

# Chestnut Residence Wellness Room Expansion

**Client: Lucy Chandler**

**Team 121**  
**Final Presentation**  
**4:20 pm**

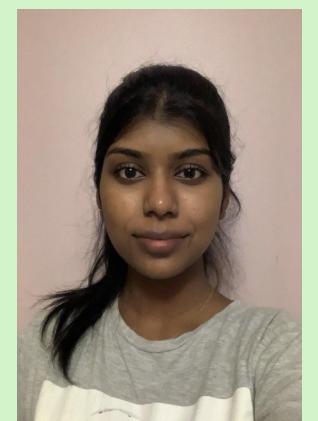
**Team Leader**  
Warrick Tsui



**Lead Editor**  
Aileen Sun



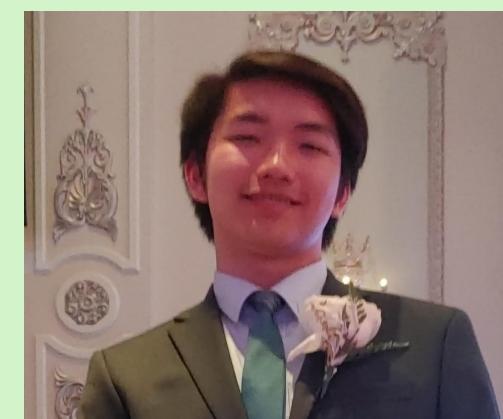
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# DOES U of T NEED A WELLNESS ROOM?

Figure 1:  
showing

TORONTO

**Students speak of long wait times for counselling appointments at U of T**

Toronto

**Student pressure 'really is there': Task force calls on U of T to simplify mental health services**

School faced criticism last year for its handling of student suicides

CBC News · Posted: Jan 15, 2020 3:16 PM EST | Last Updated: January 15, 2020

Considered suicide	12%
Intentionally injured	8%
Attempted suicide	2%

**It's literally life or death: Students say University of Toronto dragging feet on mental health services**

Despite several deaths, U of T won't say how long waiting list for therapy is

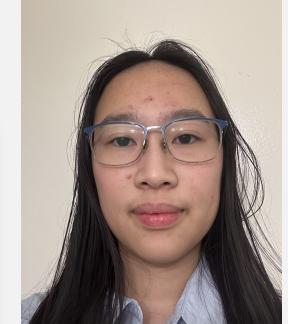
[1] "Report on Student Health and Well-Being - University of Toronto," Universit <https://www.provost.utoronto.ca/wp-content/uploads/sites/155/2018/03/Report>

[2] "Student Mental Health at the University of Toronto" University of Toronto Innovation Hub. [Online]. Available: [https://blogs.studentlife.utoronto.ca/innovationhub/files/2019/06/StudentMentalHealth\\_Report\\_June2019.pdf](https://blogs.studentlife.utoronto.ca/innovationhub/files/2019/06/StudentMentalHealth_Report_June2019.pdf)

[3] "Students speak of long wait times for counselling appointments at U of T," CTV News. [Online]. Available: <https://toronto.ctvnews.ca/students-speak-of-long-wait-times-for-counselling-appointments-at-u-of-t-1.4343443>

[4] "'It's literally life or death': Students say University of Toronto dragging feet on mental health services," CBC News. [Online]. Available <https://www.cbc.ca/news/canada/toronto/student-suicides-mental-health-support-1.5363242>

[5] "Student pressure 'really is there': Task force calls on U of T to simplify mental health services," CBC News. [Online]. Available <https://www.cbc.ca/news/canada/toronto/task-force-university-of-toronto-student-mental-health-1.5427944>



Aileen Sun

[3]

[4]

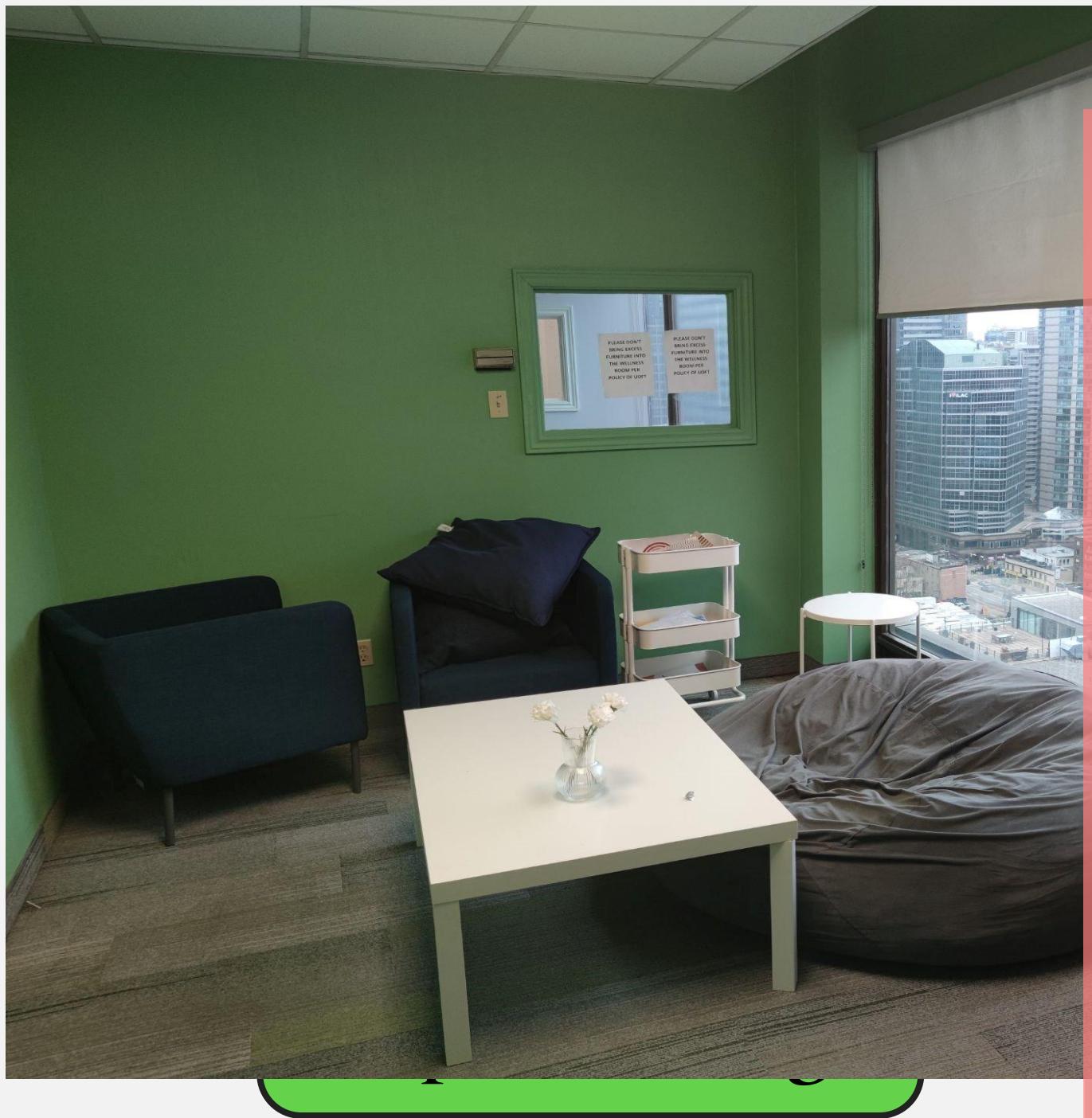
[5]

The current room is Underutilized  
because it lacks wellness features



# Akshaya mVelmurugan

Warrick Tsui



of all plants in the existing room

Please book an appointment for yourself

# Client needs a space that is:

## Inviting and Calm

## Welcoming

## Quiet

# of all plants in the existing room Velmurugan

# Typical booking availability of current room

# Our recommended design immerses users in a natural environment



Youssef Bayoudh

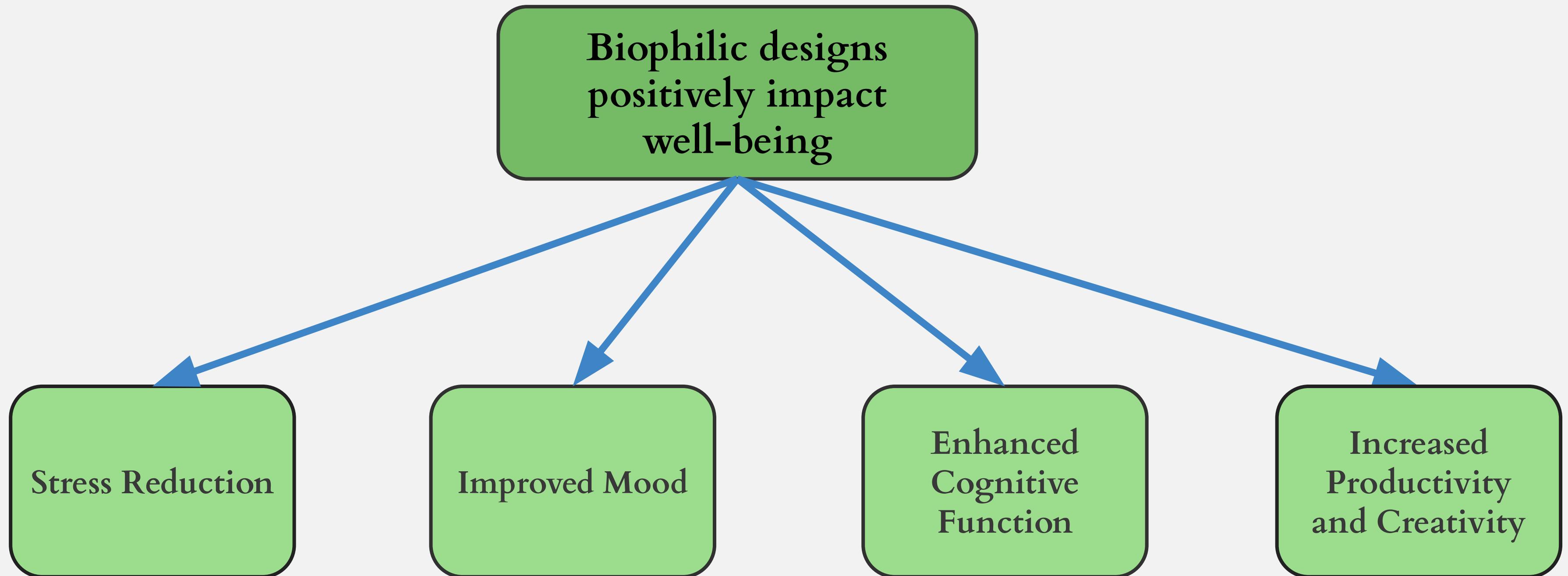
Figure 8: A video walkthrough of our Blender model of *Nature's Haven*



