

Waterfront Analyses by Students of Worcester Polytechnic Institute: “Cool and Covered”

Hong Kong Project Center 2024

VERONIKA GORSKI, LOTTIE MCLEOD, ROHAN PRASAD, DREW TRUST



WPI



Our Team



**VERONIKA
GORSKI**

Biomedical Engineer
United States



**LOTTIE
MCLEOD**

Civil Engineer
United States



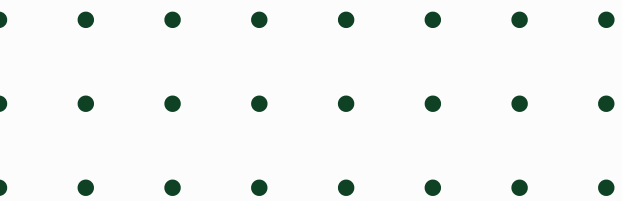
**ROHAN
PRASAD**

Data Scientist
United States



**DREW
TRUST**

Electrical Engineer
United States



Sponsors



Paul Zimmerman (right)
Samuel Wong (left)

副運
DesigningHongKong
香港.com

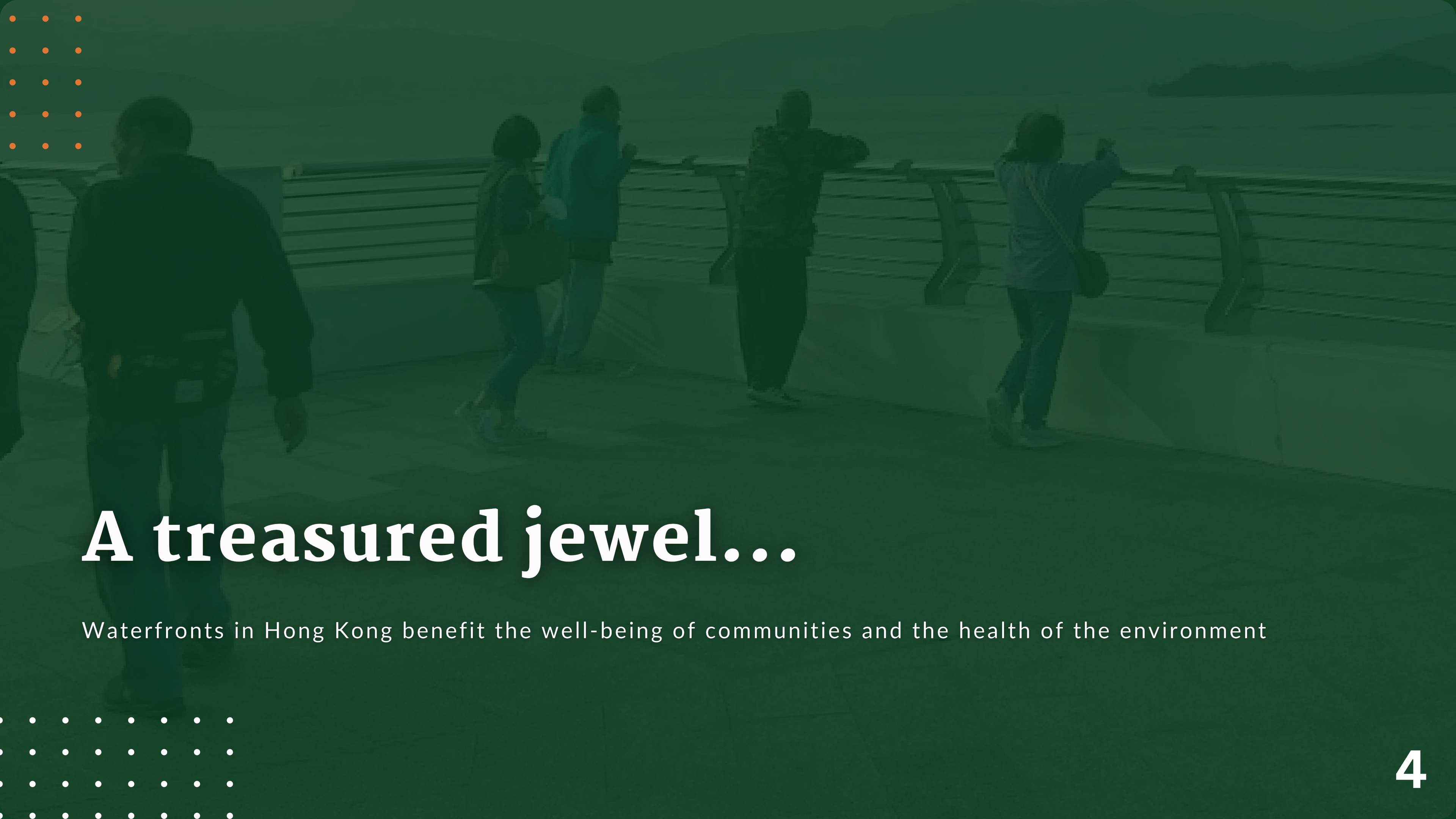


Alain Chiaradia



THE UNIVERSITY OF HONG KONG 香港大學
faculty of architecture 建築學院





A treasured jewel...

Waterfronts in Hong Kong benefit the well-being of communities and the health of the environment



Waterfront sites are spaces for community engagement and personal leisure





Weather is a strong factor in waterfront attendance

At a temperature of 30°C, a 1°C increase in temperature is associated with a 4% drop in park attendance.

