

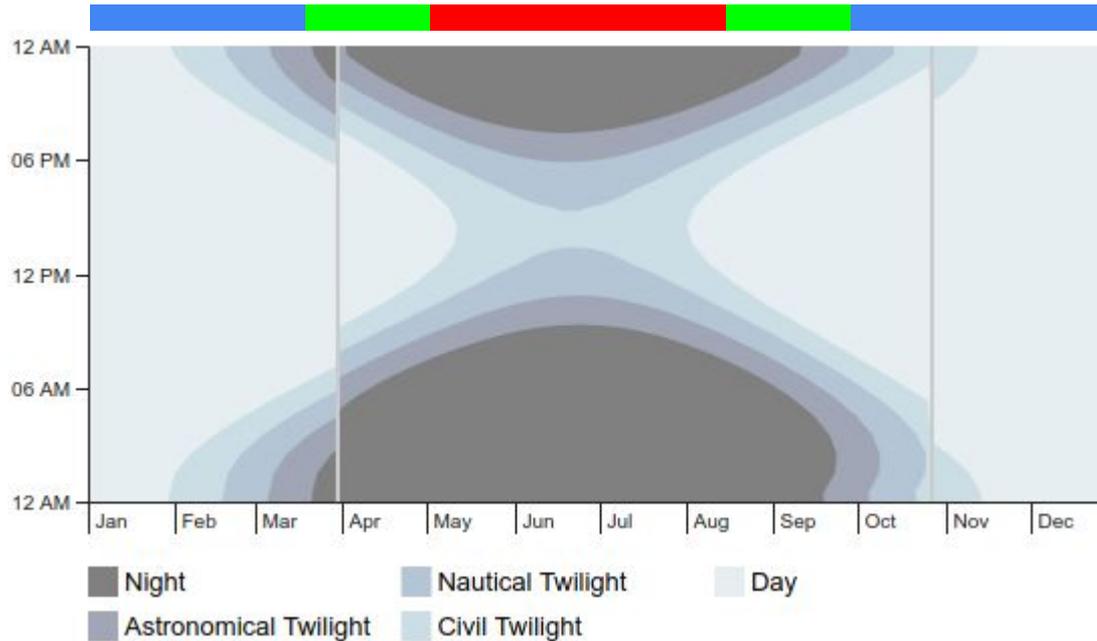
1:1 IAP - Troll Station Meeting 06/03/2026

Group 4

Anaëlle Mathieu
Niels Koenraad
Luca Marchetti
Aashna Singh
Sohyun Park
Ilai Debazi



01 Nature of Daylight: **Daylight Cycle**



■ **Arctic Summer (Midnight Sun)**
(~ 4 months)

■ **Arctic Winter (Polar Night)**
(~ 4 months)

■ **Transition (Spring+Autumn)**
(~ 4 months)

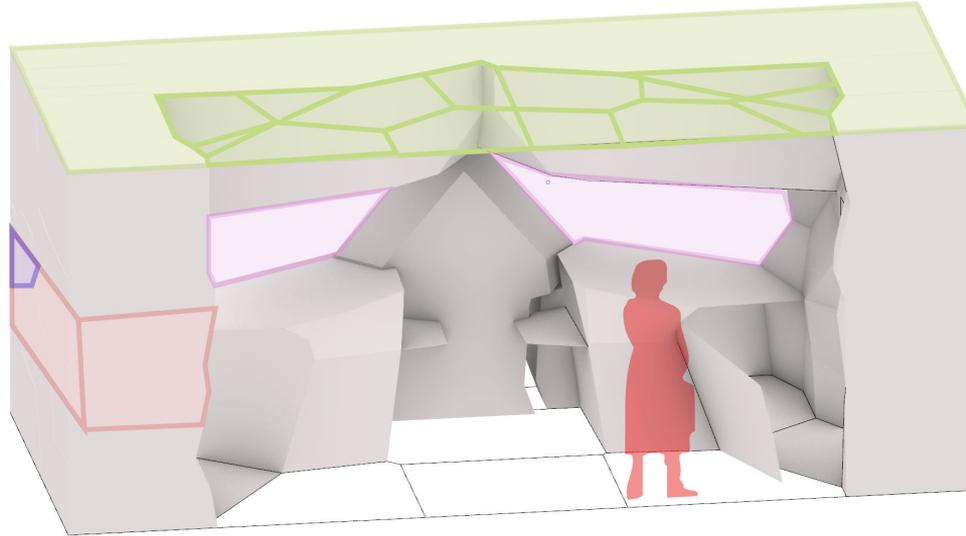
02 Integration of Light

(I) Skylight

(II) Light as Spectacle

(III) Individual Lighting

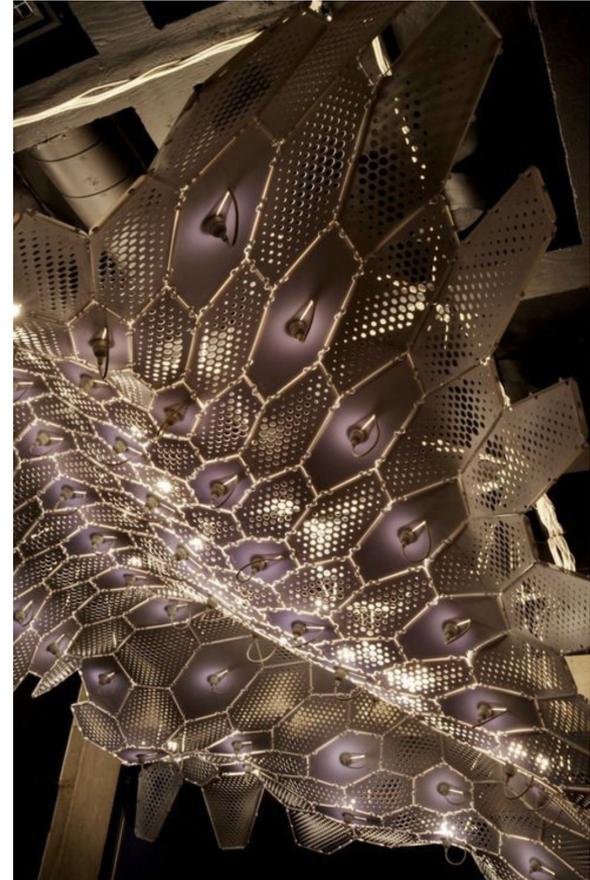
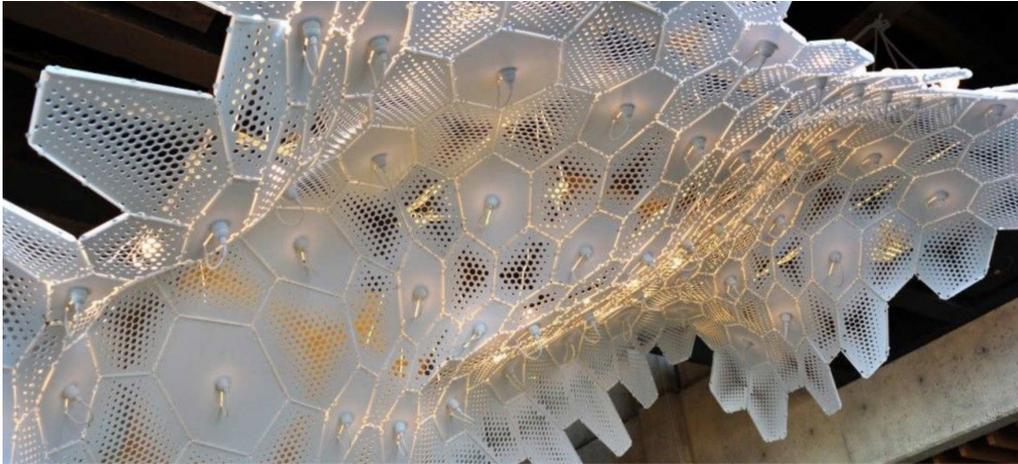
(IV) Light Therapy



02 Integration of light: **Skylight**

(I) Skylight

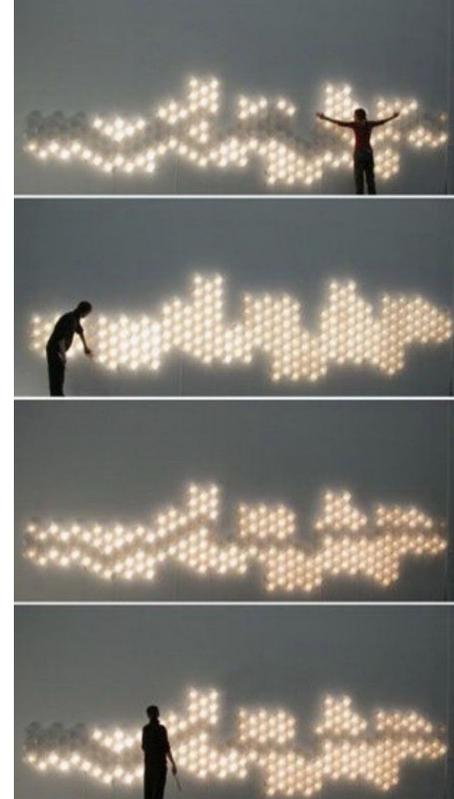
- + Human Activity Recognition (HAR)
- + Reacting to different temporalities
- + Performative Uses (i.e. Wind blowing through leaves)
- + Hue, brightness and color-temperature
- + Panels integrate Ventilation; fire detection; adaptive lighting; environmental sensors; acoustic absorption