# *Nature's Haven follows biophilic principles to stimulate well-being*



Youssef Bayoudh



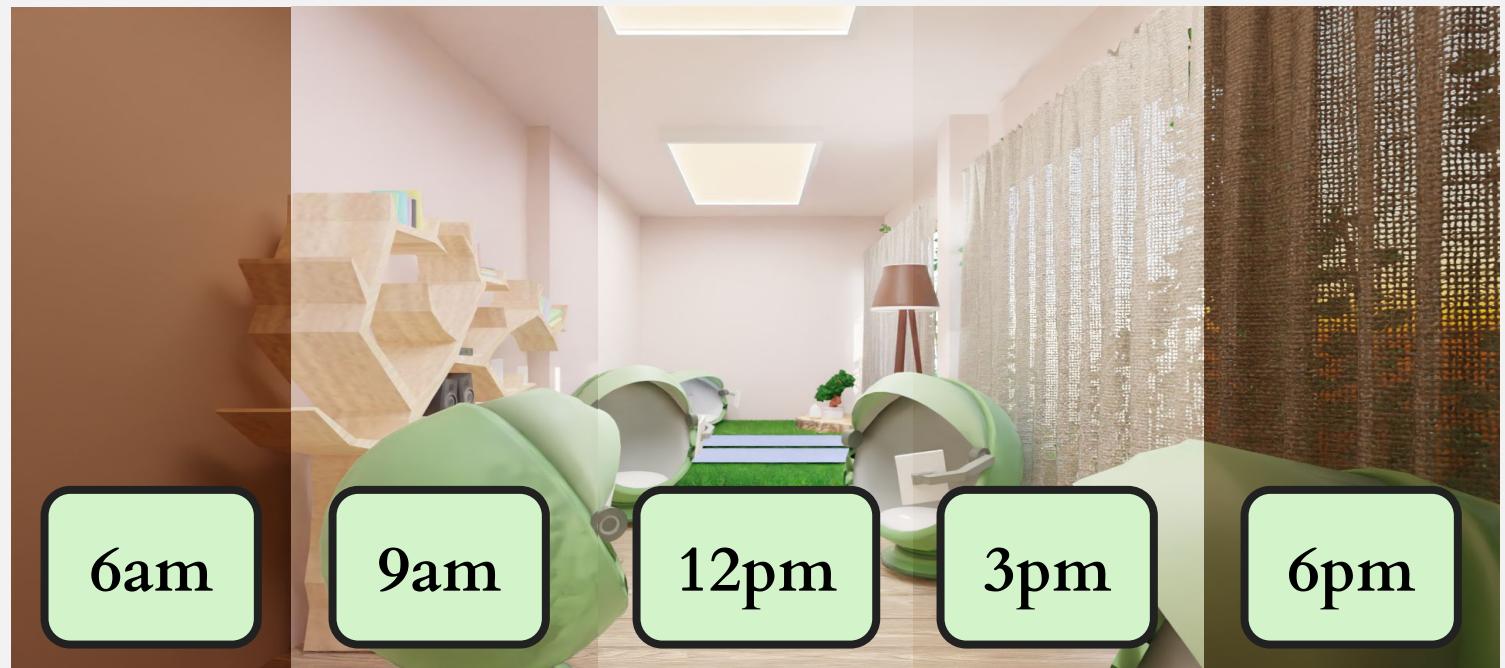
# Enhancing ambient lighting and sound to satisfy the client's needs



Ethan Lam

Client Statement:  
Comfortable & Calm

Lighting



[7]



[8]

Sound



[9]



[10]

[7] "The Application of Human-Centric Lighting in Response to Working from Home Post-COVID-19" MDPI [Online]. Available: <https://www.mdpi.com/2075-5309/13/10/25326>

[8] "Treatment - Seasonal affective disorder (SAD)" NHS UK [Online]. Available: <https://www.nhs.uk/mental-health/conditions/seasonal-affective-disorder-sad/treatment/>

[9] "10.2 Acoustic Fabrics - ABSORBER CS" Gerriets GmbH. [Online]. Available: <https://view.publitas.com/gerriets-gmbh/10-2-akustikgewebe-vorhange-acoustic-fabrics-curtains/page/2-3>

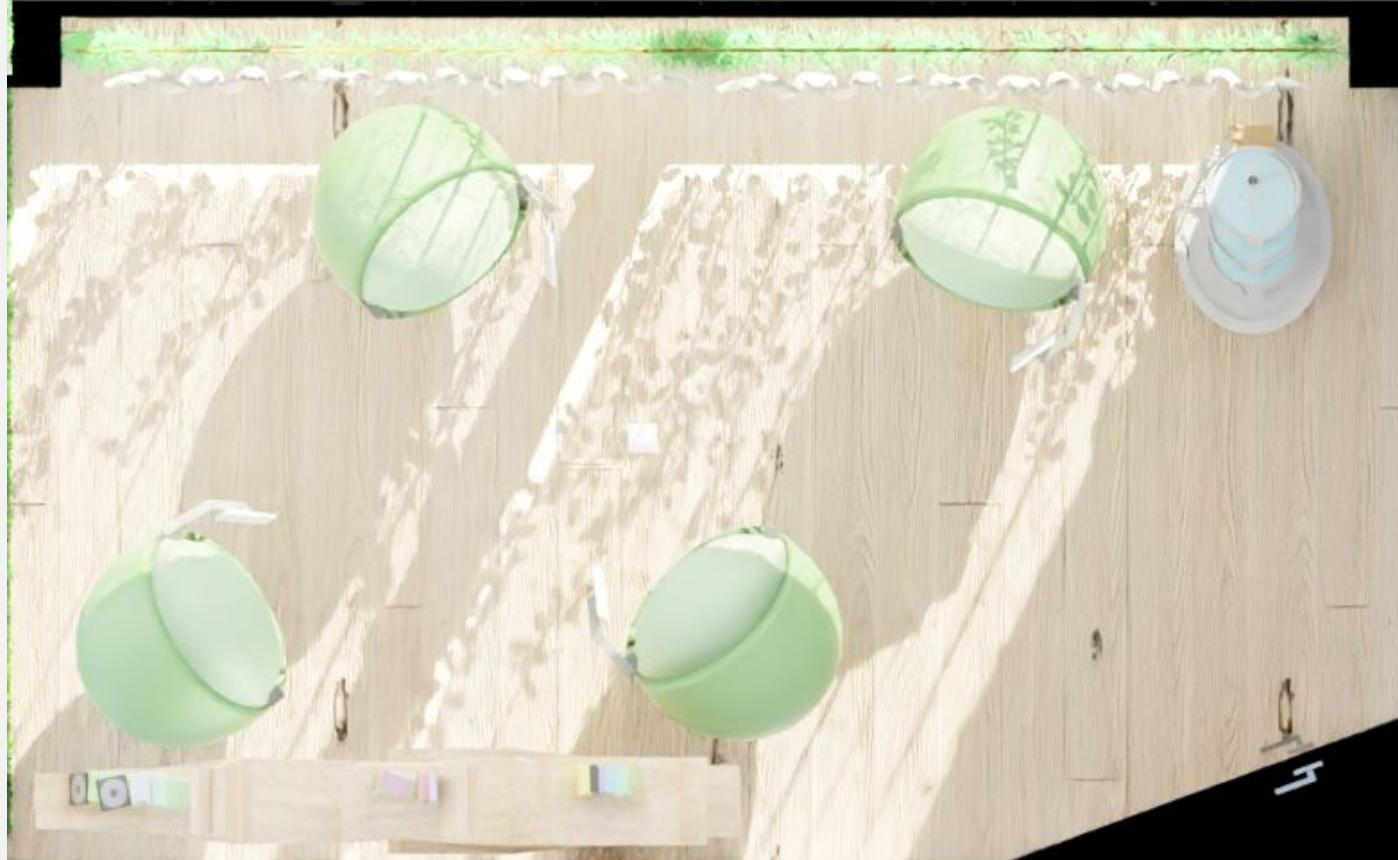
[10] "White Noise and Its Potential Applications in Occupational Health: A Review" National Library of Medicine - PubMed Central. [Online]. Available: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10135504/>

# Trading off room capacity and Maintainability to meet client's needs



Warrick Tsui

Trade Offs:



