INFLUENCE OF LIGHTING CONDITIONS ON PEDESTRIAN NIGHTTIME BEHAVIORAL ENGAGEMENT AROUND ELLIPTICAL ROAD IN QUEZON CITY, PHILIPPINES

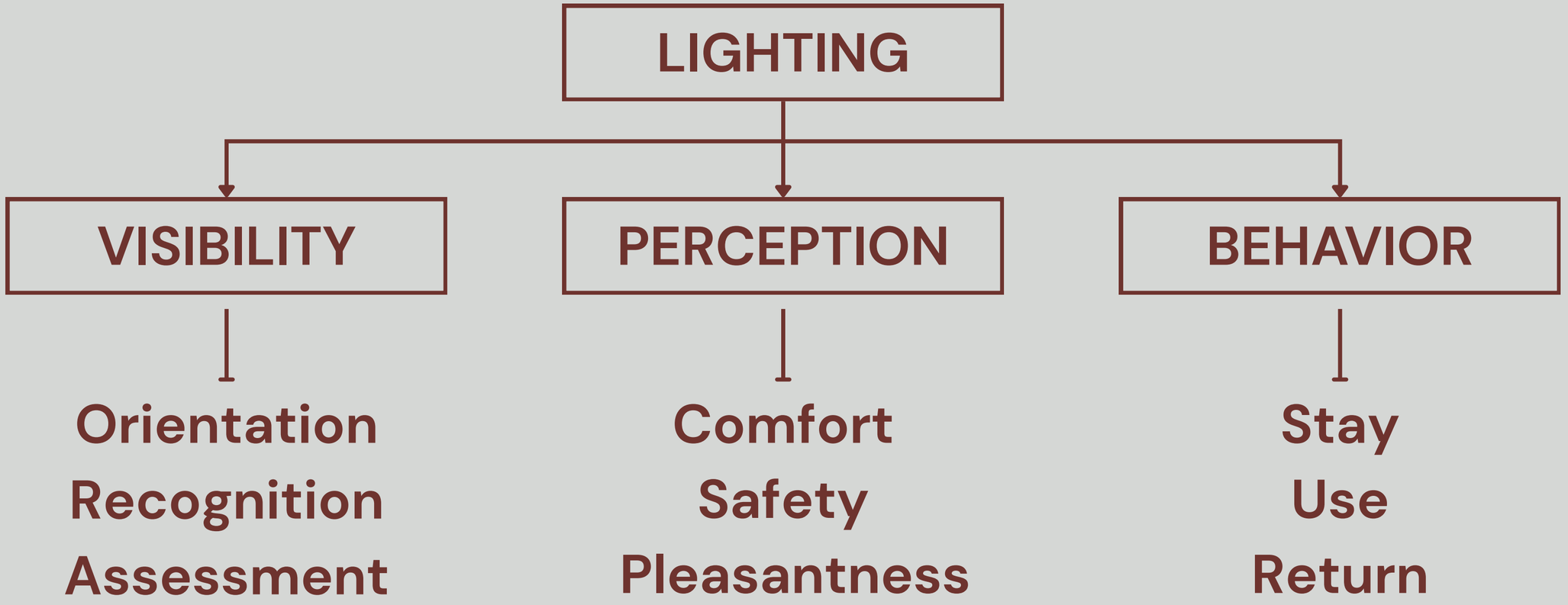
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15th World Congress on Design & Health
(WCDH 2026)

Why this Study?

Nighttime lighting is more than a visibility requirement



Lighting is part of the spatial and experiential character of the city

Research Question

“Does lighting influence pedestrian engagement differently across different environments?”



1 QUEZON CITY PROMENADE BRIDGE

Elevated park connector



2 QUEZON CITY HALL UNDERPASS ENTRANCE

Underground connector + stop



3 TANDANG SORA TRANSPORT TERMINAL

Commuter stop

Research Goal

Determine how existing nighttime lighting conditions relate to pedestrian cognitive and emotional responses and behavioral engagement

Lighting Conditions → *Perception* → *Behavioral Engagement*

Conceptual Framework

Adapted from Stimulus–Organism–Response Theory
(Mehrabian & Russell, 1974) & (Jacoby, 2002)

STIMULUS

LIGHTING CONDITIONS

- Color Temperature (Kelvin)
- Illuminance (lux)

