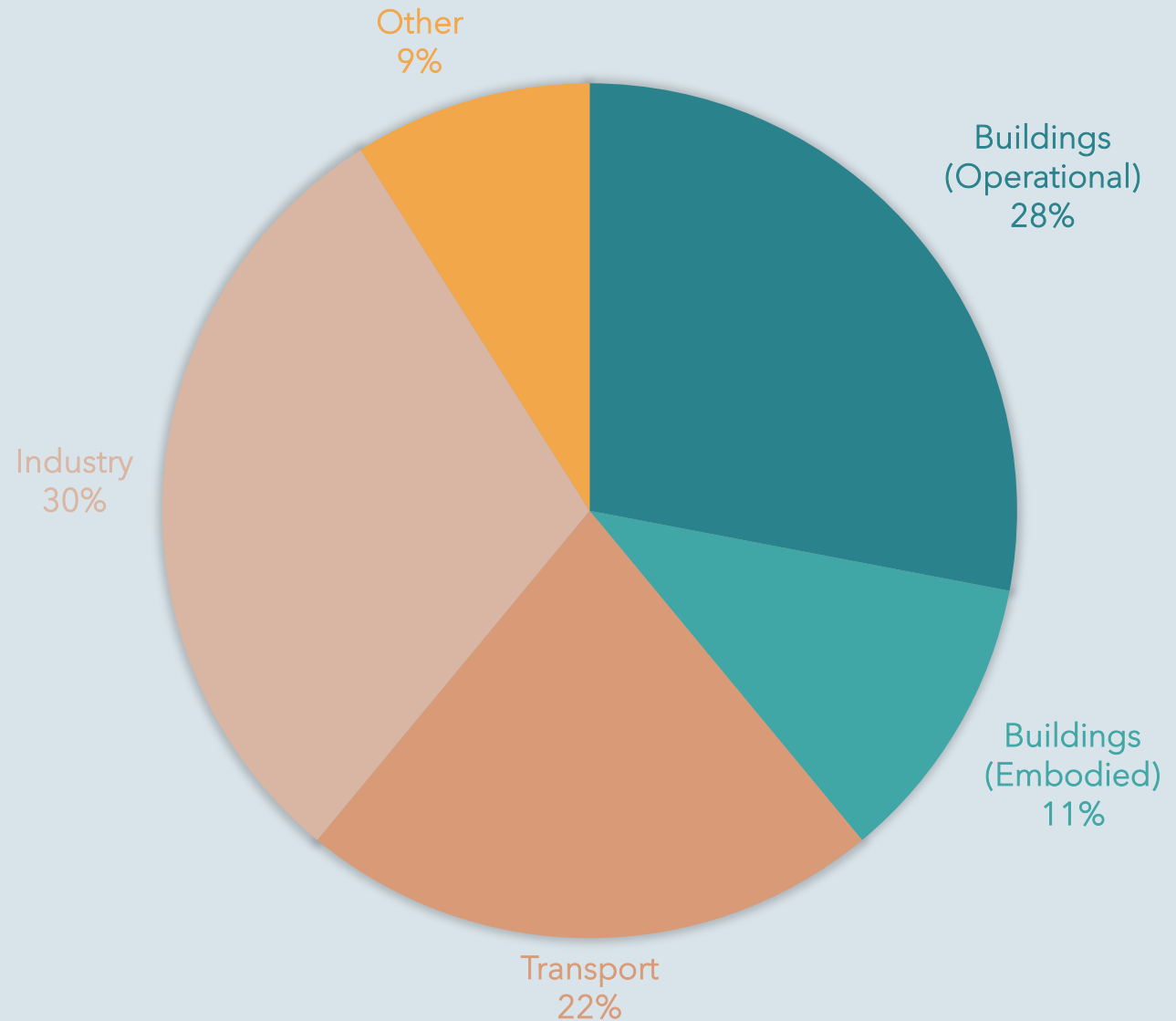


BUILDING PLACEMENT

ACBA5019 Construction Technology 2

CARBON EMISSIONS

- Our buildings are responsible for around 40% of all global CO₂ emissions.
- Decarbonisation of the building and construction sector is paramount to meet urgent climate change objectives.



PASSIVE DESIGN

Massing is deciding on the overall shape and size of the building.

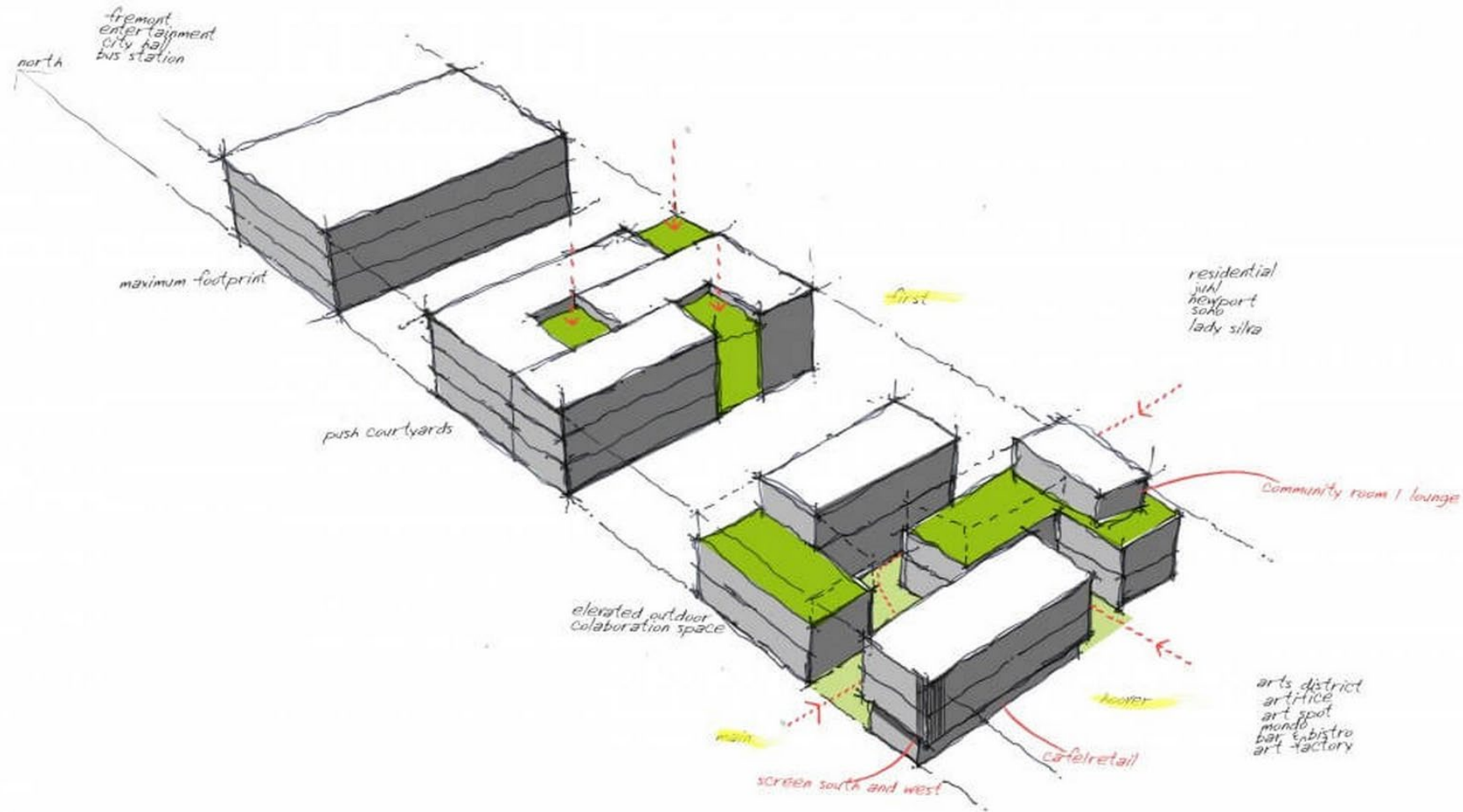
Orientation is simply what compass direction the building faces.

These can be the most important steps in providing a building with passive thermal and visual comfort.



MASSING

Building massing refers to the overall shape, form, and three-dimensional volume of a structure, focusing on its bulk, scale, and relationship to its surroundings rather than detailed design.



Architectural massing is the process of defining a building's shape and its relationship to the surrounding environment. By balancing geometry, human scale, and spatial voids, designers control how a structure is perceived and how it functions within its site.

Defining Primary Volume

Overall Form and Geometry

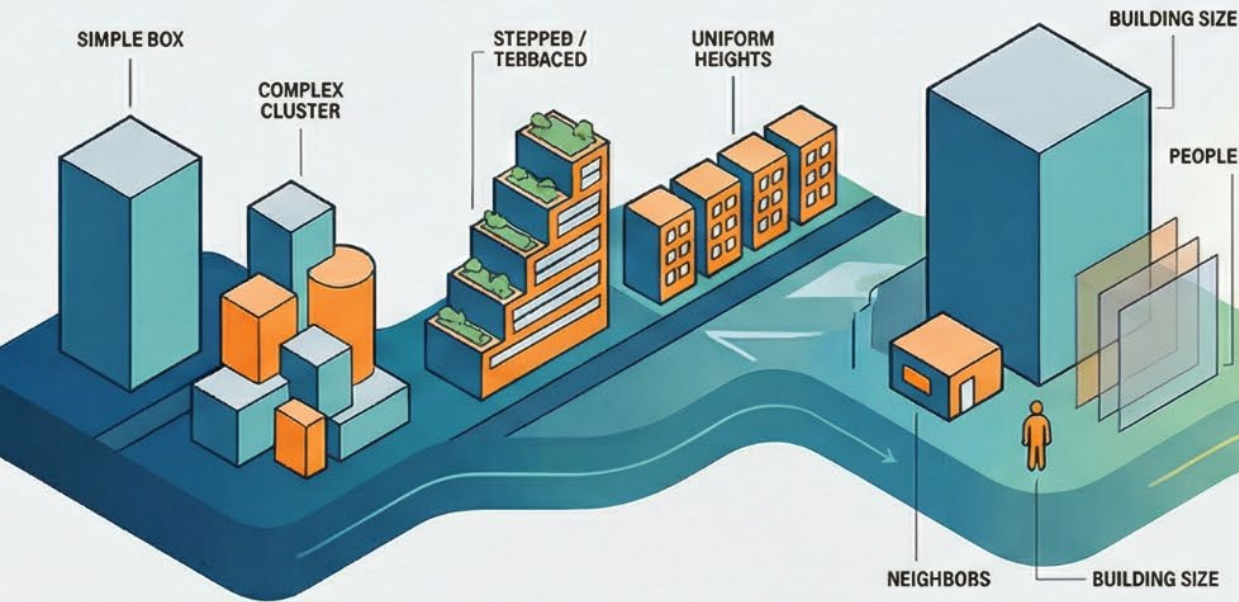
Categorizing buildings as simple boxes or complex clusters of combined volumes.

Height and Volume Distribution

Utilizing stepped, terraced, or uniform heights to organize building mass.

Scale and Proportion

Defining the building's size relative to people, neighbors, and the site.



Overall Form and Geometry

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Visual and Spatial Refinement

Articulation and Modulation

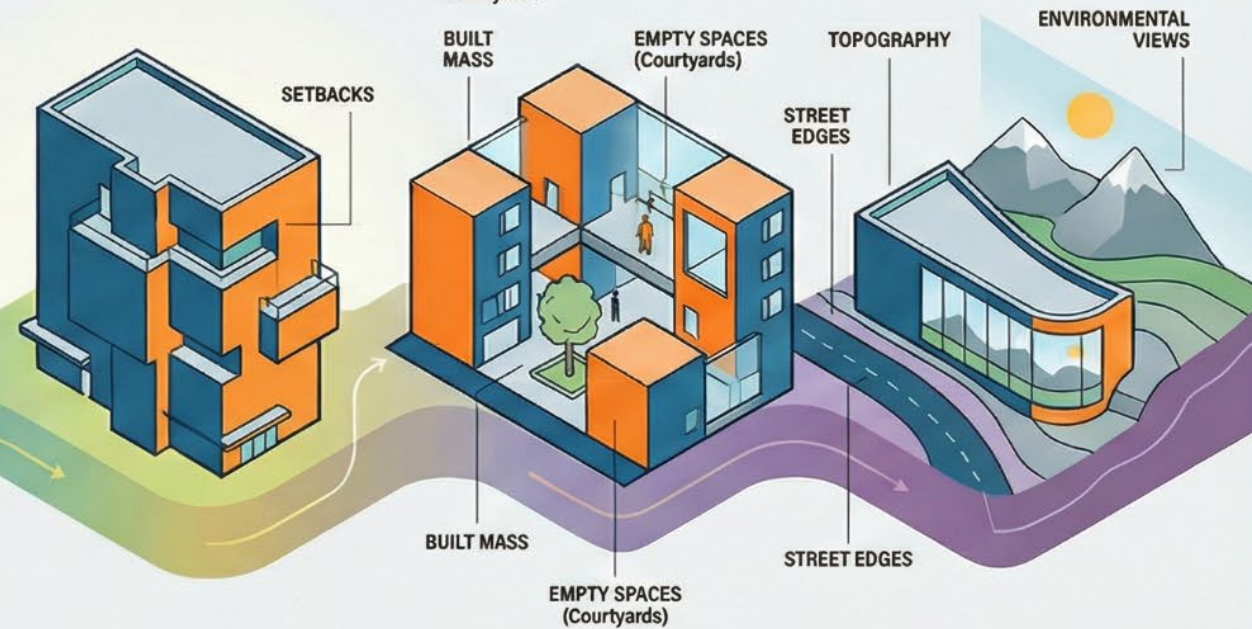
Using setbacks and recesses to break down visual bulk into smaller parts.

Solid vs. Void Balance

Creating rhythm through the interplay of built mass and empty spaces like courtyards.

Contextual Site Relationship

Aligning volumes with topography, street edges, and environmental views.



Articulation and Modulation

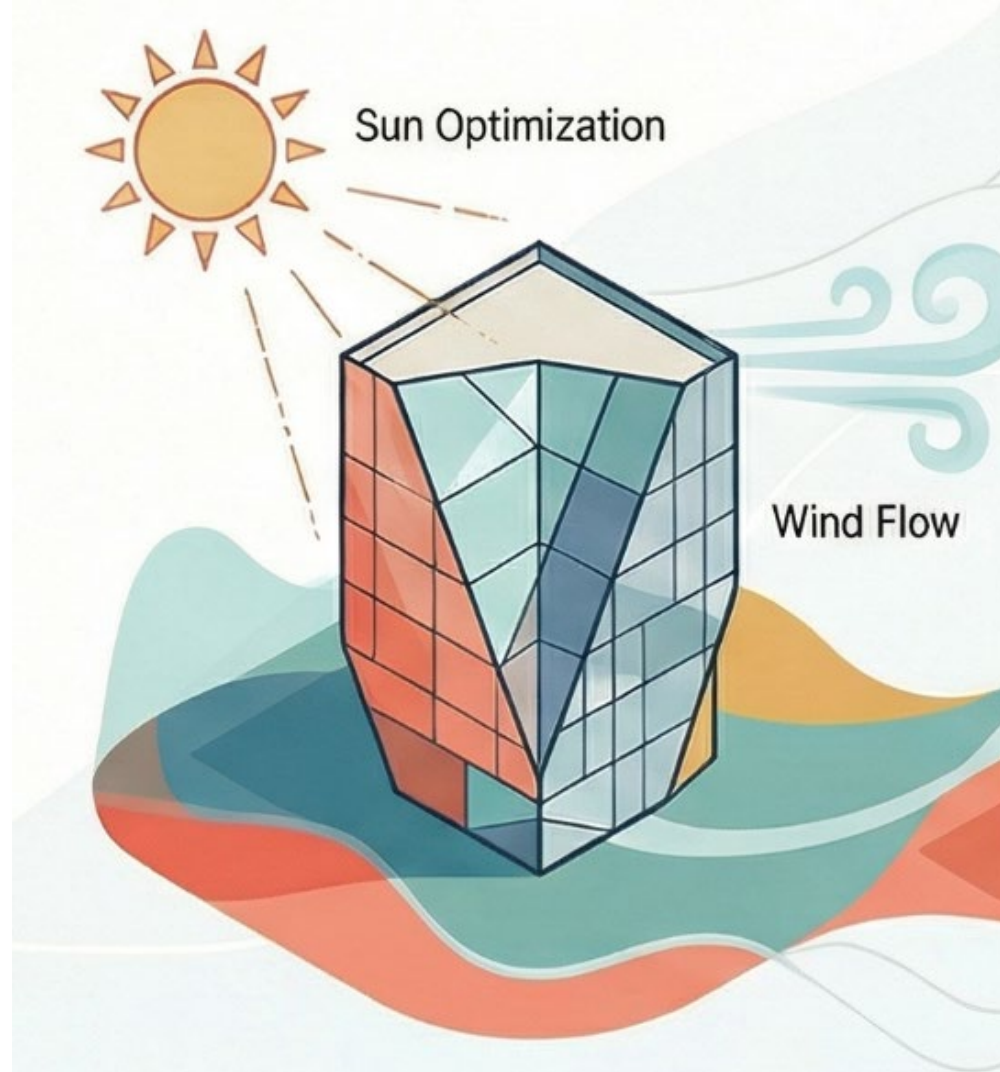
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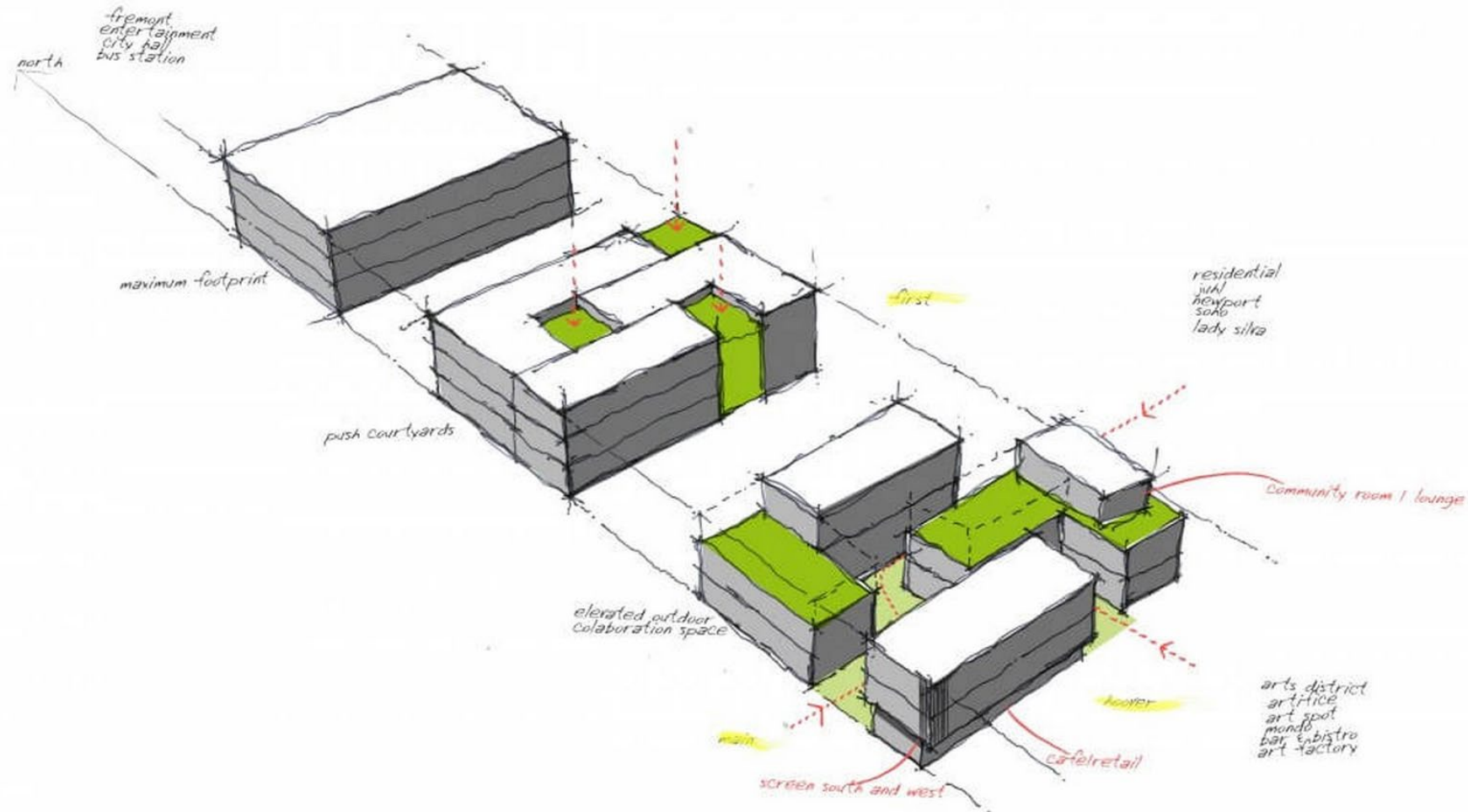


Environmental Responsiveness

Designing volumes to optimize for sun exposure, wind patterns, and specific landscape views.

MASSING

For many building types, massing is one of the most important factors in passive heating, cooling, and daylighting, yet often these are not considered until after massing is finished.