02 Integration of light: **Light as Spectacle**

(II) Light as Spectacle (Walls, Window)

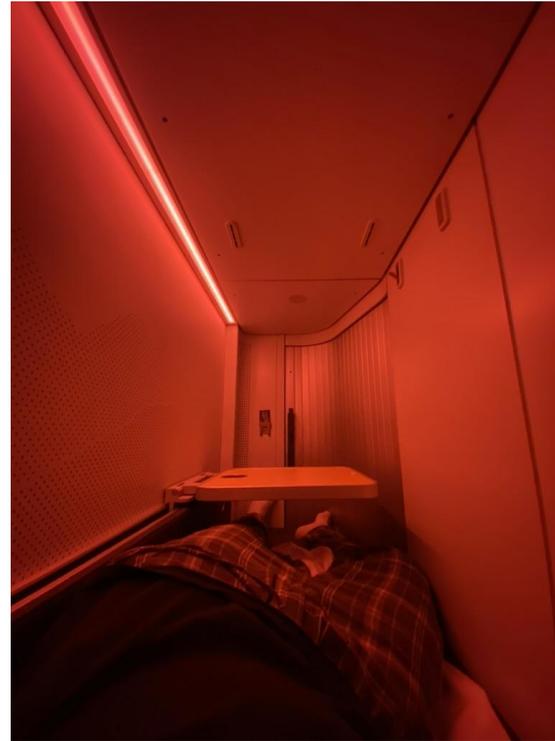
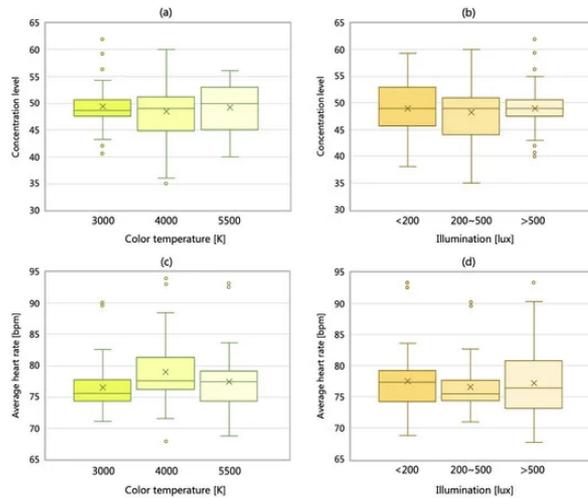
- + Computer Vision (CV) translates outdoor environment into spectacle
- + Reacting to different temporalities
- + Performative
- + **Cognitive Stimulation and Psychological orientation**
- + Shows live from outside



02 Integration of light: Individual Lighting

(III) Individual Lighting

- + Autoregressive Integrated Moving Average (ARIMA) and Ventilation Autoregressive (AR)
- + Personalized circadian cycle
- + Personalized atmospheric lighting
- + Personalized Hue and Brightness



02 Integration of light: **Light Therapy**

(IV) Light Therapy

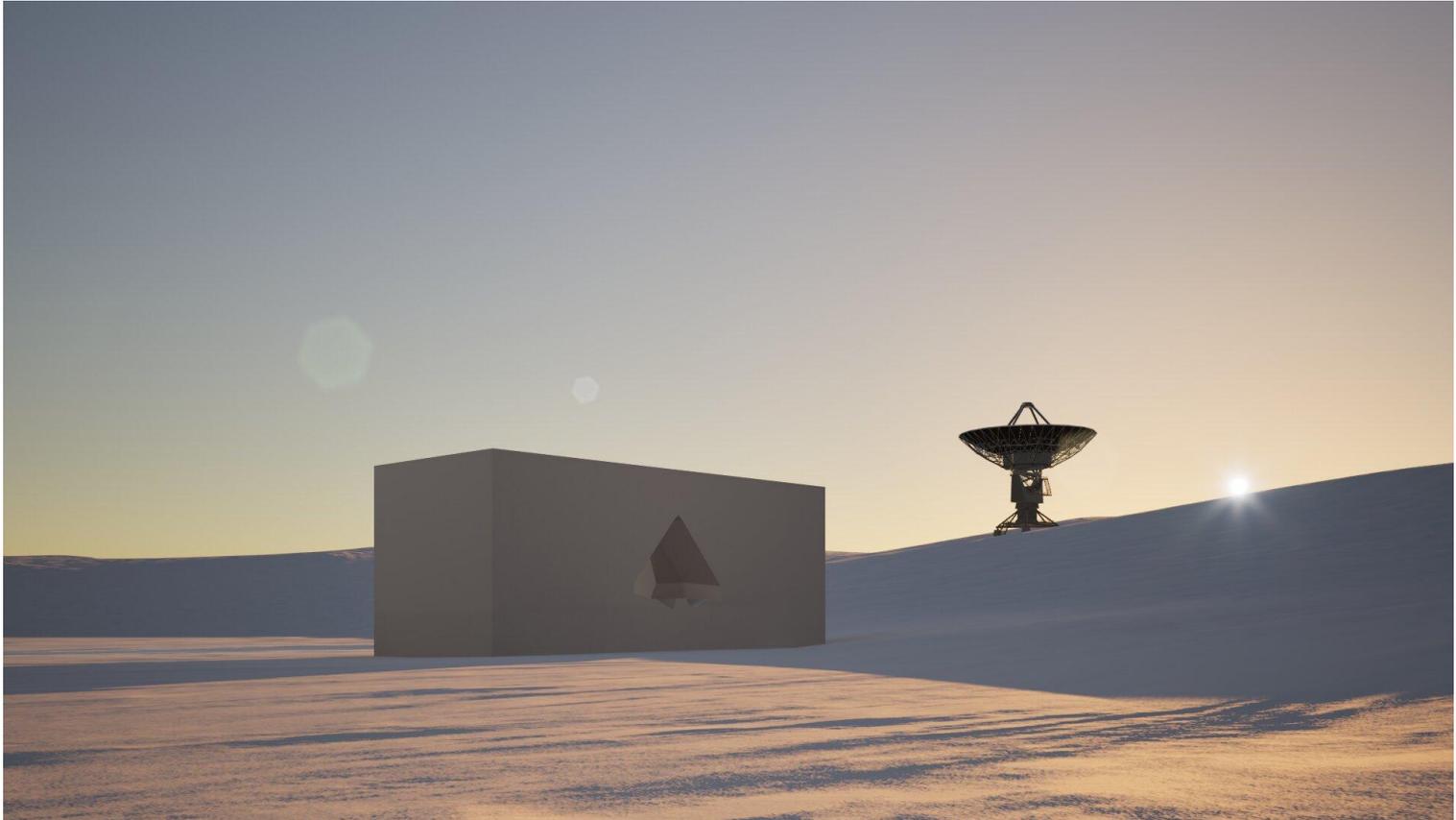
- + Red-light (630–850nm) for recovery + mood
- + 10,000 lux daylight therapy for winter activation
- + adaptive circadian cycle (seasonal sunrise–sunset + summer dimming) (ML) (DL)
- + **AI-controlled lux/CCT via biometric feedback (ML) (DL)**
- + glare-free integrated panels with timed exposure