ORGANISM

PEDESTRIAN PERCEPTION

- Safety
- Comfort
- Visibility
- Pleasantness
- Risk

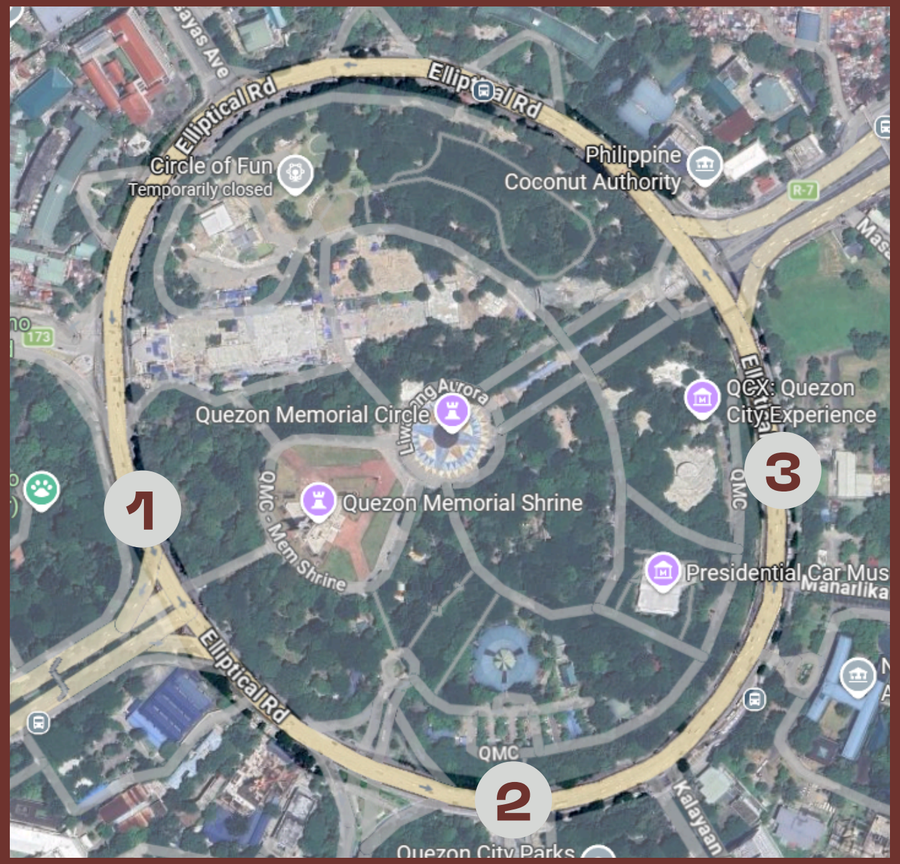
RESPONSE

BEHAVIORAL ENGAGEMENT

- Stay
- Use
- Return
- Recreation
- Experience

Environmental Input → *Internal State* → *Behavioral Outcome*

Study Sites



QUEZON CITY, PHILIPPINES

diverse nighttime pedestrian environments
+
high pedestrian and commuter activity
+
contrasting spatial conditions



1 QUEZON CITY PROMENADE BRIDGE

Elevated park connector

TRANSITIONAL



2 QUEZON CITY HALL UNDERPASS ENTRANCE

Underground connector + stop

MIXED-USE



3 TANDANG SORA TRANSPORT TERMINAL

Commuter stop

TRANSPORT

Different spatial functions → *Different nighttime conditions and activities*

What did we measure?

PHYSICAL ENVIRONMENT

LIGHTING PERFORMANCE

Color Temperature
(Kelvin)

Illuminance
(lux)