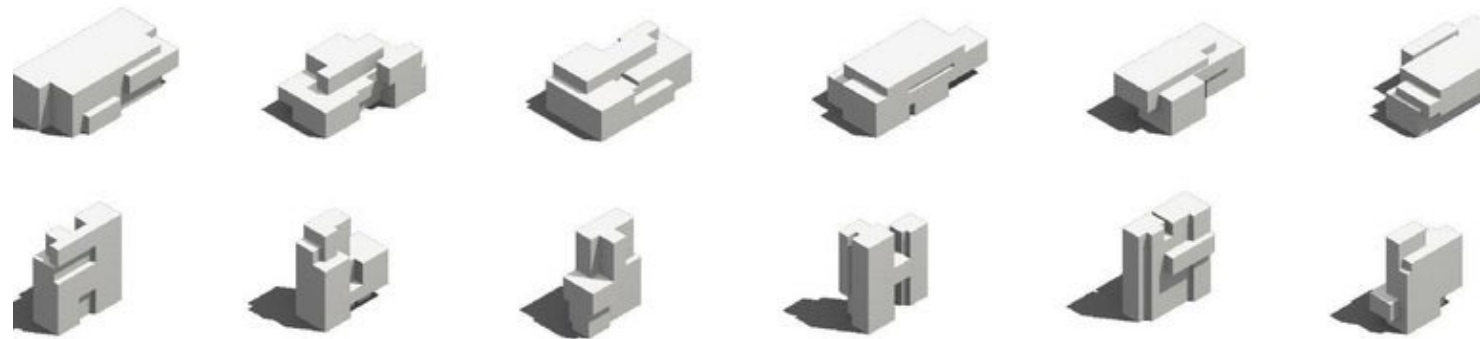


MASSING

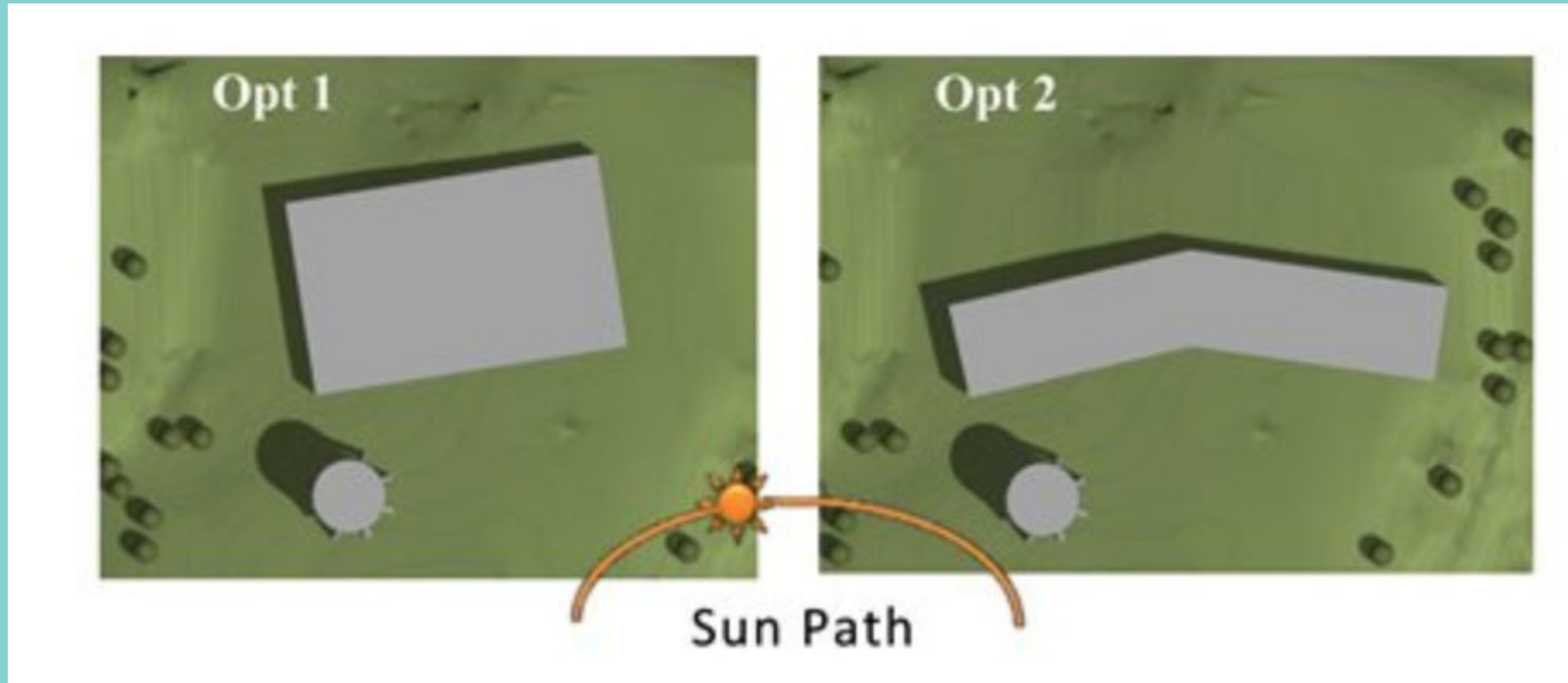
It's important to begin considering passive design strategies in the massing stage, so that the surface areas exposed to sun at different times of day, building height, and building width can all be optimised for passive comfort.



Building massing generation model based on the subtractive form generation principle



Building massing generation model based on the additive form generation principle



WHICH OPTION WILL USE THE LEAST ENERGY?

ORIENTATION

Building orientation is critical in architectural design to optimise environmental performance, enhance functionality, and respond to the context.



ORIENTATION

Orientation affects many aspects of a building or room, such as

- The amount of natural light and heat that comes in through the windows



ORIENTATION

Orientation affects many aspects of a building or room, such as

- The views and scenery that can be enjoyed from inside the building



ORIENTATION

Orientation affects many aspects of a building or room, such as

- The energy efficiency and comfort of the occupants



ORIENTATION

Orientation affects many aspects of a building or room, such as

- The aesthetics and harmony with the surroundings



NATURAL LIGHT

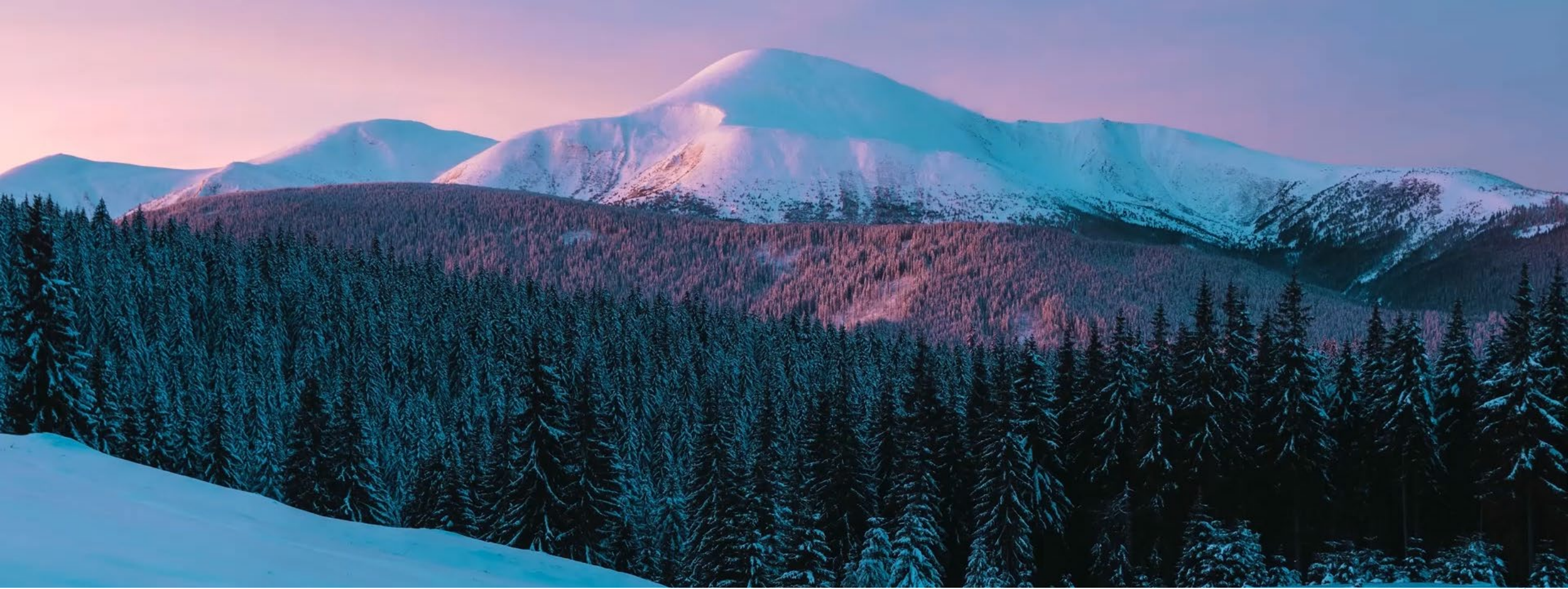
- Natural light in our buildings plays a vital part in functionality and is known to improve occupant comfort and well-being.
- Implementing natural light into a design also leads to substantial energy savings, by way of reducing the electricity requirements for artificial lighting.



NATURAL LIGHT

- Sunlight serves as the primary source of natural daylight, shaping how buildings are designed to maximise its benefits while mitigating potential challenges.
- Its intensity, direction, and duration vary depending on location, time of day, and season.

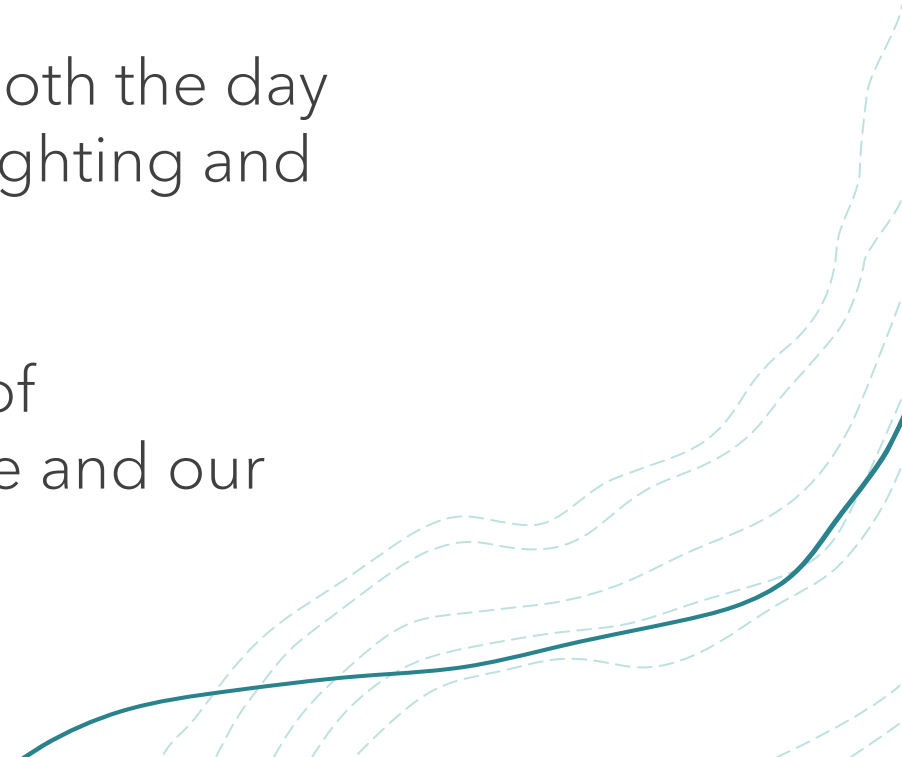


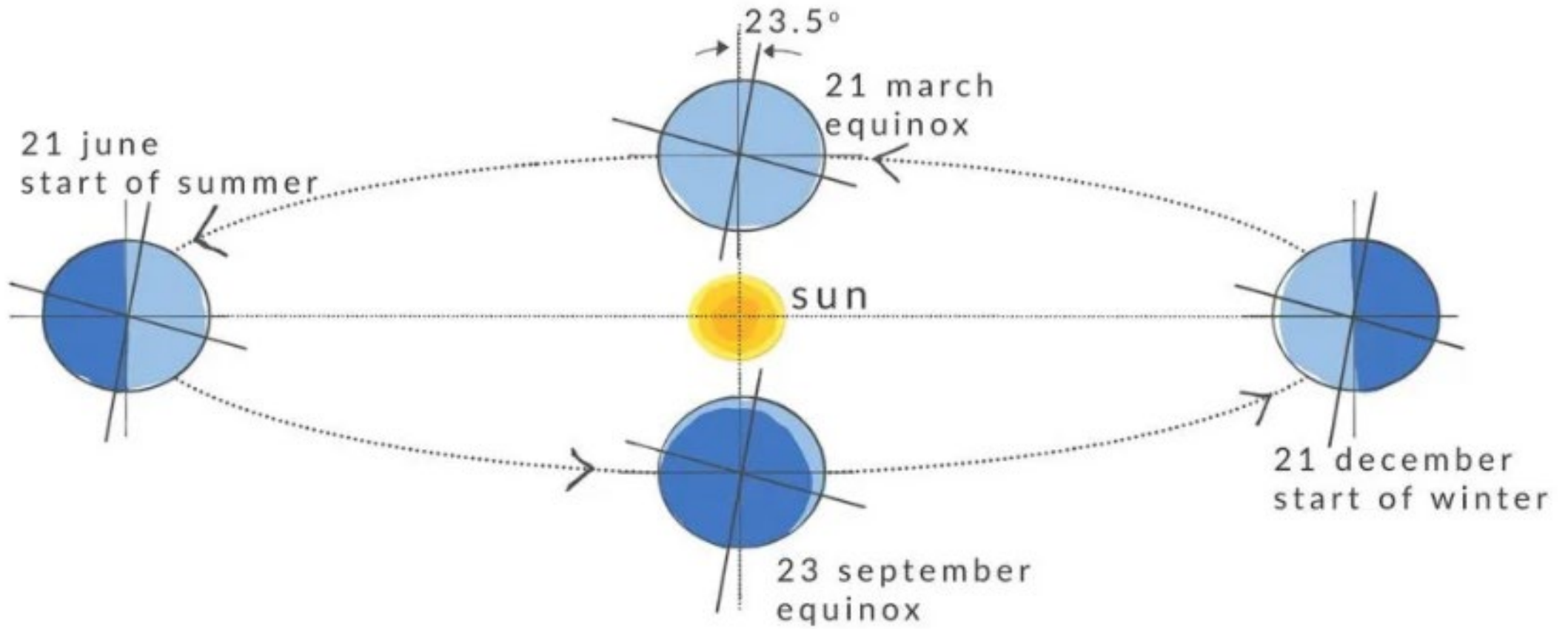


The earth movement around the sun generates sun paths that vary through the day and the year, and it is one of most crucial environmental factors to understand when designing high performance buildings.

SUN POSITION

- There is much data, diagrams and mapping to enable us to design a detailed strategy to maximise on the natural benefits of the sun's rays.
- Understanding the path of the sun throughout both the day and the year will help in the design of both daylighting and factoring in solar gain, solar shading and glare.
- Sun path diagrams provide us with a visual way of understanding the impact the sun has on our site and our proposed building.



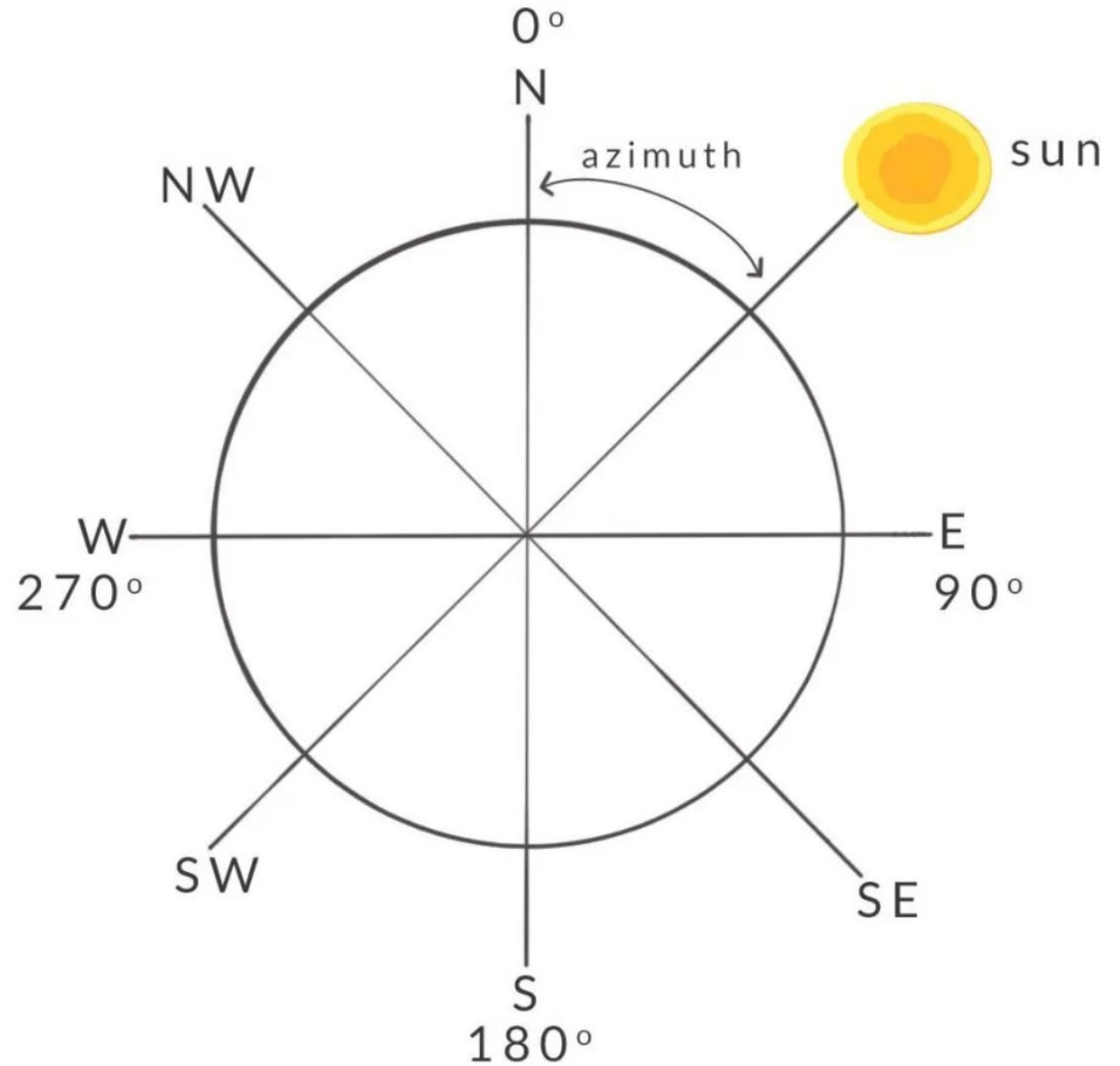


SUN POSITION

The angle of the earth's axis is 23.5° – which causes the exposure to the sun to vary as the earth rotates around the sun.

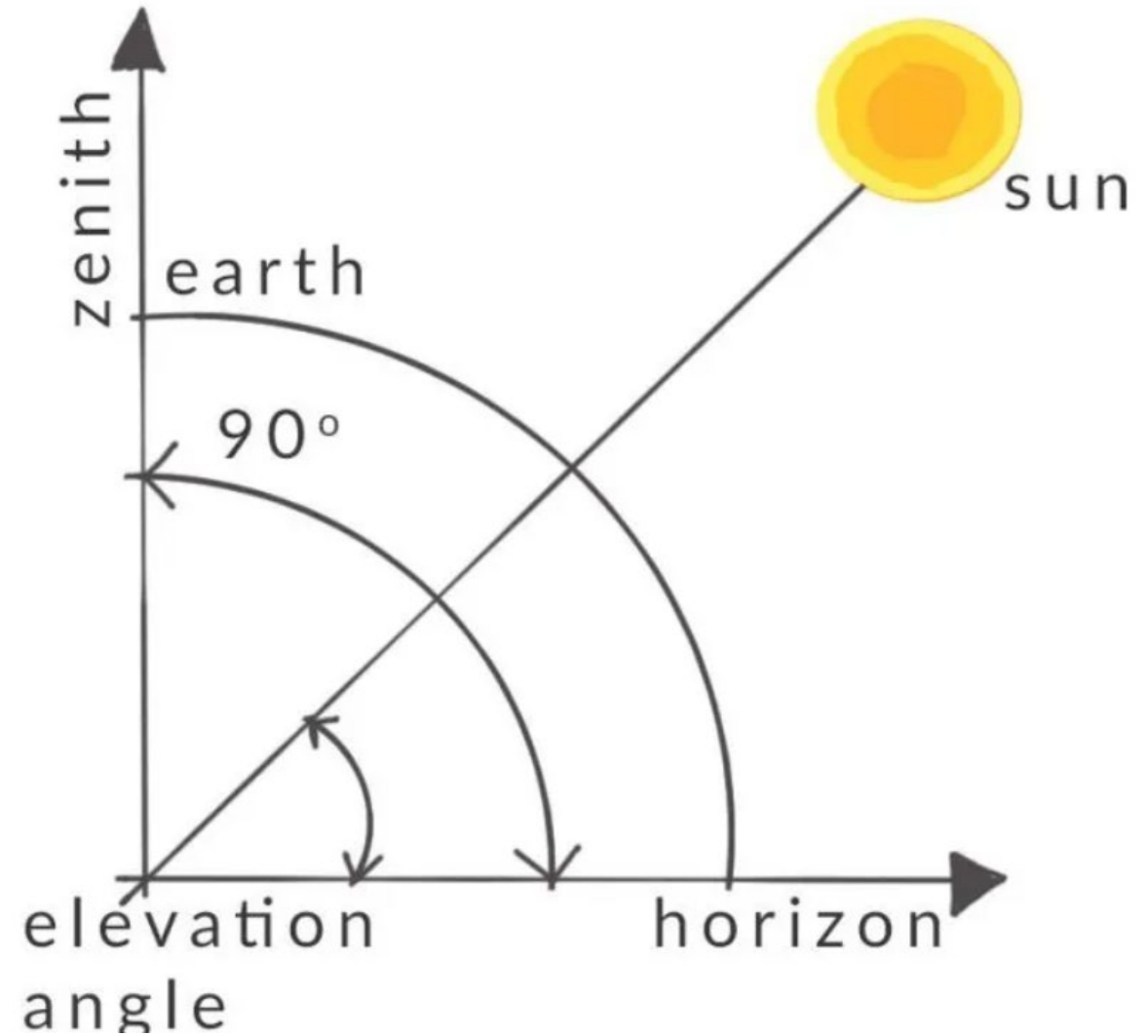
SUN POSITION

The azimuth is the projection on a plan of the position of the sun measured from north 0° .



SUN POSITION

The elevation angle is the projection of the position on the elevation of the sun above the horizon.