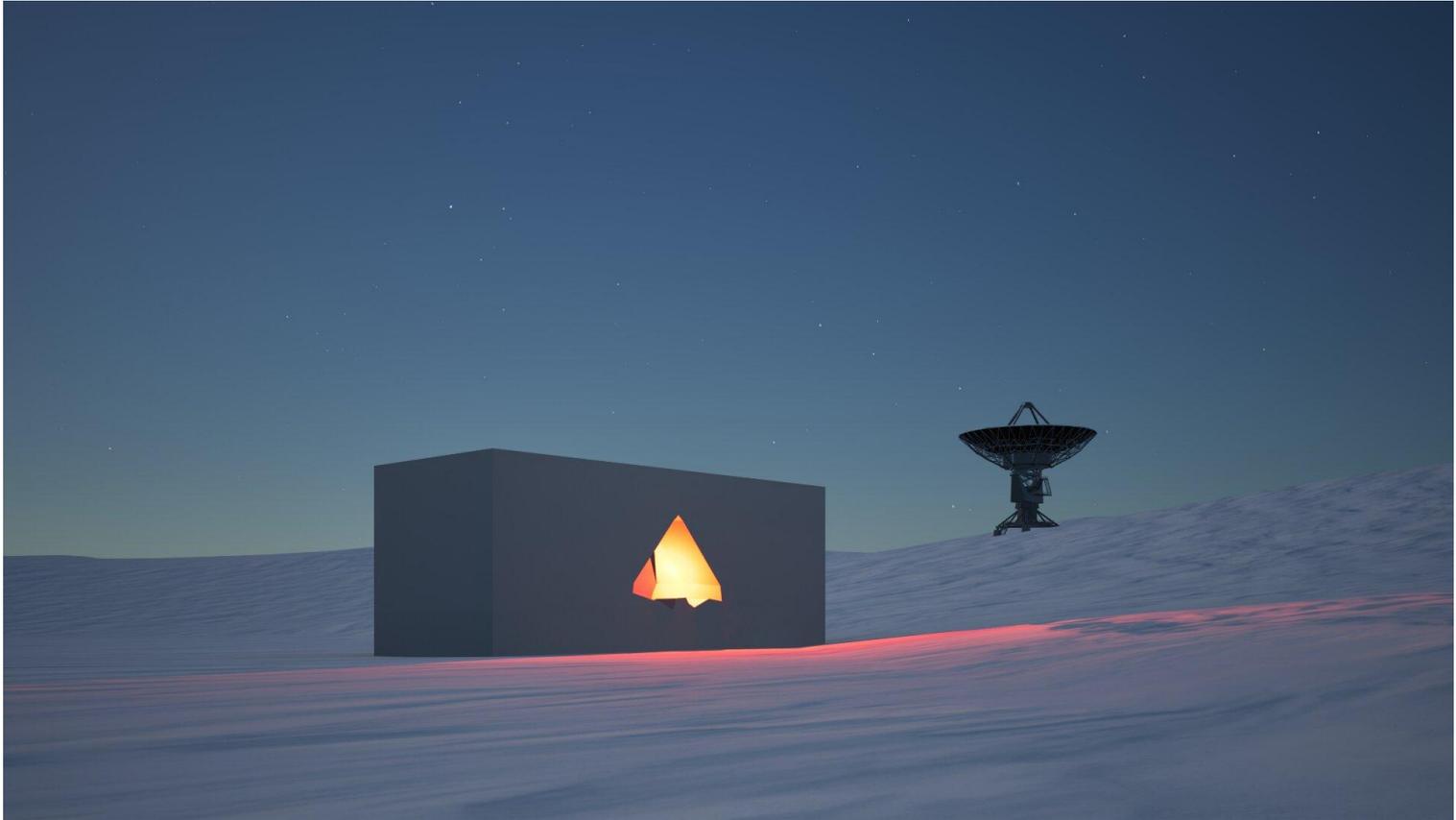
02 Integration of light: **Visualizations**



02 Integration of light: **Visualization Exterior**



02 Integration of light: **Visualization Interior**



02 Integration of AI in lighting **Summary of tutorial**

Supervised learning:

- + Input variables / features (weather data and physiological data)
- + Output values / labels (lighting condition generation)

Data Visualization:

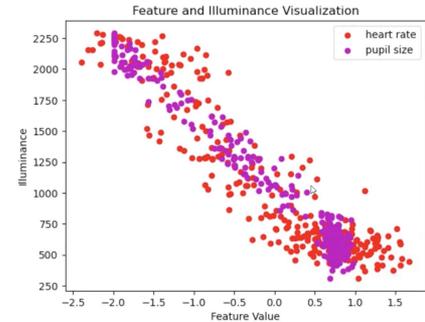
- + Visualizing data sets using scatter plots (show correlations in the data)
- + Understanding the data before training the model for more accuracy

Training the model:

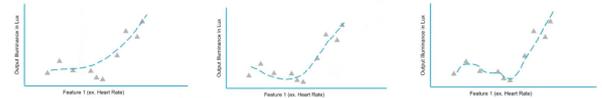
- + Supervised learning regression: learning to predict from data
- + Poor or limited datasets can cause the model to learn incorrect patterns and produce unreliable results

Evaluation of model performance:

- + R square score (MSE, MAE)
- + Evaluation of how well the model is trained to reflect the data accurately



Supervised Learning Regression



02 Integration of AI in lighting **Relevance to project**

(A)

	INPUT DATA	DEFINITION	INFLUENCE ON ILLUMINANCE (OUTPUT DATA)	INFLUENCE ON CCT (KELVIN) (OUTPUT DATA)	
WEATHER DATA	1	OUTDOOR TEMPERATURE	AMBIENT OUTDOOR AIR TEMPERATURE	INCREASE LUX IN COLDER ENVIRONMENTS TO SUPPORT ALERTNESS AND COMFORT.	COOLER CCT IN COLD ENVIRONMENTS TO STIMULATE ALERTNESS OR WARMER CCT FOR COMFORT.
	2	DIRECT NORMAL RADIATION	DIRECT SOLAR RADIATION ON A PERPENDICULAR SURFACE TO THE SUN'S RAYS	HIGH VALUE = STRONG SUNLIGHT.DIM ARTIFICIAL LIGHTS WHEN DIRECT SUNLIGHT IS HIGH TO AVOID OVER-ILLUMINATION.	STRONG DIRECT SUNLIGHT = NEUTRAL-COOL SPECTRUM; MATCH NATURAL DAYLIGHT (5000-6500K).
	3	RELATIVE HUMIDITY	AMOUNT OF WATER VAPOR IN AIR RELATIVE TO MAXIMUM POSSIBLE AT THAT TEMPERATURE	INCREASE INDOOR LUX ON HUMID, OVERCAST DAYS TO COMPENSATE FOR LOWER DAYLIGHT.	CLOUDY, HUMID CONDITIONS= COOLER DIFFUSED DAYLIGHT; ADJUST KELVIN COOLER TO SIMULATE NATURAL DAYLIGHT
	4	DIFFUSE NORMAL RADIATION	SOLAR RADIATION SCATTERED BY ATMOSPHERE REACHING THE GROUND INDIRECTLY	OVERCAST AND SCATTERED LIGHTING INCREASE LUX TO MAINTAIN STABLE VISUAL CONDITIONS.	DIFFUSE LIGHT FROM CLOUDS= COOLER AND SOFTER DAYLIGHT; ADJUST TOWARD NEUTRAL-COOL CCT.
	5	GLOBAL HORIZONTAL RADIATION	TOTAL SOLAR RADIATION ON A HORIZONTAL SURFACE (DIRECT + DIFFUSE)	HIGH RADIATION = STRONG NATURAL LIGHT REDUCE ARTIFICIAL LUX WHEN SOLAR	CALIBRATE TOWARD HIGHER KELVIN (5500-6500K) ON BRIGHT DAYLIGHT DAYS.
	6	INFRARED RADIATION	THERMAL RADIATION EMITTED BY ATMOSPHERE AND SURROUNDING SURFACES	DOES NOT DIRECTLY AFFECT VISIBLE LUX BUT HIGH INFRARED LEVELS MAY SIGNAL A NEED TO ADJUST COMFORT LIGHTING	DOES NOT DIRECTLY INFLUENCE VISIBLE SPECTRUM; MATCH NATURAL DAYLIGHT TO REFLECT WARMER ATMOSPHERE
	7	DIRECT NORMAL ILLUMINANCE	DIRECT SUNLIGHT MEASURED AS VISIBLE LIGHT INTENSITY	HIGH VALUE = BRIGHT DIRECT LIGHT DECREASE ARTIFICIAL LUX TO PREVENT GLARE AND OVEREXPOSURE.	SET NEUTRAL TO SLIGHTLY WARM CCT (4500-5500K) BASED ON SOLAR ANGLE.
	8	DIFFUSE HORIZONTAL ILLUMINANCE	SCATTERED DAYLIGHT ILLUMINATION MEASURED ON A HORIZONTAL SURFACE	SOFT DAYLIGHT UNDER CLOUD COVER INCREASE ARTIFICIAL LUX TO COMPENSATE FOR SOFT, LOW DAYLIGHT.	SET COOLER CCT (6000-7500K) TO MATCH SCATTERED DAYLIGHT CONDITIONS.
	9	GLOBAL HORIZONTAL ILLUMINATION	TOTAL VISIBLE DAYLIGHT ILLUMINATION ON A HORIZONTAL SURFACE (DIRECT + DIFFUSE)	REDUCE ARTIFICIAL LUX WHEN VALUES ARE HIGH; INCREASE WHEN VALUES ARE LOW.	MATCH OUTDOOR DAYLIGHT SPECTRUM WHEN DAYLIGHT DOMINATES TO MAINTAIN CIRCADIAN ALIGNMENT.
	10	TOTAL SKY COVER	FRACTION OF THE SKY COVERED BY CLOUDS	INCREASE ARTIFICIAL LUX AS SKY COVER INCREASES TO MAINTAIN CONSTANT BRIGHTNESS.	SHIFT TOWARD HIGHER KELVIN AS CLOUD COVER INCREASES DUE TO SCATTERED COOLER DAYLIGHT.
PHYSIOLOGICAL DATA	11	HRV RMSSD MS (HEART RATE VARIABILITY - ROOT MEAN SQUARE OF SUCCESSIVE DIFFERENCES, MILLISECONDS)	MEASURE OF AUTONOMIC NERVOUS SYSTEM BALANCE AND STRESS LEVEL.	LOW HRV = STRESS INDICATOR REDUCE LUX WHEN HRV IS LOW TO CREATE A CALMER, LESS STIMULATING ENVIRONMENT.	SET WARMER KELVIN WHEN HRV IS LOW TO SUPPORT RELAXATION AND PARASYMPATHETIC ACTIVATION.
	12	HEART RATE BPM (BEATS PER MINUTE)	NUMBER OF HEARTBEATS PER MINUTE	REDUCE LUX WHEN HEART RATE IS ELEVATED TO CALM THE USER; INCREASE LUX WHEN HEART RATE IS LOW TO STIMULATE	SET COOLER KELVIN (5000-6500K) TO INCREASE ALERTNESS AND PHYSIOLOGICAL ACTIVATION.
	13	PUPIL_MM (PUPIL DIAMETER, MILLIMETERS)	SIZE OF THE PUPIL INDICATING LIGHT ADAPTATION OR COGNITIVE LOAD	LARGER PUPILS OFTEN INDICATE LOW LIGHT; SYSTEM MAY INCREASE ILLUMINANCE.	SHIFT TOWARD COOLER DAYLIGHT KELVIN WHEN PUPILS ARE SMALL IN BRIGHT CONDITIONS.
	14	BLINK RATE PER MINUTE	FREQUENCY OF EYE BLINKS, OFTEN LINKED TO FATIGUE OR COGNITIVE LOAD	INCREASE LUX WHEN BLINK RATE IS HIGH TO REDUCE FATIGUE AND IMPROVE ALERTNESS.	SET COOLER KELVIN TO REDUCE DROWSINESS AND IMPROVE ATTENTIONAL FOCUS.
	15	SKIN CONDUCTANCE US (SKIN CONDUCTANCE)	ELECTRICAL CONDUCTANCE OF SKIN LINKED TO STRESS OR AROUSAL	HIGH CONDUCTANCE INDICATES STRESS; LIGHTING LUX MAY BE LOWERED TO REDUCE STIMULATION.	SET WARMER KELVIN (2700-3500K) TO SUPPORT A CALMING ENVIRONMENT.
	16	RESPIRATORY RATE BPM (BREATHS PER MINUTE)	NUMBER OF BREATHS PER MINUTE	REDUCE LUX WHEN RESPIRATORY RATE IS HIGH FOR CALMNESS; INCREASE LUX WHEN RESPIRATORY RATE IS LOW TO STIMULATE	SET WARMER KELVIN FOR SLOWER BREATHING STATES; COOLER KELVIN FOR FASTER ALERT STATES.