1-week nighttime measurement

USER EXPERIENCE

PEDESTRIAN RESPONSE

n = 66
18 variables
5-point Likert scale

Perception
+
Behavioral Engagement

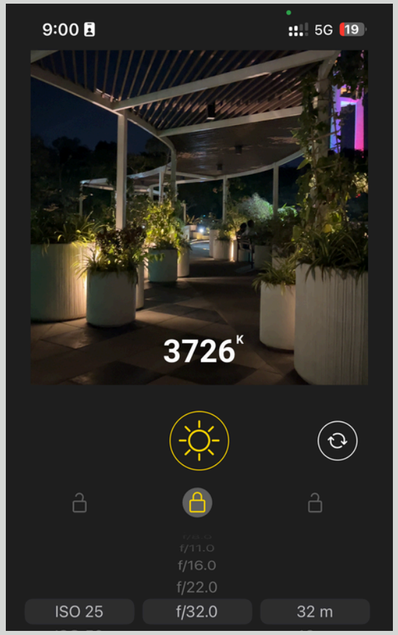
Stimulus → *Organism + Response*

Physical Environment → *Human Experience*

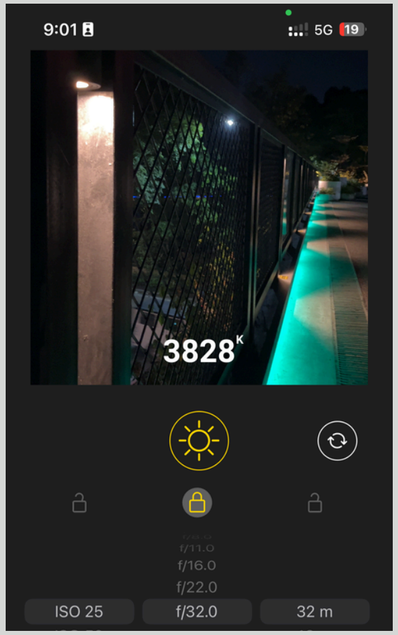
Data Collection

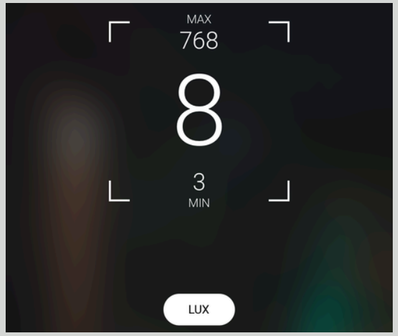
Lighting conditions were measured across one week (April 6-12, 2026)