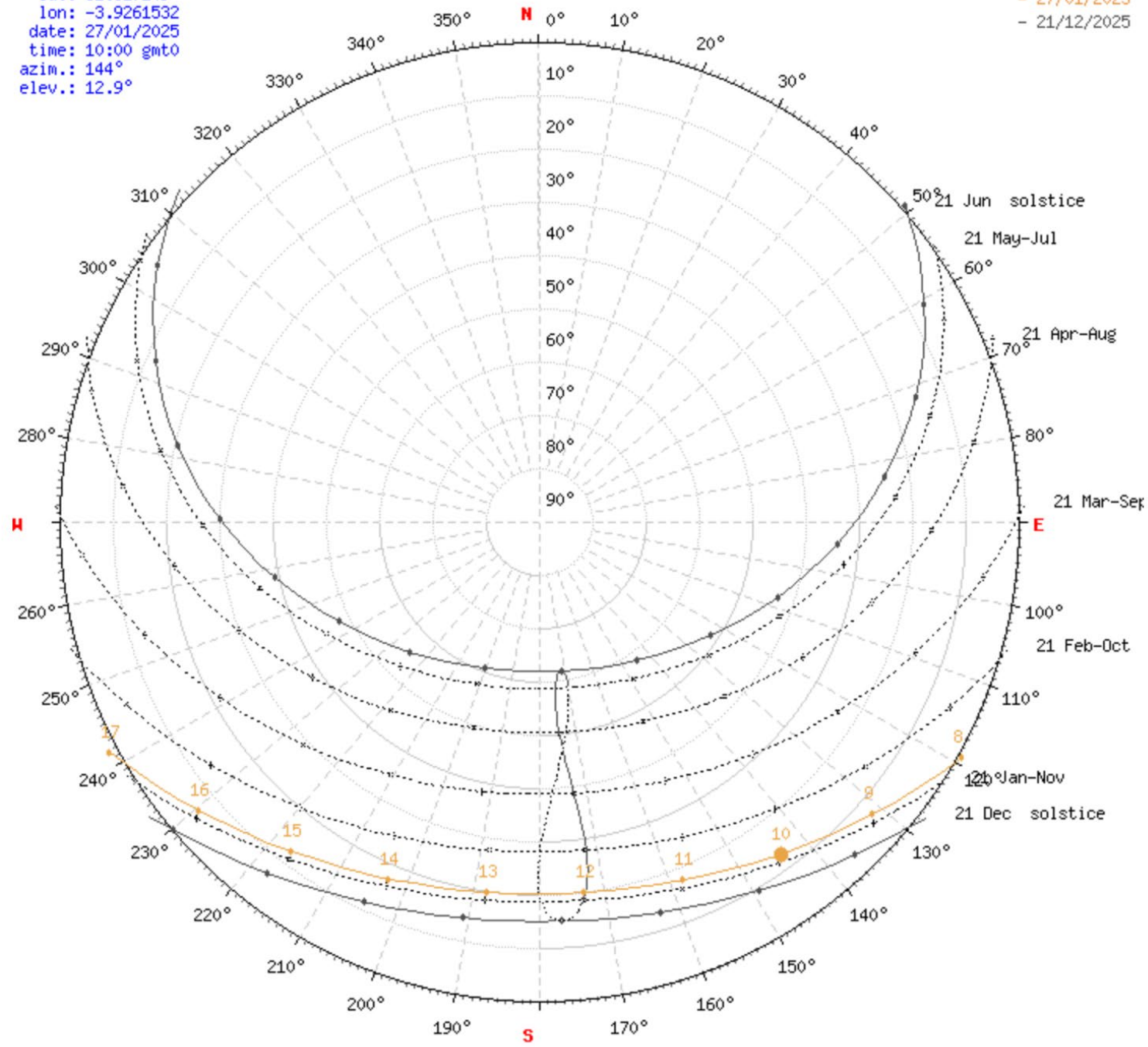


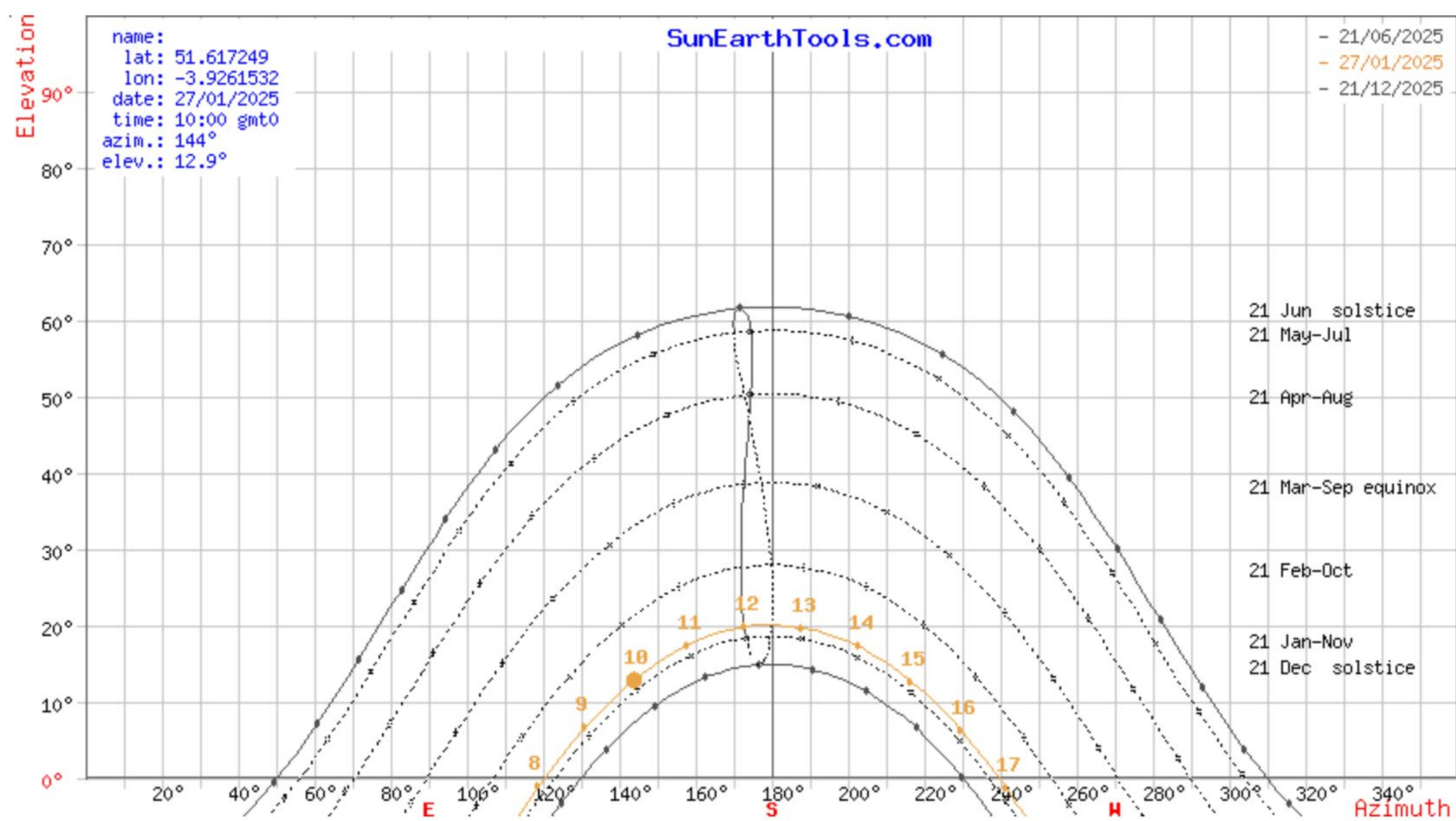


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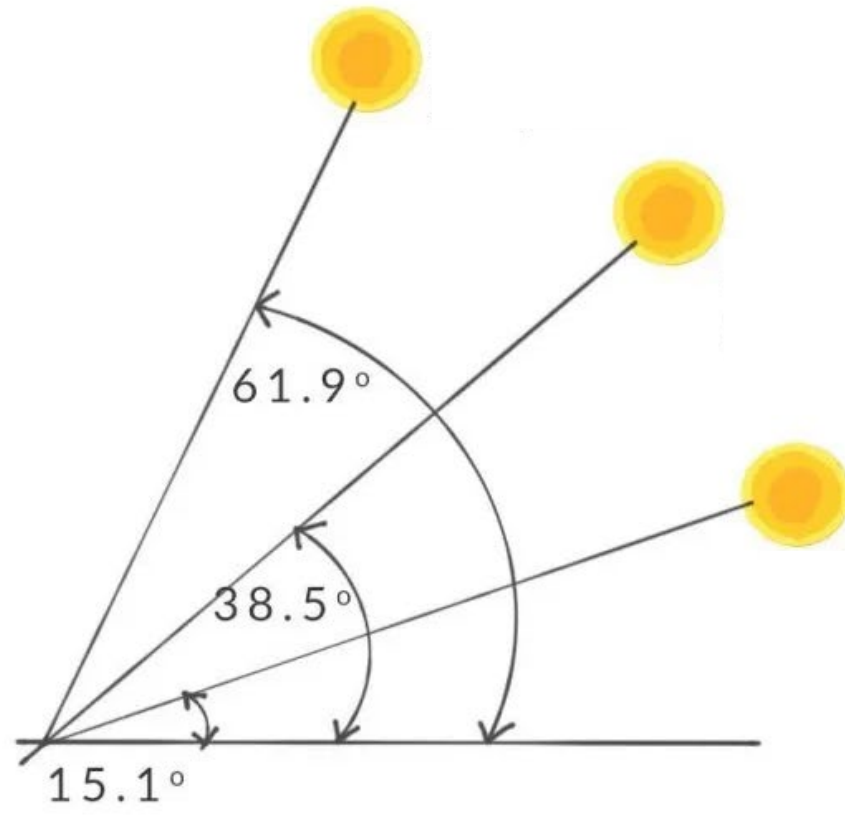
SunEarthTools.com

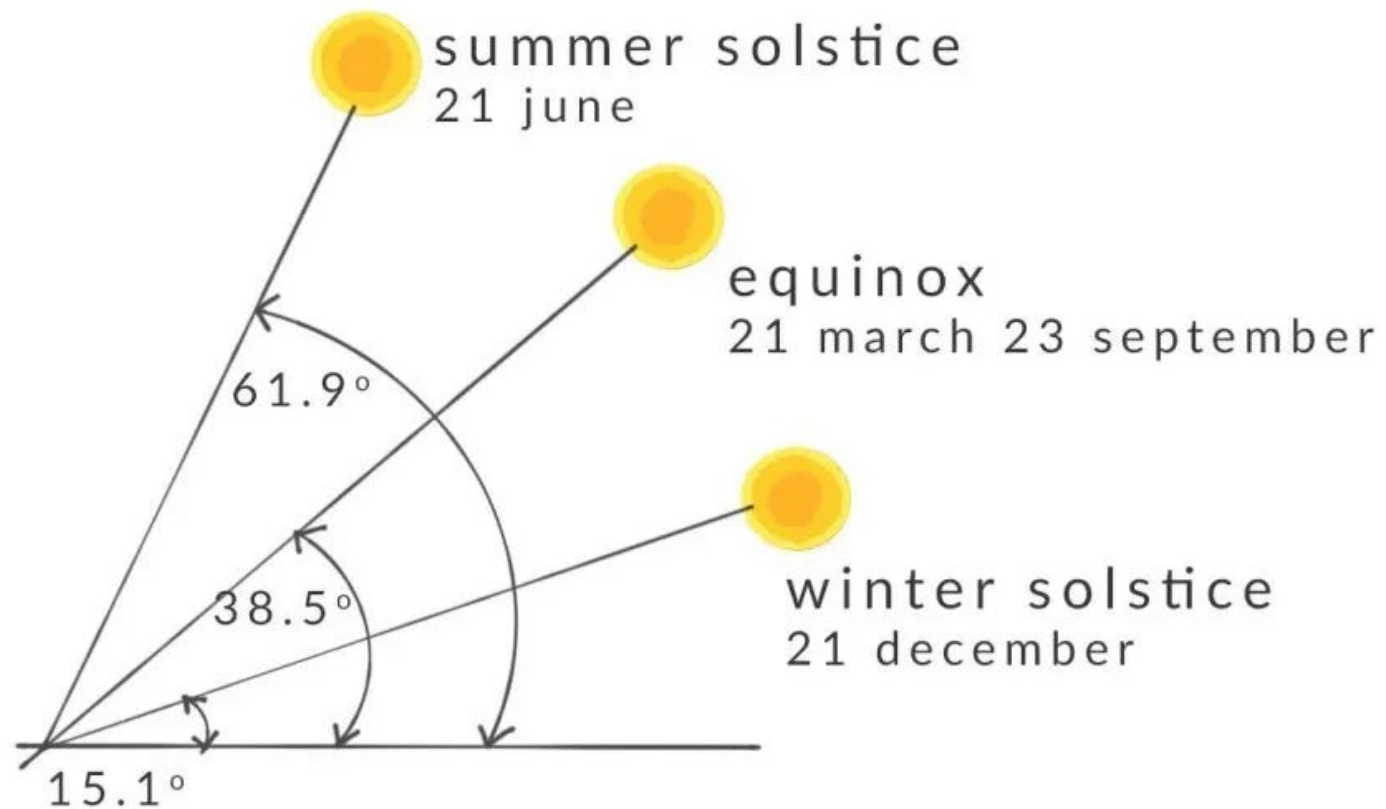
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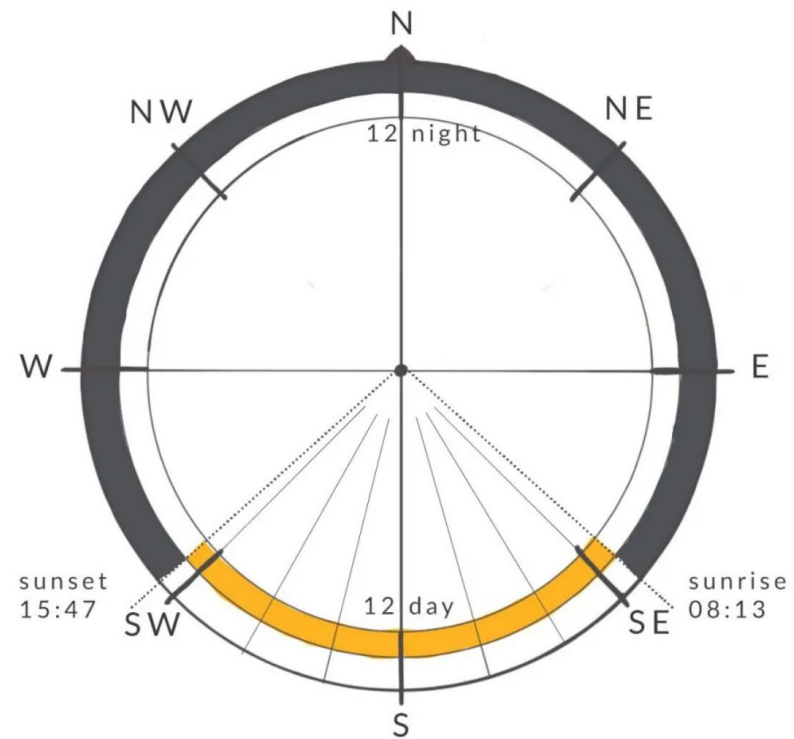
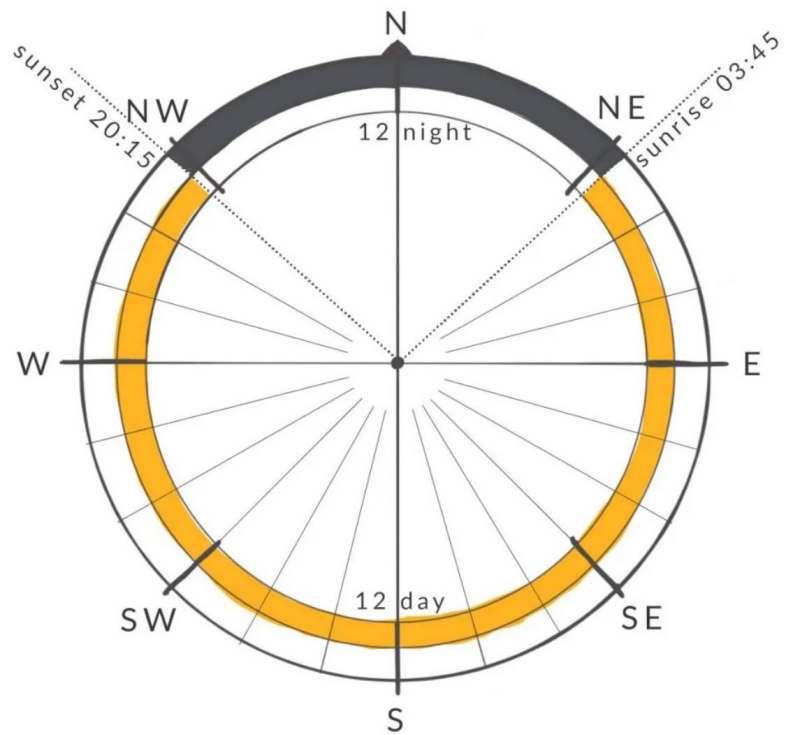
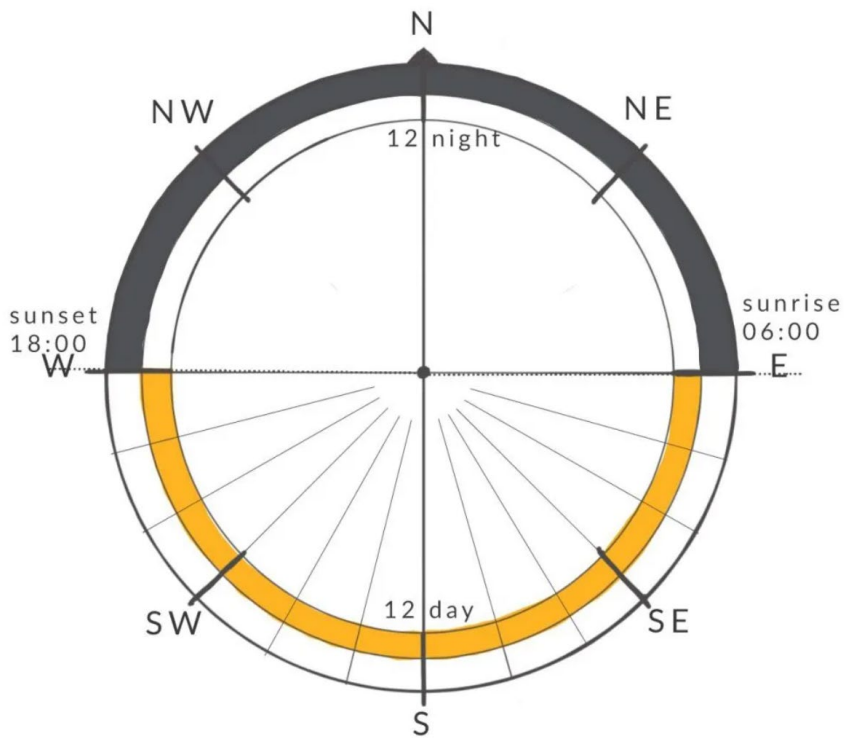




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10:00:00	12.9°	144°
11:00:00	17.43°	157.99°
12:00:00	19.79°	172.81°
13:00:00	19.74°	187.94°
14:00:00	17.29°	202.73°
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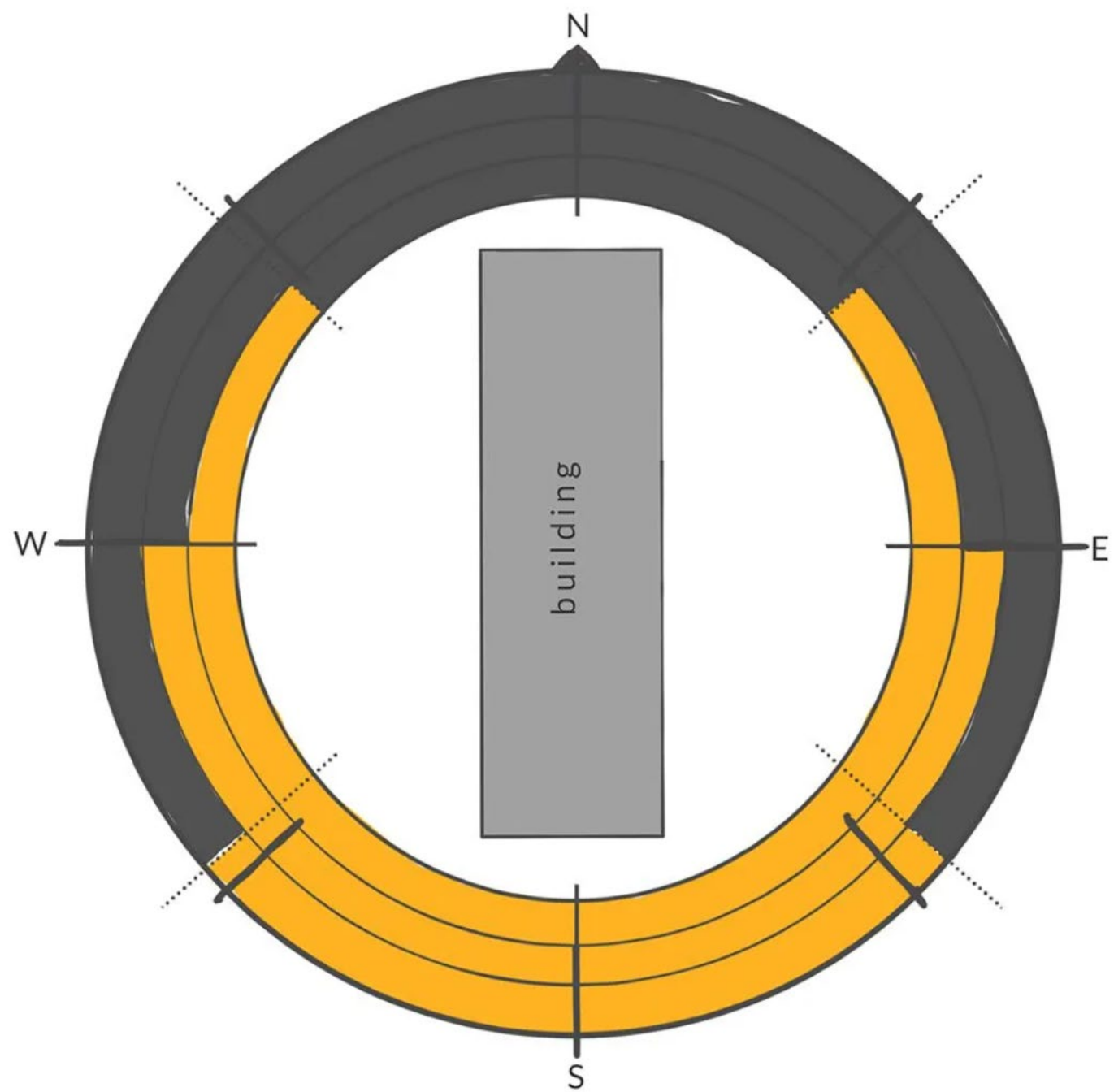