Less Seating/Community Events

Gains

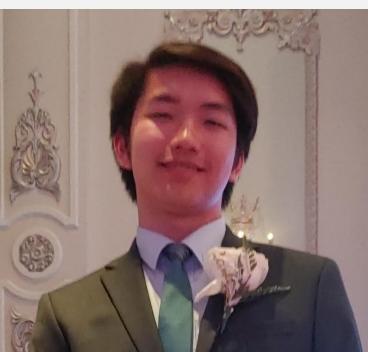


More maintenance needed

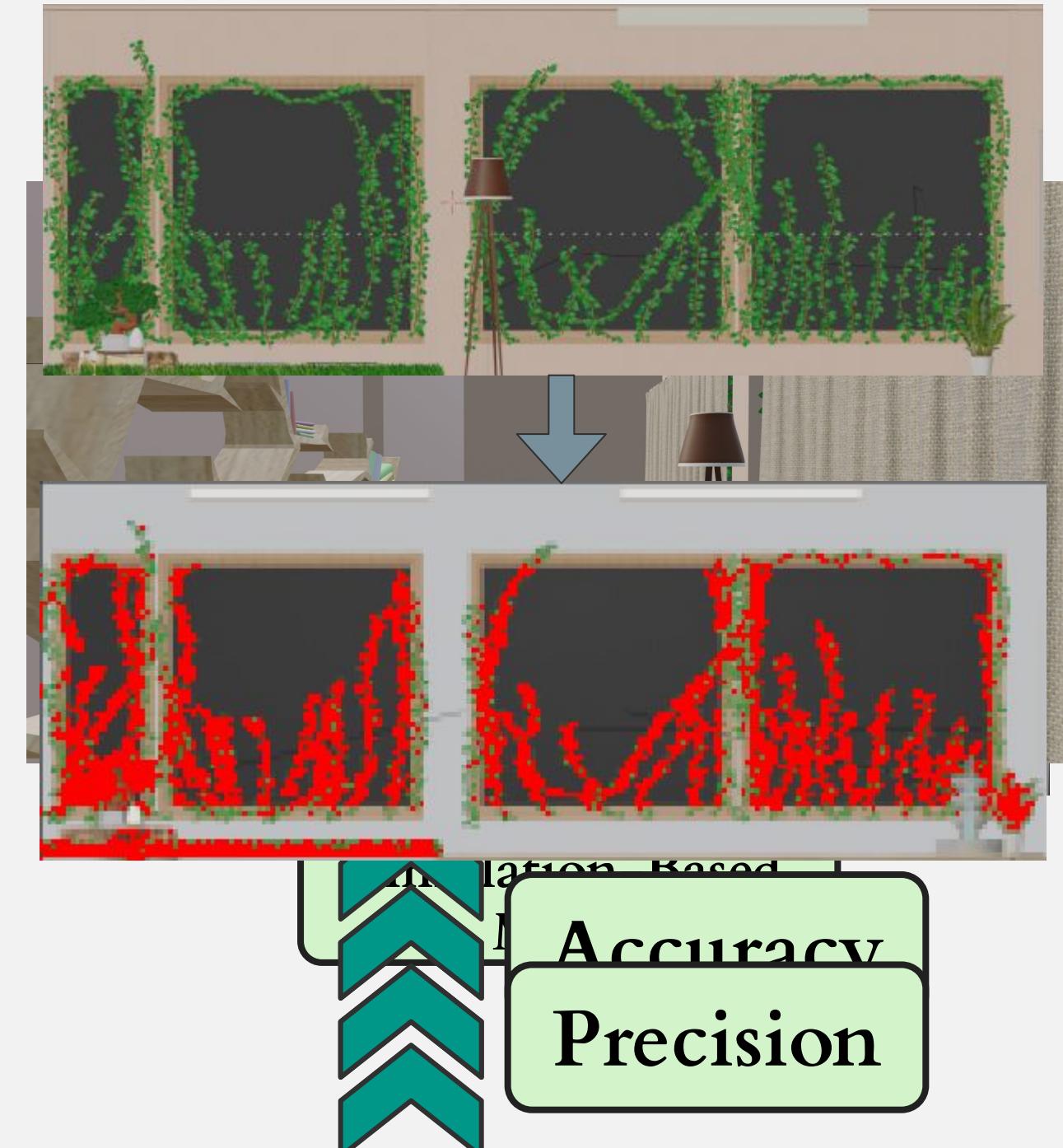
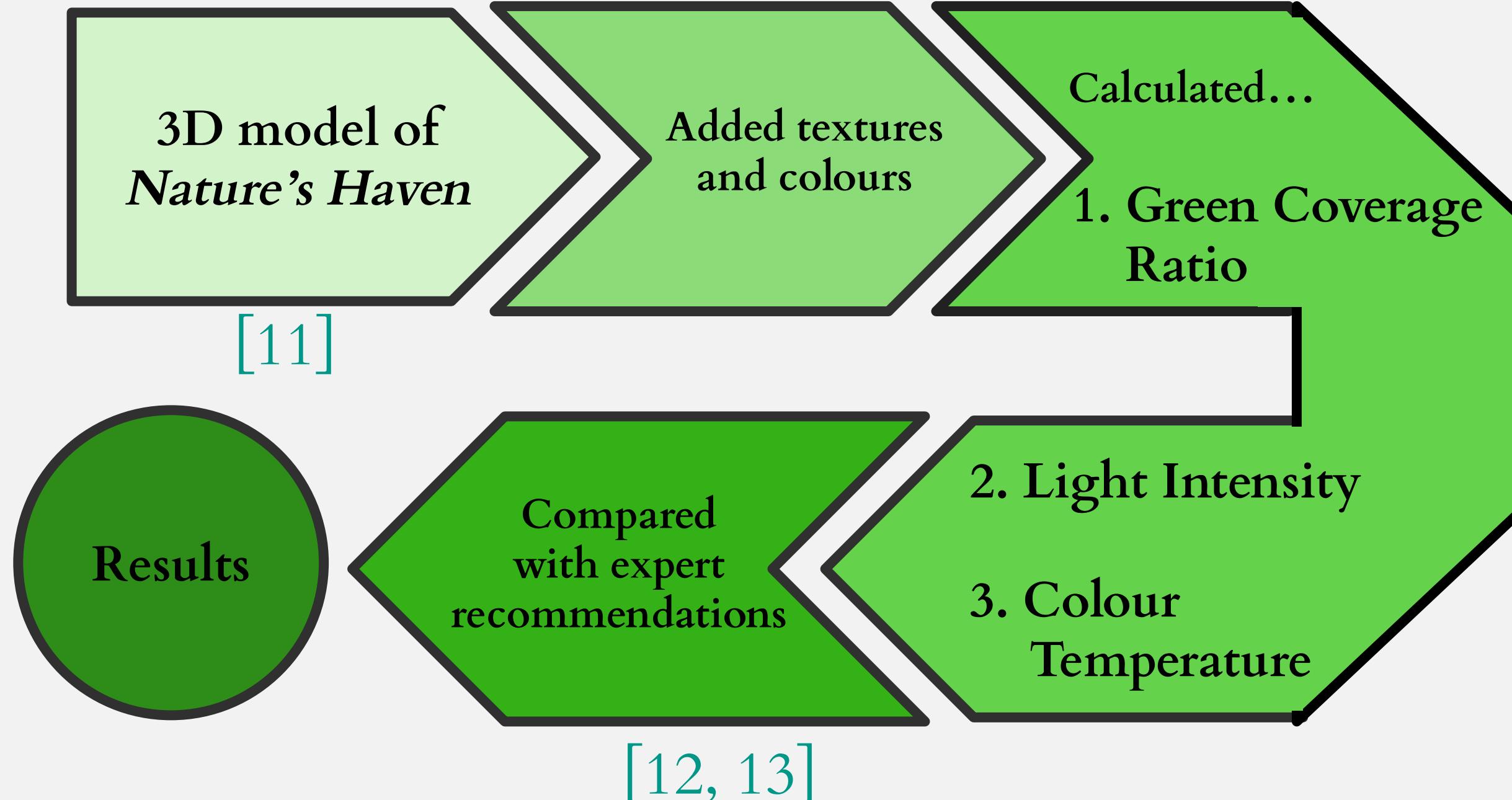
Meeting client needs

Achieving biophilic benefits

# A credible measure of success was used to evaluate the design's alignment with nature



Ethan Lam



[11] "A simulation-based approach for evaluating indoor environmental quality at the early design stage" ResearchGate. [Online]. Available: [https://www.researchgate.net/publication/369048724\\_A\\_simulation-based\\_approach\\_for\\_evaluating\\_indoor\\_environmental\\_quality\\_at\\_the\\_early\\_design\\_stage](https://www.researchgate.net/publication/369048724_A_simulation-based_approach_for_evaluating_indoor_environmental_quality_at_the_early_design_stage)

[12] "A quantitative study for indoor workplace biophilic design to improve health and productivity performance" ScienceDirect. [Online]. Available: <https://www.sciencedirect.com/science/article/pii/S0959652621033540>

[13] "Recommendations for daytime, evening, and nighttime indoor light exposure to best support physiology, sleep, and wakefulness in healthy adults" National Library of Medicine - PubMed Central. [Online]. Available: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8929548/figure/pbio.3001571.g002/>