QUEZON CITY PROMENADE BRIDGE

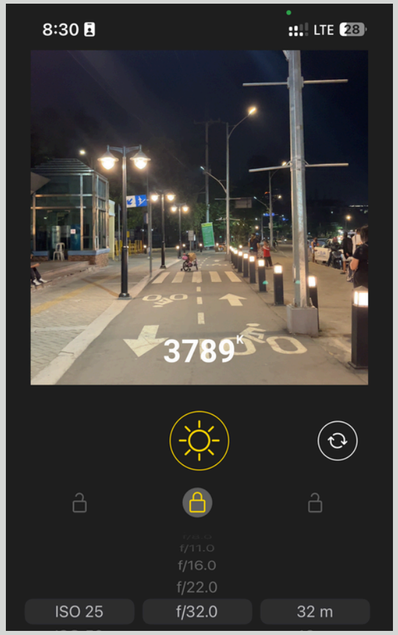




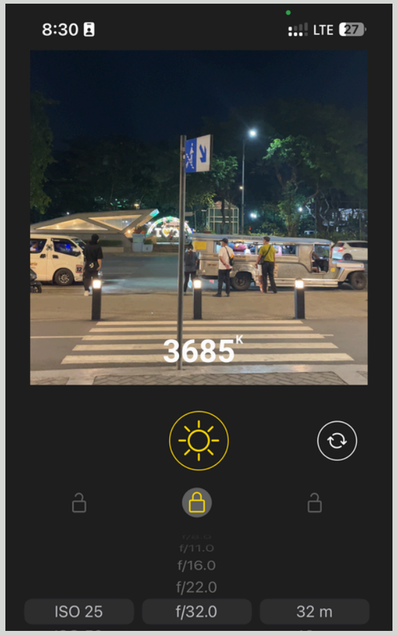




QUEZON CITY HALL UNDERPASS ENTRANCE

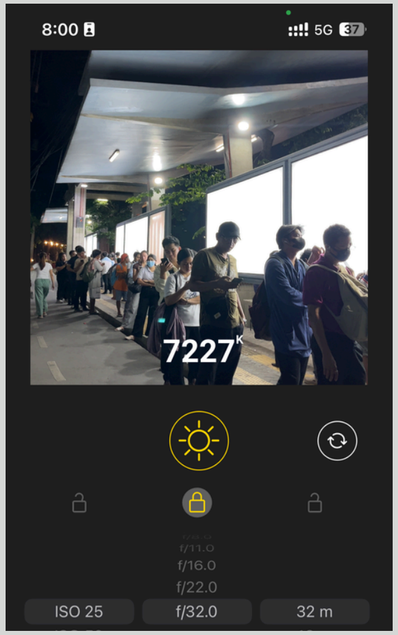




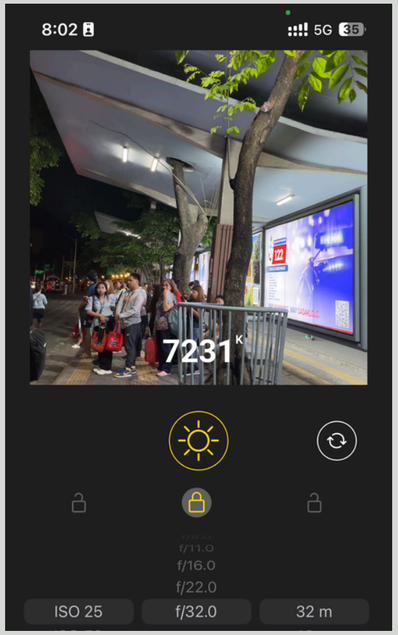


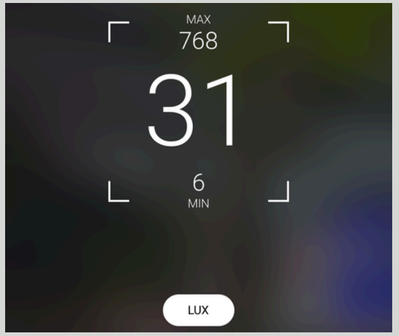


TANDANG SORA TRANSPORT TERMINAL









Application: *Lux Light Meter Pro (mobile app - iOS)*

Analytical Stategy

01 DESCRIBE

"Who participated?"

Descriptive statistics

02 COMPARE

How did lighting conditions differ?

Kruskal-Wallis Test

03 ASSESS

How did pedestrians evaluate the sites?

Means and Standard Deviation
Repeated Measures

04 PREDICT

Which perceptions were associated with engagement?

Simple linear regression

From physical conditions → *Pedestrian Experience* → *Behavioral Engagement*

Who participated?

n=66

Demographic Profile

GENDER
Male/ Female

AGE GROUP
18 - 39 y.o

LGBTQIA+
Yes/ No

PWD
Yes/ No

Relationship to Quezon City

RESIDENTS

NON – RESIDENTS

Site Familiarity

Respondents could select multiple familiar locations.



AREA 1



AREA 2



AREA 3

The study sites function as both local community spaces and regional urban corridors.