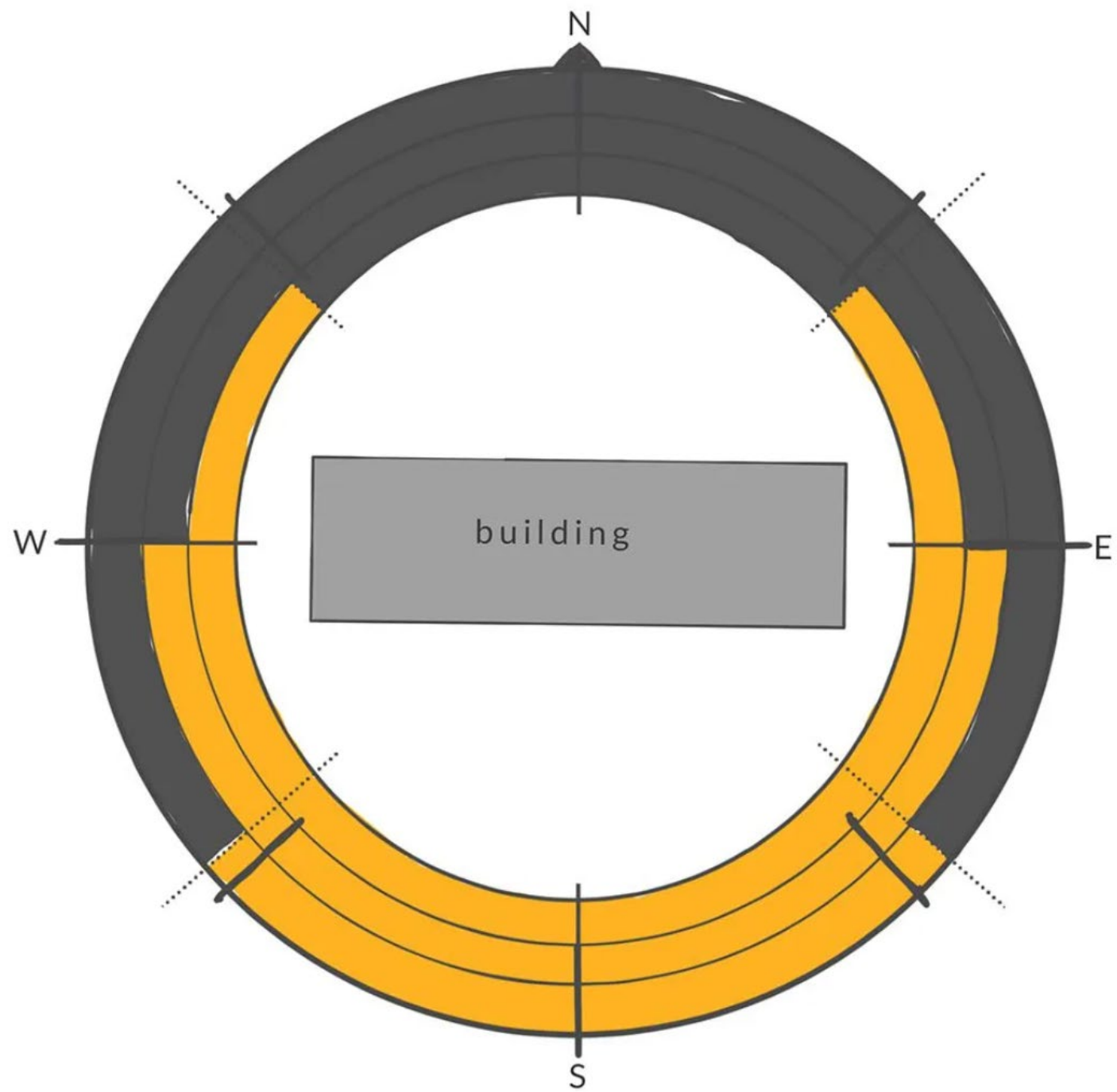


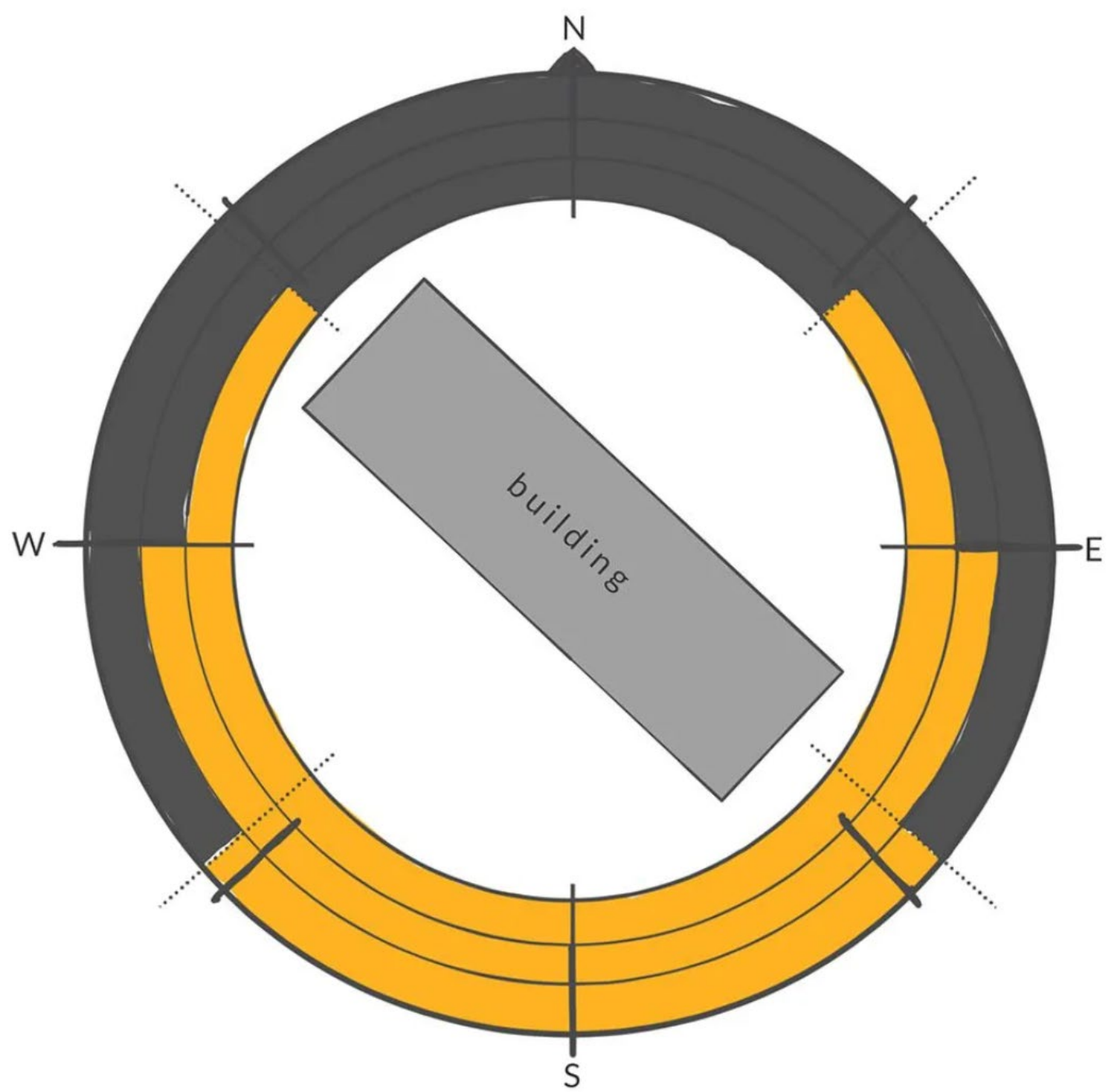
NATURAL LIGHT

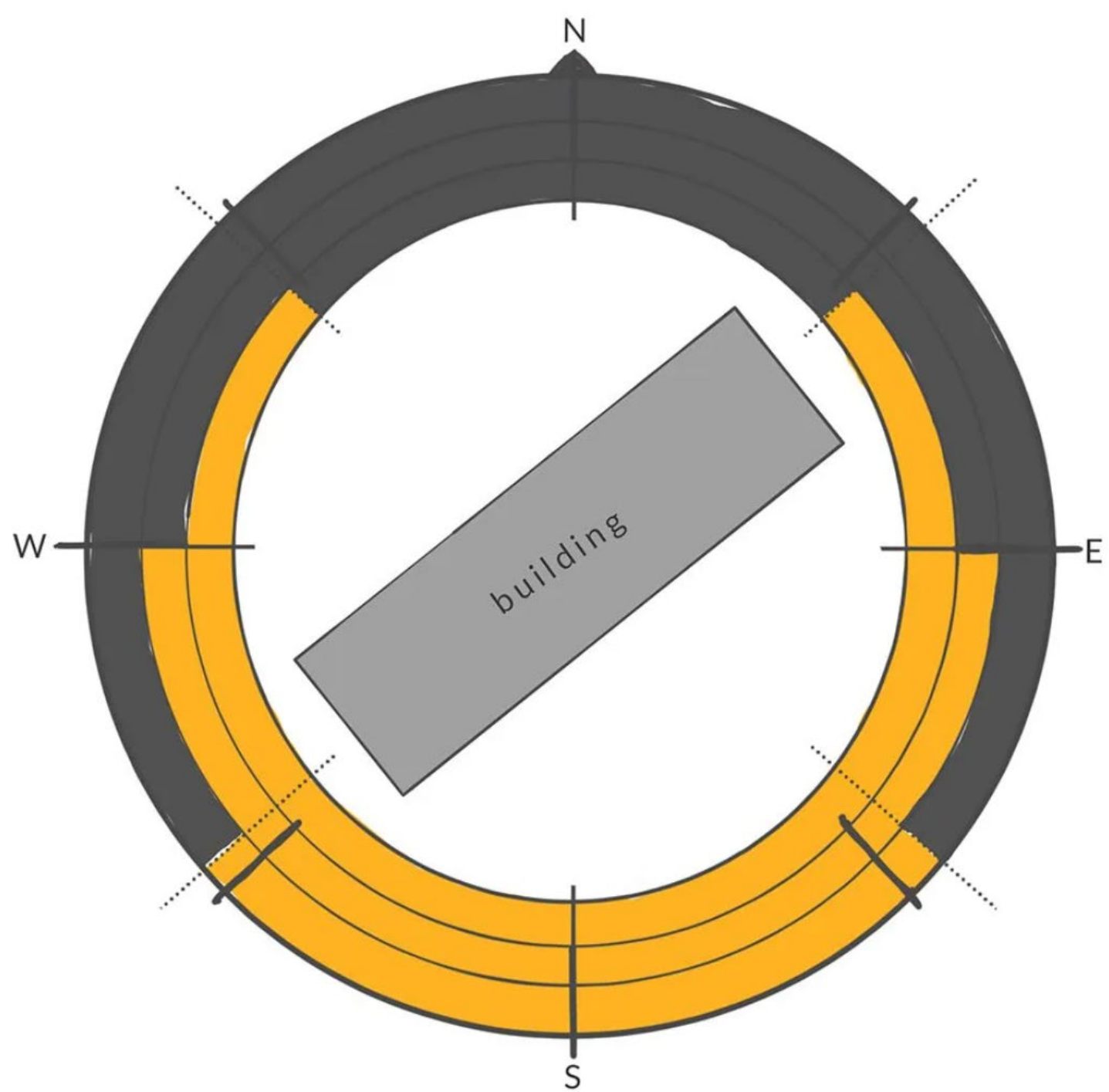
- To maximise the daylighting of a building design, the building must be in correct alignment with the sun.
- Sunshine entering the rooms in the autumn and winter, and in the morning is preferable.
- Sunshine at midday and in the afternoon between June and August is not desirable.











WEST

NORTH

EAST



SOUTH

NATURAL LIGHT

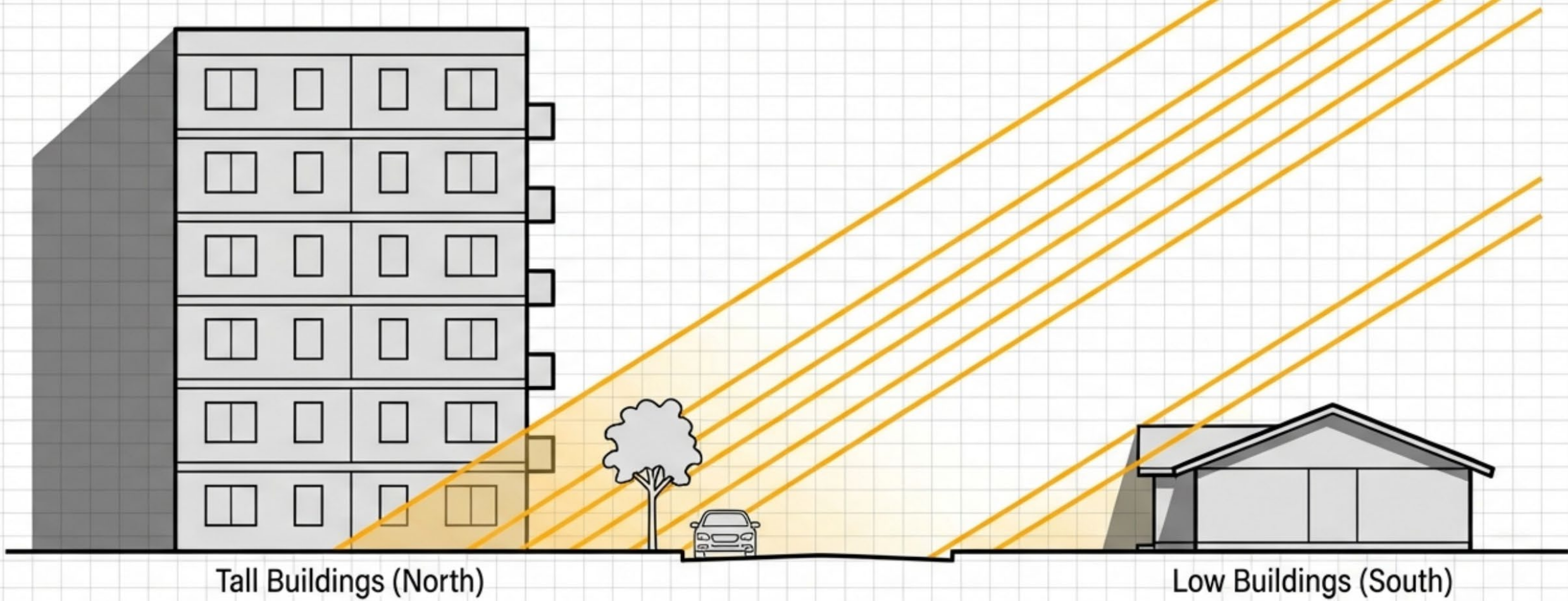
The amount of daylight a room receives is dependant on:

- external overshadowing from neighbouring buildings,
- overhangs or balconies;
- the size and location of windows;
- the depth of the room; the materials and colours used;
- and the visible light transmittance of the windows.



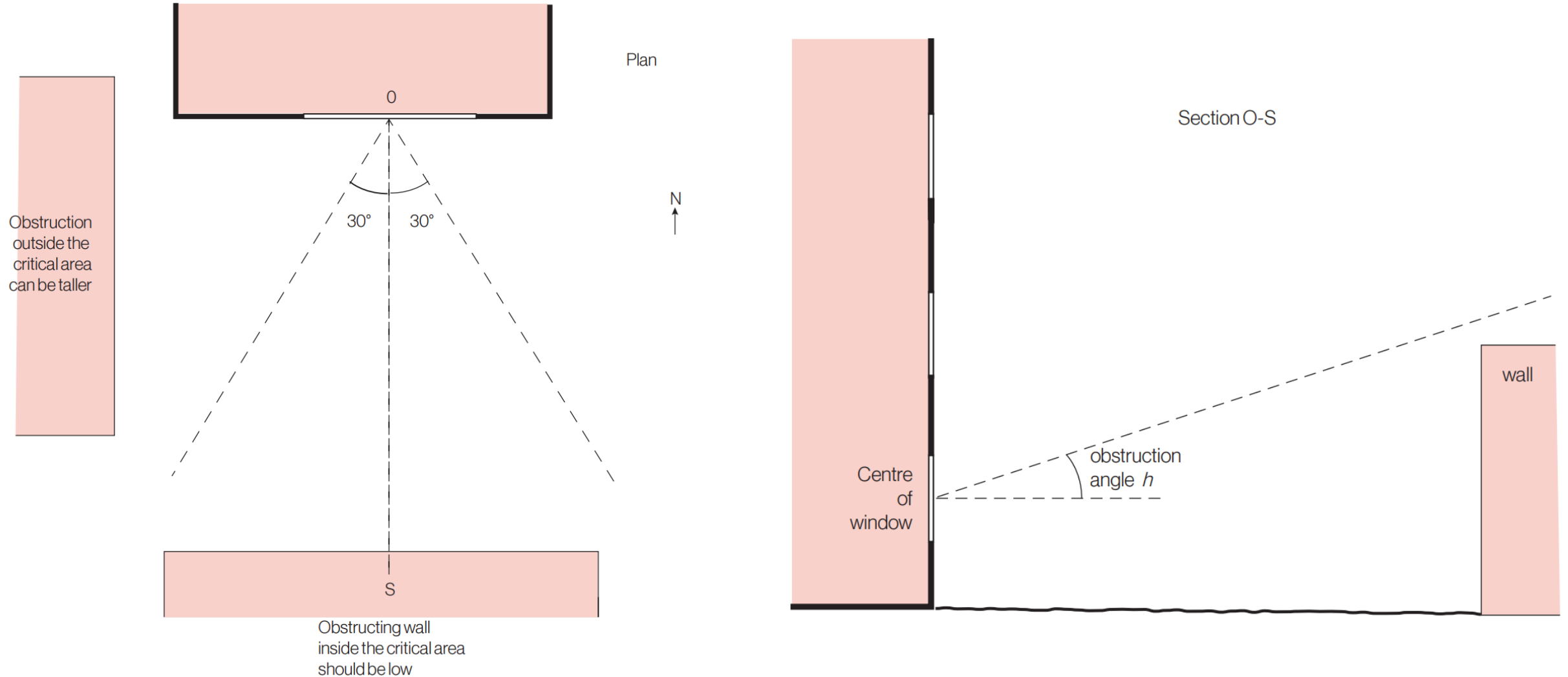
OVERSHADOWING

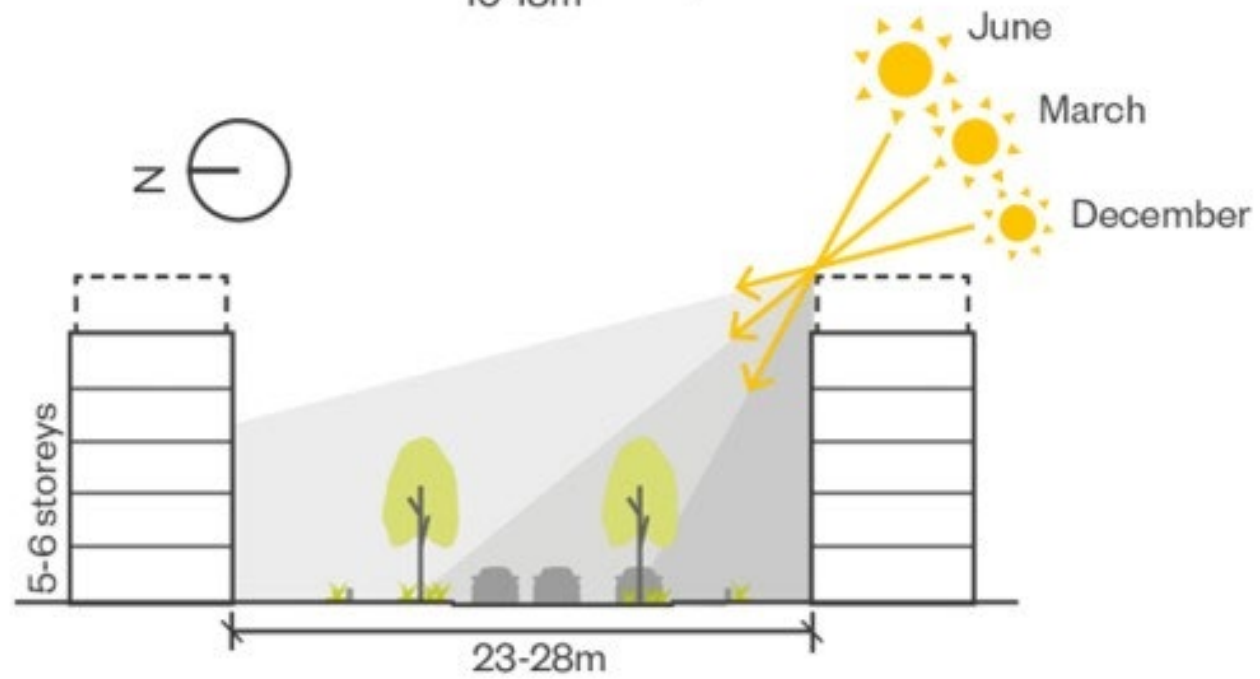
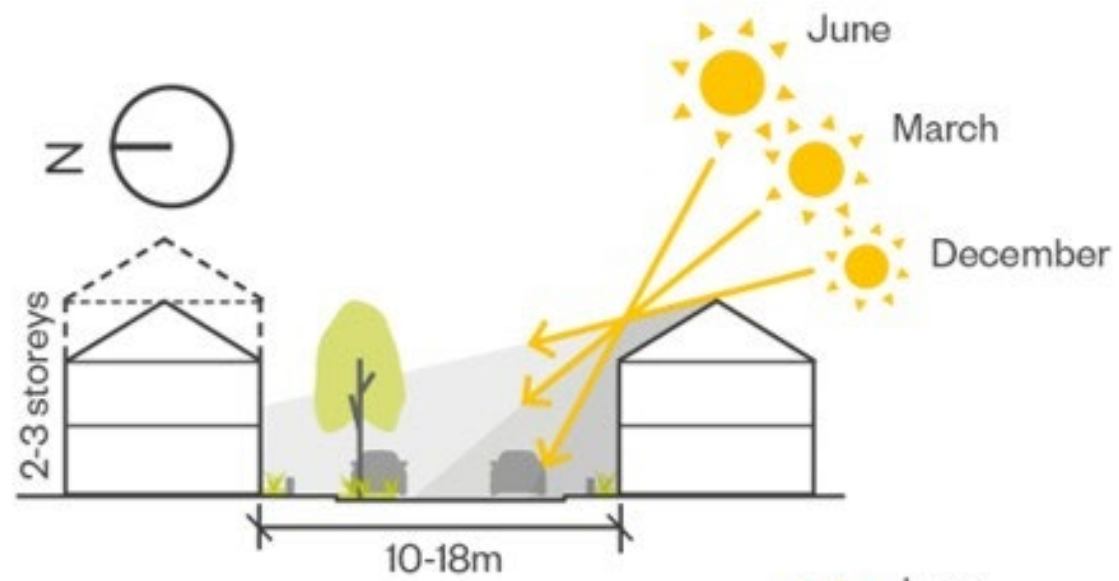
- Tall buildings have the potential to cause excessive overshadowing and need to be positioned carefully if this is to be avoided.