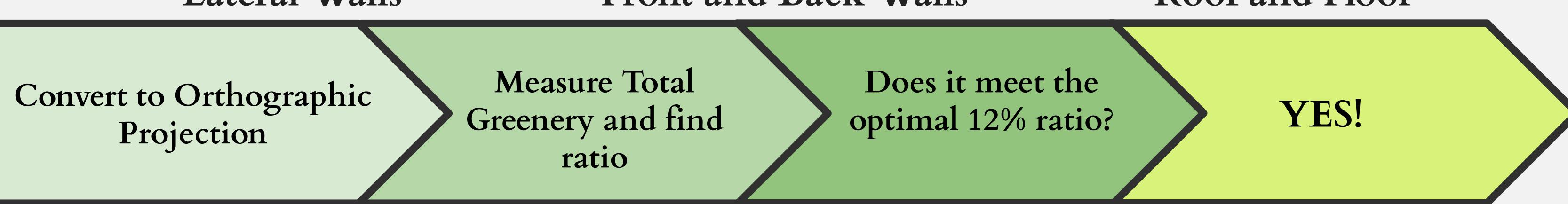
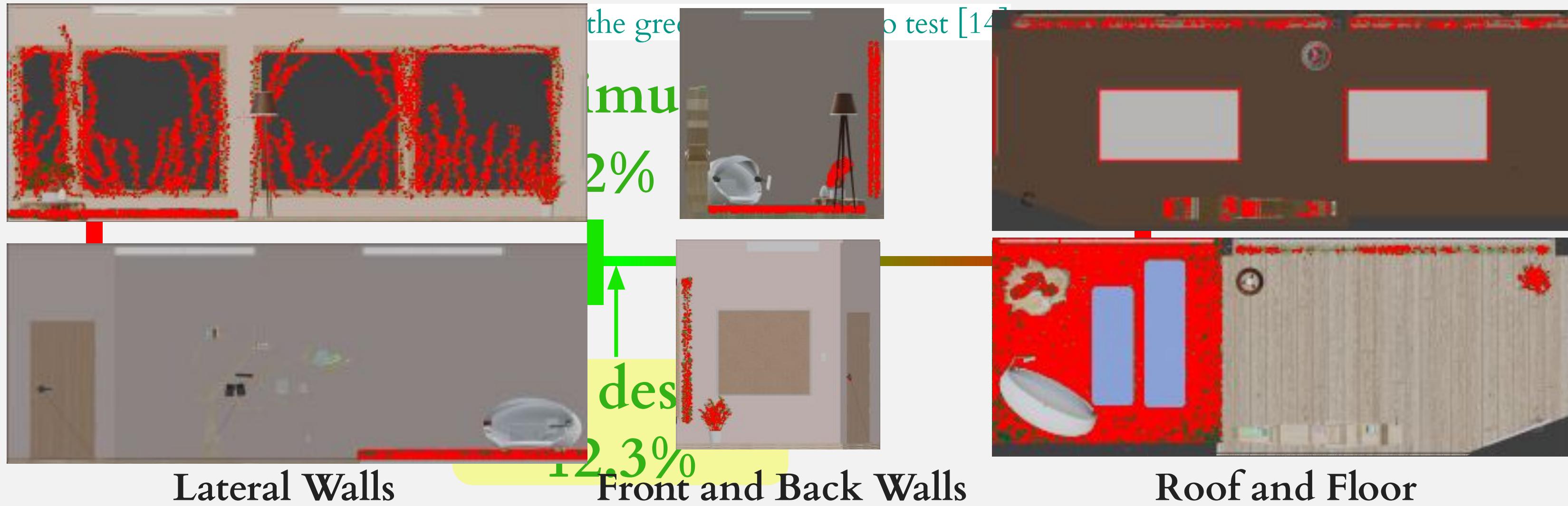
# Measure of Success #1:

## Green coverage ratio passed the test

Six 2D Orthographic Projections



Yongkang (Ken)  
Cheng



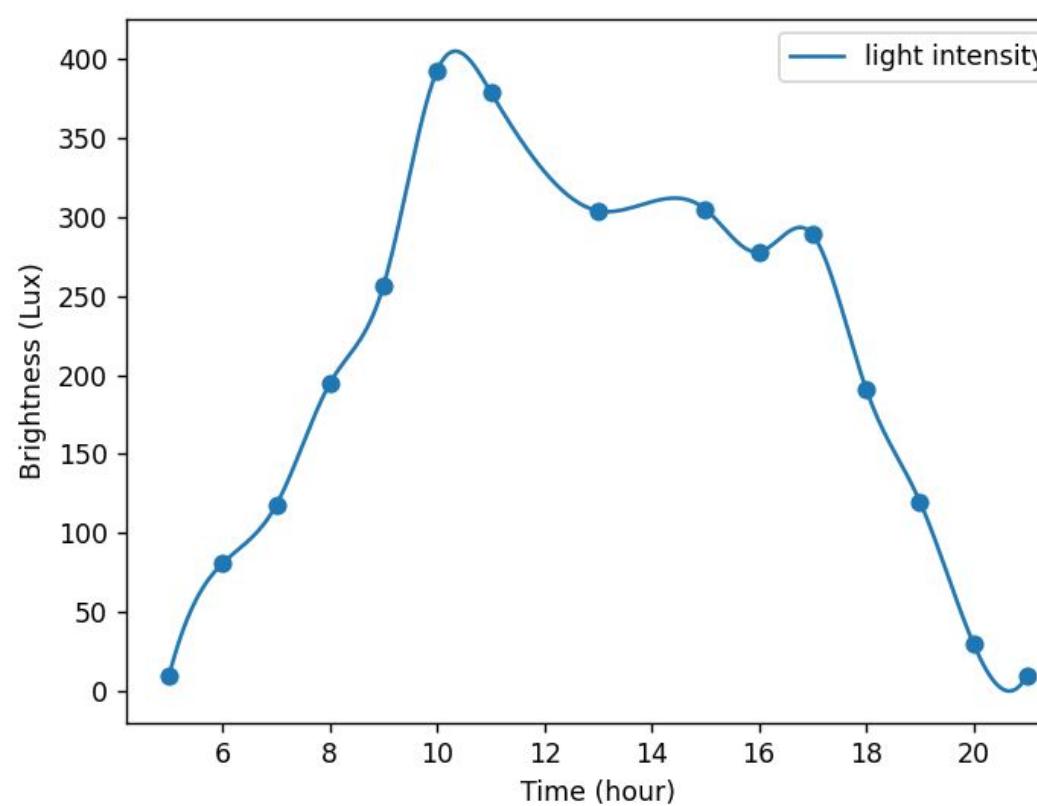
[14] "A quantitative study for indoor workplace biophilic design to improve health and productivity performance" ScienceDirect. [Online]. Available: <https://www.sciencedirect.com/science/article/abs/pii/S0959652621033540>

# Measure of Success #2: Lighting Condition passed the test

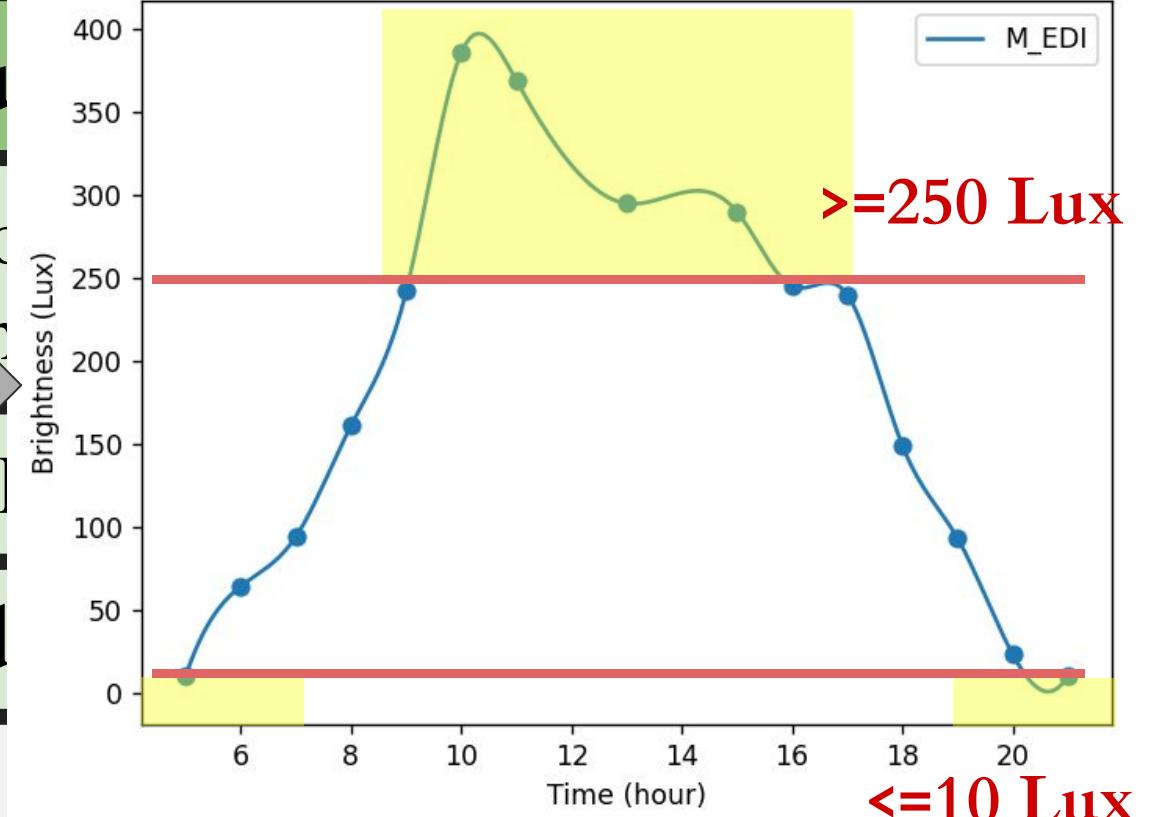
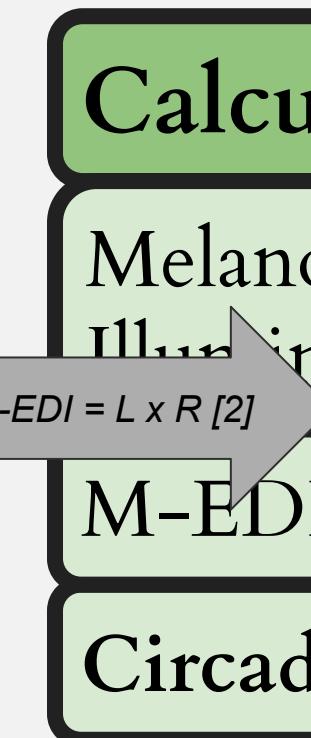
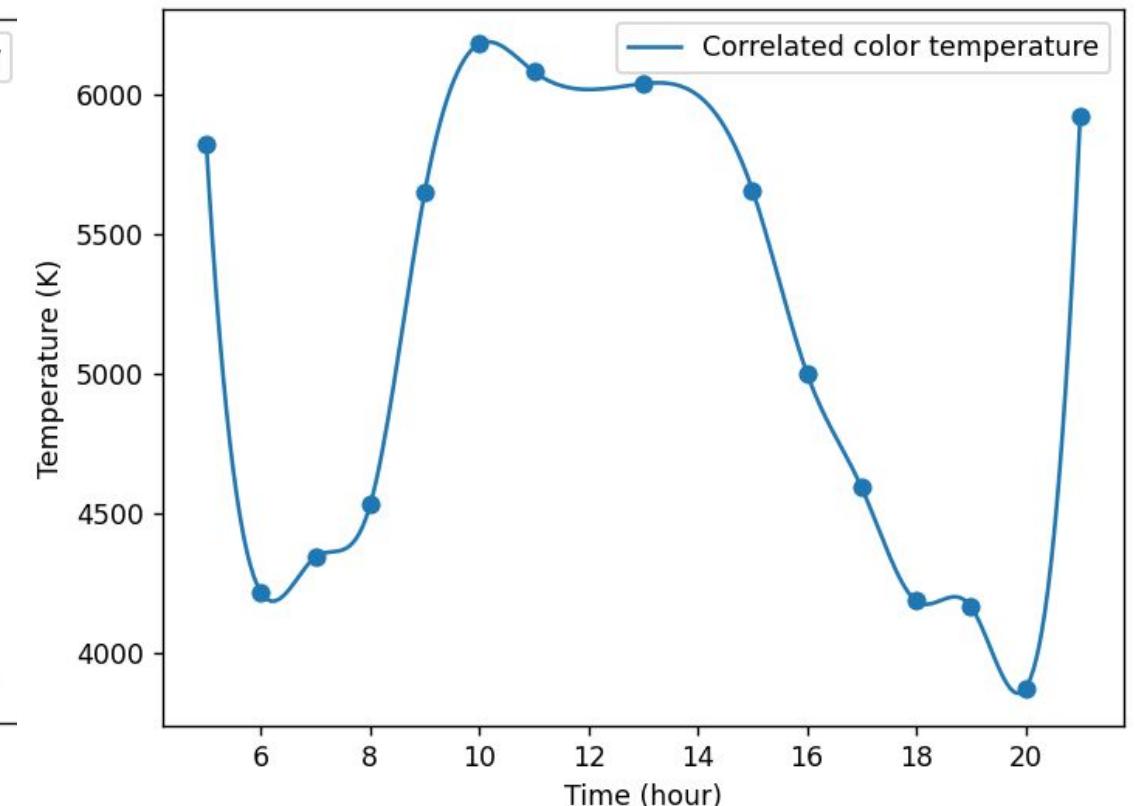