Tongping Hao
The University of Hong Kong

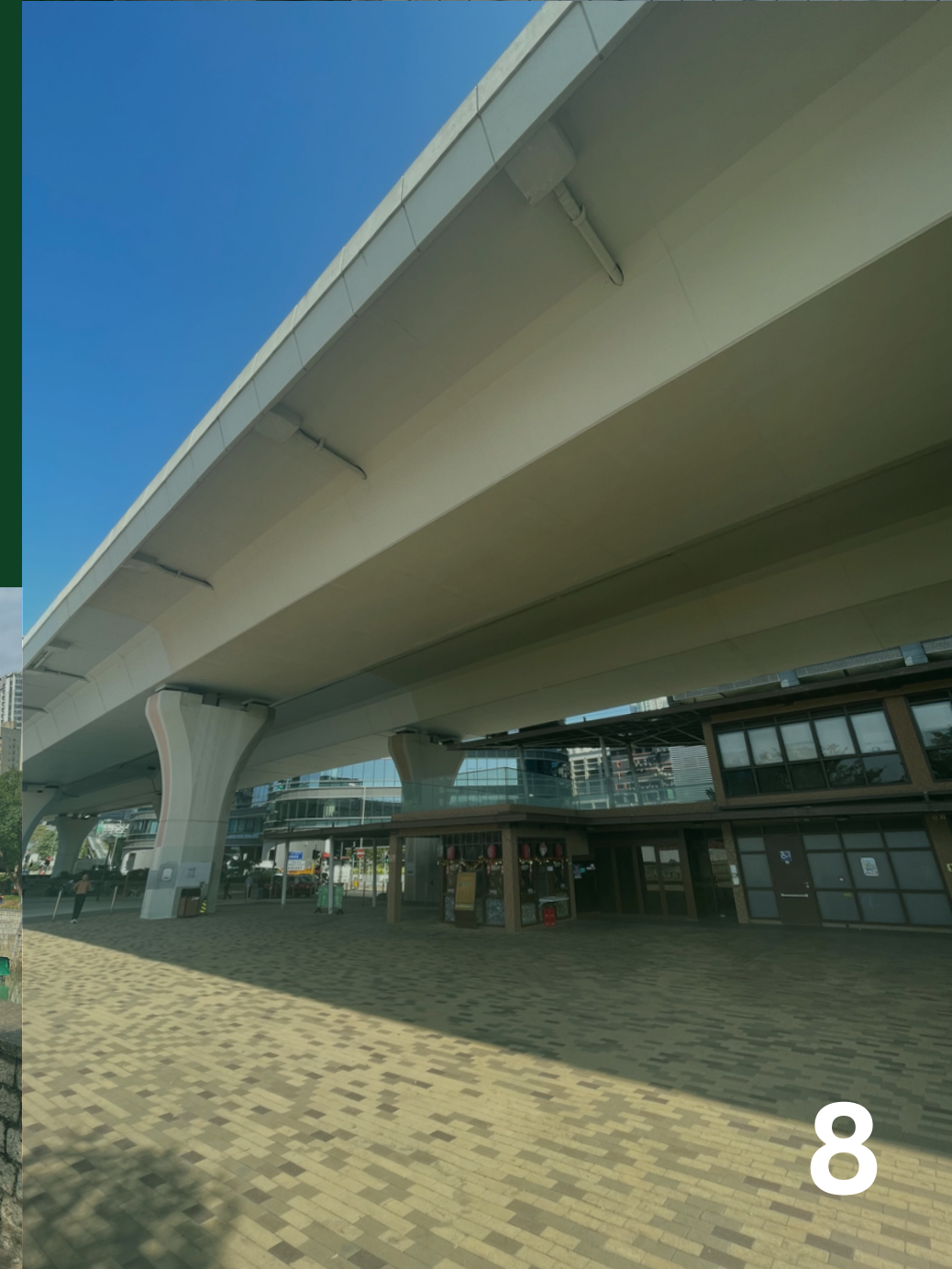
Building cover structures are a method of mediating hot weather, and making spaces more enjoyable.



But how impactful are they throughout the year?



**So, let's investigate
the scope of the
cooler season.**



Project Goal

Understand if structures that provide cover on the Hong Kong waterfronts effect waterfront usage during the winter season.

Question 1

Where and when on the waterfront do people choose to spend time when static?

Question 2

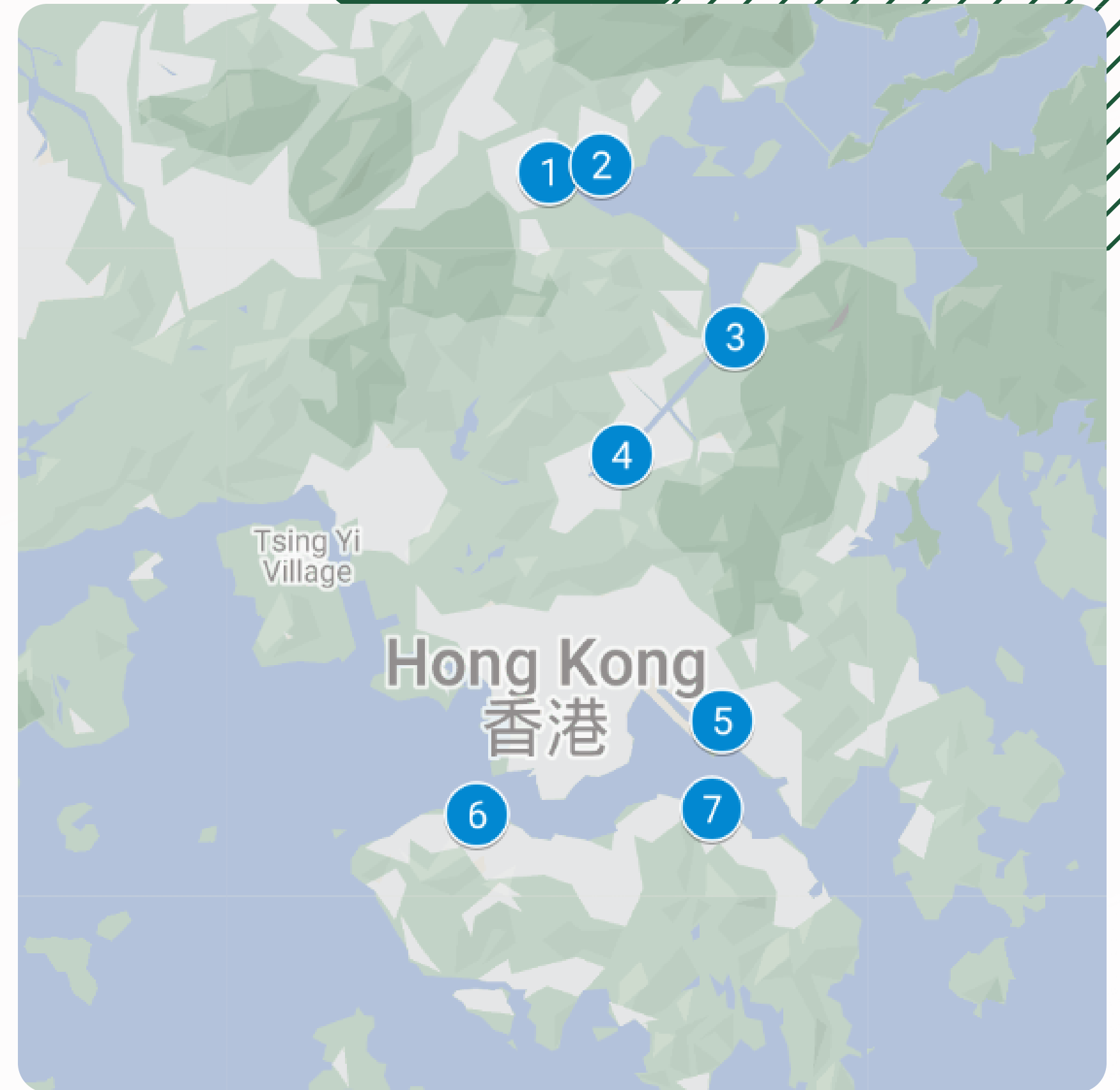
Do specific weather patterns impact the utilisation of cover?

Question 3

Are observed activity patterns consistent throughout all the waterfronts?

Areas of Study

1. Lam Tsuen River Promenade
2. Tai Po Waterfront Park
3. Ma On Shan Promenade
4. Sha Tin Park
5. Kwun Tong Promenade
6. Sheung Wan Promenade
7. Quarry Bay Promenade



Methods



Static mapping



Behaviour tracking



Observational Studies



Static Mapping



- 9-10AM Covered
- 9-10AM Uncovered
- 1-2PM Covered
- 1-2PM Uncovered
- 5-6PM Covered
- 5-6PM Uncovered

KEY

Date: 06/02/2024
Day of Week: TUE

	9-10AM	1-2PM	5-6PM
Weather:	P/Cloudy 19C	Cloudy 22C	Cloudy 21C
Wind:	15 kph W	17 kph W	19 kph W

Each dot represents 1 person





Behaviour Tracking

- Time & day
- Location
- Weather
- Static activity
 - Structure
 - Number of people
 - Covered/Not covered
 - Green structure/Grey structure?