RESULTS/ FINDINGS

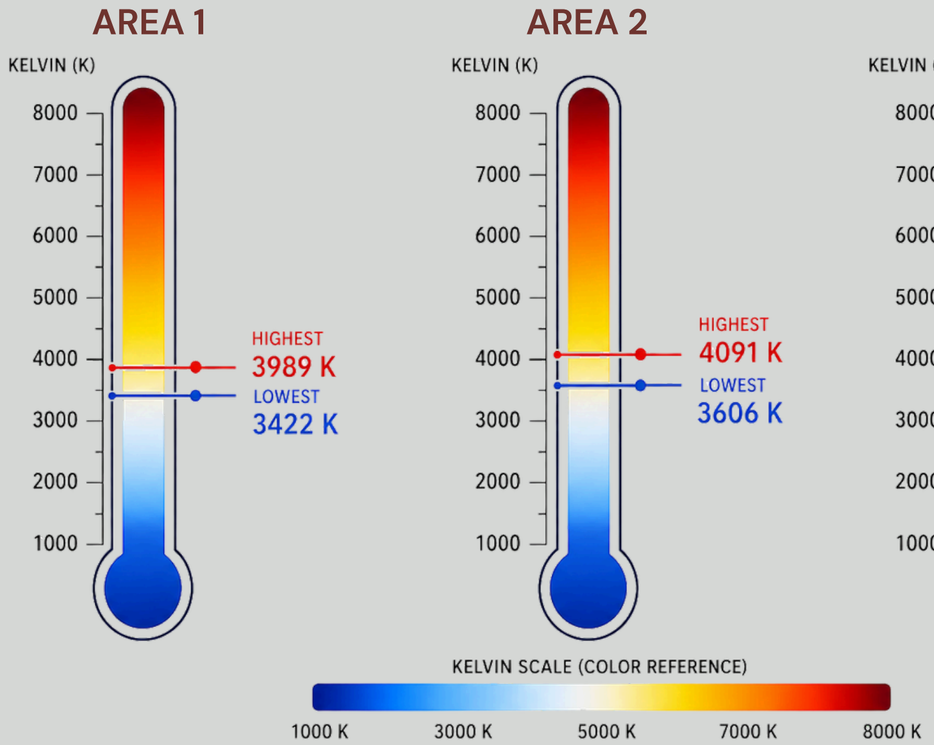
Lighting Conditions

Pedestrian Perception

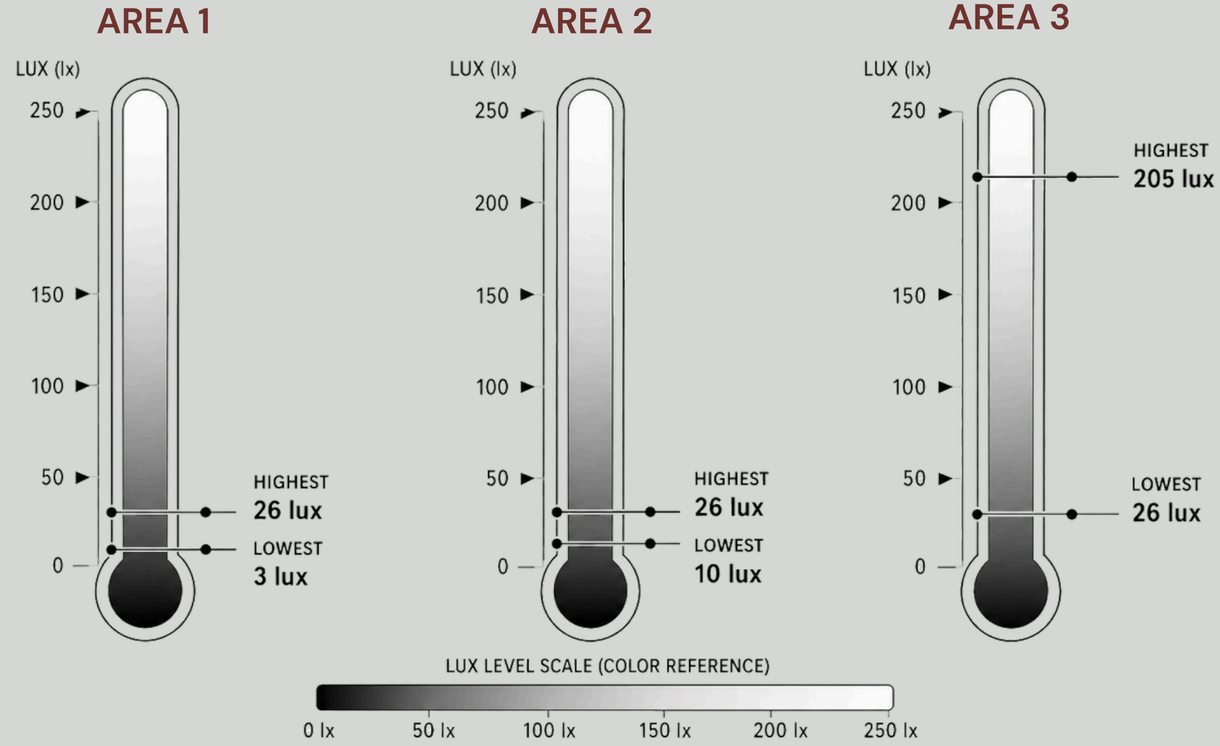
Behavioral Engagement

Lighting Conditions

Color Temperature - Kelvin



Illuminance - Lux



1 QUEZON CITY PROMENADE BRIDGE

Elevated park connector

TRANSITIONAL

3,846K (Color Temperature)

6 lux (Illuminance)

2 QUEZON CITY HALL UNDERPASS ENTRANCE

Underground connector + stop

MIXED-USE

3,834K (Color Temperature)

14 lux (Illuminance)