Yongkang (Ken)  
Cheng

Light Intensity



Color Temperature



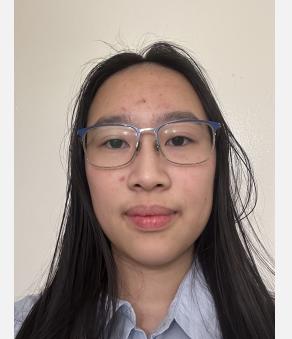
Insert light probe, get  
lighting data

Calculate M-EDI  
using light intensity  
and color temperature

Does it meet the  
recommended  
M-EDI?

YES!

# Although our testing is thorough, caution needs to be taken with simulated data

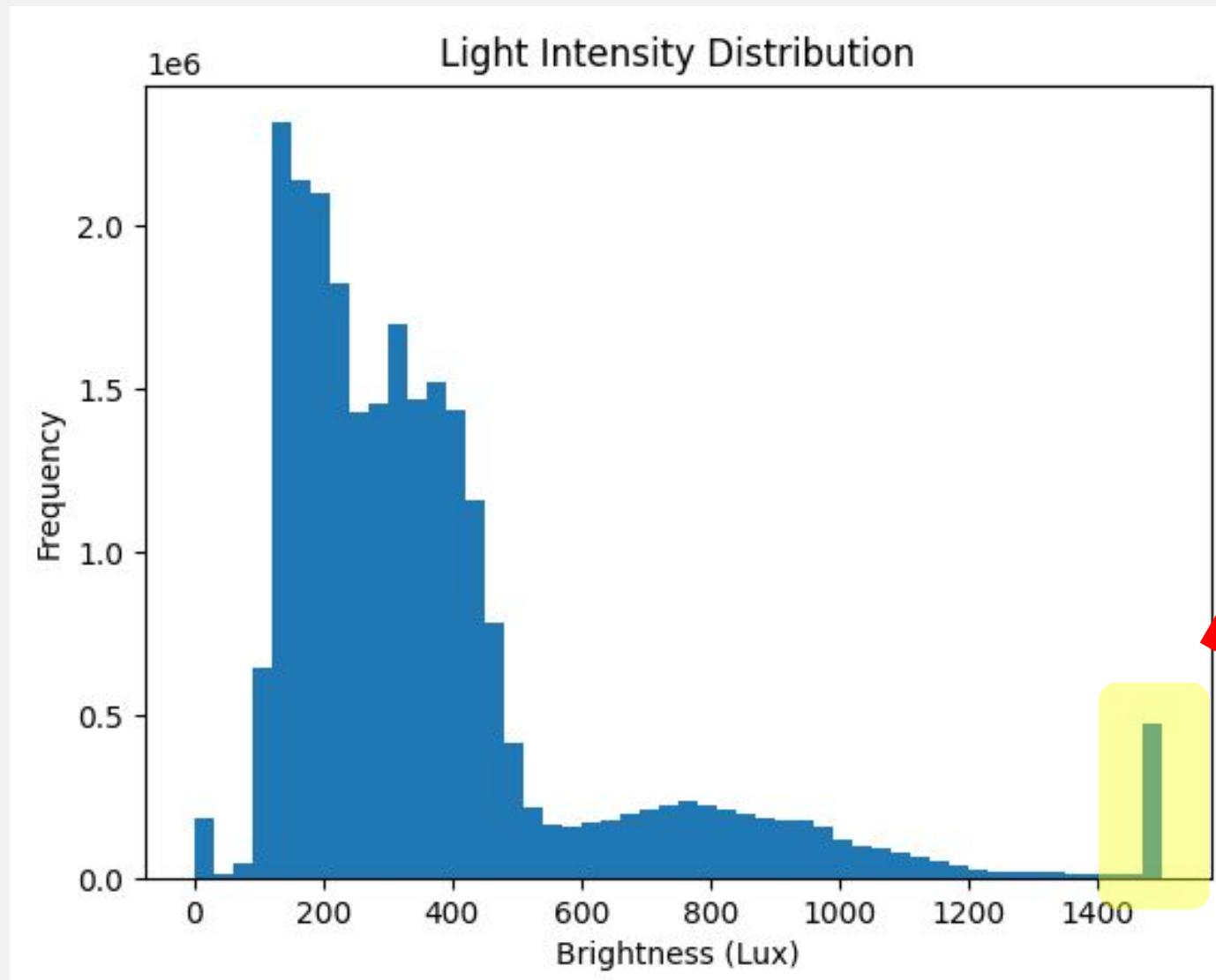


Aileen Sun

1

## Out of scale:

Figure 10: Histogram of lux frequency captured by our light probes



Probes cannot capture measurement values close to direct sunlight, creating flawed data collection

2

## 2-13% error

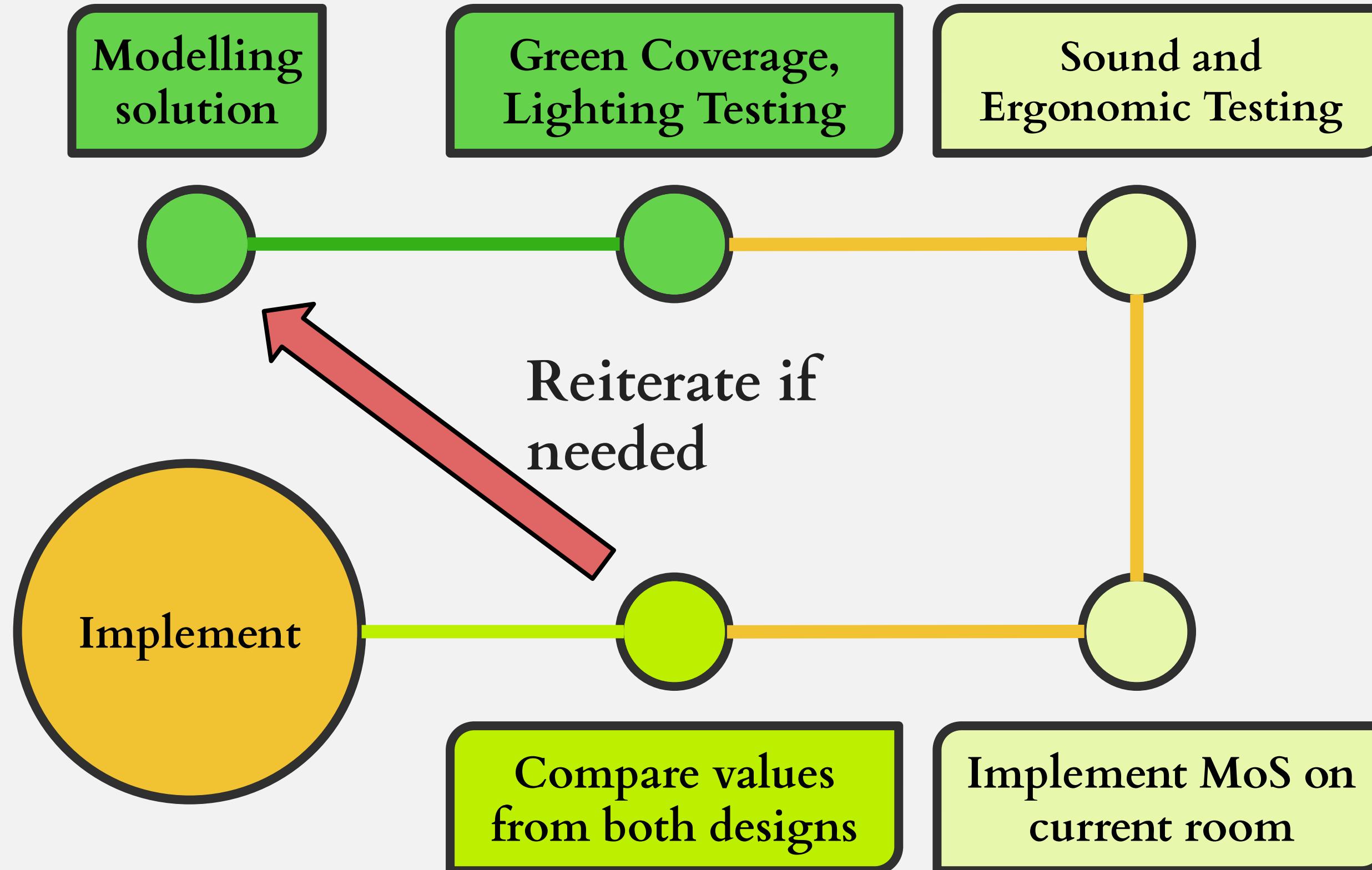
Accepted margin of error due to programming approximations [18]