Static Activity Chart

Date: _____ Time: _____ Day of Week: _____ Location: _____ Weather: _____ Wind (speed and direction): _____

Structure Characteristics ↓	Type of Structure →	Bench/ Table		Ampitheater/ Pavillion		Kiosk/ Bathrooms		Bridge/ Overpass		Natural Structure (Tree, bush etc.)		Decoration (Display, Art)		Other:	
		A:	B:	A:	B:	A:	B:	A:	B:	A:	B:	A:	B:	A:	B:
Structure (A,B,C,D – include description of object) (ex. Bench {A}, Bench {B}, etc.)															
Number of People (#)		A:	B:	A:	B:	A:	B:	A:	B:	A:	B:	A:	B:	A:	B:
		C:	D:	C:	D:	C:	D:	C:	D:	C:	D:	C:	D:	C:	D:
Not Covered (# of people)															
Covered (# of people in the area) Green Or Gray?		Green:	Gray:	Green:	Gray:	Green:	Gray:	Green:	Gray:	Green:	Gray:	Green:	Gray:	Green:	Gray:

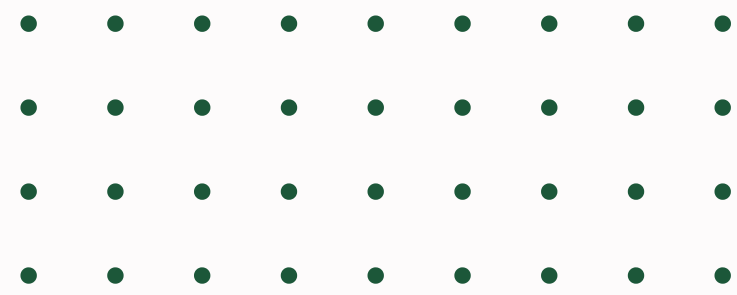


Observational Studies

- Taking photos
- Noting observations of various patterns
 - Age groups present
 - Popular structures
 - Popular activities and actions

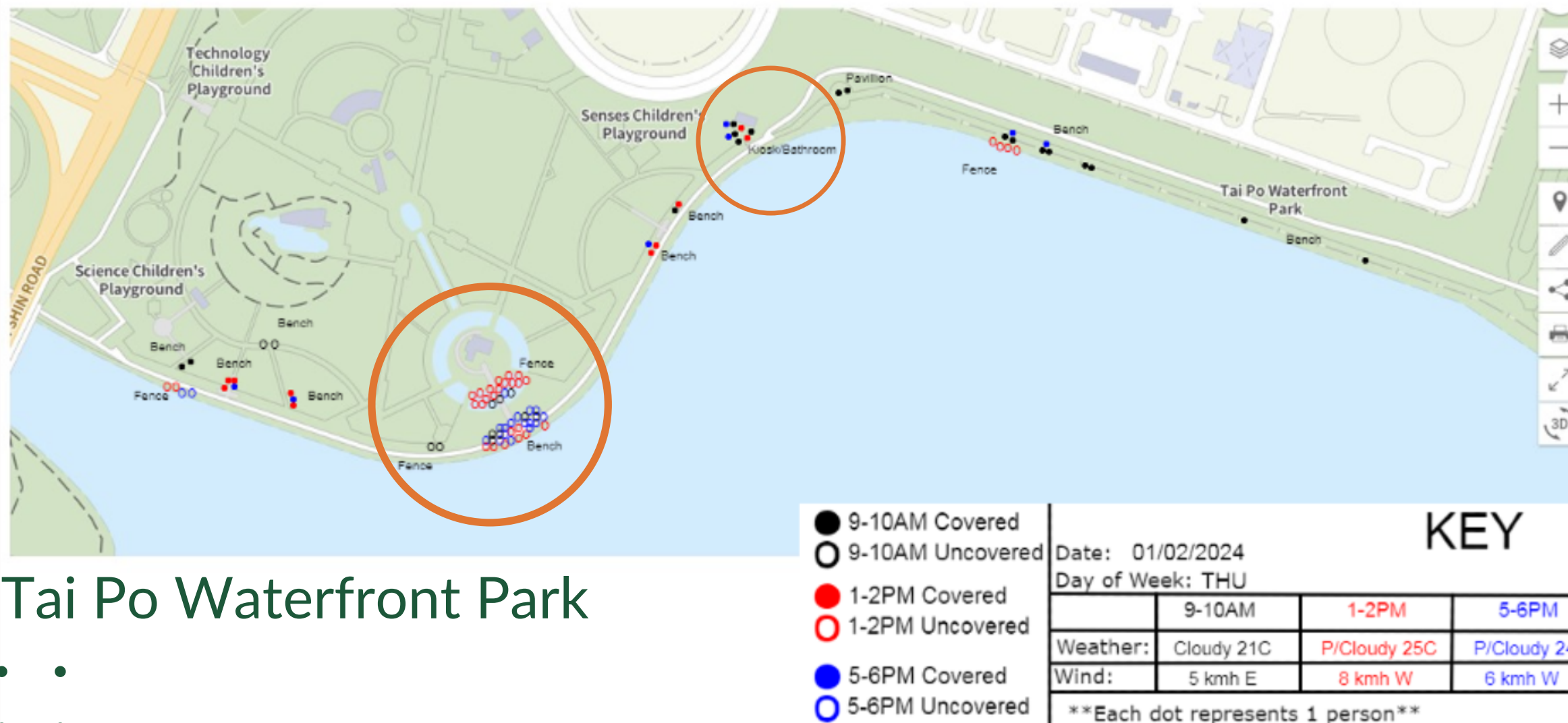


Results



Where on the waterfront do people choose to spend time when static?

- Key areas:
 - Waterfront fences
 - Benches that face the water
 - Grouped benches



Where on the waterfront do people choose to spend time when static?

- Key areas:
 - Waterfront fences
 - Benches that face the water
 - Grouped benches



- 9-10AM Covered
- 9-10AM Uncovered
- 1-2PM Covered
- 1-2PM Uncovered
- 5-6PM Covered
- 5-6PM Uncovered

KEY

Date: 03/02/2024
Day of Week: SAT

	9-10AM	1-2PM	5-6PM
Weather:	Cloudy 20C	P/Cloudy 23C	Cloudy 22C
Wind:	19 kph SE	17 kph SE	7 kph SE