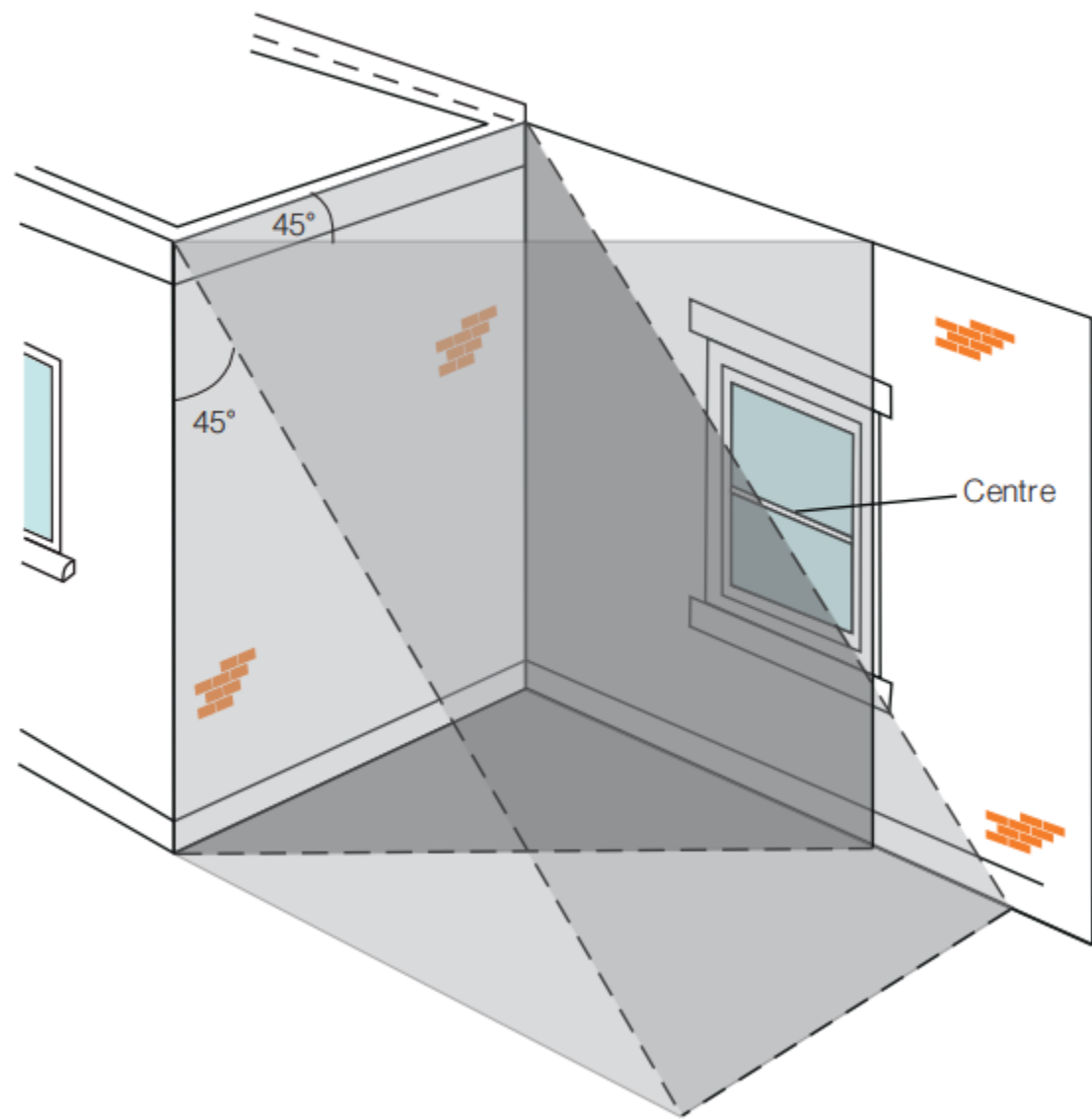


OVERSHADOWING

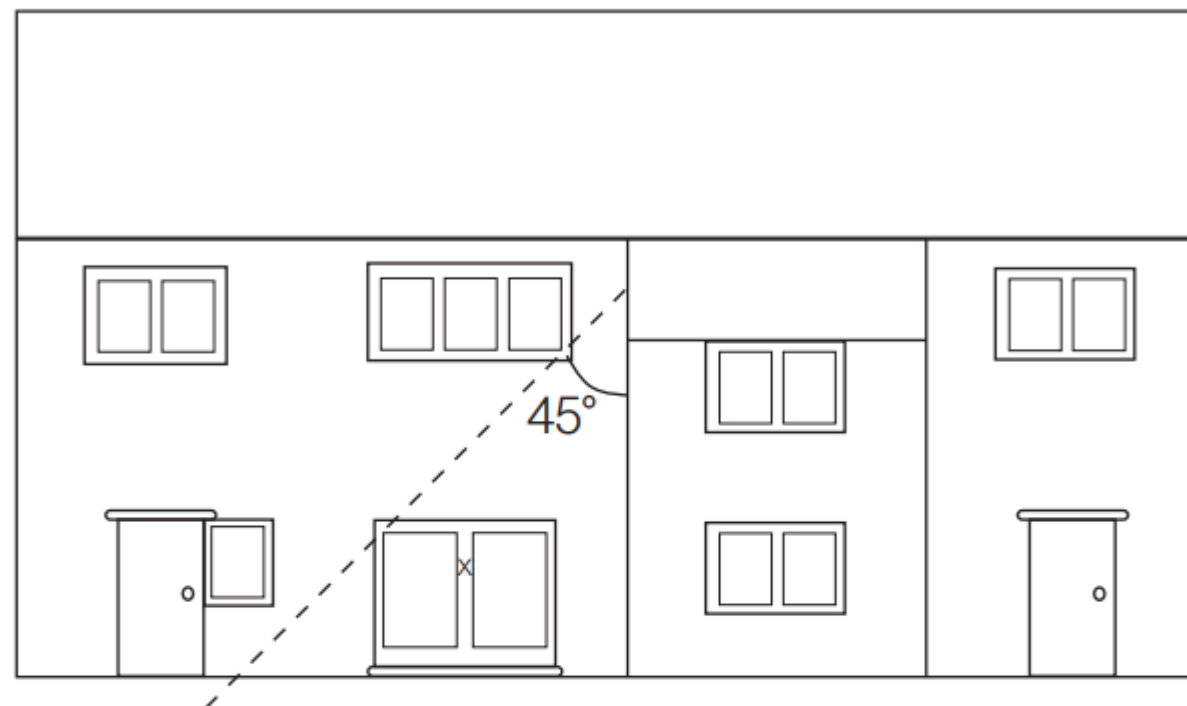
GEOMETRY OF OBSTRUCTION



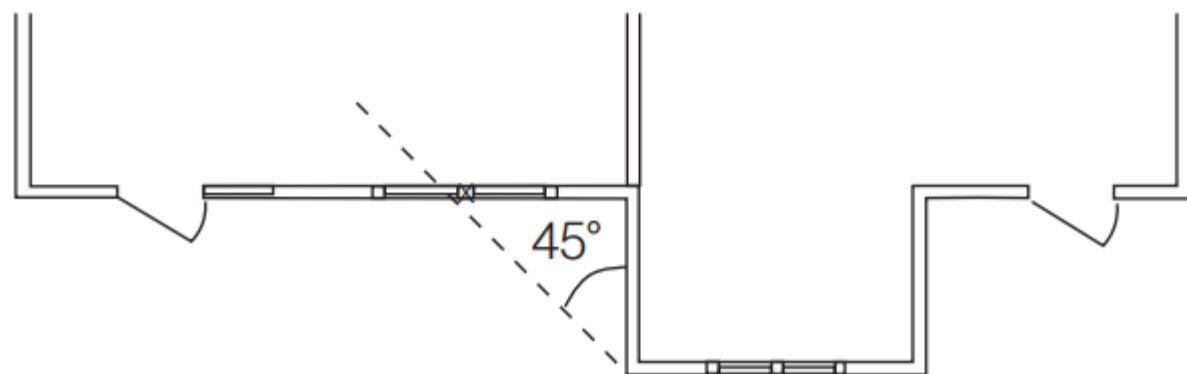




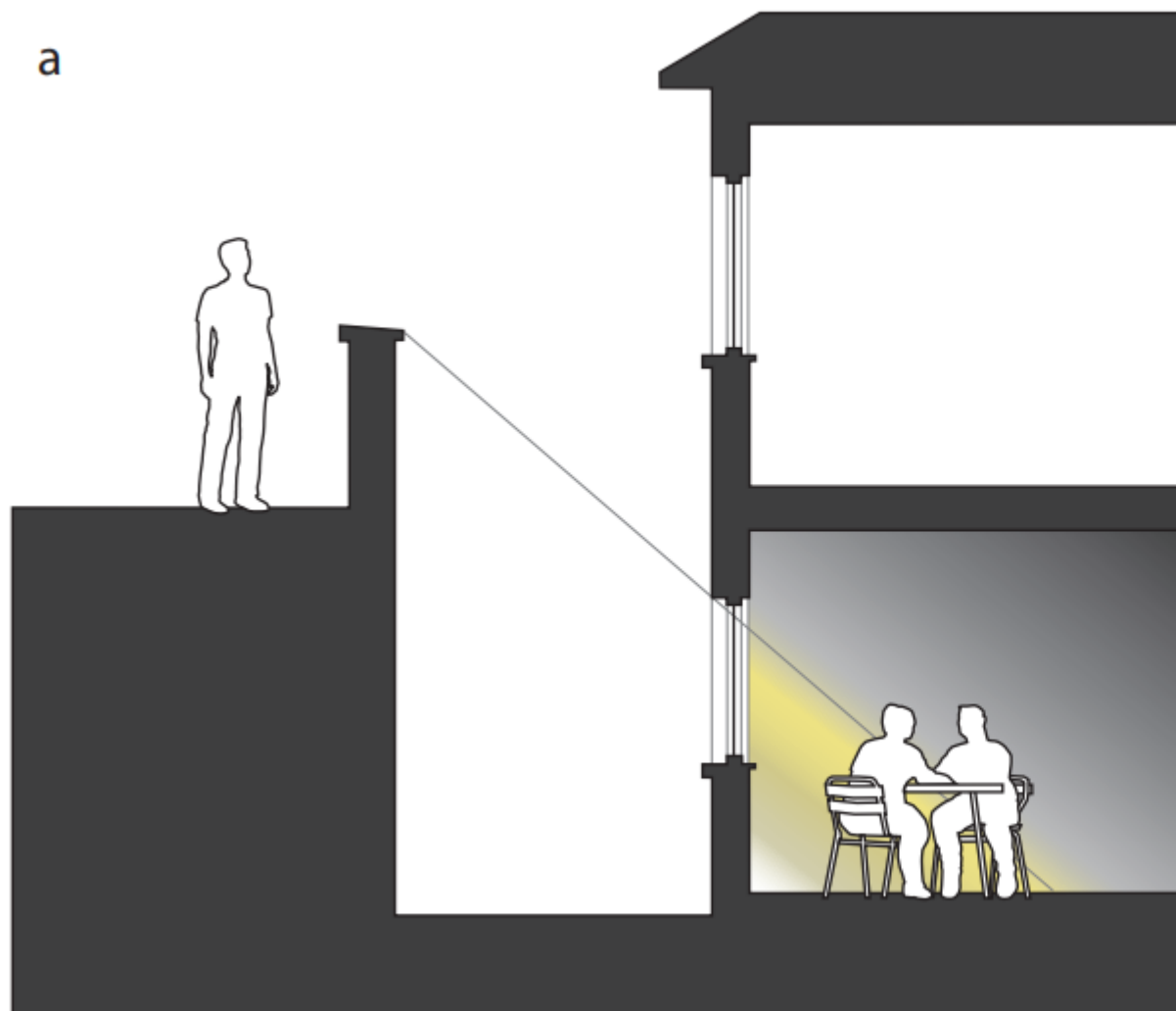
Section



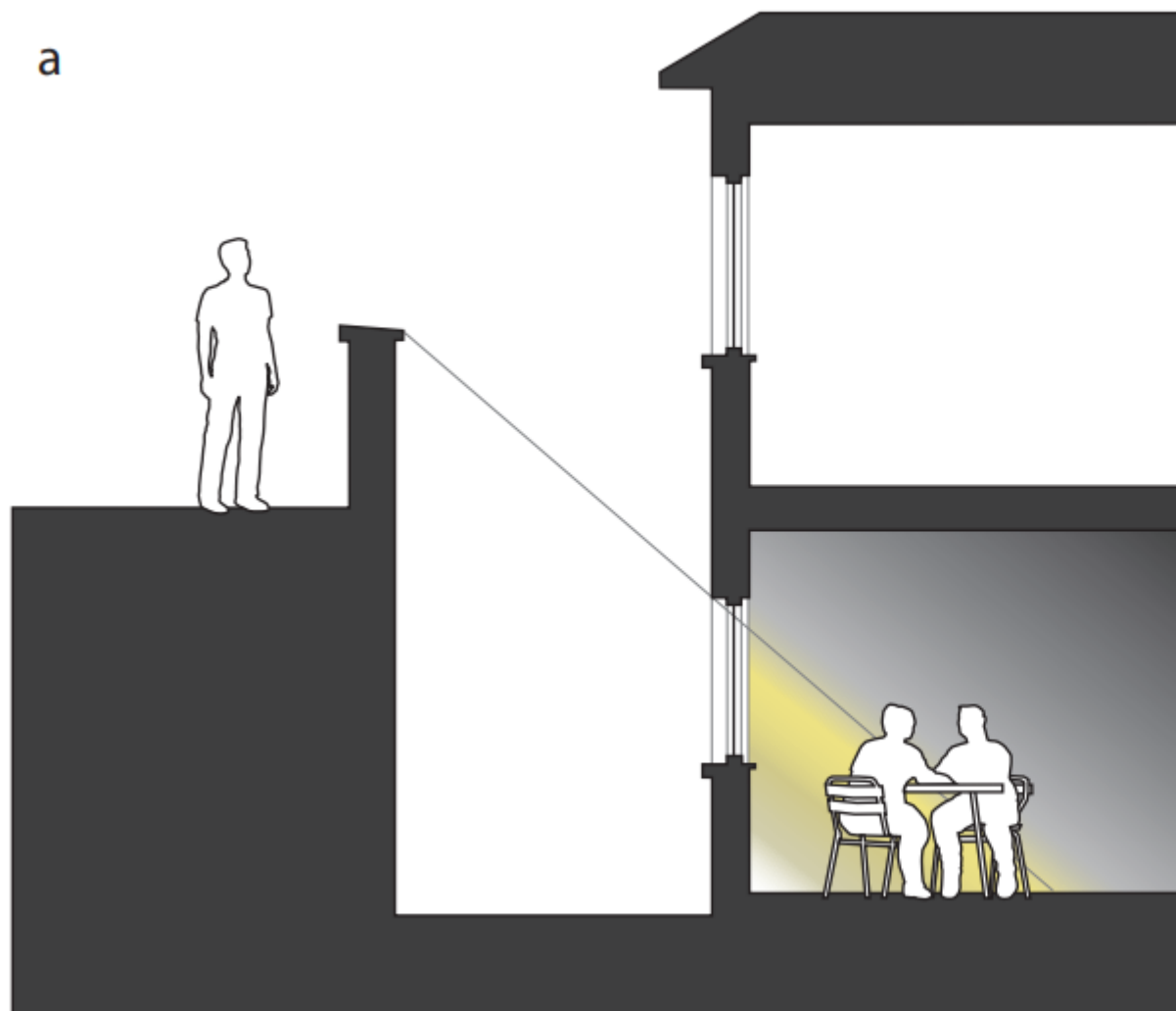
Plan



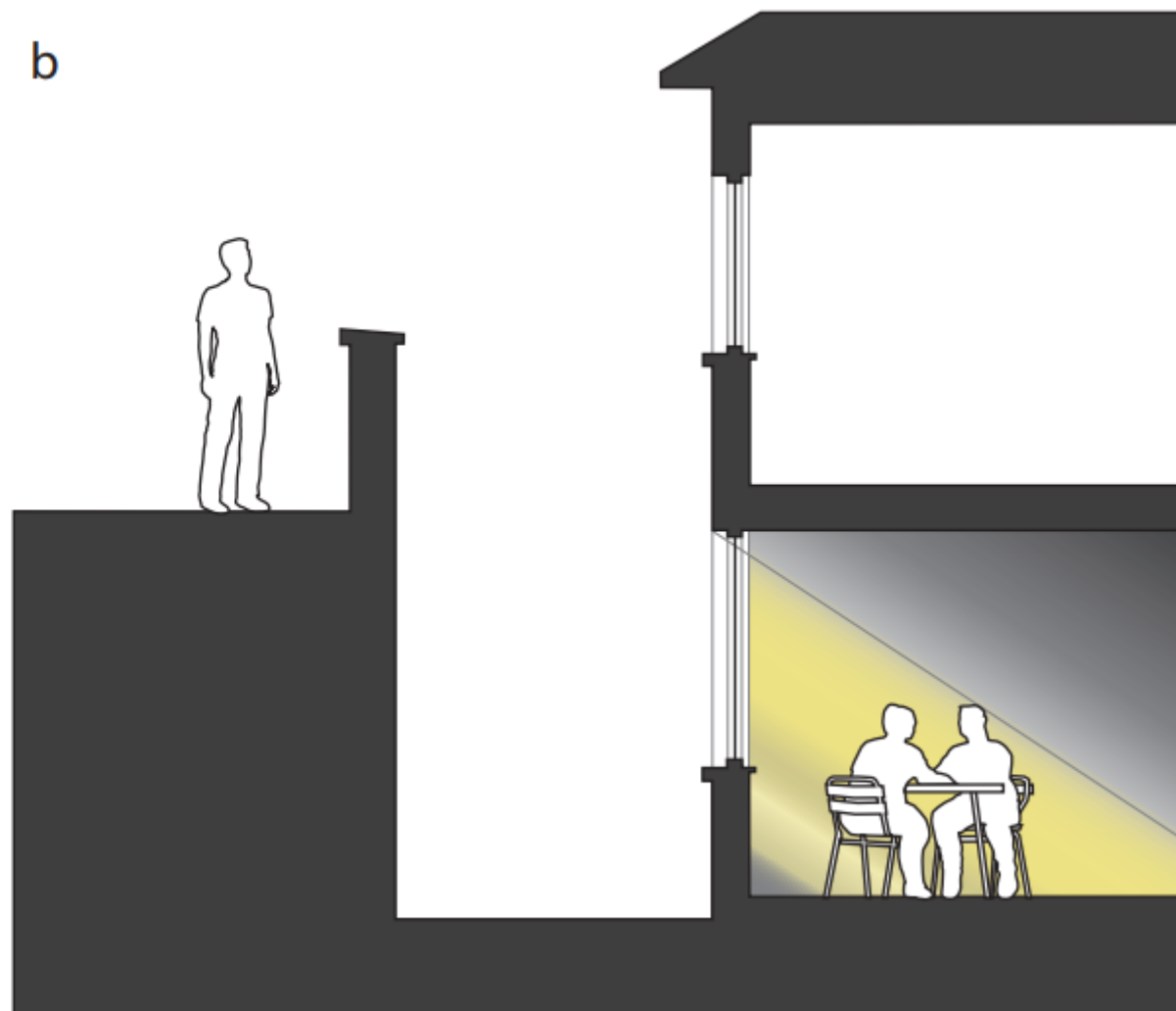
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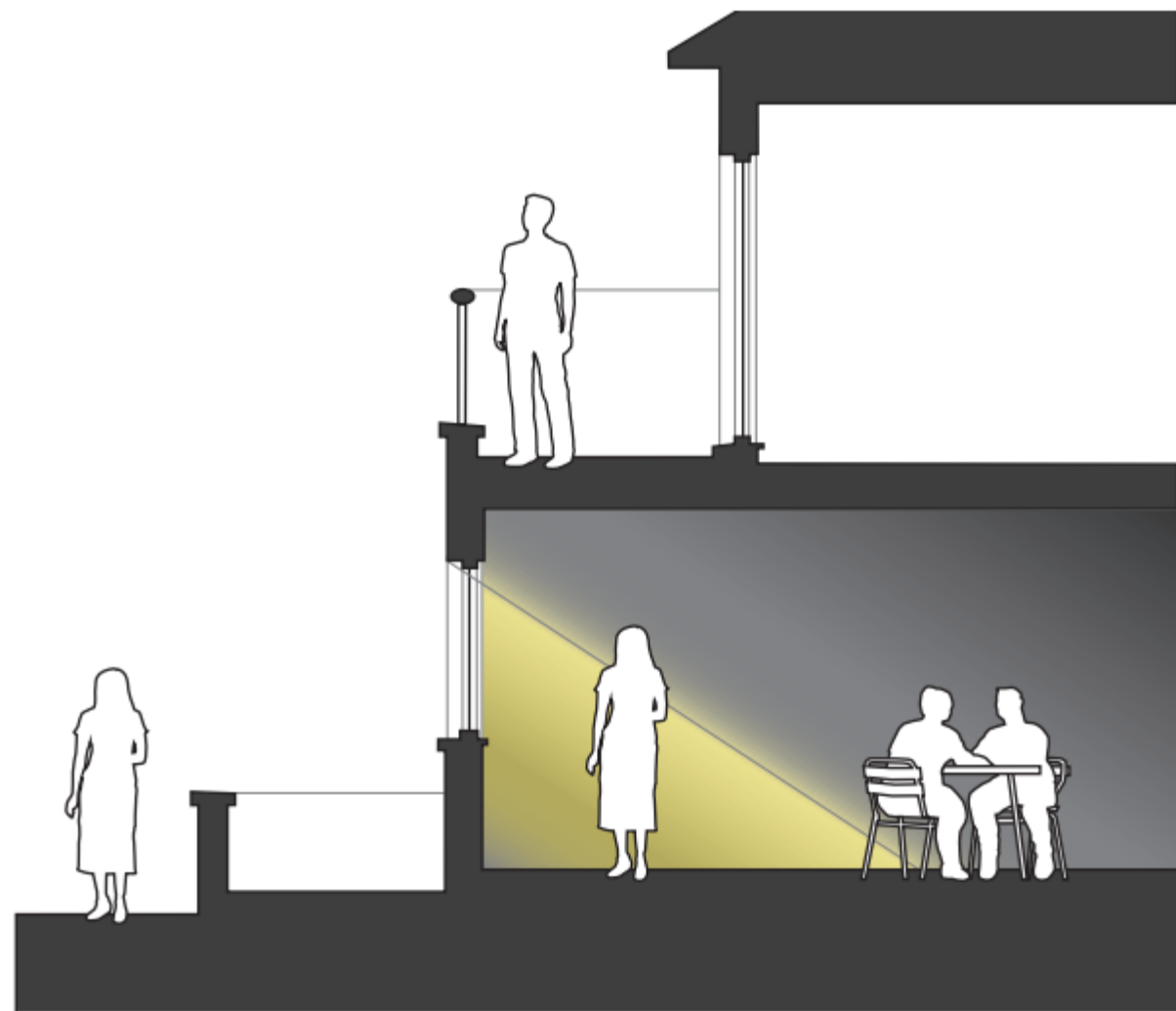
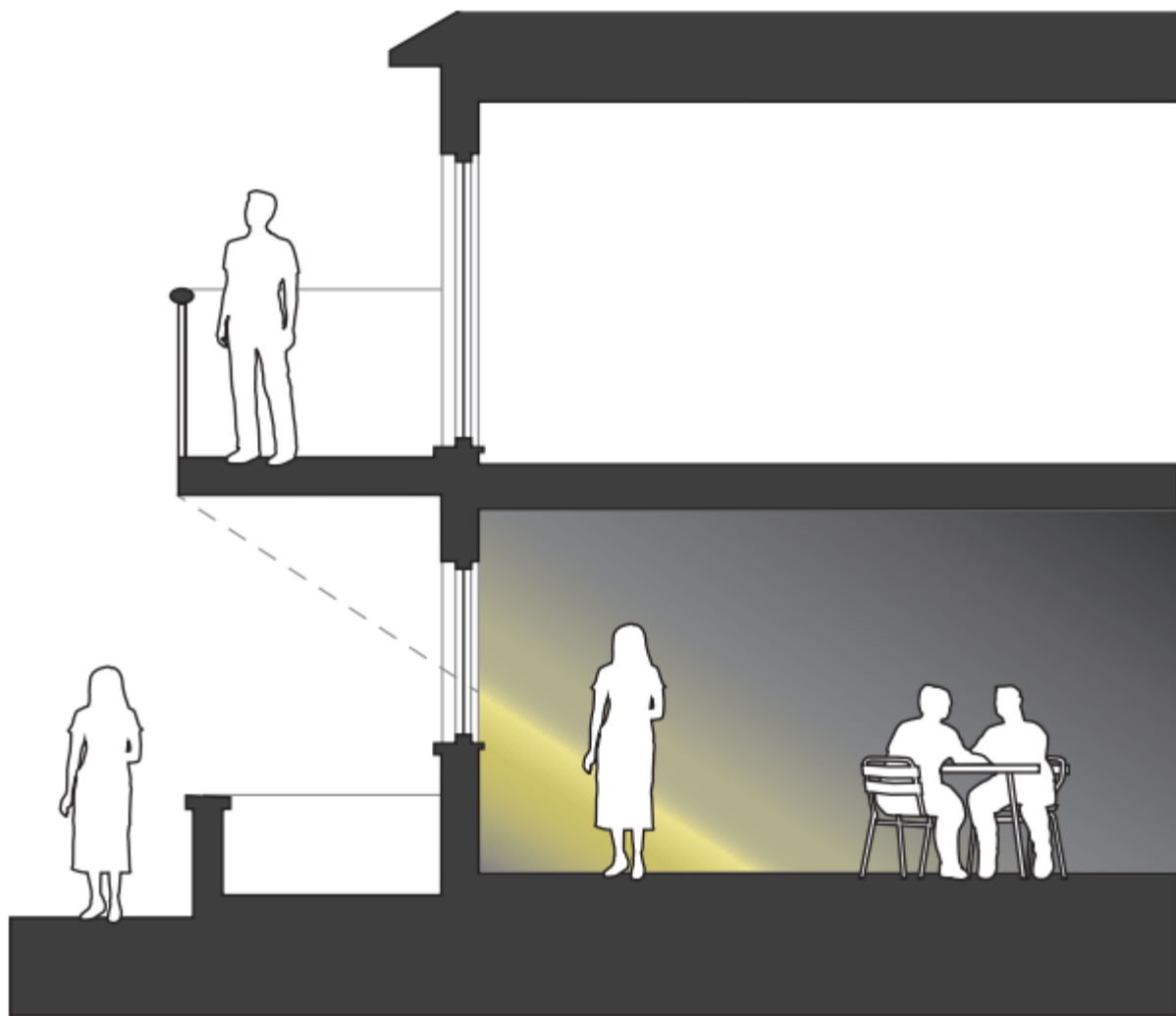