(B)

- + 16 Input variables / features from data set **(weather data and physiological data)**
- + Output values / labels from data set: optimal lighting conditions (illuminance in lux and CCT in Kelvin)"

02 Lighting with use of AI Weather data

INTEGRATION IN OUR PROJECT

		INPUT DATA	DEFINITION	INFLUENCE ON ILLUMINANCE (OUTPUT DATA)	INFLUENCE ON CCT (KELVIN) (OUTPUT DATA)	TYPE OF ARTIFICIAL LIGHT	PROPOSED IMPLEMENTATION
WEATHER DATA	1	OUTDOOR TEMPERATURE	AMBIENT OUTDOOR AIR TEMPERATURE	INCREASE LUX IN COLDER ENVIRONMENTS TO SUPPORT ALERTNESS AND COMFORT.	COOLER CCT IN COLD ENVIRONMENTS TO STIMULATE ALERTNESS OR WARMER CCT FOR COMFORT.	(I) SKYLIGHT (II) LIGHT AS SPECTACLE	SHOWCASING VISUALLY HOW COLD OR SUPER COLD IT IS OUTSIDE
	2	DIRECT NORMAL RADIATION	DIRECT SOLAR RADIATION ON A PERPENDICULAR SURFACE TO THE SUN'S RAYS	HIGH VALUE = STRONG SUNLIGHT.DIM ARTIFICIAL LIGHTS WHEN DIRECT SUNLIGHT IS HIGH TO AVOID OVER-ILLUMINATION.	STRONG DIRECT SUNLIGHT = NEUTRAL COOL SPECTRUM. MATCH NATURAL DAYLIGHT (5000-6500K).	(I) SKYLIGHT (II) LIGHT AS SPECTACLE	BRIGHTER = LIGHTS CAN DIM MORE (FOR ENERGY EFFICIENCY DURING SUMMER)
	3	RELATIVE HUMIDITY	AMOUNT OF WATER VAPOR IN AIR RELATIVE TO MAXIMUM POSSIBLE AT THAT TEMPERATURE	INCREASE INDOOR LUX ON HUMID, OVERCAST DAYS TO COMPENSATE FOR LOWER DAYLIGHT.	CLOUDY, HUMID CONDITIONS= COOLER DIFFUSED DAYLIGHT; ADJUST KELVIN COOLER TO SIMULATE NATURAL DAYLIGHT	(I) SKYLIGHT (II) LIGHT AS SPECTACLE	DOESNT CHANGE A LOT DURING THE YEAR
	4	DIFFUSE NORMAL RADITATION	SOLAR RADIATION SCATTERED BY ATMOSPHERE REACHING THE GROUND INDIRECTLY	OVERCAST AND SCATTERED LIGHTING INCREASE LUX TO MAINTAIN STABLE VISUAL CONDITIONS.	DIFFUSE LIGHT FROM CLOUDS= COOLER AND SOFTER DAYLIGHT; ADJUST TOWARD NEUTRAL-COOL CCT.	(I) SKYLIGHT	SHIFT TO COOLER LIGHT WHEN CLOUDY
	5	GLOBAL HORIZONTAL RADIATION	TOTAL SOLAR RADIATION ON A HORIZONTAL SURFACE (DIRECT + DIFFUSE)	HIGH RADIATION = STRONG NATURAL LIGHT REDUCE ARTIFICIAL LUX WHEN SOLAR	CALIBRATE TOWARD HIGHER KELVIN (5500-6500K) ON BRIGHT DAYLIGHT DAYS.	(I) SKYLIGHT	BRIGHTER = LIGHTS CAN DIM MORE (FOR ENERGY EFFICIENCY DURING SUMMER)
	6	INFRARED RADIATION	THERMAL RADIATION EMITTED BY ATMOSPHERE AND SURROUNDING SURFACES	DOES NOT DIRECTLY AFFECT VISIBLE LUX BUT HIGH INFRARED LEVELS MAY SIGNAL A NEED TO ADJUST COMFORT LIGHTING	DOES NOT DIRECTLY INFLUENCE VISIBLE SPECTRUM KELVIN; SHIFT SLIGHTLY WARMER TO REFLECT WARMER ATMOSPHERIC CONDITIONS.	(I) SKYLIGHT	BRIGHTER = LIGHTS CAN DIM MORE (FOR ENERGY EFFICIENCY DURING SUMMER)
	7	DIRECT NORMAL ILLUMINANCE	DIRECT SUNLIGHT MEASURED AS VISIBLE LIGHT INTENSITY	HIGH VALUE = BRIGHT DIRECT LIGHT DECREASE ARTIFICIAL LUX TO PREVENT GLARE AND OVEREXPOSURE.	SET NEUTRAL TO SLIGHTLY WARM CCT (4500-5500K) BASED ON SOLAR ANGLE.	(I) SKYLIGHT	BRIGHTER = LIGHTS CAN DIM MORE (FOR ENERGY EFFICIENCY DURING SUMMER)
	8	DIFFUSE HORIZONTAL ILLUMINANCE	SCATTERED DAYLIGHT ILLUMINATION MEASURED ON A HORIZONTAL SURFACE	SOFT DAYLIGHT UNDER CLOUD COVER INCREASE ARTIFICIAL LUX TO COMPENSATE FOR SOFT, LOW DAYLIGHT.	SET COOLER CCT (6000-7500K) TO MATCH SCATTERED DAYLIGHT CONDITIONS.	(I) SKYLIGHT	BRIGHTER = LIGHTS CAN DIM MORE (FOR ENERGY EFFICIENCY DURING SUMMER)
	9	GLOBAL HORIZONTAL ILLUMINATION	TOTAL VISIBLE DAYLIGHT ILLUMINATION ON A HORIZONTAL SURFACE (DIRECT + DIFFUSE)	REDUCE ARTIFICIAL LUX WHEN VALUES ARE HIGH; INCREASE WHEN VALUES ARE LOW.	MATCH OUTDOOR DAYLIGHT SPECTRUM WHEN DAYLIGHT DOMINATES TO MAINTAIN CIRCADIAN ALIGNMENT.	(I) SKYLIGHT	BRIGHTER = LIGHTS CAN DIM MORE (FOR ENERGY EFFICIENCY DURING SUMMER)
	10	TOTAL SKY COVER	FRACTION OF THE SKY COVERED BY CLOUDS	INCREASE ARTIFICIAL LUX AS SKY COVER INCREASES TO MAINTAIN CONSTANT BRIGHTNESS.	SHIFT TOWARD HIGHER KELVIN AS CLOUD COVER INCREASES DUE TO SCATTERED COOLER DAYLIGHT.	(I) SKYLIGHT (II) LIGHT AS SPECTACLE	BRIGHTER = LIGHTS CAN DIM MORE (FOR ENERGY EFFICIENCY DURING SUMMER)