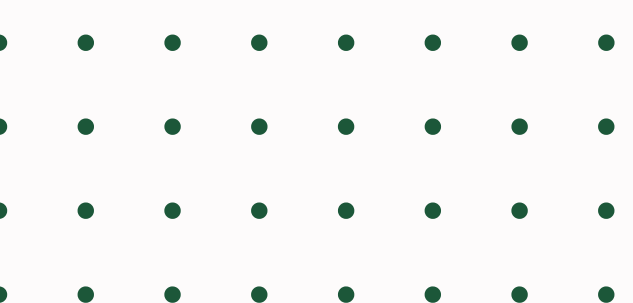
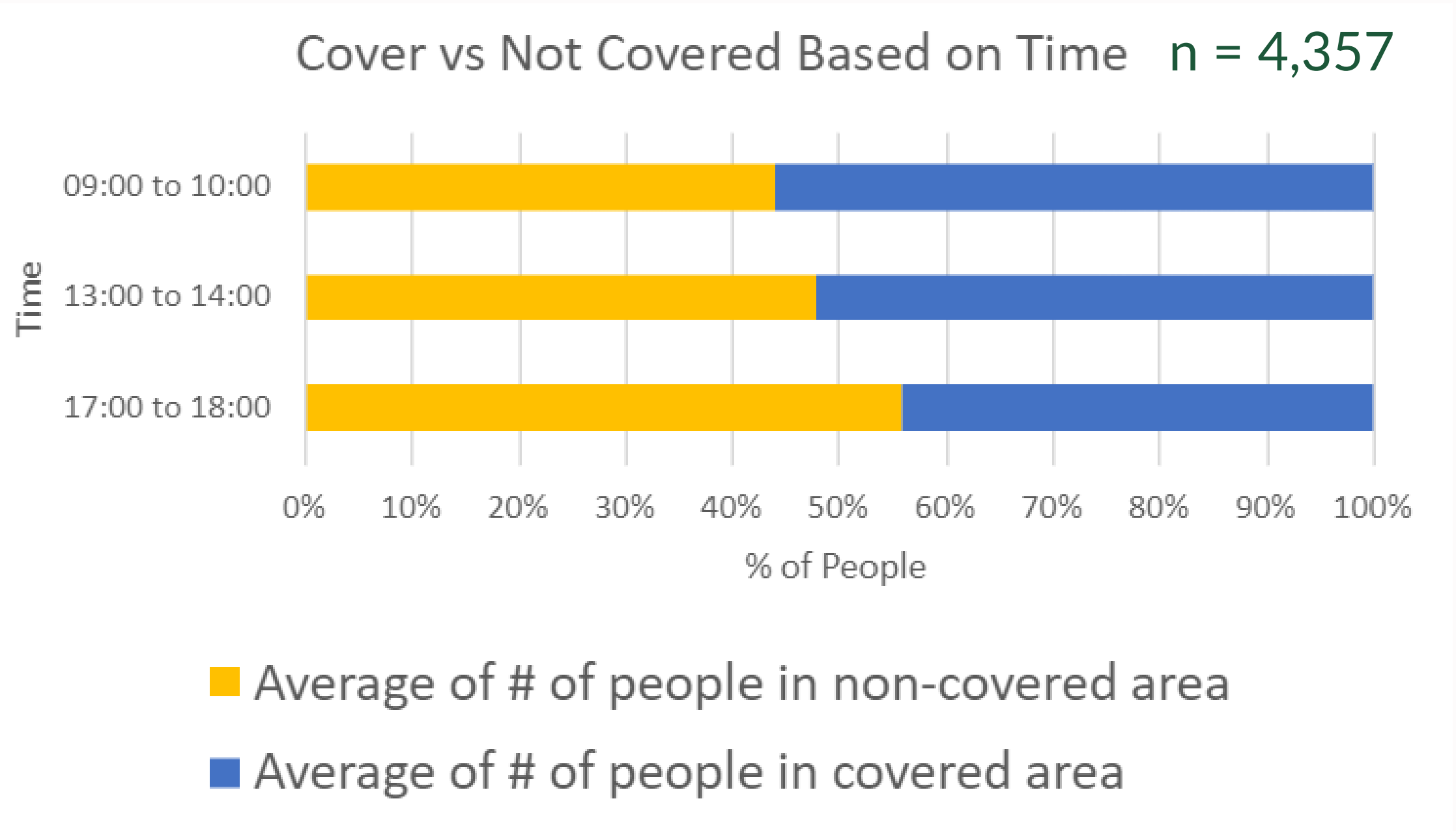
Each dot represents 1 person

Sha Tin

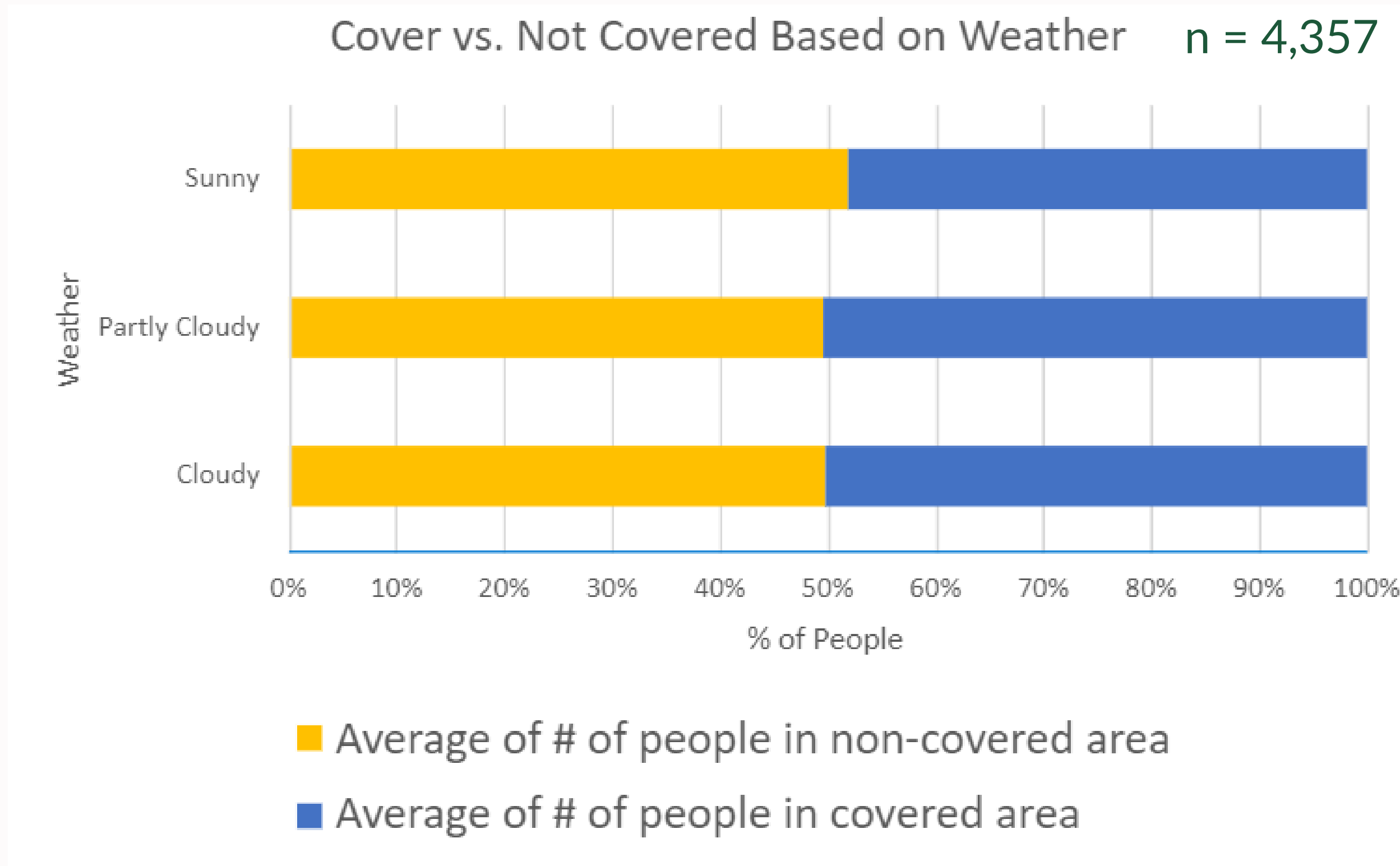
When do people choose to spend time on the waterfront?