[18] M. Cvetković, J.-D. Lenard, L. Mudri. "Simulation of Luminaires in Radiance: Verification Method," De Luminae Lab. [Online]. Available: [https://deluminaelab.com/download/papers/bci\\_051.pdf](https://deluminaelab.com/download/papers/bci_051.pdf)

# Design requires further testing for sound insulation & ergonomic principles before implementation



Akshaya Velmurugan



# Takeaway: Our recommended design is promising



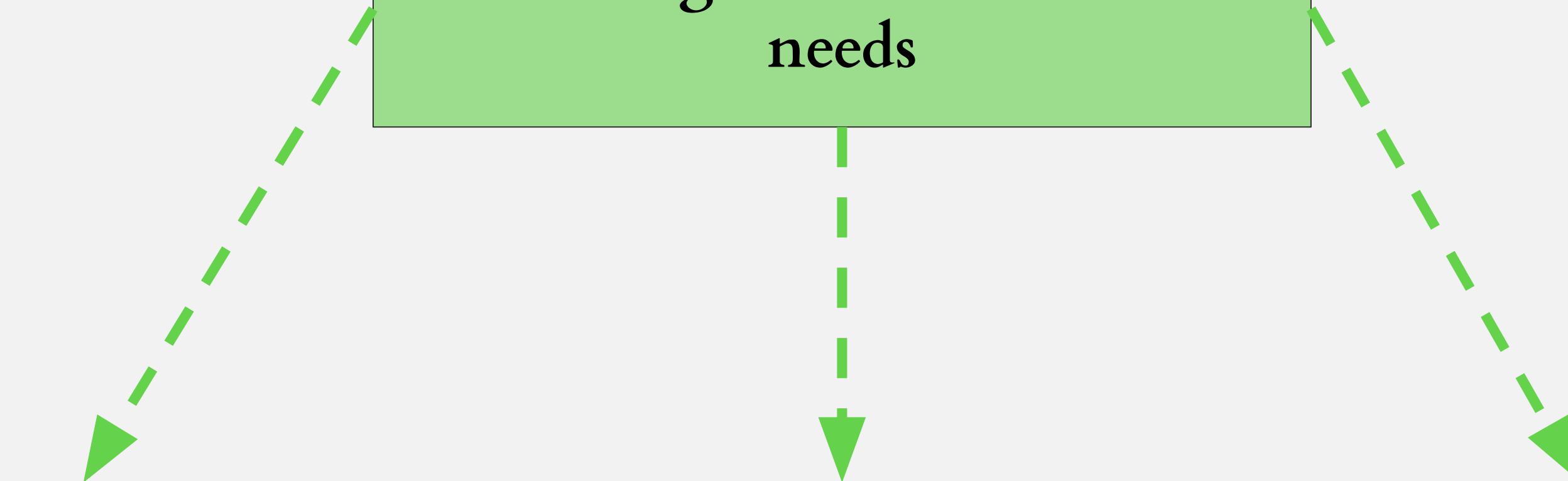
Youssef Bayoudh

Our design meets our client's needs

Our measures of success shows a solid lighting system

Established a theoretical sound insulation system

Our design conveys wellness through biophilic aspects



# Reference List

- [1] "Report on Student Health and Well-Being - University of Toronto," University of Toronto Provost. [Online]. Available: <https://www.provost.utoronto.ca/wp-content/uploads/sites/155/2018/03/Report-on-Student-Health-Well-Being.pdf>
- [2] "Student Mental Health at the University of Toronto" University of Toronto Innovation Hub. [Online]. Available: [https://blogs.studentlife.utoronto.ca/innovationhub/files/2019/06/StudentMentalHealth\\_Report\\_June2019.pdf](https://blogs.studentlife.utoronto.ca/innovationhub/files/2019/06/StudentMentalHealth_Report_June2019.pdf)
- [3] "Students speak of long wait times for counselling appointments at U of T," CTV News. [Online]. Available: <https://toronto.ctvnews.ca/students-speak-of-long-wait-times-for-counselling-appointments-at-u-of-t-1.4343443>
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- [5] "Student pressure 'really is there': Task force calls on U of T to simplify mental health services," CBC News. [Online]. Available <https://www.cbc.ca/news/canada/toronto/task-force-university-of-toronto-student-mental-health-1.5427944>
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- [9] "10.2 Acoustic Fabrics – ABSORBER CS" Gerriets GmbH. [Online]. Available: <https://view.publitas.com/gerriets-gmbh/10-2-akustikgewebe-vorhange-acoustic-fabrics-curtains/page/2-3>
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- [12] "A quantitative study for indoor workplace biophilic design to improve health and productivity performance" ScienceDirect. [Online]. Available: <https://www.sciencedirect.com/science/article/abs/pii/S0959652621033540>
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- [14] "A quantitative study for indoor workplace biophilic design to improve health and productivity performance" ScienceDirect. [Online]. Available: <https://www.sciencedirect.com/science/article/abs/pii/S0959652621033540>
- [15] Allied Scientific Pro, "Human-Centric Lighting (HCL) and Circadian Parameters," Allied Scientific Pro Blo. Available: <https://www.alliedscientificpro.com/blog/welcome-to-our-blogs-1/human-centric-lighting-hcl-and-circadian-parameters-177>.
- [16] "Lighting Design Strategy L1: Daylight," WELL v2 Building Standard. Available: <https://v2.wellcertified.com/en/v2.2/appendix/l1>.
- [17] ChromaViso, "What is Melanopic EDI?," ChromaViso.com, 2024. Available: <https://chromaviso.com/en/knowledge-about-light/what-is-melanopic-edi>.
- [18] M. Cvetković, J.-D. Lenard, L. Mudri. "Simulation of Luminaires in Radiance: Verification Method," De Luminae Lab. [Online]. Available: [https://deluminaelab.com/download/papers/bci\\_051.pdf](https://deluminaelab.com/download/papers/bci_051.pdf)

# Appendix A: MoS - light Intensity

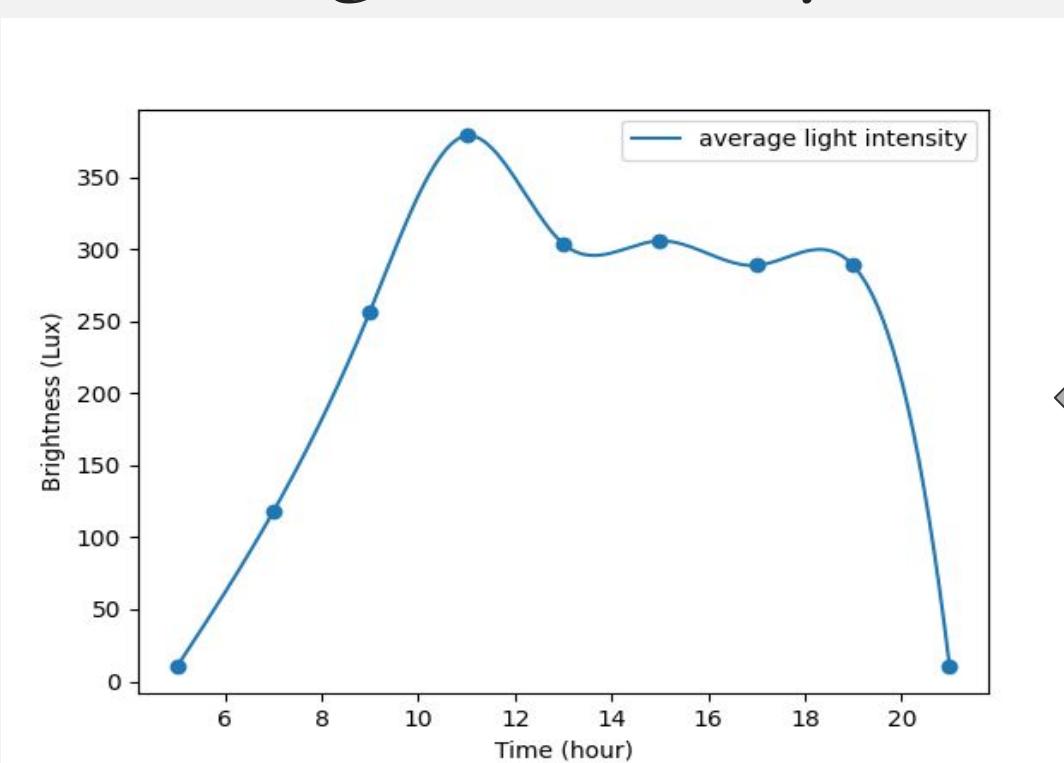
Lighting Schedule of Smart LED Lights

Time → Data↓	5am	7am	9am	11am	13pm	15pm	17pm	19pm
Overhead light power (watt)	5	6.6	14.9	23.2	25	21.8	18.7	6.9
Overhead light color (hex)	7FBBFF	F6E8E3	D6CBE0	F4F9FF	D1F8FF	FFF7F1	FFDDC2	FFD8B4
Lamp power (watt)	5	25	34.6	45	50	40.7	32.4	27
Lamp color (hex)	CADFFF	F9B794	DEC9CA	E3EBF4	FFAB72	F2FCFF	F0E6F0	FCB794
Mean light intensity (lux)	10	118	257	379	304	306	289	289
Mean color temperature (kelvin)	7258	4344	5653	6083	6040	5659	4592	4437
M_EDI (lux)	10	94	242	369	295	290	240	85