02 Lighting with use of AI **Physiological data**

INTEGRATION IN OUR PROJECT

PHYSIOLOGICAL DATA		INPUT DATA	DEFINITION	INFLUENCE ON ILLUMINANCE (OUTPUT DATA)	INFLUENCE ON CCT (KELVIN) (OUTPUT DATA)	TYPE OF ARTIFICIAL LIGHT	PROPOSED IMPLIMENTATION
11	HRV RMSSD MS (HEART RATE VARIABILITY - ROOT MEAN SQUARE OF SUCCESSIVE DIFFERENCES, MILLISECONDS)	MEASURE OF AUTONOMIC NERVOUS SYSTEM BALANCE AND STRESS LEVEL	LOW HRV = STRESS INDICATOR REDUCE LUX WHEN HRV IS LOW TO CREATE A CALMER, LESS STIMULATING ENVI-	SET WARMER KELVIN WHEN HRV IS LOW TO SUPPORT RELAXATION AND PARASYMPATHETIC ACTIVATION.	(III) INDIVIDUAL LIGHTING (IV) LIGHT THERAPY	MEASURED DURING NIGHTTIME: CORRELATION BETWEEN SLEEP QUALITY. AIM: IMPROVE SLEEP QUALITY IN THE LONG RUN VIE PERSONALIZED LIGHT SETTINGS	
12	HEART RATE BPM (BEATS PER MINUTE)	NUMBER OF HEARTBEATS PER MINUTE	REDUCE LUX WHEN HEART RATE IS ELEVATED TO CALM THE USER; INCREASE LUX WHEN HEART RATE IS LOW TO STIMULATE	SET COOLER KELVIN (5000-6500K) TO INCREASE ALERTNESS AND PHYSIOLOGICAL ACTIVATION.	(III) INDIVIDUAL LIGHTING (IV) LIGHT THERAPY		
13	PUPIL MM (PUPIL DIAMETER, MILLIMETERS)	SIZE OF THE PUPIL INDICATING LIGHT ADAPTATION OR COGNITIVE LOAD	LARGER PUPILS OFTEN INDICATE LOW LIGHT; SYSTEM MAY INCREASE ILLUMINANCE.	SHIFT TOWARD COOLER DAYLIGHT KELVIN WHEN PUPILS ARE SMALL IN BRIGHT CONDITIONS.	(III) INDIVIDUAL LIGHTING (IV) LIGHT THERAPY		
14	BLINK RATE PER MINUTE	FREQUENCY OF EYE BLINKS, OFTEN LINKED TO FATIGUE OR COGNITIVE LOAD	INCREASE LUX WHEN BLINK RATE IS HIGH TO REDUCE FATIGUE AND IMPROVE ALERTNESS.	SET COOLER KELVIN TO REDUCE DROWSINESS AND IMPROVE ATTENTIONAL FOCUS.	(III) INDIVIDUAL LIGHTING (IV) LIGHT THERAPY		
15	SKIN CONDUCTANCE US (SKIN CONDUCTANCE,	ELECTRICAL CONDUCTANCE OF SKIN LINKED TO STRESS OR AROUSAL	HIGH CONDUCTANCE INDICATES STRESS; LIGHTING LUX MAY BE LOWERED TO REDUCE STIMULATION.	SET WARMER KELVIN (2700-3500K) TO SUPPORT A CALMING ENVIRONMENT.	(III) INDIVIDUAL LIGHTING (IV) LIGHT THERAPY		
16	RESPIRATORY RATE BPM (BREATHS PER	NUMBER OF BREATHS PER MINUTE	REDUCE LUX WHEN RESPIRATORY RATE IS HIGH FOR CALMNESS; INCREASE LUX WHEN RESPIRATORY RATE IS LOW TO STIMULATE	SET WARMER KELVIN FOR SLOWER BREATHING STATES; COOLER KELVIN FOR FASTER ALERT STATES.	(III) INDIVIDUAL LIGHTING (IV) LIGHT THERAPY		

02 Lighting with use of AI Data groupings

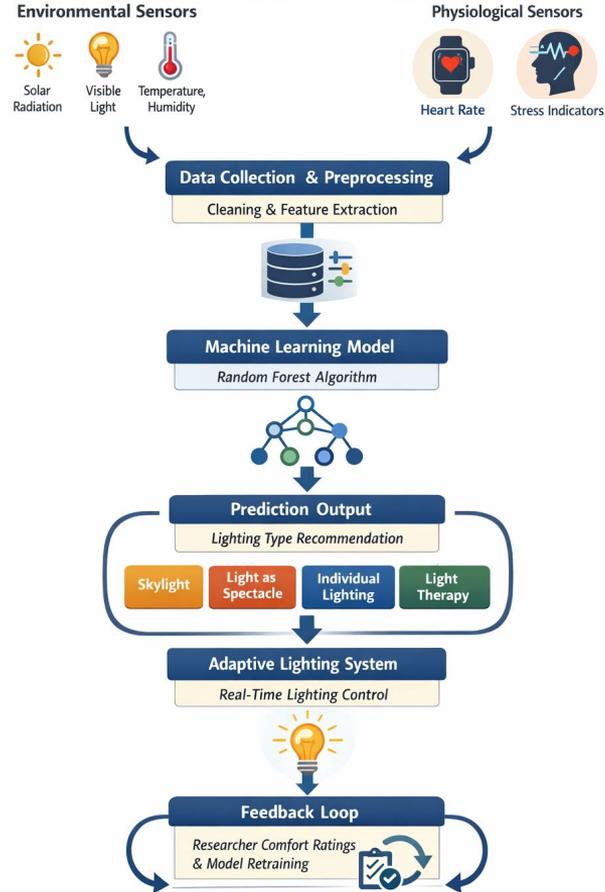
WEATHER DATA		INPUT DATA	DEFINITION
1	OUTDOOR TEMPERATURE	AMBIENT OUTDOOR AIR TEMPERATURE	
2	DIRECT NORMAL RADIATION	DIRECT SOLAR RADIATION ON A PERPENDICULAR SURFACE TO THE SUN'S RAYS	
3	RELATIVE HUMIDITY	AMOUNT OF WATER VAPOR IN AIR RELATIVE TO MAXIMUM POSSIBLE AT THAT TEMPERATURE	
4	DIFFUSE NORMAL RADIATION	SOLAR RADIATION SCATTERED BY ATMOSPHERE REACHING THE GROUND INDIRECTLY	
5	GLOBAL HORIZONTAL RADIATION	TOTAL SOLAR RADIATION ON A HORIZONTAL SURFACE (DIRECT + DIFFUSE)	
6	INFRARED RADIATION	THERMAL RADIATION EMITTED BY ATMOSPHERE AND SURROUNDING SURFACES	
7	DIRECT NORMAL ILLUMINANCE	DIRECT SUNLIGHT MEASURED AS VISIBLE LIGHT INTENSITY	
8	DIFFUSE HORIZONTAL ILLUMINANCE	SCATTERED DAYLIGHT ILLUMINATION MEASURED ON A HORIZONTAL SURFACE	
9	GLOBAL HORIZONTAL ILLUMINATION	TOTAL VISIBLE DAYLIGHT ILLUMINATION ON A HORIZONTAL SURFACE (DIRECT + DIFFUSE)	
10	TOTAL SKY COVER	FRACTION OF THE SKY COVERED BY CLOUDS	

PHYSIOLOGICAL DATA		INPUT DATA	DEFINITION
11	HRV RMSSD MS (HEART RATE VARIABILITY - ROOT MEAN SQUARE OF SUCCESSIVE DIFFERENCES, MILLISECONDS)	MEASURE OF AUTONOMIC NERVOUS SYSTEM BALANCE AND STRESS LEVEL	
12	HEART RATE BPM (BEATS PER MINUTE)	NUMBER OF HEARTBEATS PER MINUTE	
13	PUPIL MM (PUPIL DIAMETER, MILLIMETERS)	SIZE OF THE PUPIL INDICATING LIGHT ADAPTATION OR COGNITIVE LOAD	
14	BLINK RATE PER MINUTE	FREQUENCY OF EYE BLINKS, OFTEN LINKED TO FATIGUE OR COGNITIVE LOAD	
15	SKIN CONDUCTANCE US (SKIN CONDUCTANCE)	ELECTRICAL CONDUCTANCE OF SKIN LINKED TO STRESS OR AROUSAL	
16	RESPIRATORY RATE BPM (BREATHS PER MINUTE)	NUMBER OF BREATHS PER MINUTE	

+ **Grouping correlated features removes redundant data, helping the model focus on meaningful patterns and reducing the risk of overfitting.** (Allows for removal of some data features)