3 TANDANG SORA TRANSPORT TERMINAL

Commuter stop

TRANSPORT

7,250K (Color Temperature)

94 lux (Illuminance)

Three different nighttime environments → *Three markedly different measured lighting conditions*

Pedestrian Perception

ORGANISM (10 variables)

7 of 10

variables showed significant differences

OV1. Lighting satisfaction
OV2. Color temperature comfort
OV3. Lighting distribution
OV4. Visibility of surroundings
OV5. Visibility of people/movement
OV6. Reduction of dark areas
OV7. Perceived safety

NOT SIGNIFICANT:

OV8. Comfortable stay
OV9. Welcoming/ pleasant environment
OV10. Reduced worry about risks

MEAN SCORES (Variables)

	AREA 1	AREA 2	AREA 3
Lighting satisfaction	3.15	3.51	3.36
Color temperature comfort	3.38	3.49	3.02
Lighting distribution	3.05	3.42	2.92
Visibility of surroundings	3.15	3.66	3.54
Visibility of people/movement	3.00	3.59	3.56

	AREA 1	AREA 2	AREA 3
Reduction of dark areas	3.20	3.56	3.52
Perceived safety	3.25	3.59	3.48
Comfortable stay	3.15	3.37	3.10
Welcoming/ pleasant environment	3.22	3.47	3.18
Reduced worry about risks	3.15	3.39	3.44

Pedestrians experienced the three sites differently

Behavioral Engagement

RESPONSE (8 variables)

- DURATION OF STAY — RV1
- REGULAR USE — RV2
- PASS/ WAIT — RV3
- RETURN INTENTION — RV4
- SUPPORT IMPROVEMENTS — RV5
- RECOMMENDATION — RV6
- NIGHTTIME RECREATION — RV7
- OVERALL EXPERIENCE — RV8

5 of 8 behavioral variables showed significant differences

SIGNIFICANT ($p < 0.05$):

RV1.	Duration of Stay	($p = .002$)
RV2.	Regular Use	($p = .008$)
RV3.	Pass/ Wait	($p < .001$)
RV4.	Return Intention	($p < .001$)
RV7.	Nighttime Recreation	($p = .035$)

NOT SIGNIFICANT:

RV5.	Support Improvements	($p = .328$)
RV6.	Recommendation	($p = .085$)
RV8.	Overall Experience	($p = .155$)

Differences also appeared in Behavioral Engagement

The key question

What psychological responses were associated with behavior?

STIMULUS



LIGHTING CONDITIONS

- Color Temperature (Kelvin)
- Illuminance (lux)

ORGANISM



PEDESTRIAN PERCEPTION

- Safety
- Comfort
- Visibility
- Pleasantness
- Risk

RESPONSE



BEHAVIORAL ENGAGEMENT

- Stay
- Use
- Return
- Recreation
- Experience

Regression findings



1 QUEZON CITY PROMENADE BRIDGE

Elevated park connector

OV8
Comfortable Stay

OV9
Welcoming/ pleasant environment

OV10
Reduced worry about risks

BEHAVIORAL OUTCOMES *(predicted)*

RV1
Duration of stay

RV4
Return Intention

RV7
Nighttime Recreation

RV2
Regular Use

RV6
Recommendation

RV8
Overall Experience

In a transitional environment, psychological comfort and perceived atmosphere were closely associated with engagement.

Regression findings



2 QUEZON CITY HALL UNDERPASS ENTRANCE

Underground connector + stop

OV2
Color Temperature Comfort

OV4
Visibility of Surroundings

OV5
Visibility of people/ movement

OV7
Perceived Safety

OV8
Comfortable Stay

OV9
Welcoming/ pleasant environment

OV10
Reduced worry about risks

BEHAVIORAL OUTCOMES *(predicted)*

RV1
Duration of stay

RV2
Regular Use

RV3
Pass/ Wait

RV4
Return Intention

RV5
Support Improvements

RV6
Recommendation

RV7
Nighttime Recreation

RV8
Overall Experience

In a mixed-use environment, lighting experience extended beyond visibility to comfort, atmosphere, and lighting tone.