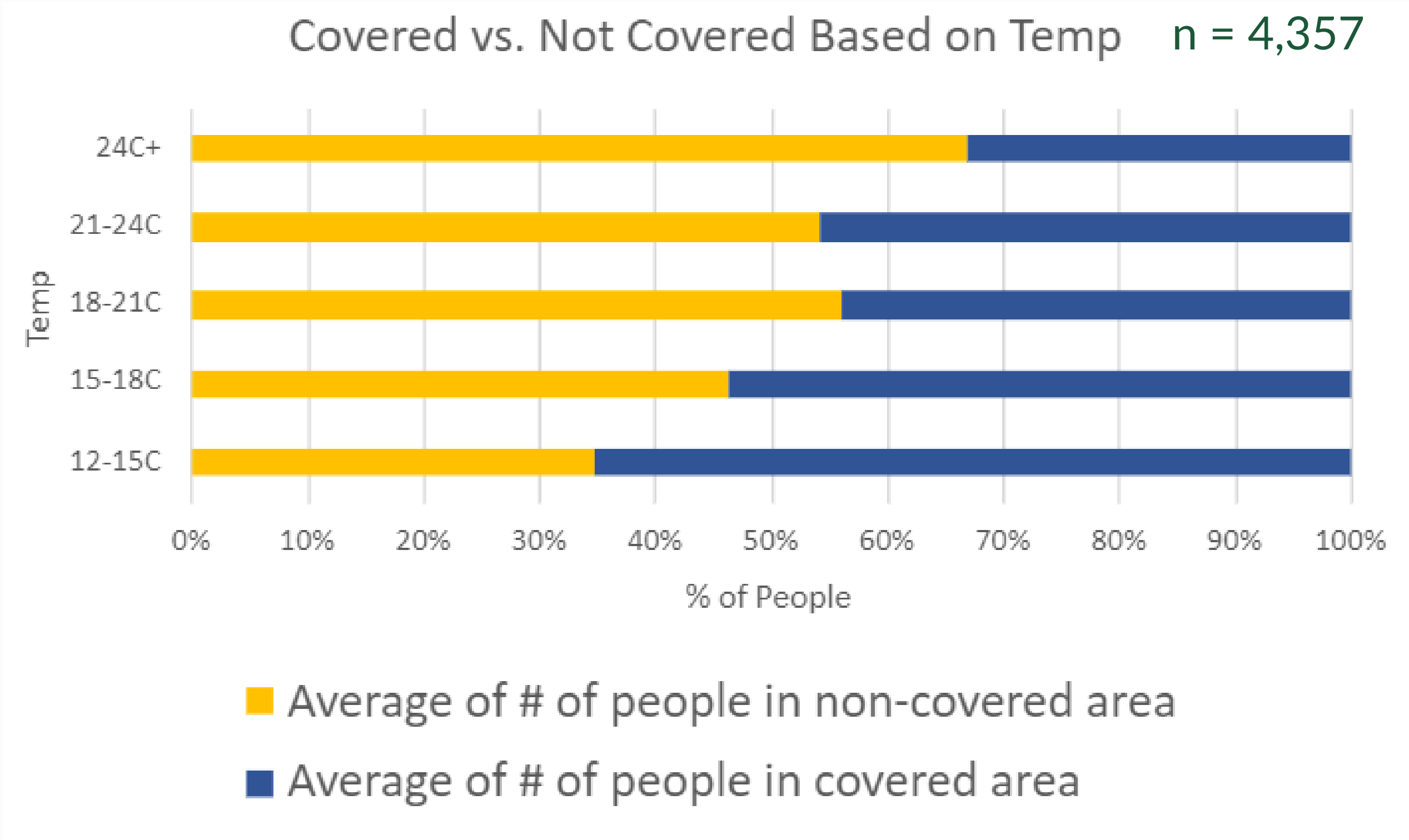
- Consistent patterns
 - More people prefer to be in non-covered areas later in the day
 - In most cases, increase in temperature increases preference for non-covered areas



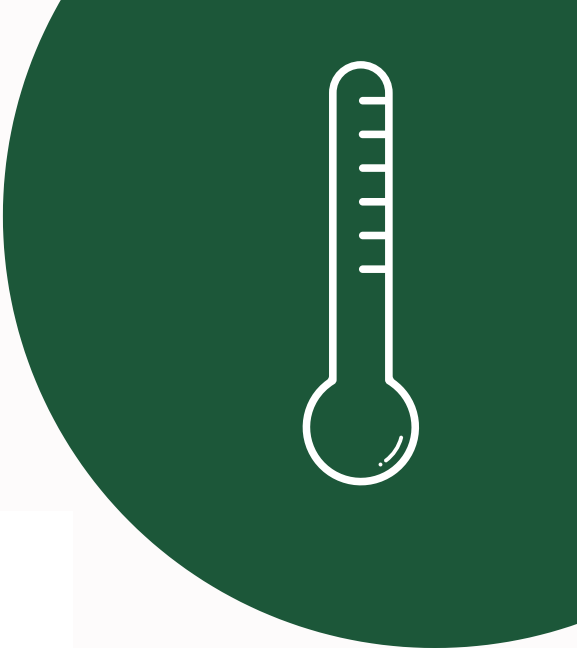
Do specific weather patterns impact the utilization of cover?



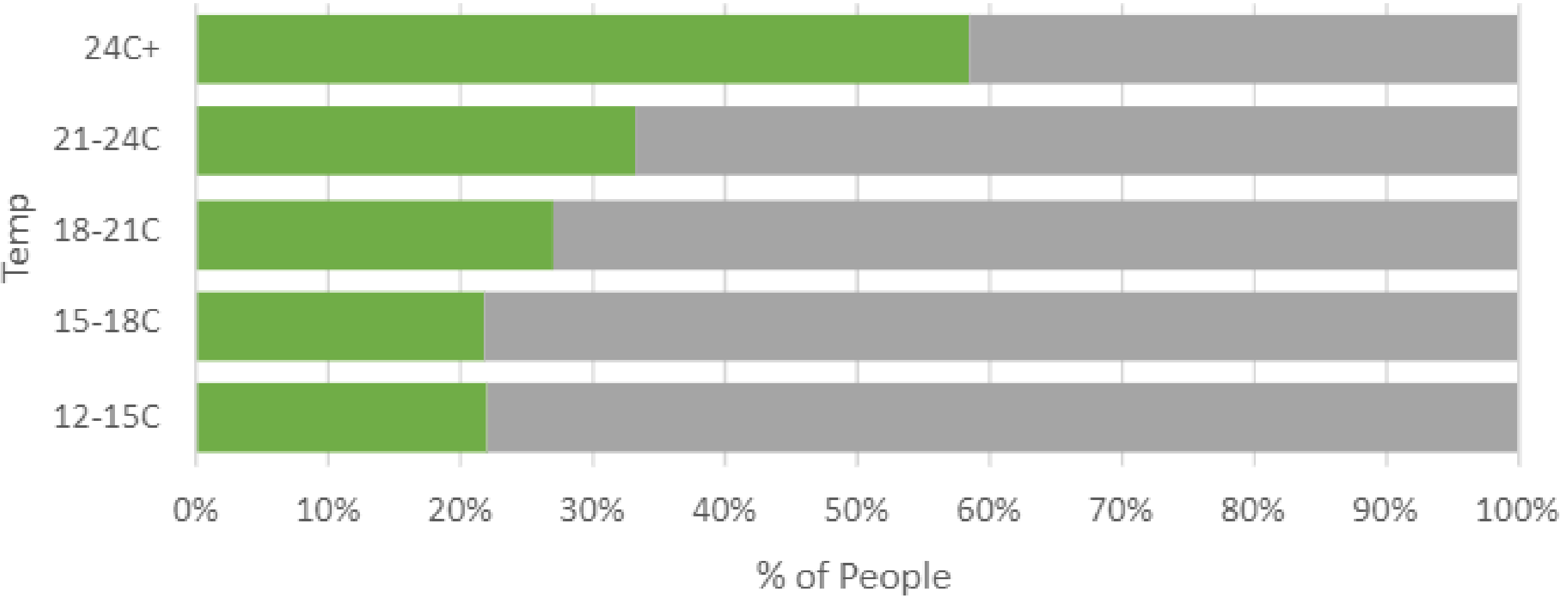
Temperature has the greatest impact on cover utilization.