- + **Group 1: Solar Radiation Features** Direct normal radiation, diffuse normal radiation, global horizontal radiation (Measures total solar energy from different angles)
- + **Group 2: Visible Light Features:** Direct normal illumination, diffuse horizontal illumination, global horizontal illumination (Visible portion of light to human eye)
- + **Group 3: Atmospheric Conditions:** Outdoor temp, relative humidity, infrared radiation, total sky cover (overall atmosphere and weather)
- + **Group 4: Physiological stress indicators:** HRV rmssd, heart rate, skin conductance, respiratory rate (reflect stress and nervous system)
- + **Group 5: Eye response metrics:** Pupil diameter, blink rate (visual strain and fatigue measurements)

AI-Driven Adaptive Lighting Workflow



02 Lighting with use of AI **Next steps**

- + **Creating scatter plots and training the model**
- + **Finding practical ways to measure physiological data at the Trollstation:**
 - Group 4 - Smart watches
 - Group 5: Smart eyewear? (Hard to measure) - Could possibly leave the dataset out entirely
- + **Mapping model outputs to our four lighting types:**
 - Group 1: Solar Radiation features: (I) Skylight (II) Light as spectacle
 - Group 2: Visible Light Features: (I) Skylight (II) Light as spectacle
 - Group 3: Atmospheric conditions: (I) Skylight (II) Light as spectacle
 - Group 4: Physiological stress indicators: (III) Individual lighting (IV) Light therapy
 - Group 5: Eye response metrics: (IV) (III) Individual lighting (IV) Light therapy

Extra items

- + **Fine-tuning real time response**

Setting parameters so lighting doesn't immediately react to physiological changes (for example, lighting immediately turns warm for user with high heart rate)
- + **Create a feedback loop**

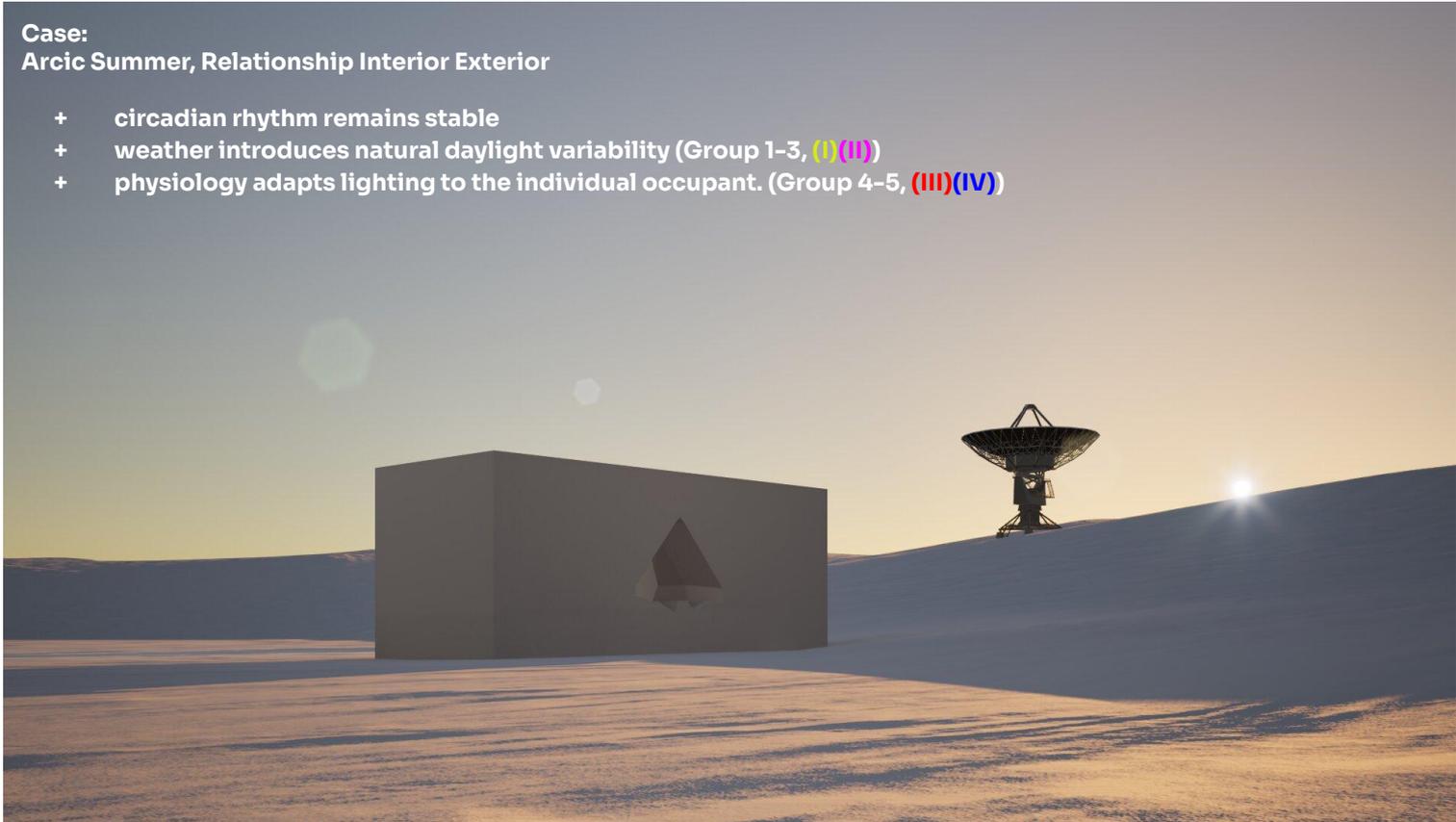
Researchers rate lighting comfort at regular intervals, allowing for the model to improve and retrain through real responses but also data over time

02 Integration of light: **Visualization Exterior Summer**

Case:

Arcic Summer, Relationship Interior Exterior

- + circadian rhythm remains stable
- + weather introduces natural daylight variability (Group 1-3, (I)(III))
- + physiology adapts lighting to the individual occupant. (Group 4-5, (III)(IV))