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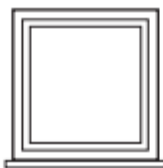
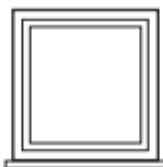
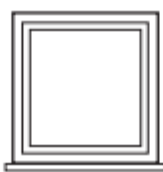
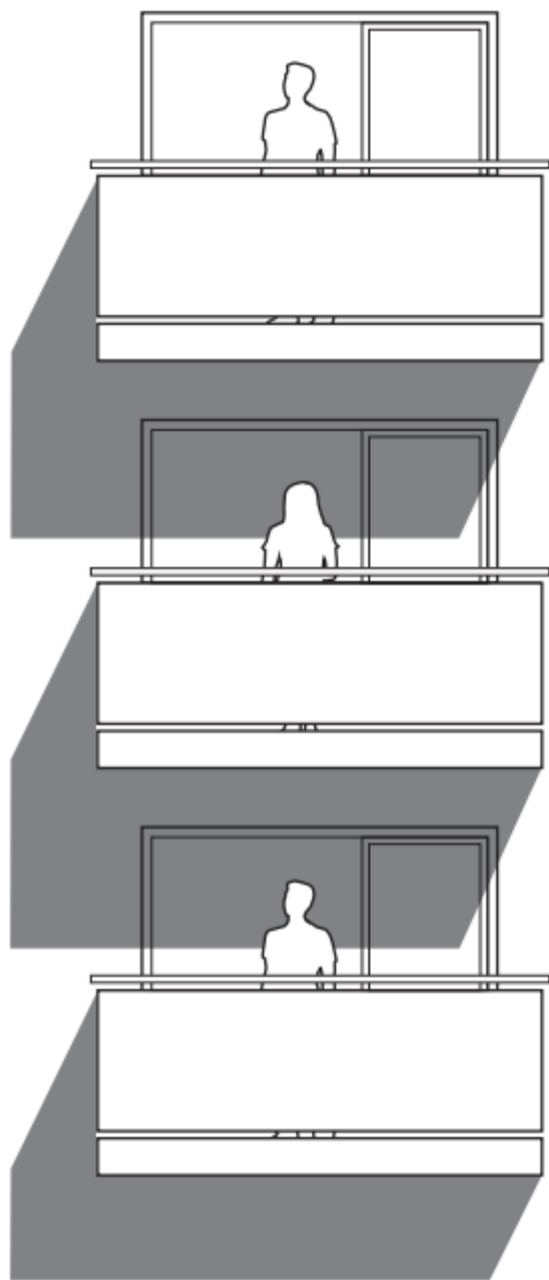


b

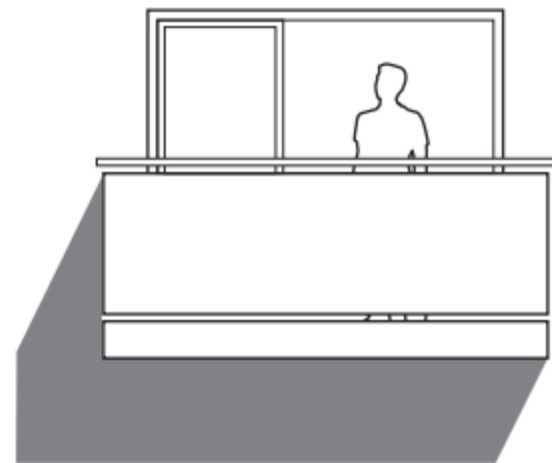
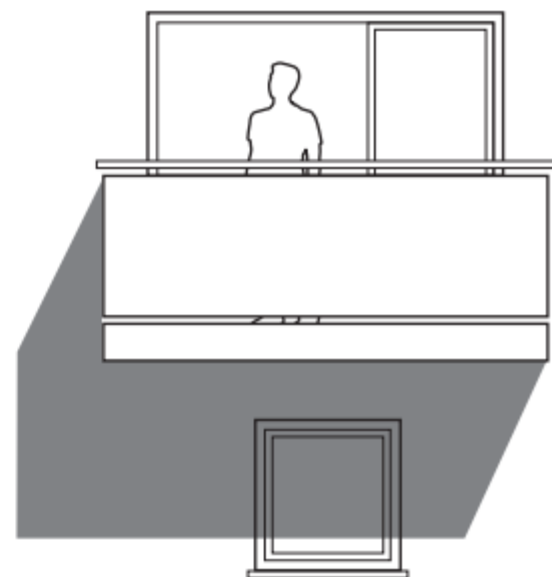
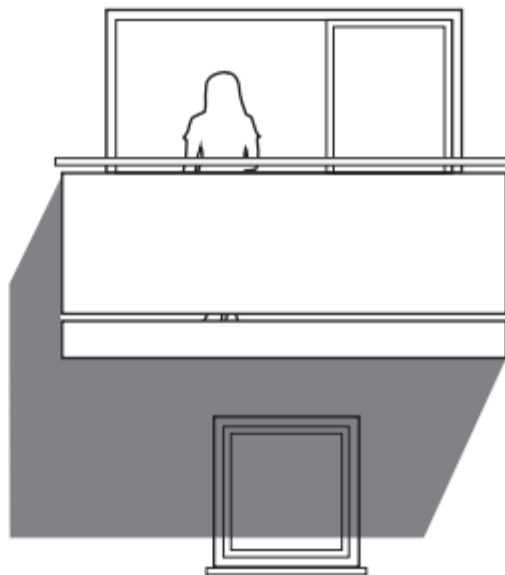
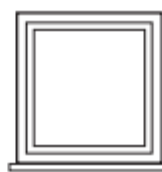




a

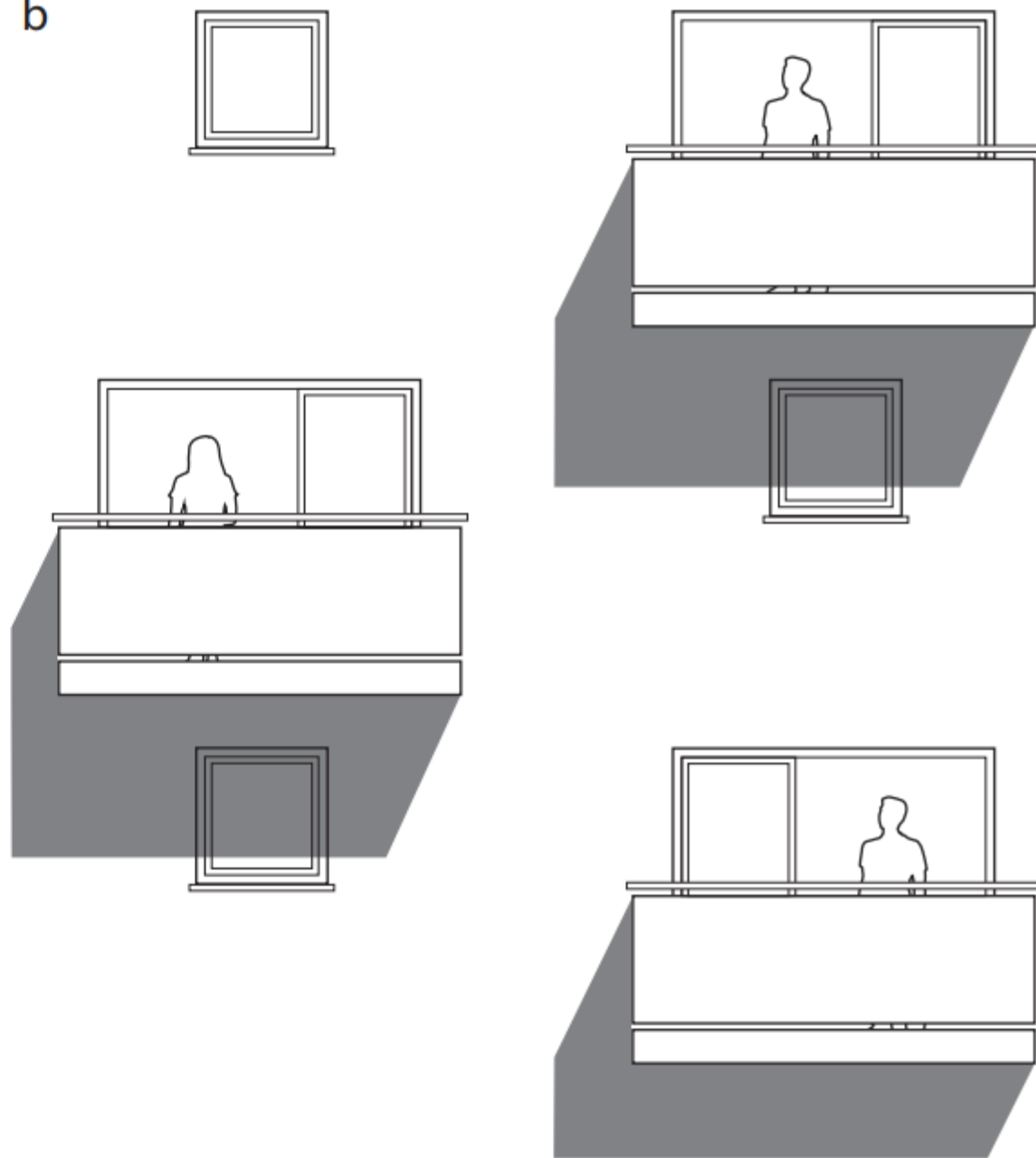


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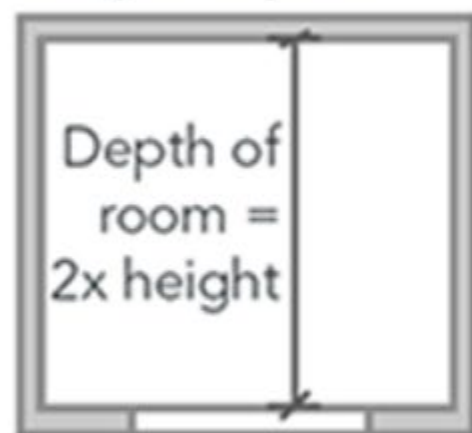


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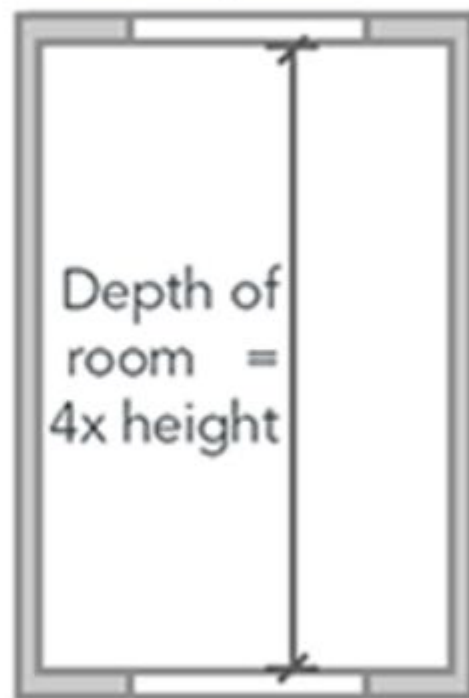


Single aspect



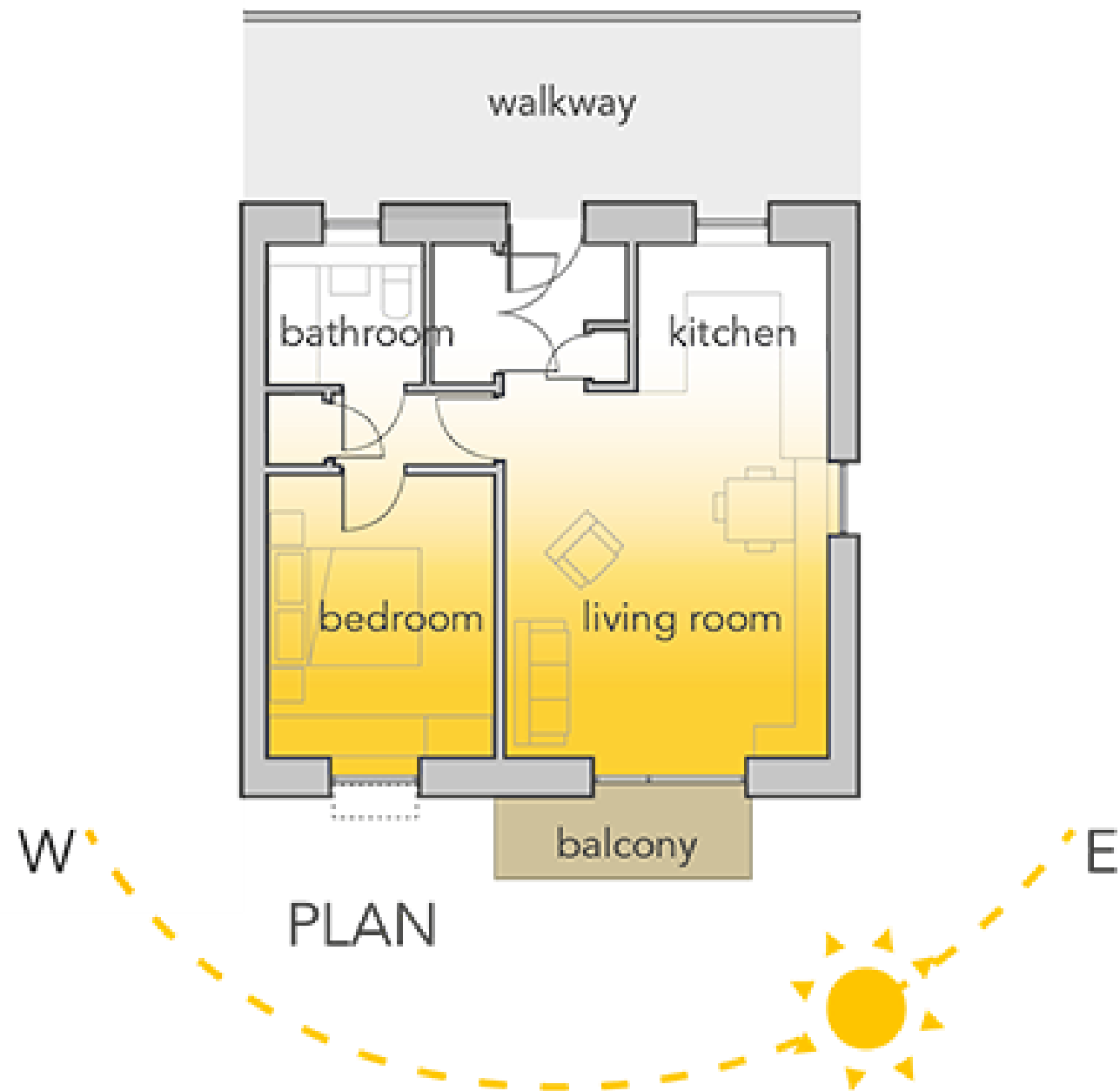
*E.g. if room is
2.5m high then it
could be up to 5m
deep*