There is a greater preference for green cover as temperature increases.



Green vs. Grey Cover based on Temp n = 2,190



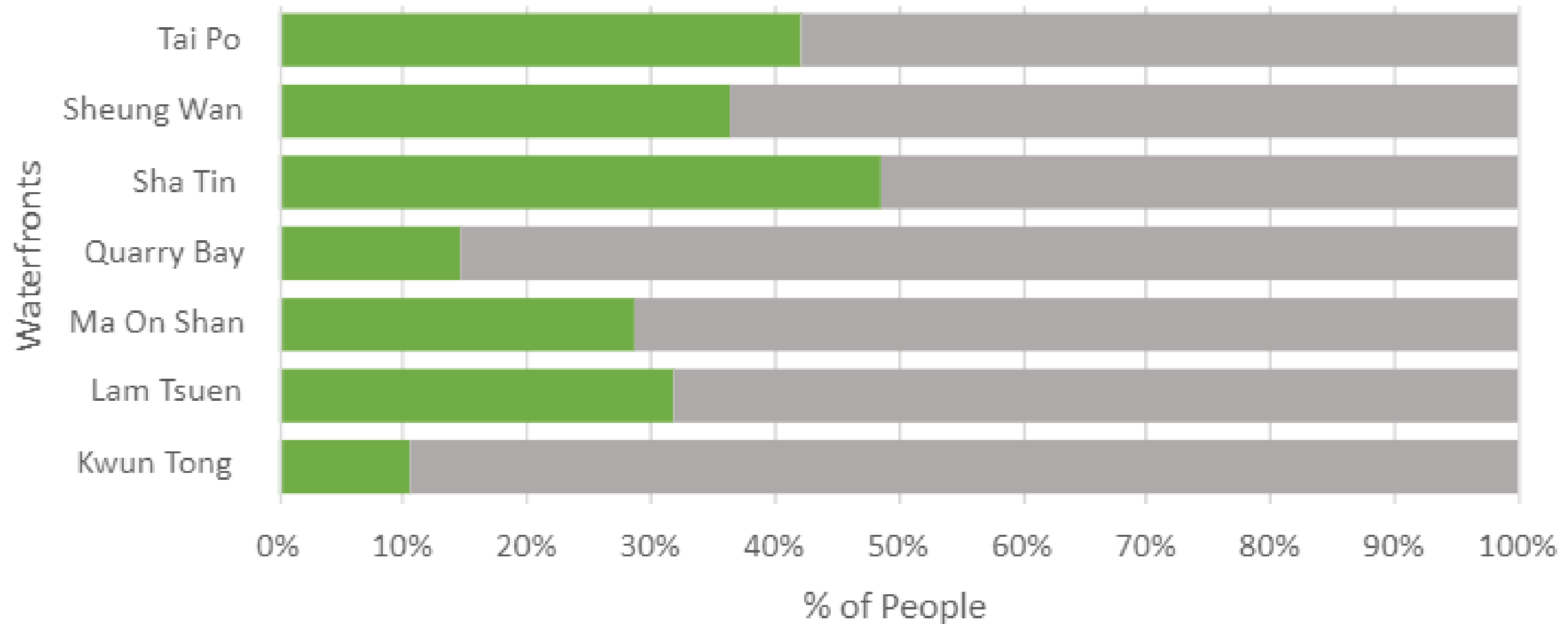
- Average of # of people in green covered space
- Average of # of people in grey covered space



Are observed activity patterns consistent throughout all the waterfronts?



Distribution of Green Cover vs. Grey Cover Usage $n = 2,190$



- Average of # of people in green covered space
- Average of # of people in grey covered space