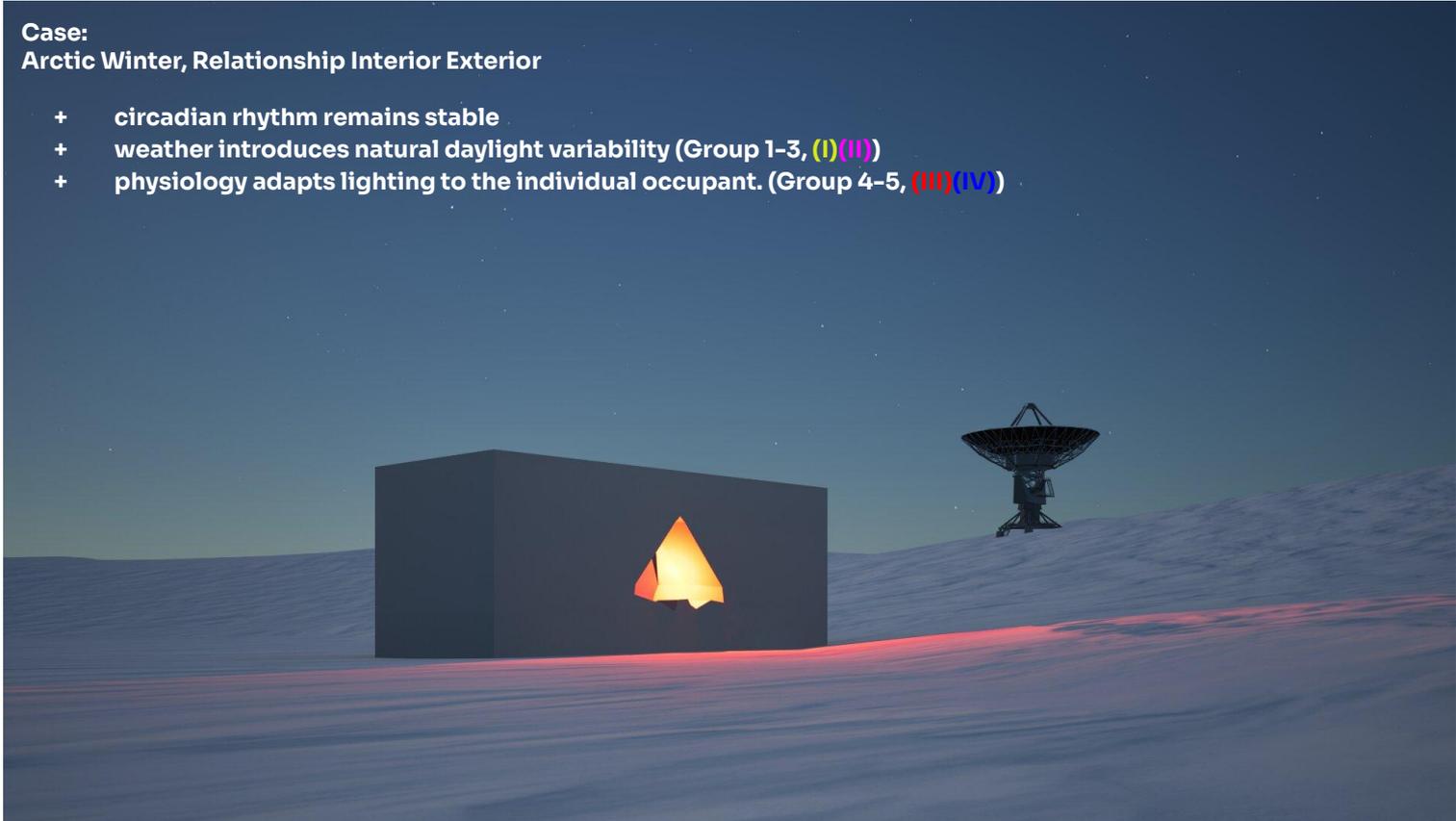


02 Integration of light: **Visualization Exterior Winter**

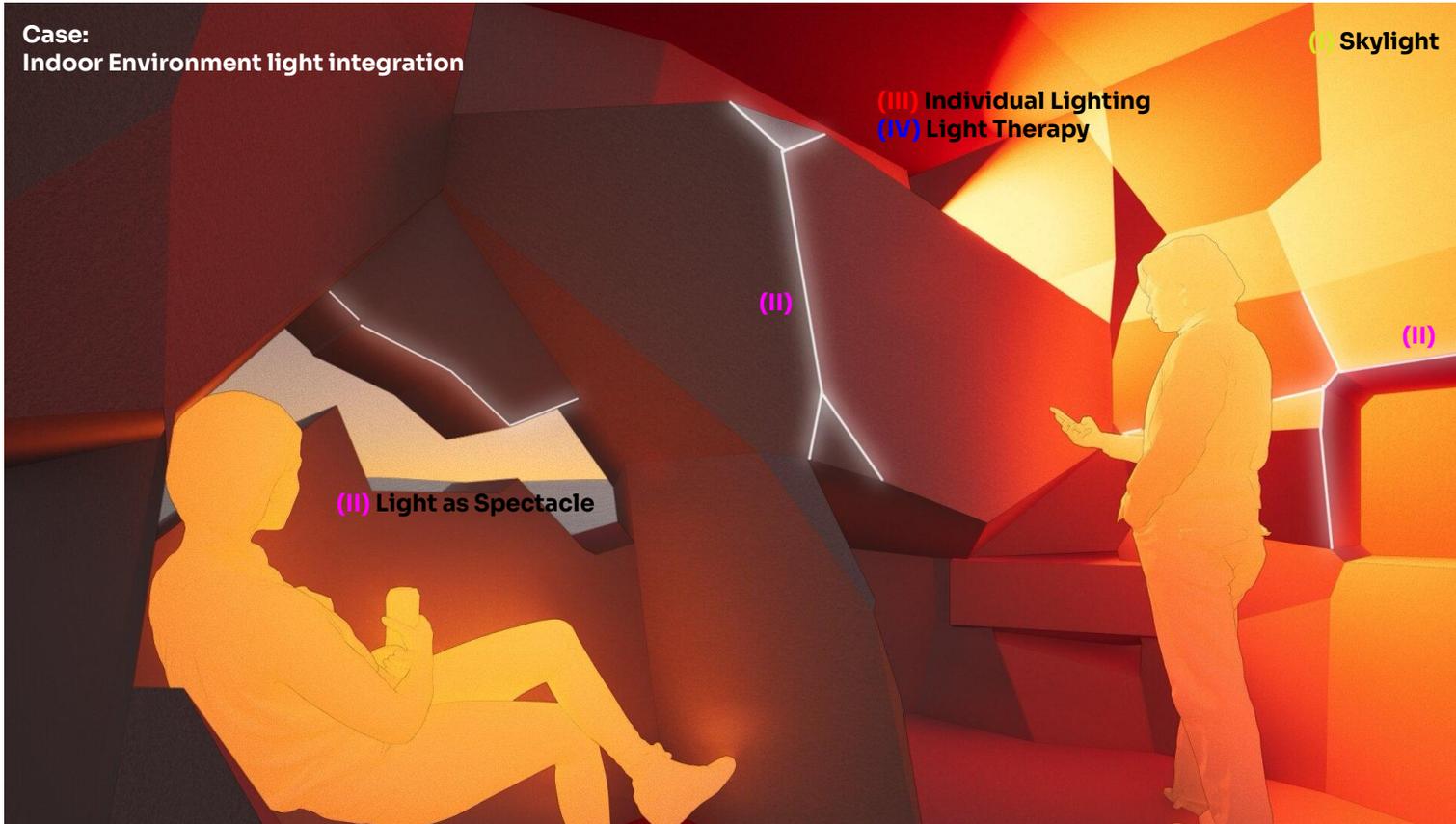
Case:

Arctic Winter, Relationship Interior Exterior

- + circadian rhythm remains stable
- + weather introduces natural daylight variability (Group 1-3, (I)(II))
- + physiology adapts lighting to the individual occupant. (Group 4-5, (III)(IV))

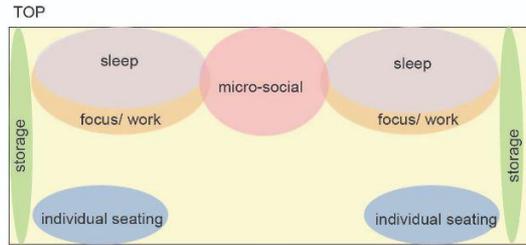
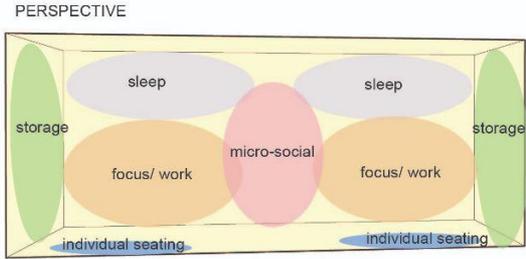


02 Integration of light: **Visualizations**

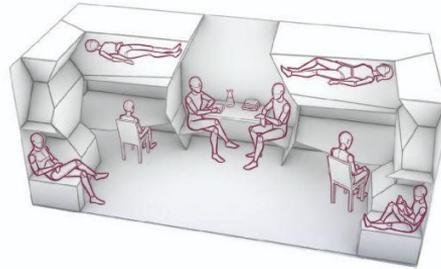
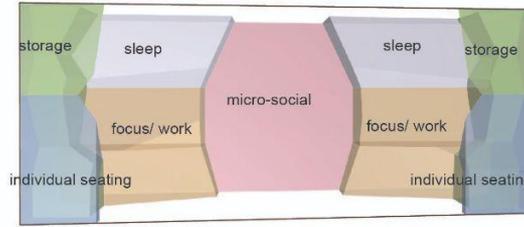


04 Design Process: from concept diagram to concept voronoi

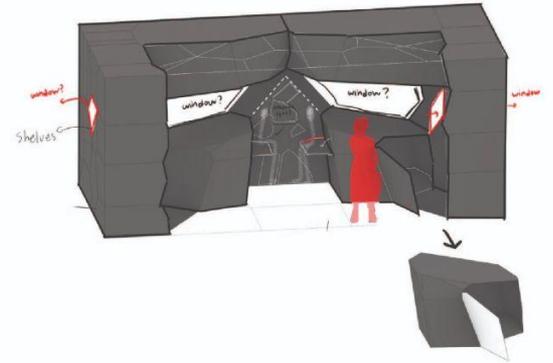
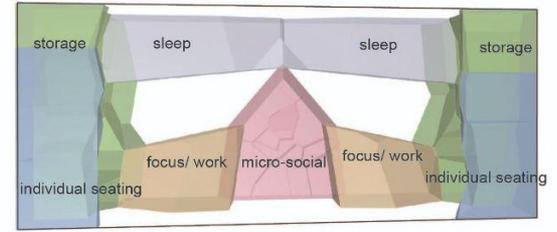
concept diagram