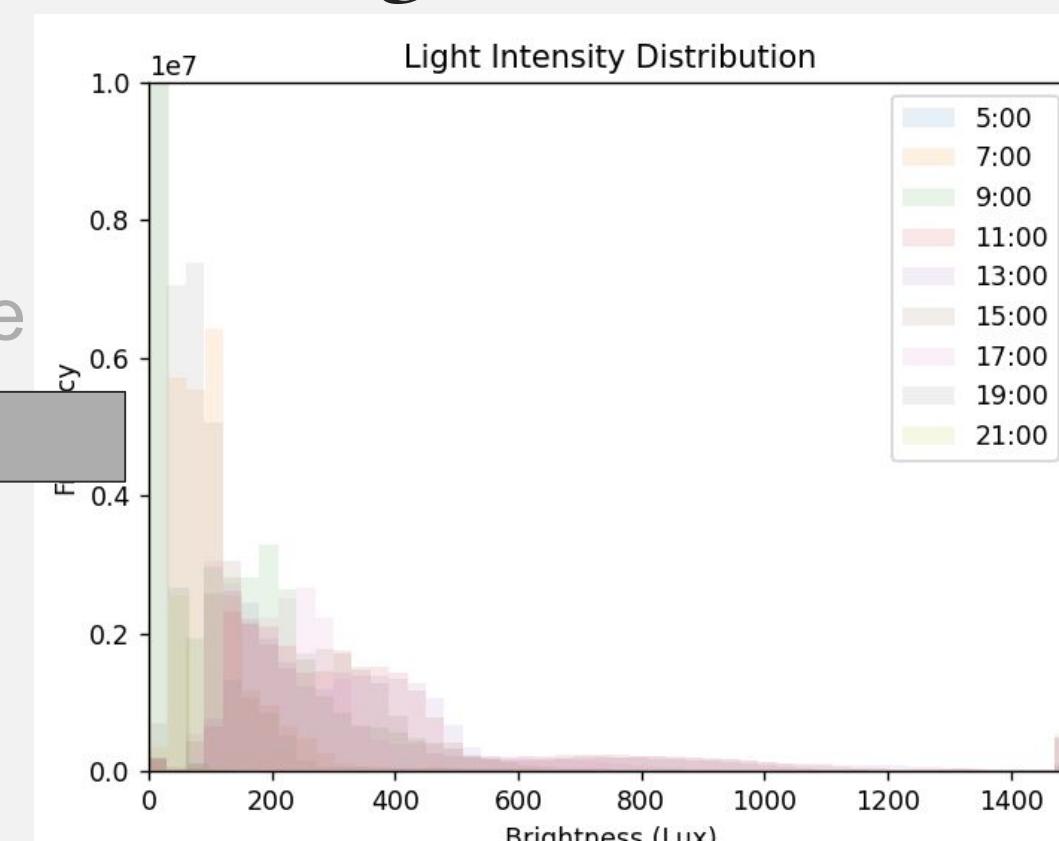
Light Probes baking result



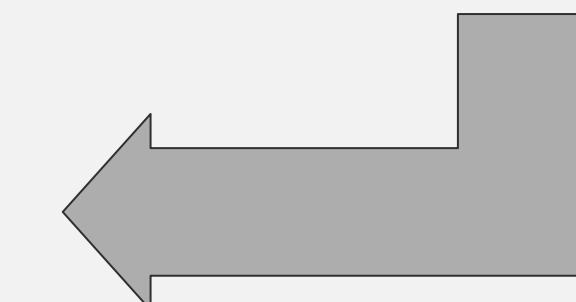
Light Intensity



Light Distribution

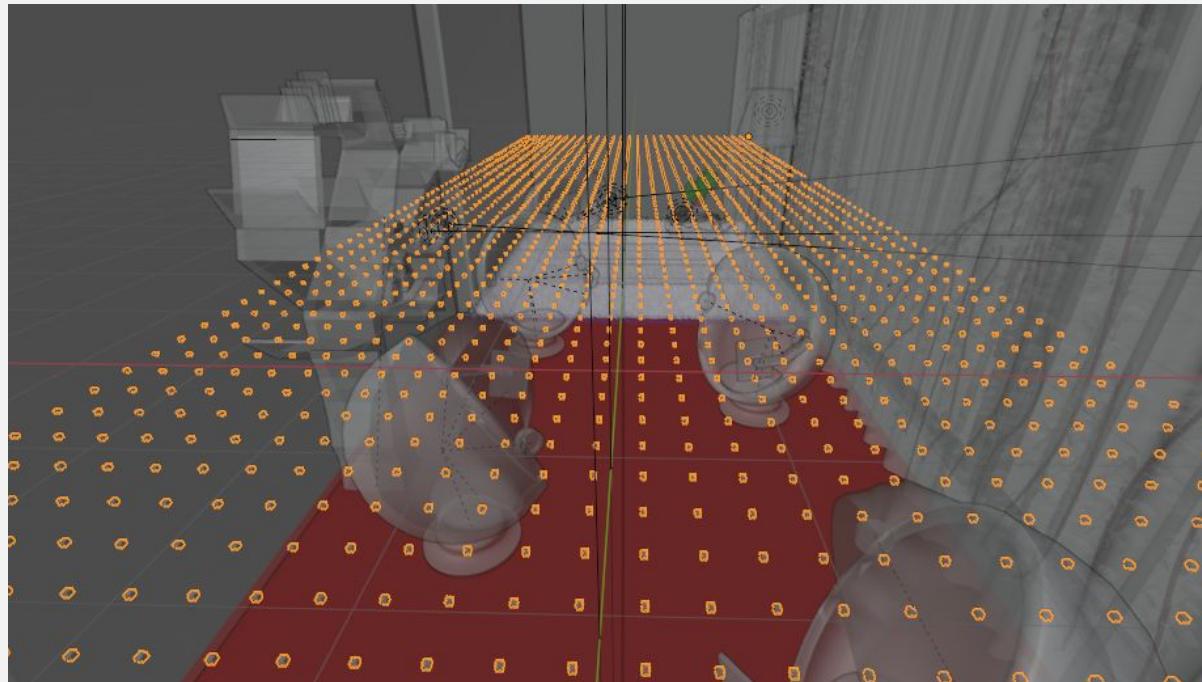


Light intensity datum points  
(for eliminating bias)