Proposed Solutions



More centralised seating



Balance of cover vs non-cover



Continue to investigate in the summer



More centralised seating

Proposed Solutions

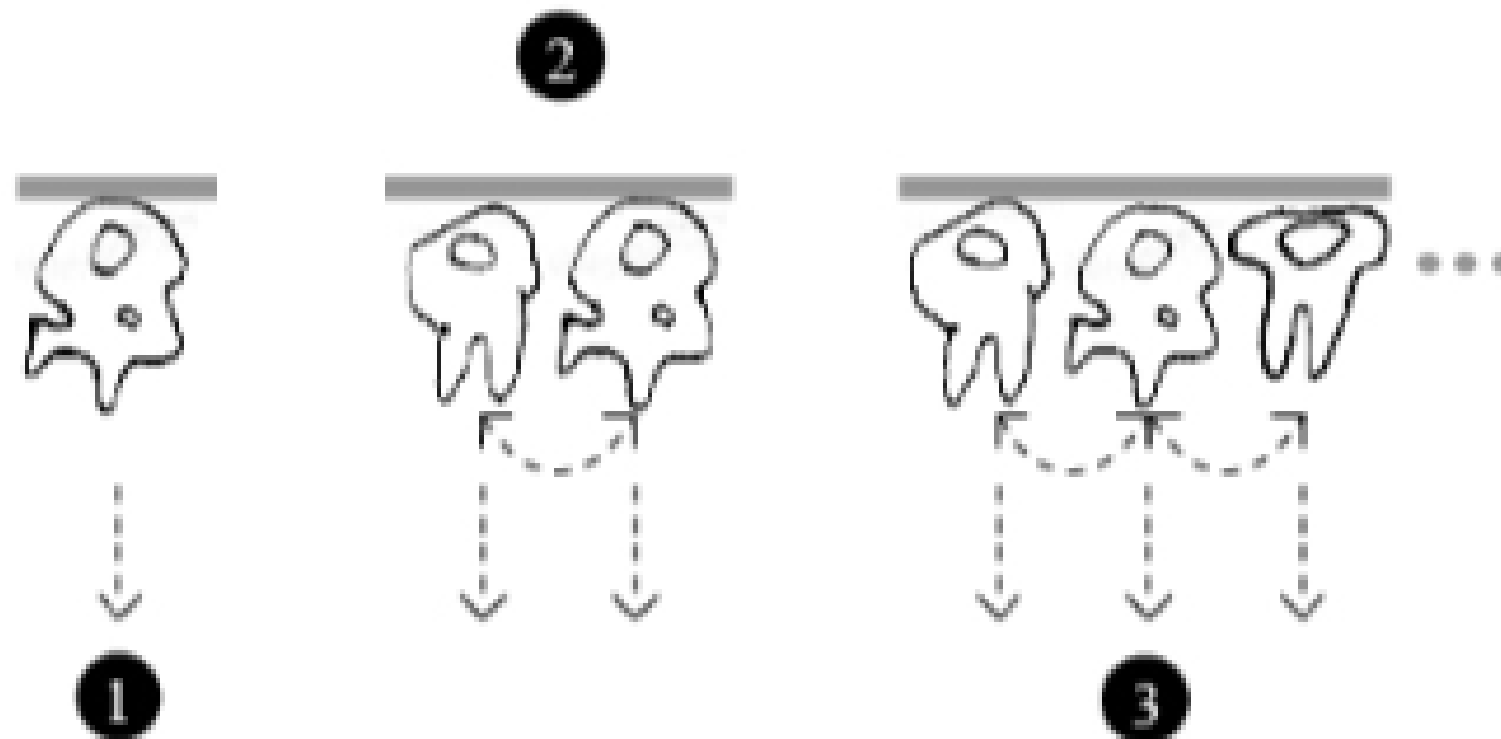
Centralised Seating

Single or linear orientated formation

Multiple & circular orientated formation

Two users sit side by side & face at scene

Users (more than three) sit in circle at a pavilion



User sits alone & faces at scene

Users (more than two) sit side by side & face at scene

Picture courtesy of Research Gate, [Lee Brian Yu-hin](#)

Exemplary Centralised Seating

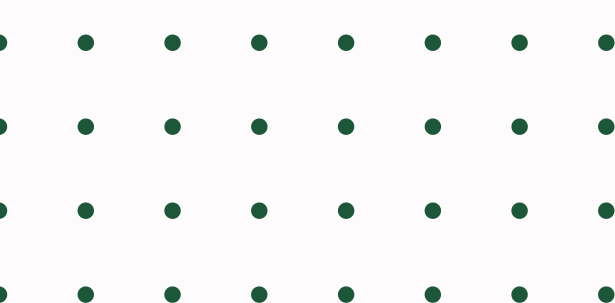
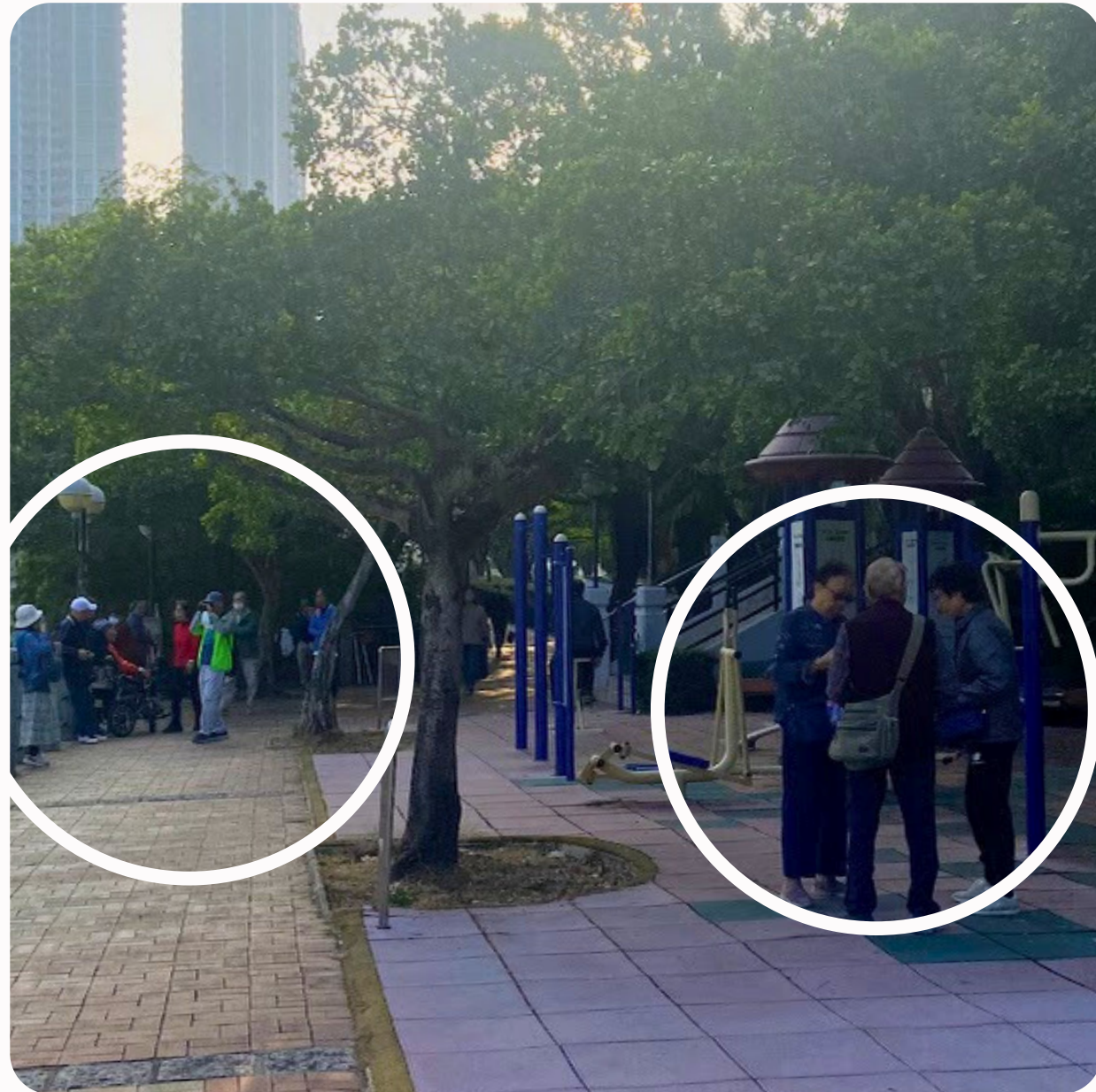
Kwun Tong