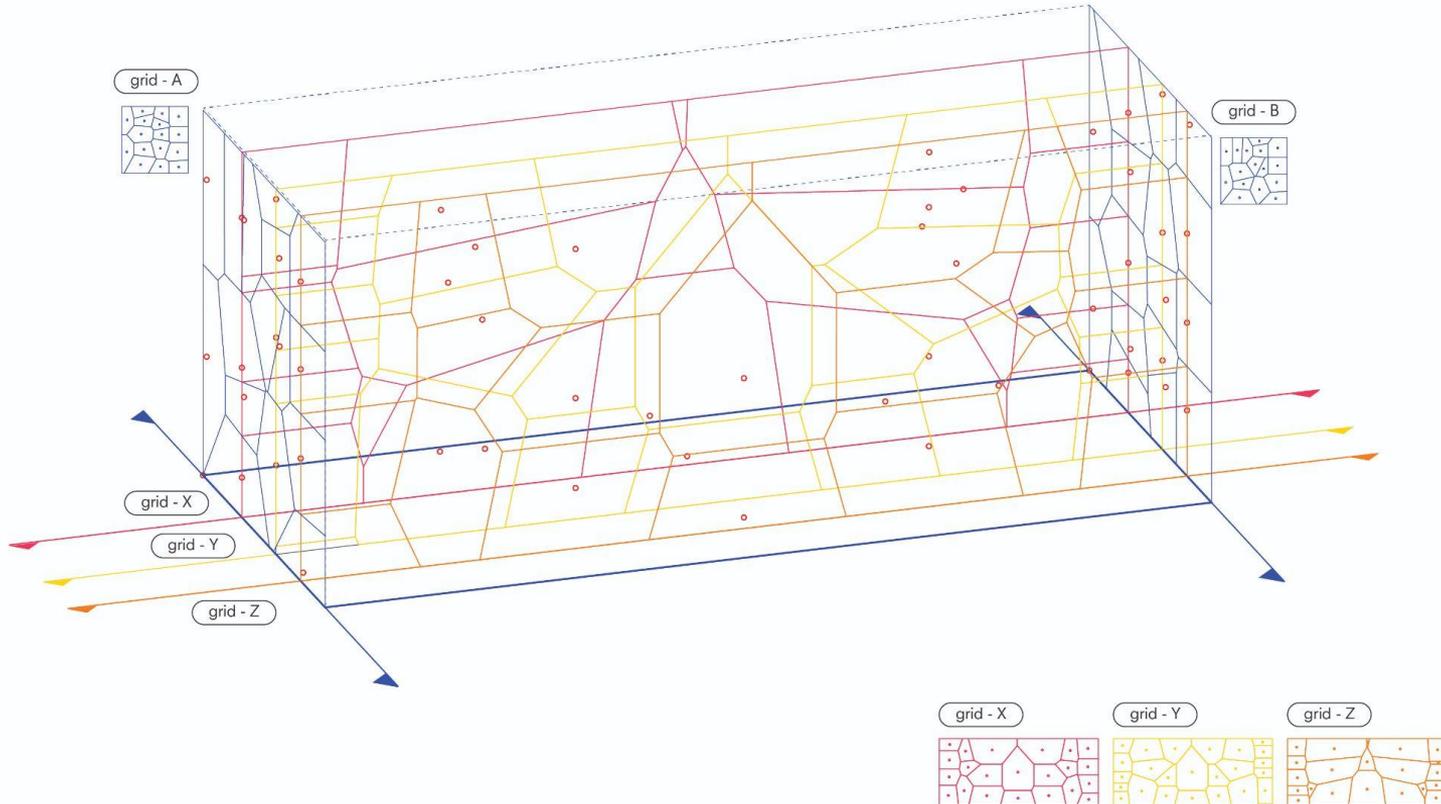
concept voronoi



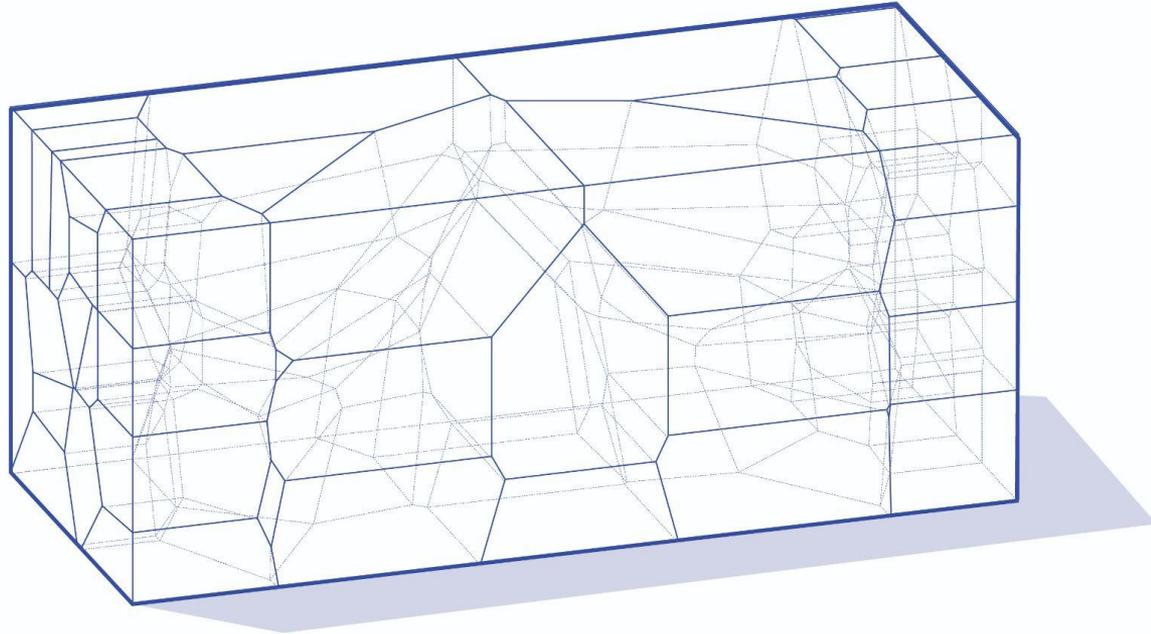
concept voronoi



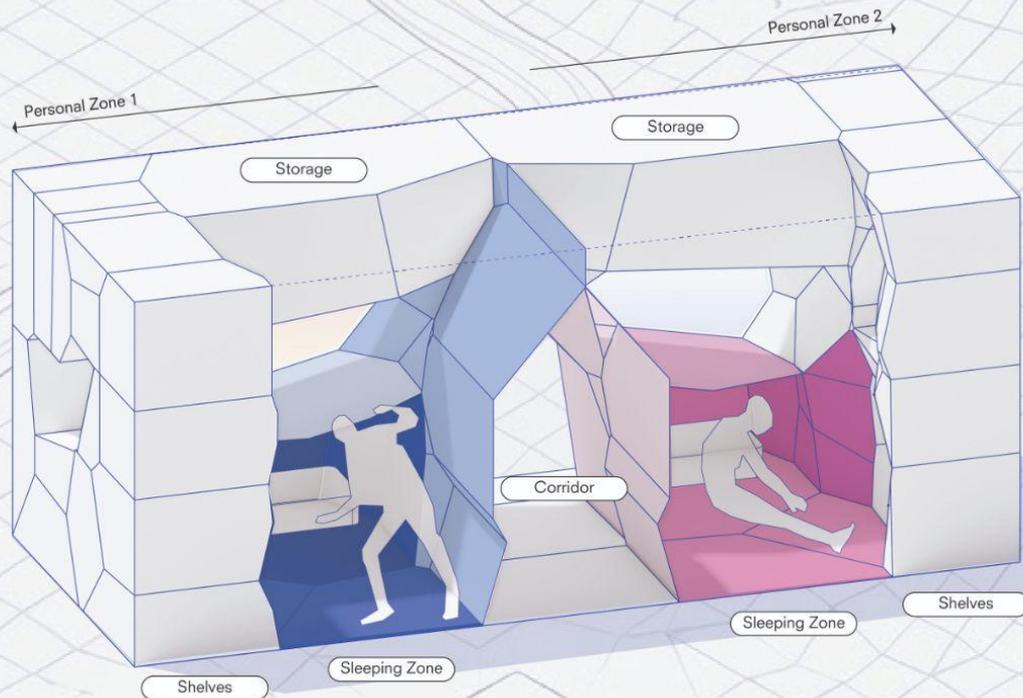
04 Design Process



04 Design Process



04 Design Process



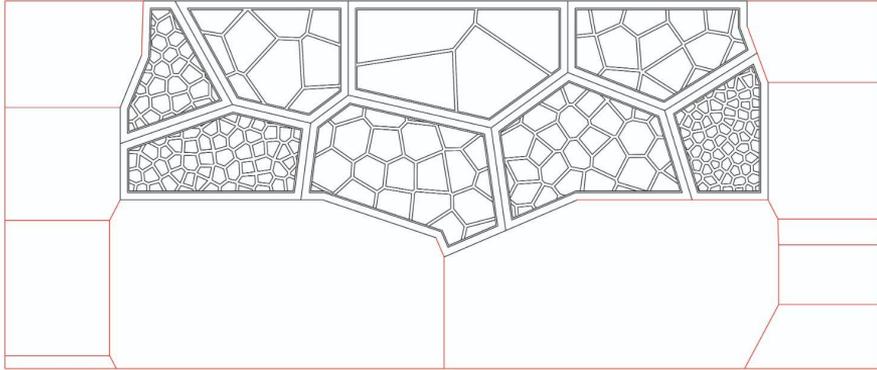
Scenario 2 No, We need Privacy!

If a more private environment is required, partitions can be installed to divide the space into two-person units. Instead of using the upper sleeping pod, the lower part can be used as a bed area.

Privacy ██████████
Interaction ██████



04 Design Process(skylight)



How can polar daylight
be integrated into living spaces?



Crown Shyness

04 Design Process