Regression findings



3 TANDANG SORA TRANSPORT TERMINAL

Commuter stop

OV4
Visibility of Surroundings

OV5
Visibility of people/ movement

OV7
Perceived Safety

OV8
Comfortable Stay

OV9
Welcoming/ pleasant environment

OV10
Reduced worry about risks

BEHAVIORAL OUTCOMES *(predicted)*

RV1
Duration of stay

RV3
Pass/ Wait

RV6
Recommendation

RV8
Overall Experience

RV2
Regular Use

RV4
Return Intention

RV7
Nighttime Recreation

In a transport-oriented environment, functional safety and visual clarity became more prominent.

Cross-site synthesis

AREA 1
QUEZON CITY PROMENADE BRIDGE



Spatial Function
Transitional

Key Responses
Comfort

Important Predictors
OV8, OV9, OV10

Behavioral Context
Passing / Staying

AREA 2
QUEZON CITY HALL UNDERPASS ENTRANCE



Spatial Function
Mixed-Use

Key Responses
Comfort + Atmosphere

Important Predictors
OV2, OV4, OV5, OV7, OV8, OV9, OV10

Behavioral Context
Staying / Interacting

AREA 3
TANDANG SORA TRANSPORT TERMINAL



Spatial Function
Transport

Key Responses
Safety + Visibility

Important Predictors
OV4, OV5, OV7, OV8, OV9, OV10

Behavioral Context
Waiting / Moving

Lighting does not operate in isolation. Its effect is experienced through the function of the space.

The most consistent predictors

The following organism variables were consistently associated with behavioral engagement in all three study areas

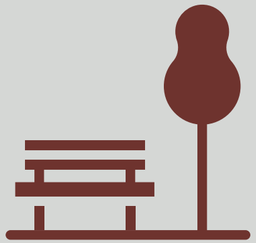
OV8



Comfortable Stay

"The lighting makes me feel comfortable staying in this area."

OV9



Welcoming/ pleasant environment

"The lighting makes the environment feel welcoming and pleasant."

OV10



Reduced worry about risks

"I feel less worried about potential risks because the area is well lit."

LIGHTING CONDITIONS
(Color Temperature + Illuminance)

↓

PEDESTRIAN PERCEPTION
(Comfort, Pleasantness, Reduced Risk)

↓

BEHAVIORAL ENGAGEMENT
(Stay, Use, Return, Recreation, Overall Experience)

OV8, OV9 and OV10 were associated with behavioral engagement across all three environments

This suggests that the perception of comfort, pleasantness and reduced risk is a key driver of nighttime engagement, regardless of the spatial function of the site.

Interpretation

STIMULUS

ORGANISM

RESPONSE

The results support the interpretation that nighttime lighting conditions are related to pedestrian perceptions, which are in turn associated with behavioral engagement.

What does this mean for design?

Human-centered lighting requires more than adequate illumination



Design for the Spatial Function

Transitional, mixed-use, and transport spaces require different lighting priorities.



Design for Perception

Evaluate comfort, safety, visibility, atmosphere, and perceived risk, not only lux levels.



Design for Behavior

Consider whether lighting supports staying, movement, return, recreation, and overall nighttime experience.

Lighting quality should be evaluated through both technical performance and human experience.

Conclusion

01

THE ENVIRONMENTS DIFFERED

The three study areas had markedly different nighttime lighting profiles in terms of illuminance and color temperature.

02

PERCEPTION MATTERED

Differences in lighting conditions were associated with differences in visibility, safety, comfort, pleasantness, and perceived risk across the three environments.

03

EXPERIENCE WAS LINKED TO ENGAGEMENT

Across all three areas, three perceptions consistently appeared as predictors of behavioral engagement: OV8 - Comfortable stay / OV9 - Welcoming/ pleasant environment / OV10 - Reduced worry about risks

Nighttime lighting is not only about how much light a space has but how that light is perceived, experienced and translated into behavior.

Recommendation

01

DESIGN FOR VISIBILITY

Prioritize balanced and uniform lighting, minimize dark spots and excessive contrast, and maintain adequate visibility of surrounding objects, people, and movement.

02

PRIORITIZE SAFETY AND COMFORT

Focus lighting improvements on crossings, waiting areas, underpasses, transport hubs, and recreational spaces where nighttime pedestrian activity is concentrated.

03

SUPPORT NIGHTTIME ENGAGEMENT

Use lighting together with seating, landscaped walkways, gathering spaces, and transport facilities to support staying, movement, recreation, and social interaction.