Tai Po Waterfront



More Centralised Seating Needed: Sha Tin



More Centralised Seating Needed: Sheung Wan



Proposed Solutions



Balance of cover
vs non-cover

Exemplary Balance of Cover vs Non-Cover: Kwun Tong

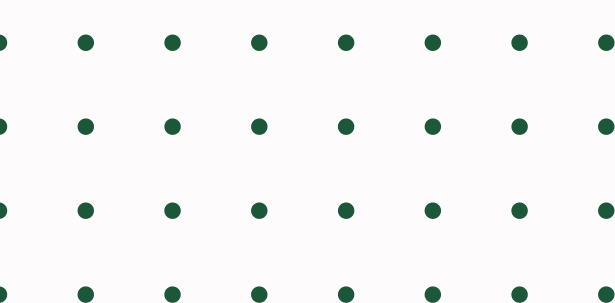
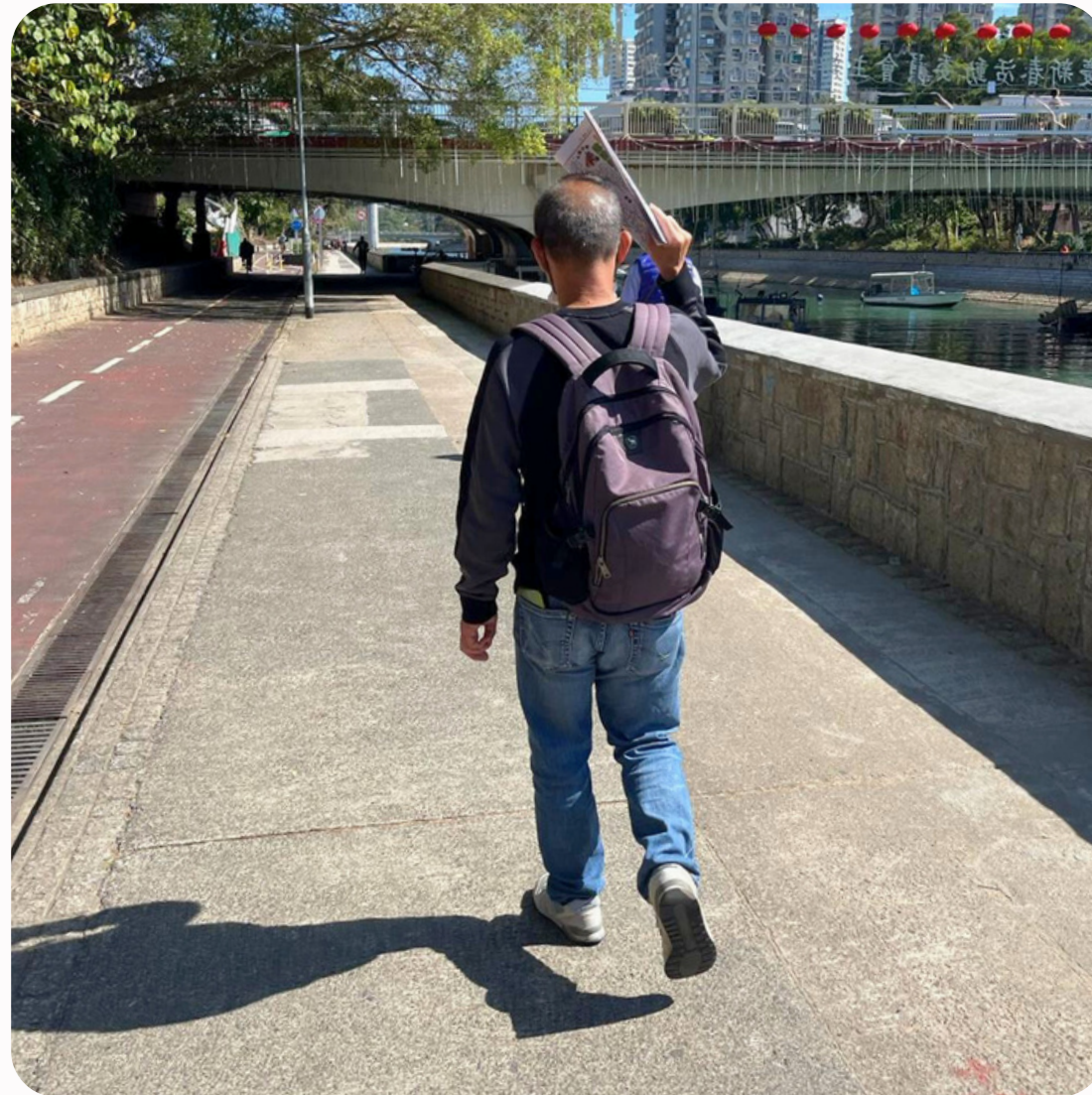


Needs Improvement on the Balance of Cover vs Non-Cover: Lam Tsuen



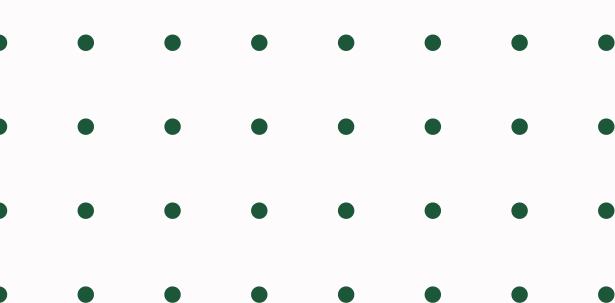
Additional Observations

- Protection from the sun is still highly valued, even during the winter



Additional Observations

- Use of trees should be reconsidered in terms of shading effectiveness
- Data supports preference for green cover as temperature increases





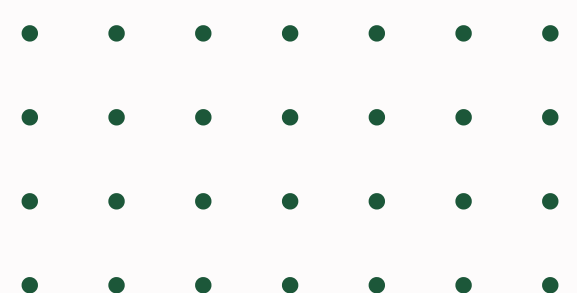
Proposed Solutions



Continue to
investigate in
the summer

Continue to Investigate in the Summer

- As temperature increases, the average number of people in non-covered areas increases
 - This relationship could change, once the temperature increases beyond 30 degrees Celsius
- Further investigation will provide a more comprehensive basis for further improvements
- Recommend conducting the same study in July or August



References

White, M. P., Elliott, L. R., Grellier, J., Economou, T., Bell, S., Bratman, G. N., Cirach, M., Gascon, M., Lima, M. L., Löhmus, M., Nieuwenhuijsen, M., Ojala, A., Roiko, A., Wesley, S. P., van, & Fleming, L. E. (2021). Associations between green/blue spaces and mental health across 18 countries. *Scientific Reports*, 11, 8903. <https://doi.org/10.1038/s41598-021-87675-0>

Hao, T., Chang, H., Liang, S., Jones, P., Chan, P. W., Li, L., & Huang, J. (2023). Heat and park attendance: Evidence from “small data” and “big data” in Hong Kong. *Building and Environment*, 234, 110123. <https://doi.org/10.1016/j.buildenv.2023.110123>

Whyte, W. H. (2012). *City: Rediscovering the Center*. In Google Books. University of Pennsylvania Press. https://books.google.com.hk/books?id=Qov3yfltdkYC&printsec=frontcover&redir_esc=y#v=onepage&q&f=false

Yu-hin, L. B., Denise, C., & Xi Tang, M. (2017, July). Park Furniture Design in Hong Kong: A Case Study of Inclusive Design and its Relation to User Interaction. https://www.researchgate.net/Publication/267042345_Park_Furniture_Design_in_Hong_Kong_A_Case_Study_of_Inclusive_Design_and_its_Relation_to_User_Interaction; ResearchGate.

Acknowledgments

WE WOULD LIKE TO EXTEND OUR THANKS TO

Our WPI advisors Professor Stephan Sturm and Professor Brajendra Mishra for their guidance throughout this project.

Paul Zimmerman, Samuel Wong, from Designing Hong Kong, and Alain Chiaradia from and The Department of Urban Planning and Design at the University of Hong Kong, for sponsoring this project.

The WPI Global School for giving us the opportunity to complete our IQP in Hong Kong in 2024.

This project would not be possible without their support.

THANK YOU

Thank you to our advisors
and sponsors for this amazing
opportunity

Questions? Feel free to
contact us at:
gr-DHK24@wpi.edu