# Appendix B: MoS - Light Probes & Color Temperature

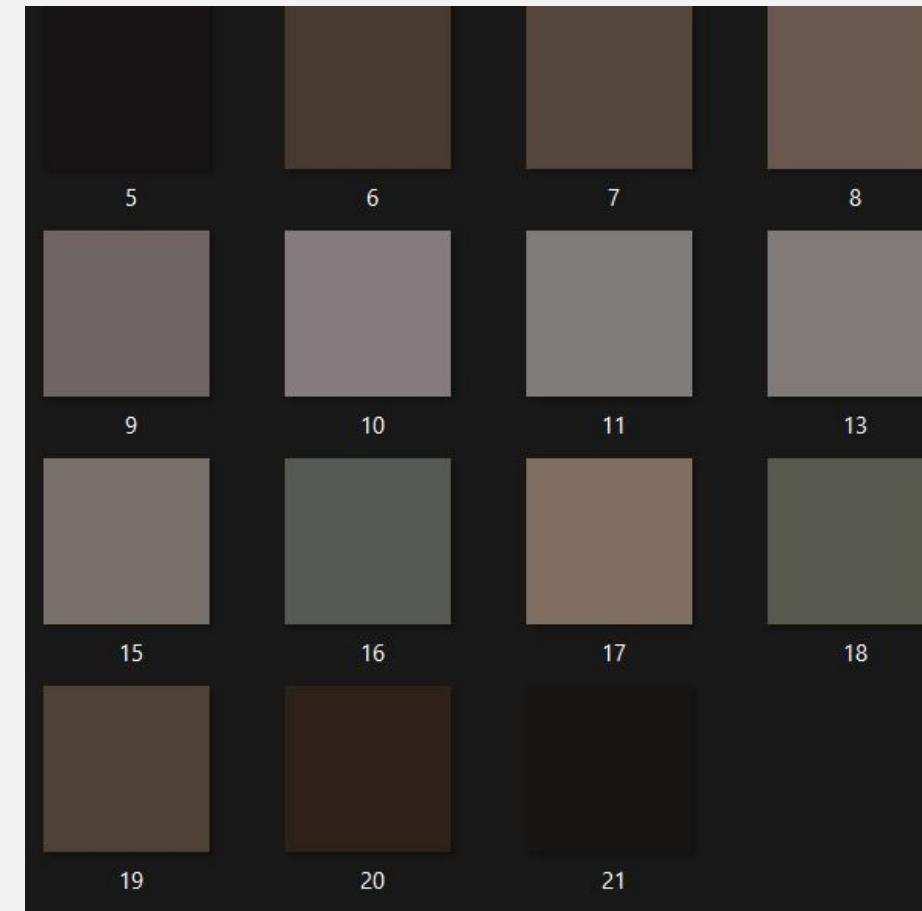
## Light Probes



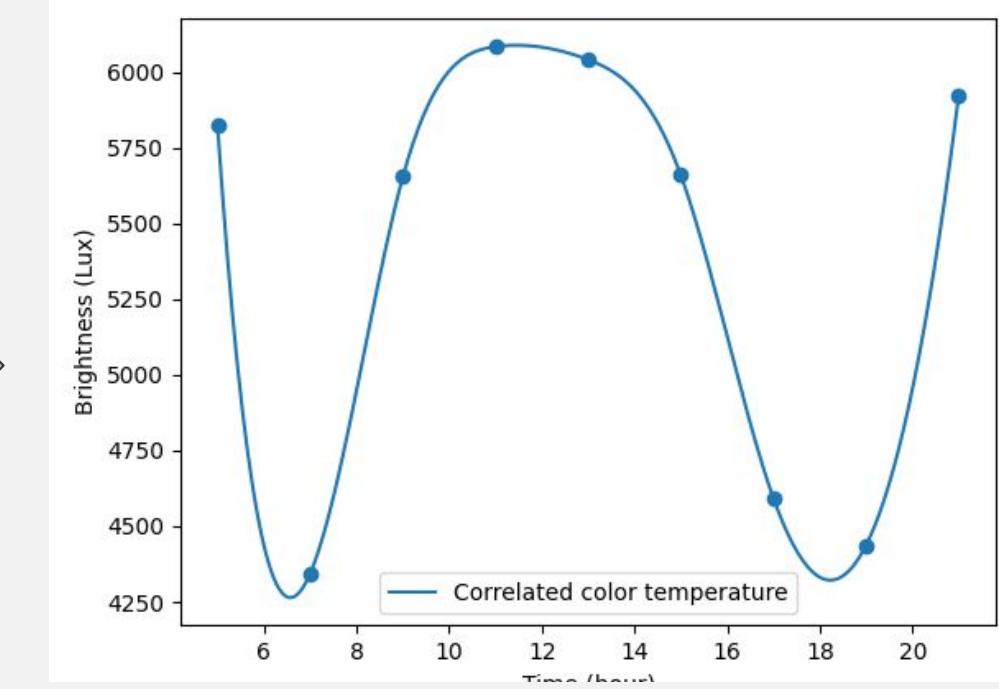
Light Probes baking result



Convert to pure color



Color temperature



# Appendix C: MoS M-EDI Calculations on Python

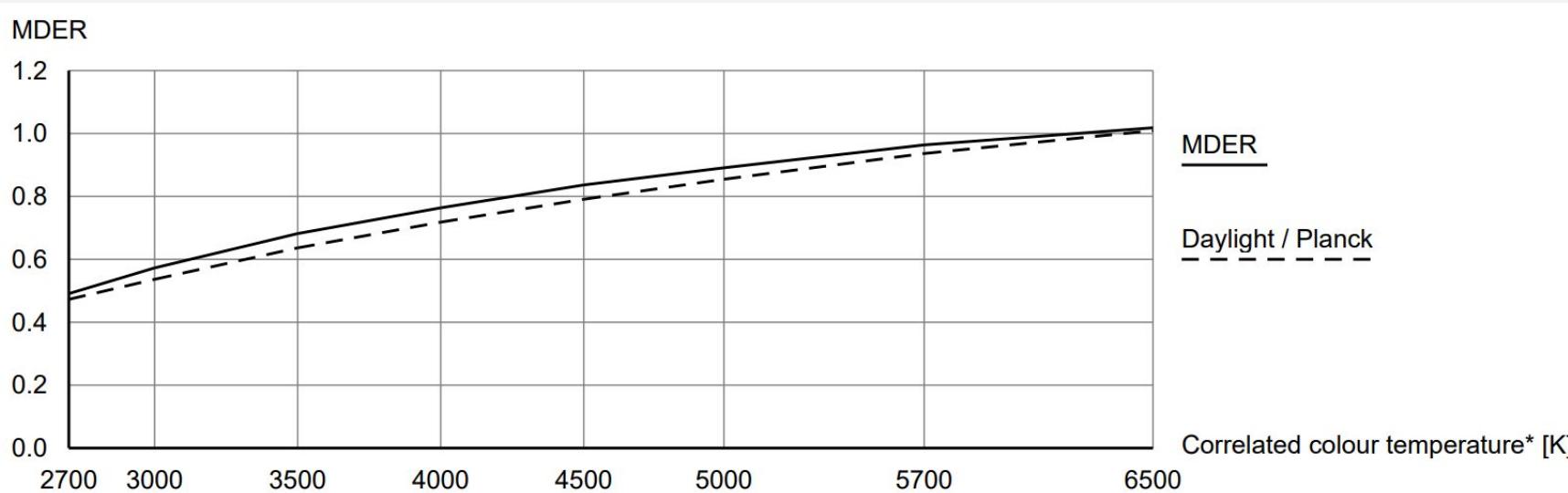
$$\mathbf{M\text{-}EDI = Intensity \times M\text{-}DER(CCT)}$$

**M-EDI** = Melanopic Equivalent Daylight Illuminance

**M-DER** = Melanopic Daylight Efficacy Ratio

**CCT** = Correlated Color Temperature

M-DER as a function of CCT [1]



```
def get_DER(temperature):
    # Data points sorted by intensity value
    data_points = [
        (2700, 0.48), (3000, 0.56), (3500, 0.67), (4000, 0.76), (4500, 0.82),
        (5000, 0.88), (5700, 0.95), (6500, 1)]

    # Handle cases outside the known range
    if temperature <= data_points[0][0]:
        return data_points[0][1]
    if temperature >= data_points[-1][0]:
        return data_points[-1][1]

    # Find the two nearest points
    for i in range(len(data_points) - 1):
        if data_points[i][0] <= temperature <= data_points[i + 1][0]:
            x1, y1 = data_points[i]
            x2, y2 = data_points[i + 1]
            break

    # Linear interpolation
    return y1 + (y2 - y1) * (temperature - x1) / (x2 - x1)

def get_MEDI(intensity, temp):
    # MEDI = intensity * M_DER
    m_der = get_DER(temp)
    return intensity * m_der
```

# Appendix D: Conceptual Design Specifications – Service Environment

## 3.1 Physical Environment

Table 1 details the indoor conditions.

Table 1. Physical Environment of the Room

Aspect	Descriptions	Impact <i>The design should factor:</i>
Dimensions	Measurements detailed in floor plan (Figure 3)	Physical space restrictions.
Facilities	Facilities in the room can all be moved without tools. Details of each furniture are in Appendix D.	No fixed furniture.
Auditory	Noise reduction when doors are closed: 12-14 dB, resulting in ambient noise of 39-45 dB (Appendix E). Dysfunctional air-conditioner in the study room produces a constant buzzing of 1.5-9 kHz (Appendix C).	
Lighting	Toggle light switches connect to overhead lights.  Curtains cover the four east windows; two of them are broken.  Light intensity: 153-346 lux, averaging 266 lux (Appendix F).	Client desires an improved soundproofing and lighting system (Appendix C) [1].
Path to the Room	Elevators service up to the 27 <sup>th</sup> floor.  Escalator and staircase connect the 28 <sup>th</sup> floor. (Appendix G)	Room inaccessibility to some mobility-impaired people.

## 3.2 Living Things

Table 2 details the living things the room must accommodate.

Table 2. Living Things With Access to the Room

Aspect	Descriptions	Impact <i>The design should factor:</i>
Users	~75% undergraduate first year students at Chestnut Residence [6].	Users physically interacting and damaging parts.
Service Animals	Service animals (Appendix C).	Animals damaging parts.
Plants	Four potted plants (Appendix D).	Plant maintenance exposing design to water.

## 3.3 Virtual Environment

Table 3 details the virtual service environment.

Table 3. Virtual Environment

Aspect	Description	Impact <i>The design should factor:</i>
Servicing Hours	Rooms are available 7am to 10pm by Online Booking [7].  Study room: maximum 2 hrs/day per person	Operational hours.
Wifi Condition	WiFi speed: 140 Mbps  Signal strength: -56 dBm (Appendix H)	New technology implementation's virtual infrastructure use.

# Appendix E: Project Specifications

## Conceptual Design Specifications Objectives

Table 5 shows objectives in descending order of priority, ranked by pairwise comparison (Appendix J). Overall, they are designed to increase privacy, relaxation, and productivity through scientifically proven methods and ergonomic principles, while allowing wellness resources to be accessible to all users.

Table 5. Objectives, Goals, and Metrics

Objective <i>The design should be:</i>	Goal <i>The design should:</i>	Metric
Mentally stimulating in its ambience	Aim for 12% of natural green coverage ratio [5, 15]	Percentage
	Aim for 40-50% of shaded area along the floor [16]	
	Mimic natural lighting patterns (Appendix K) [16, 17]	Light colour and transmittance
	Only use materials with natural grains and textures such as wood, stone, concrete, brick, plants, and plant-like material [15]	Material type
Conducive to wellness and relaxation	Allow comprehensibility of wellness information through visual, auditory, and tactile cues (Appendix M)	Modes of communication
	Incorporate ten resources to collectively stimulate all five senses (Appendix M)	Number of stimulating resources
Distraction-free	Maintain sound levels to be within 45-50 dB at all times [18]	Decibels
Physically Comfortable for users	Allow users to maintain a minimum distance of 1.2 meters from other users [19]	Meters
	Incorporate comfortable materials such as polyester woven fabrics [20]	Material type
	Ensure seat width ≥489 mm [21]	Millimetres
Community-oriented	Allow availability for one social event to occur every week (Appendix C)	Number of weekly events
	Enable users two methods of interacting with the UofT community (Appendix M)	Number of methods
Easily alterable	Only use modular, not fixed furniture [22]	Percentage

## Conceptual Design Specifications Constraints

Table 5. Objectives, Goals, and Metrics

Constraint Category	Category <i>The design shall:</i>	Metric	Constraint
Client-based constraints	Be within client's budget and timeline	Budget	≤\$25000
	Provide different types of mentally stimulating resources	Minimum mentally stimulating resources present	2 years (Appendix M) 8 different resources [23] (Appendix L)
	Require minimal maintenance	Time required for maintenance per month	< 1 hour
		Modifications made to human resources allocation	0 (Appendix M)
Research-based	Provide sufficient space	Minimum room capacity	3 occupants (Appendix N)
		Minimum space of room	7 m <sup>2</sup> + 0.1 m <sup>2</sup> /occupant [4]
	Provide tolerable sound insulation	Sound level perceived at all times	< 70 dB [24] (Threshold of annoyance)
	Comply with Ontario Building Code	See Appendix N	

## Client Statement

### Project Description:

The wellness room on the 28th floor is currently an under-utilized space in the student residence. Our project would like to consider the possibility of revamping the wellness room on the 28th floor by incorporating the study room next to it and making it a bigger space. We would want the students to design the new open space while keeping structural concerns in mind. Some things we would like them to consider while designing the space are: Can we make structural changes to the space to still keep it a quiet space? How do we make the space more inviting and calm? How could we use technology to make this space more welcoming?