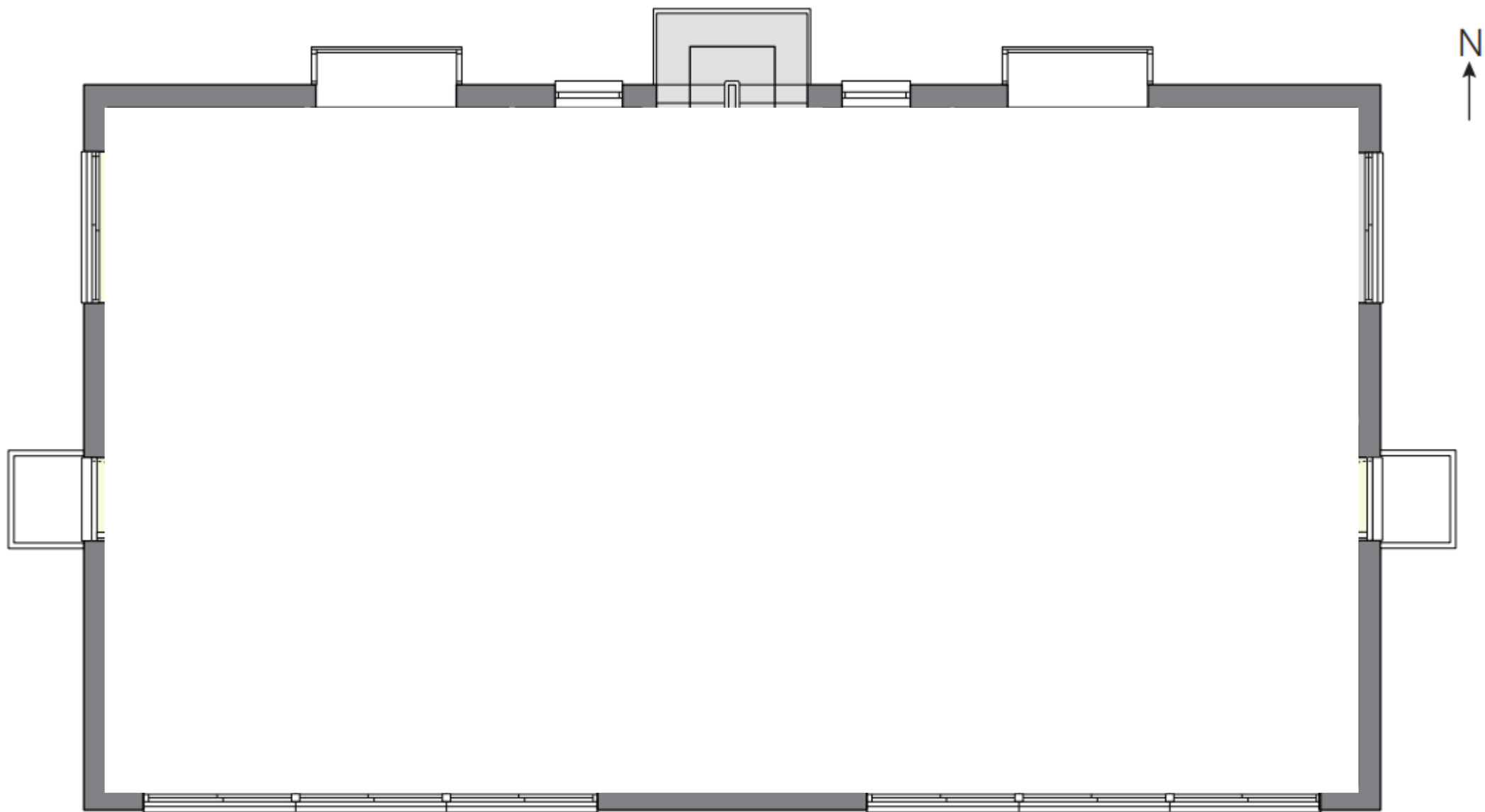
Dual aspect

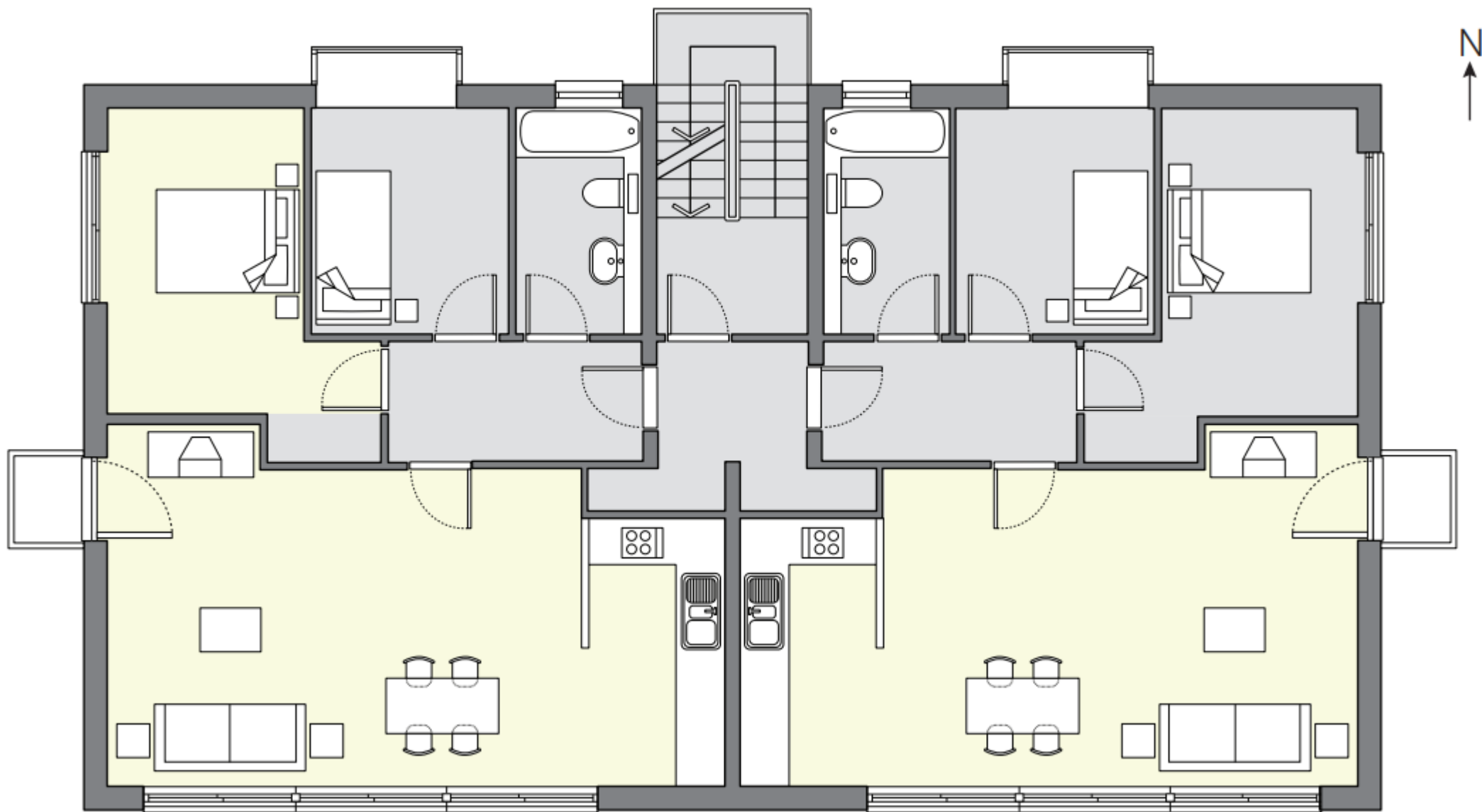


PLAN

*E.g. if room is
2.5m high then it
could be up to 10m
deep*

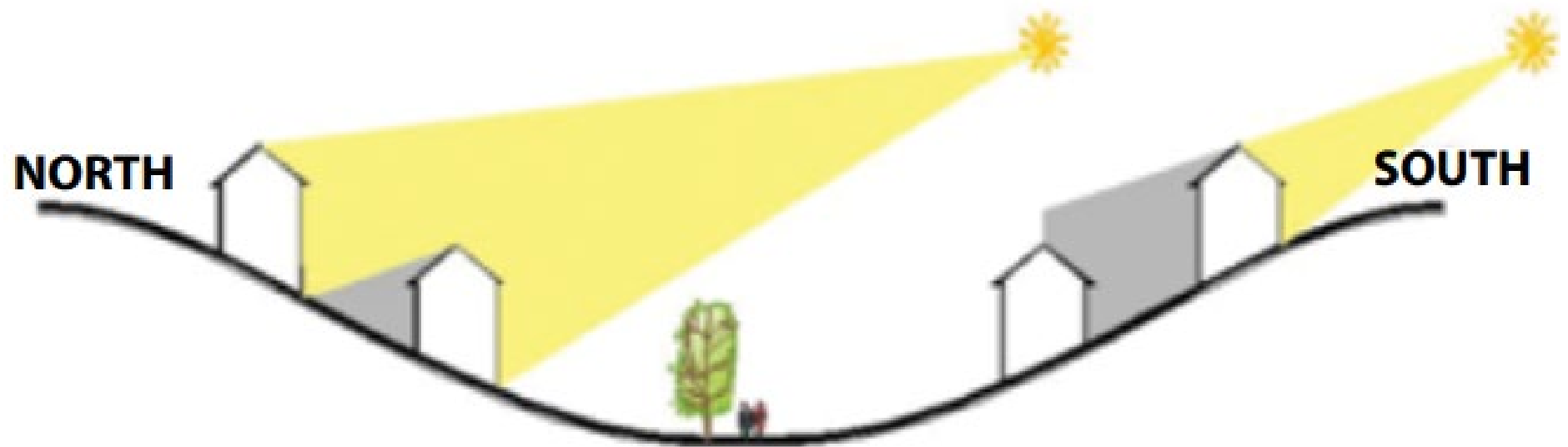






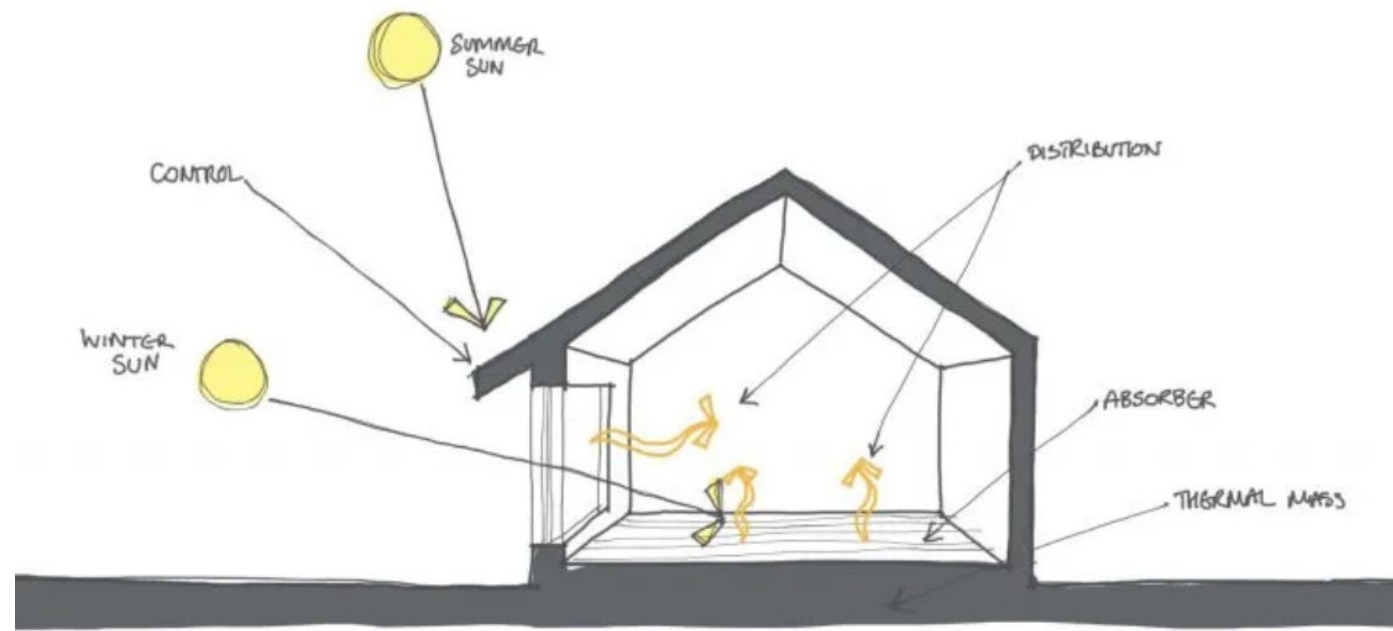
NORTH

SOUTH



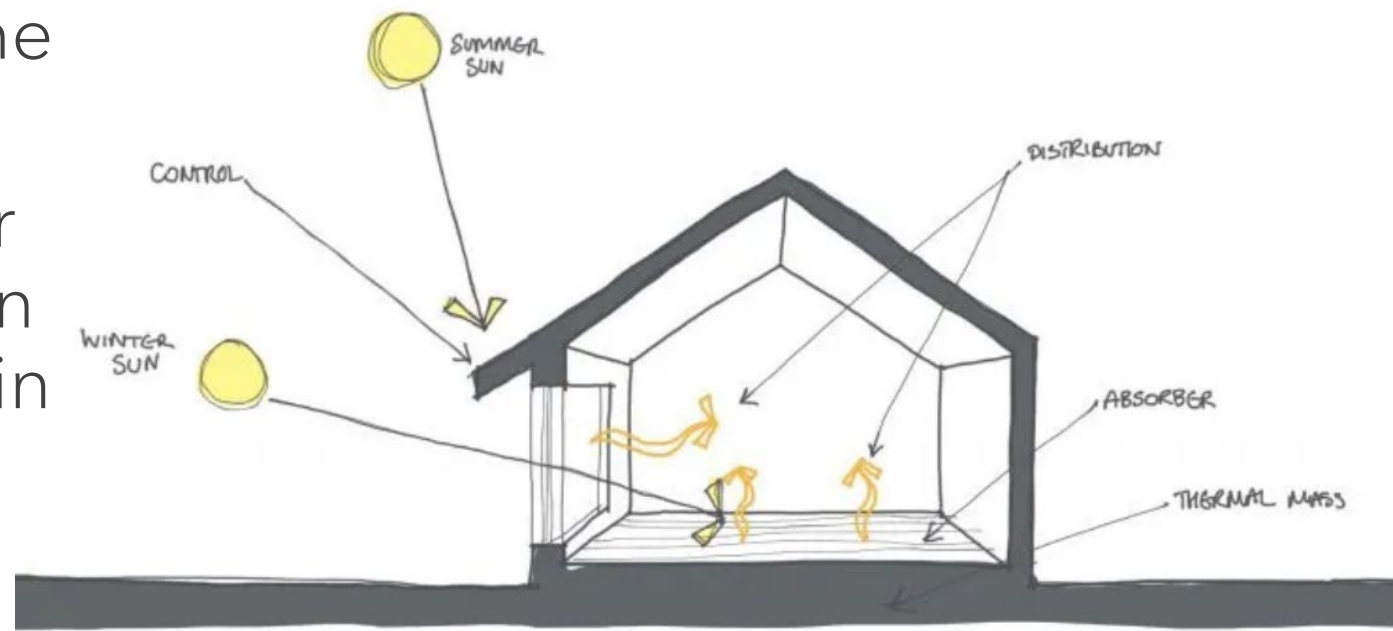
SOLAR GAIN

- Solar gain occurs when the temperature of an internal space within a building increases due to the absorption of the sun's energy by the building fabric.



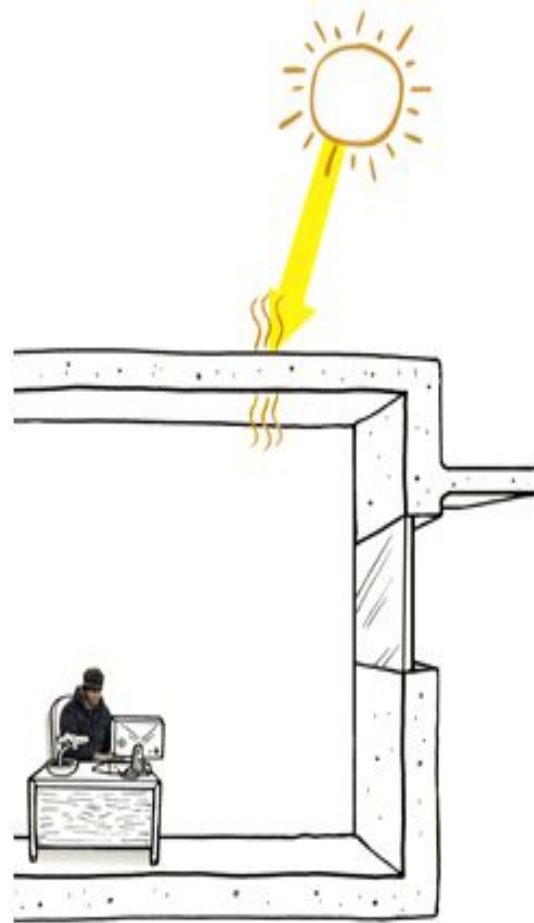
SOLAR GAIN

- We design to minimise solar gains, particularly during the summer months.
- However, during the colder months of the year we often look to exploit the solar gain to reduce heating loads.



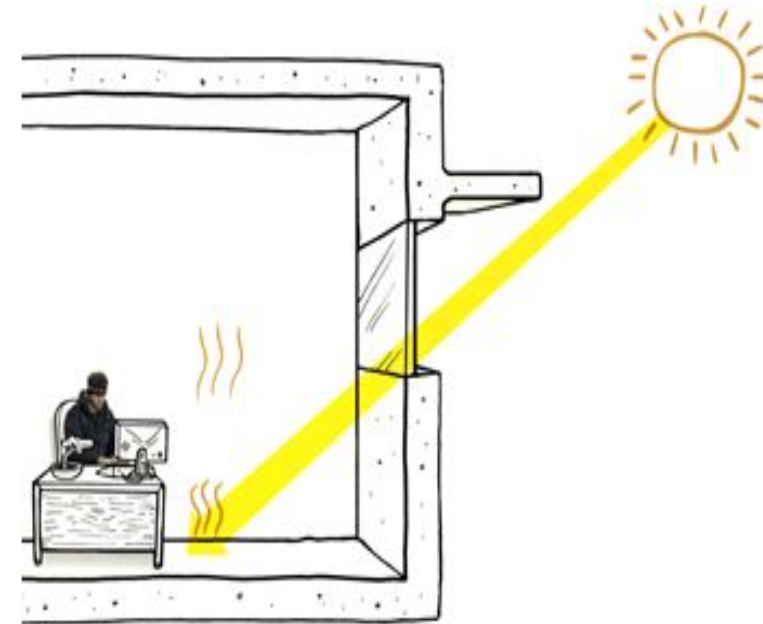
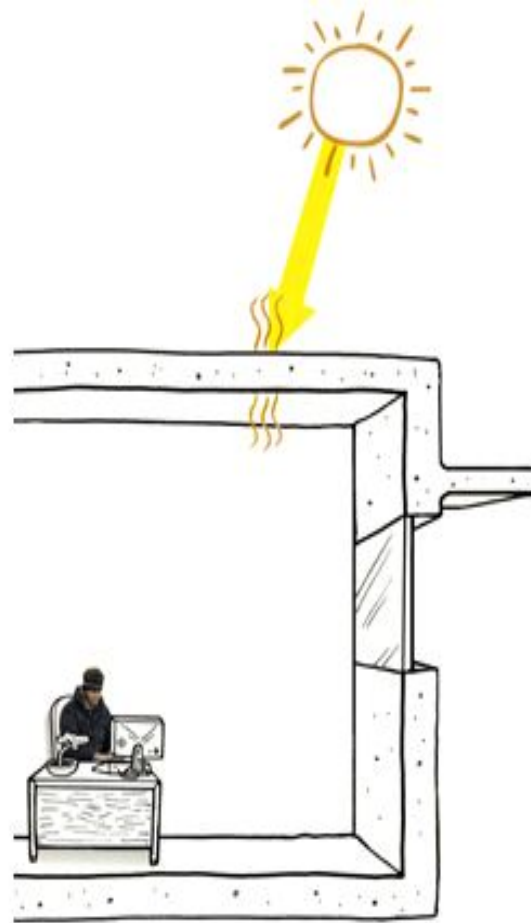
SOLAR GAIN

- The middle of the day is when the sun is at it's strongest, but it is also at its highest point, so often in the summer, the sun hits a facade at a steep angle in the middle of the day and therefore the heat transfer remains relatively low.



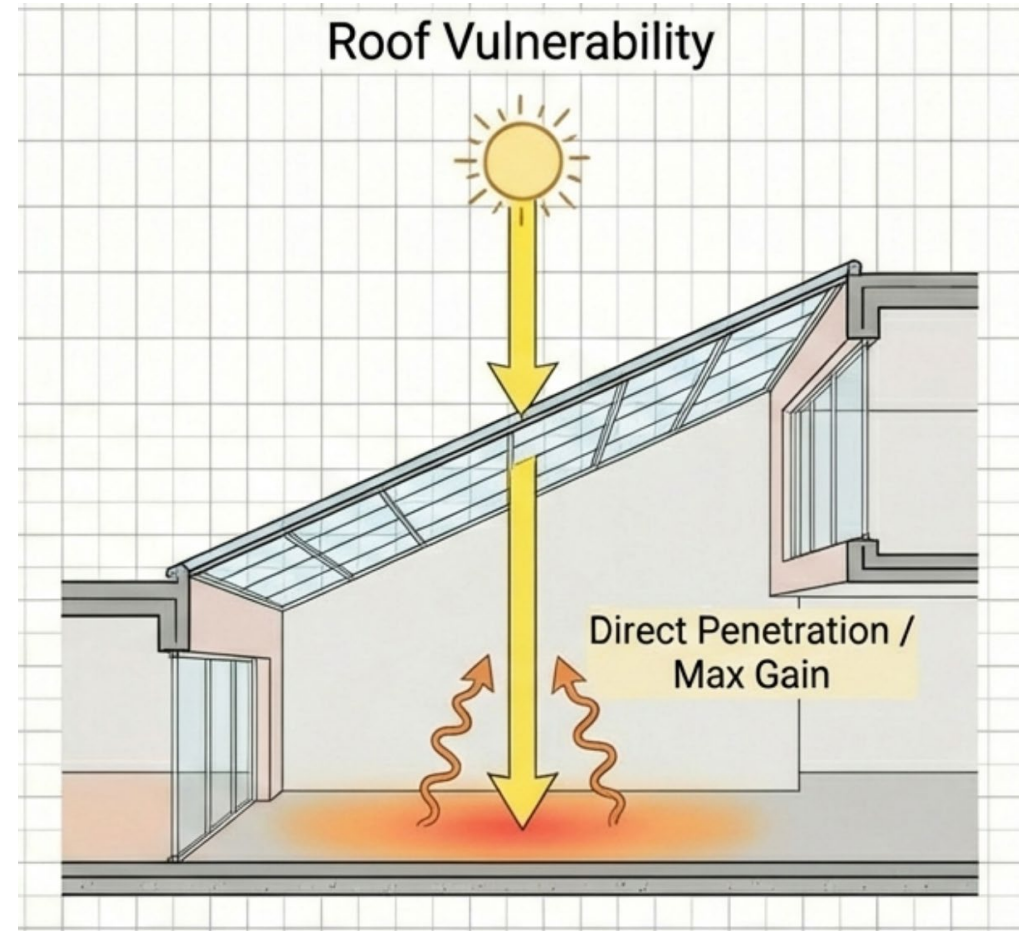
SOLAR GAIN

- It is the time either side of the peak of the day where the angle of the sun is lower, a more direct angle for impacting the facade and transferring a higher proportion of energy to the building.