04

INCLUDE USER EVALUATION

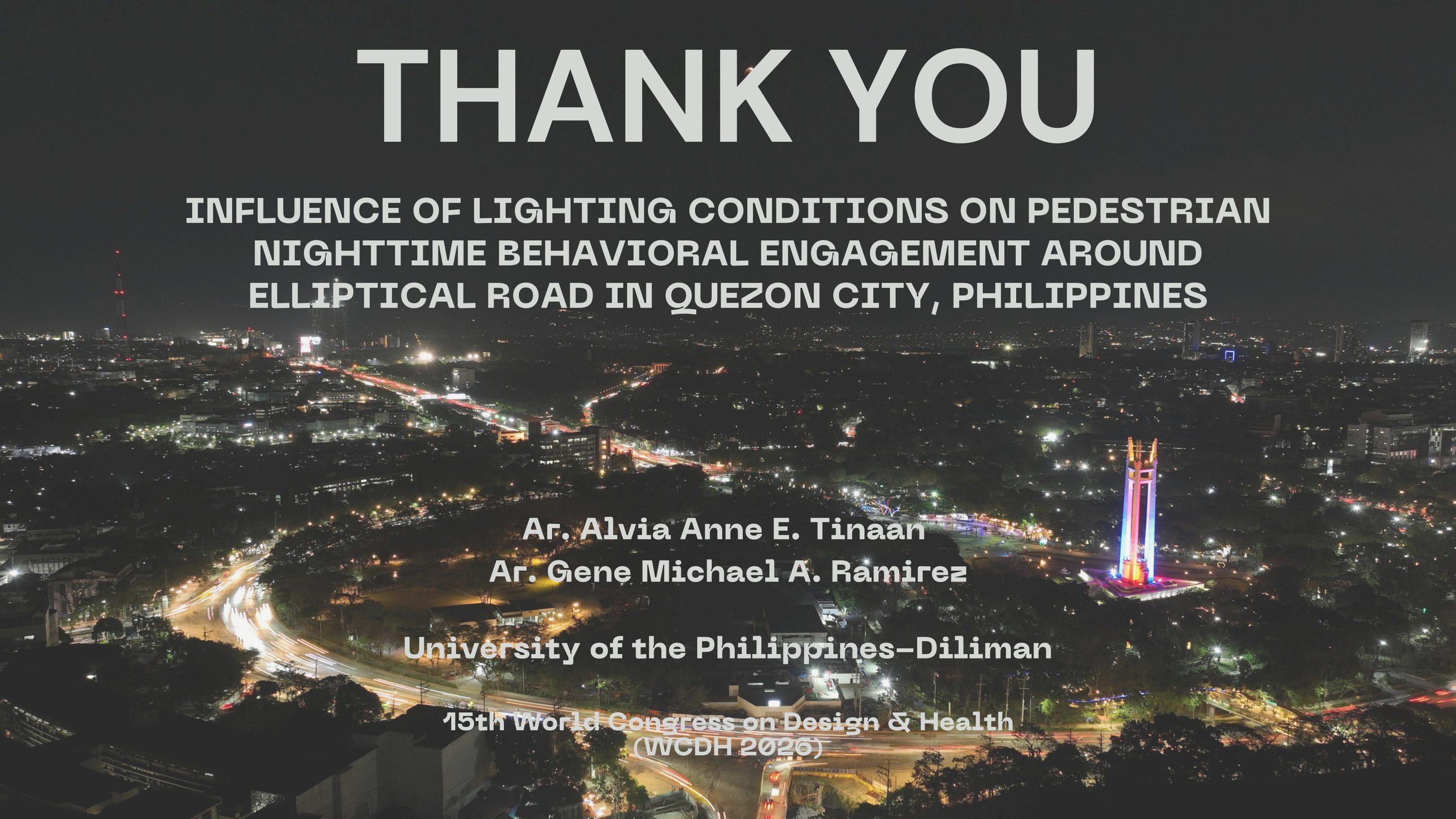
Combine technical lighting standards with user perception and behavioral evaluation when developing public lighting projects.

Future Research

Expand the evidence base through larger and more diverse samples, additional public-space types, and environmental factors such as weather, crowd density, age, glare, vertical illuminance, spectral composition, and adaptive lighting systems.

THANK YOU

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