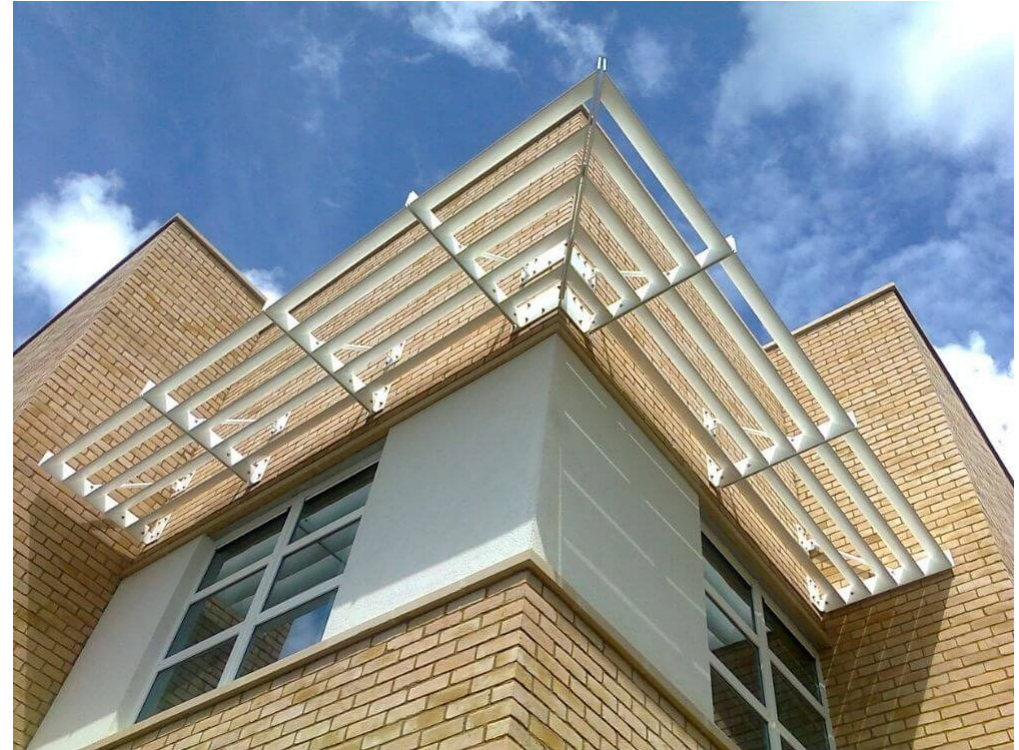
SOLAR GAIN

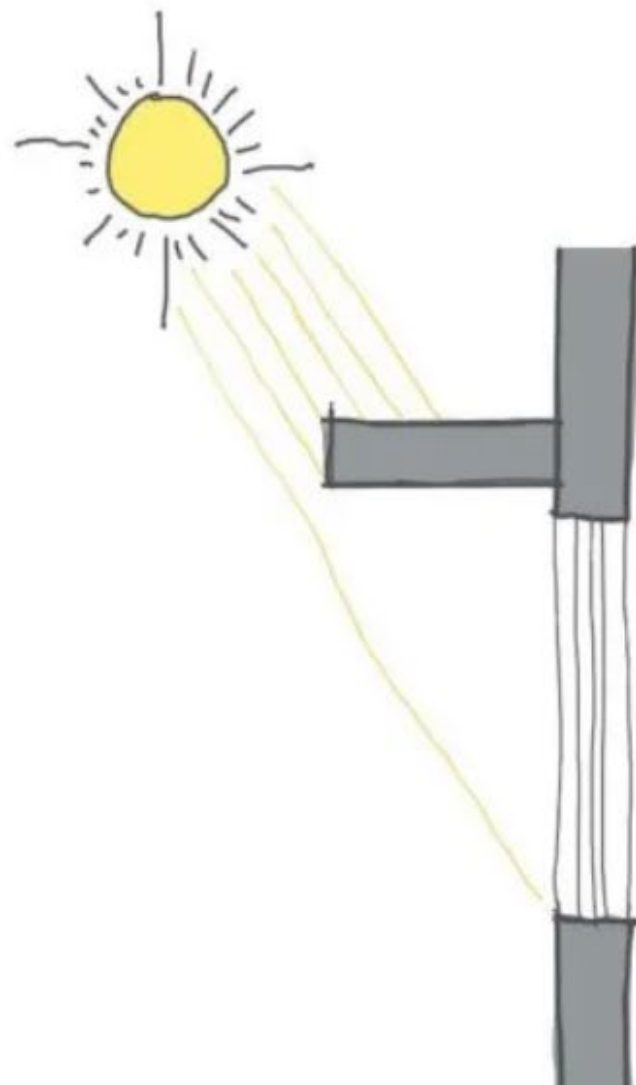
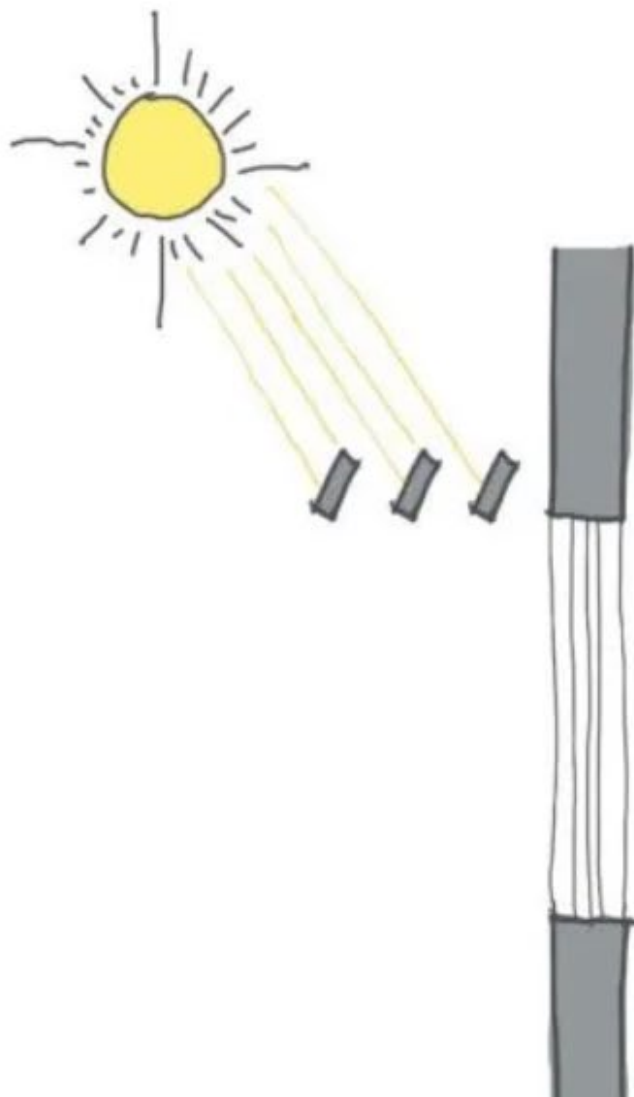
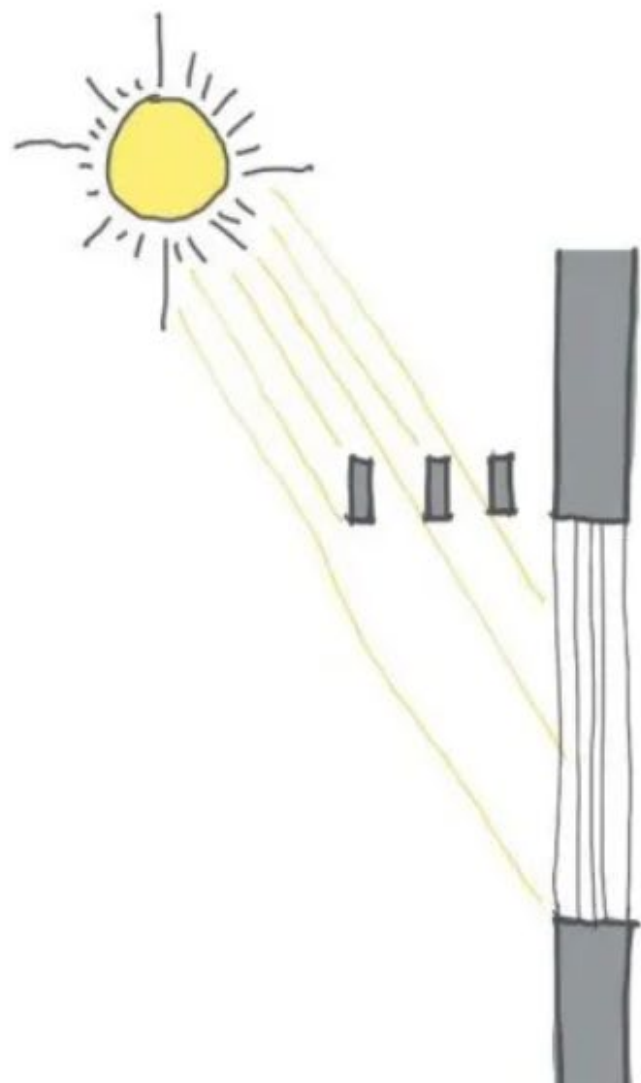
- An exception to this is atria and roofs which face the sun more directly at the middle of the day and are especially vulnerable to solar gain when the sun is at its strongest.



SHADING

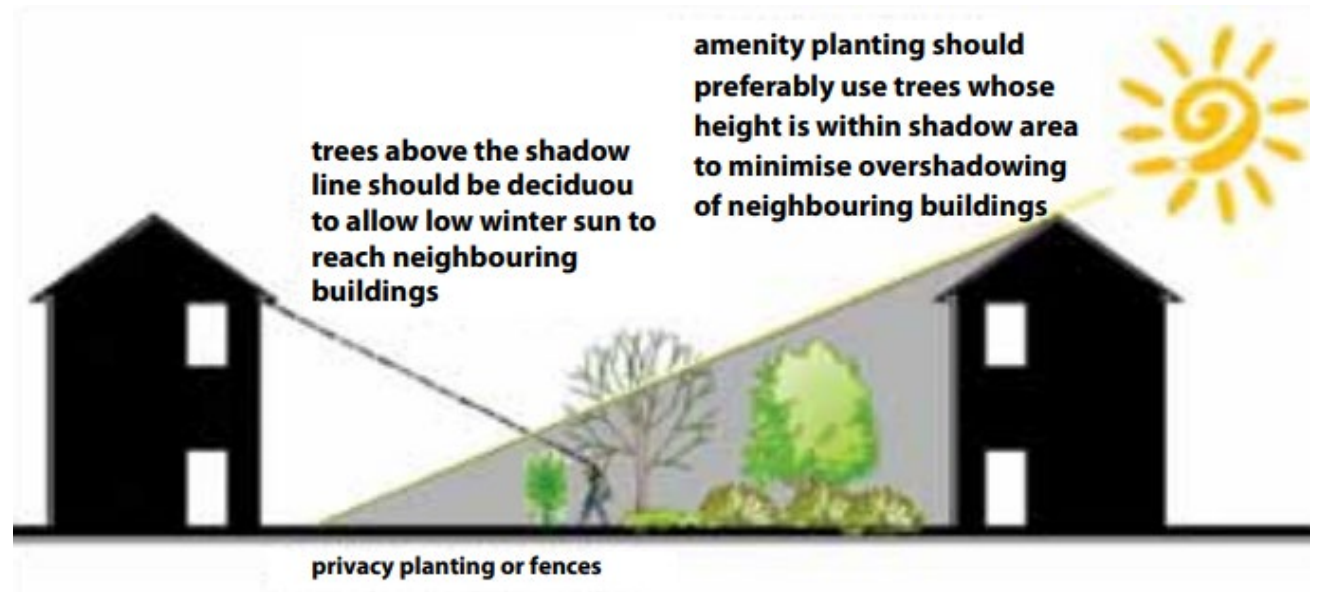
- To help control solar gain, shading systems are often applied to limit the amount of solar radiation that penetrates the facade.
- External shading devices are more effective than internal shading.

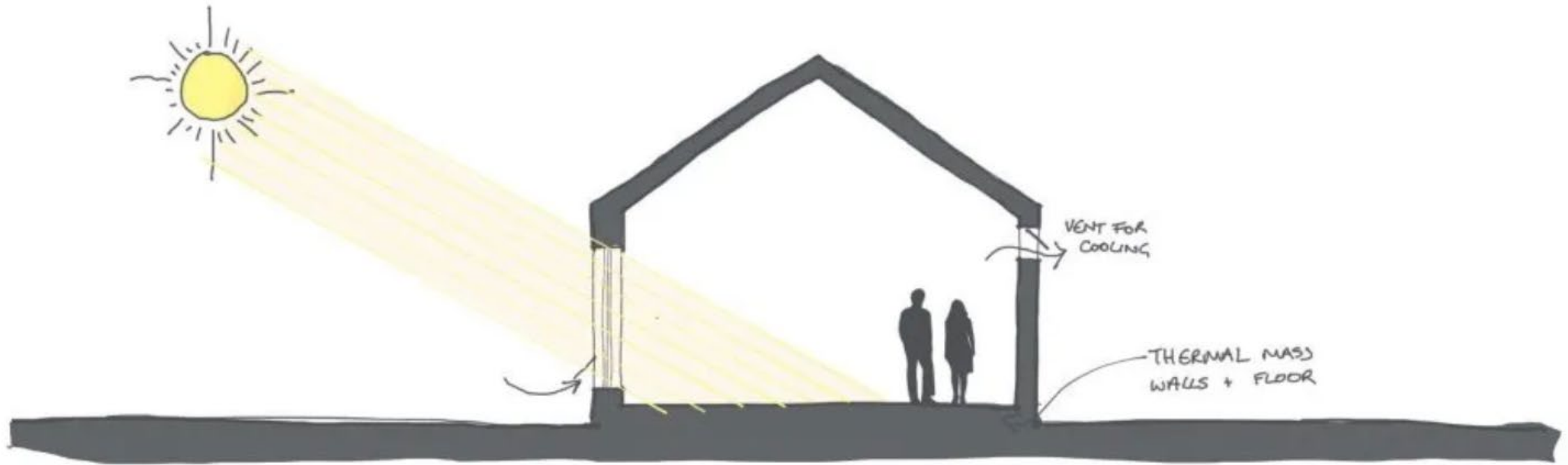




SHADING

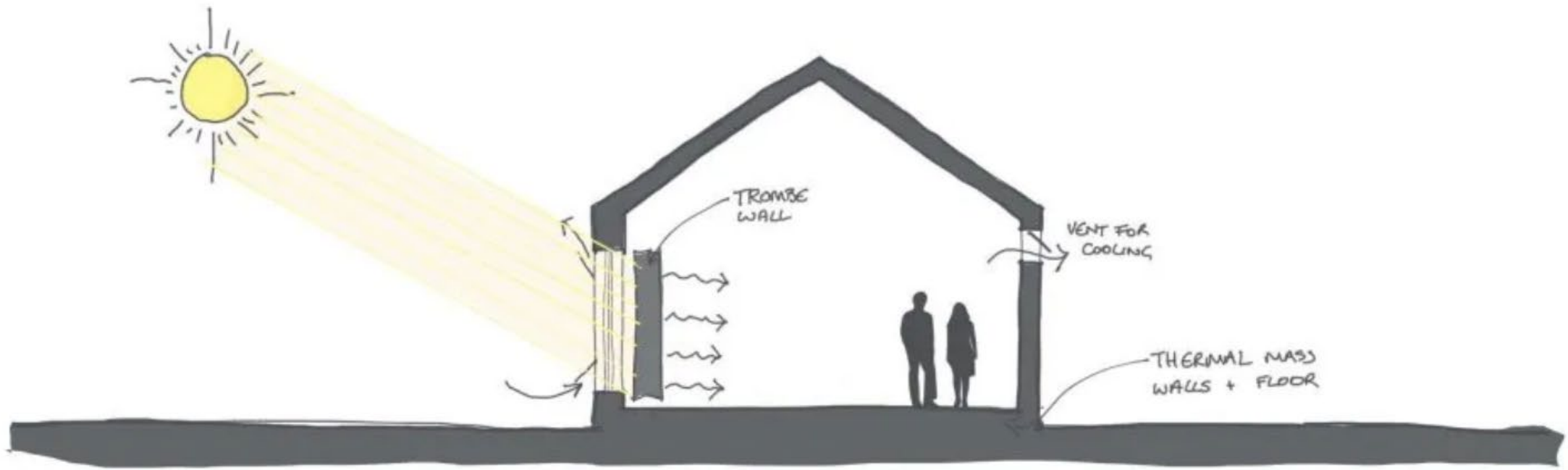
- Natural sun protection is also an option in low level buildings in the form of deciduous trees.
- The leafy tree will offer natural sun protection in summer, but in winter will allow the sun to pass through the tree letting warmth and light into the room





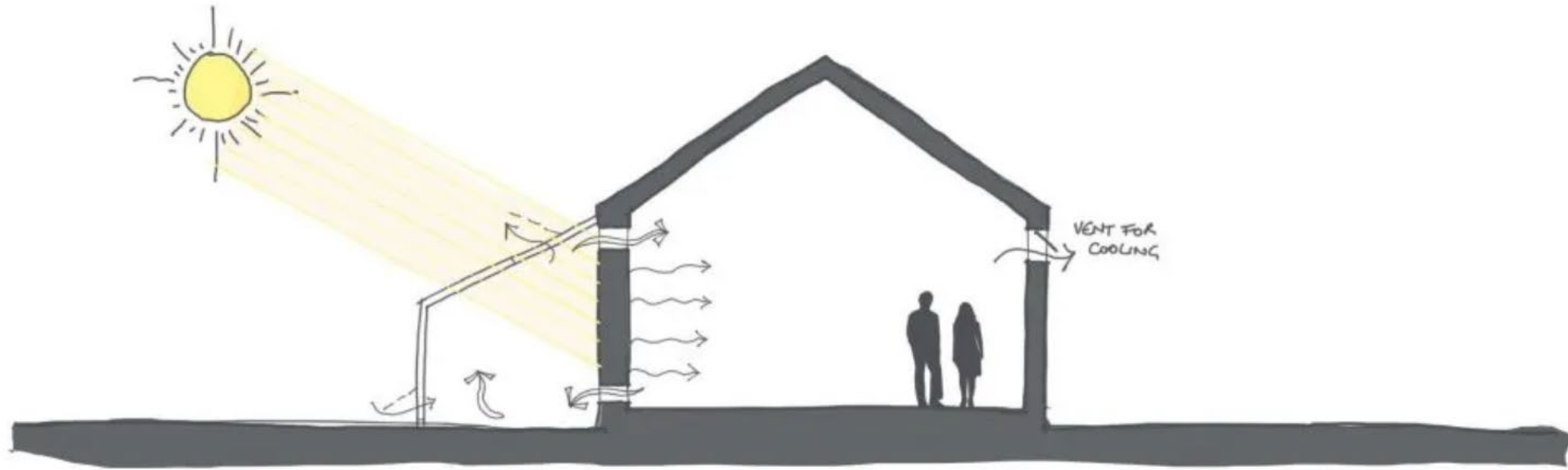
DIRECT GAIN

- Sunlight will enter the house through the south facing glazing and is absorbed into the thermal mass of the masonry floor or walls
- The heat is then slowly radiated back out into the room during the evening and night when the temperature outside is cooler.



INDIRECT GAIN

- Thermal mass between the south facing windows and the living area.
- The heat from the sun will be absorbed through the window and into the dark coloured masonry wall.
- The heat travels through the masonry wall and is radiated into the living space when the indoor temperature falls below that of the walls surface



ISOLATED GAIN

- The space will have a floor of high thermal mass and a wall separating the sunspace from the living space which is also high thermal storage.
- The space will become heated in the day and the stored heat can be radiated into the living spaces during the evening and night time.

VIEW



PRIVACY



SECURITY



ACCESS



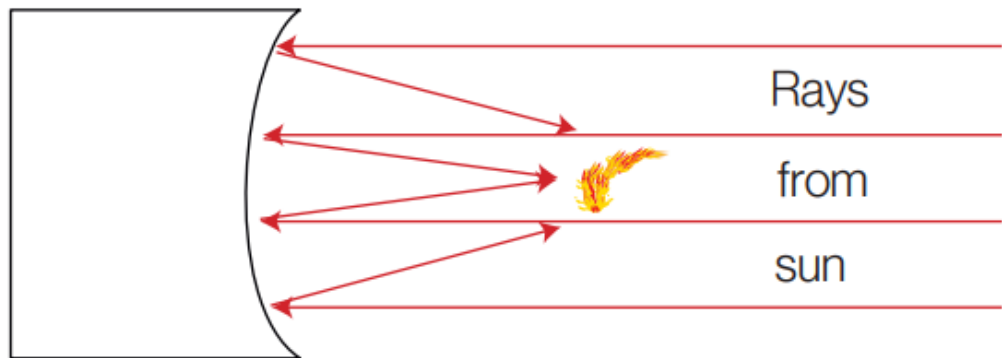
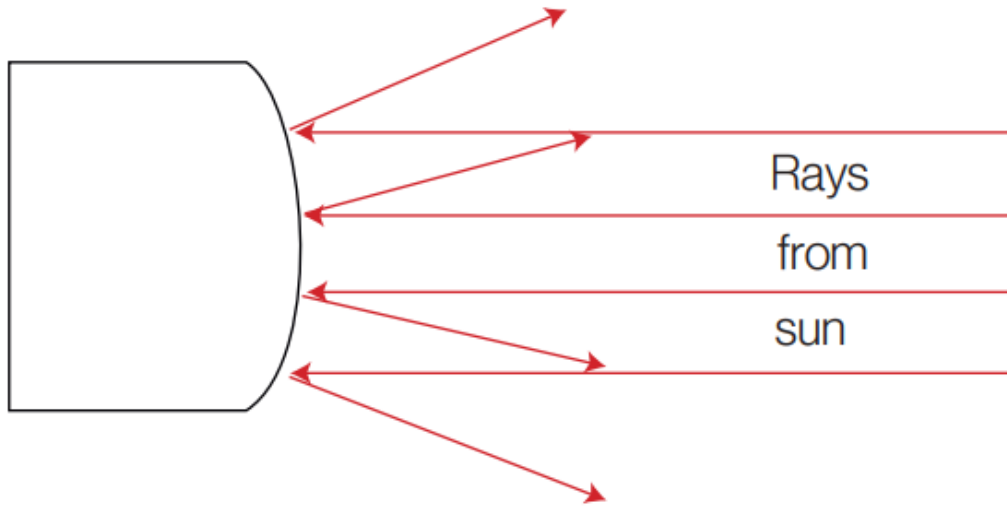
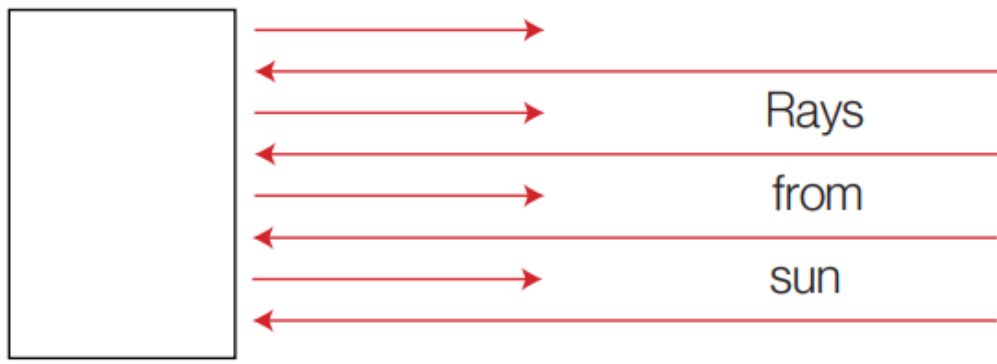
ACCESS



SOLAR DAZZLE

- Glare or dazzle can occur when sunlight is reflected from a glazed façade or area of metal cladding
- Discomfort glare causes visual discomfort without necessarily affecting the ability to see.
- Disability glare happens when a bright source of light impairs the vision of other objects.





SUN CONVERGENCE

- Solar convergence can happen when a reflective structure has a concave arrangement of elements that focus the sun's rays.
- The structure can be concave on plan, in section, or both



20 FENCHURCH ST

'Walkie-Talkie' skyscraper melts Jaguar car parts

🕒 2 September 2013



Sun rays —

The concave shape of the skyscraper means that a large amount of **sunlight** is relected into a small area



This effect currently lasts for around **two hours per day**, and is suggested to be present for approximately **two to three weeks**, due to the **changing position** of the sun in the sky

Curved face

Walkie Talkie skyscraper to be fitted with permanent sunshade after it melted cars

The 37-storey building's design reflects sun rays onto a nearby street

