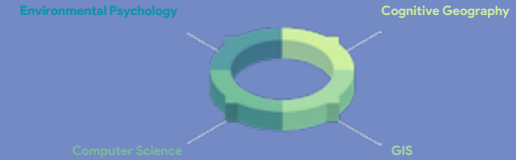


# Pedestrian wayfinding and spatial knowledge acquisition with mobile augmented reality (AR) navigation system: A comparison with 2D mobile map



CHIN Ka Hung  
Supervised by Professor KWAN Mei Po



## Background

- AR technology has brought the use of AR technology into mobile navigation
- Explores AR navigation system performance in pedestrian wayfinding and spatial knowledge acquisition when compared to the mature 2D mobile map system

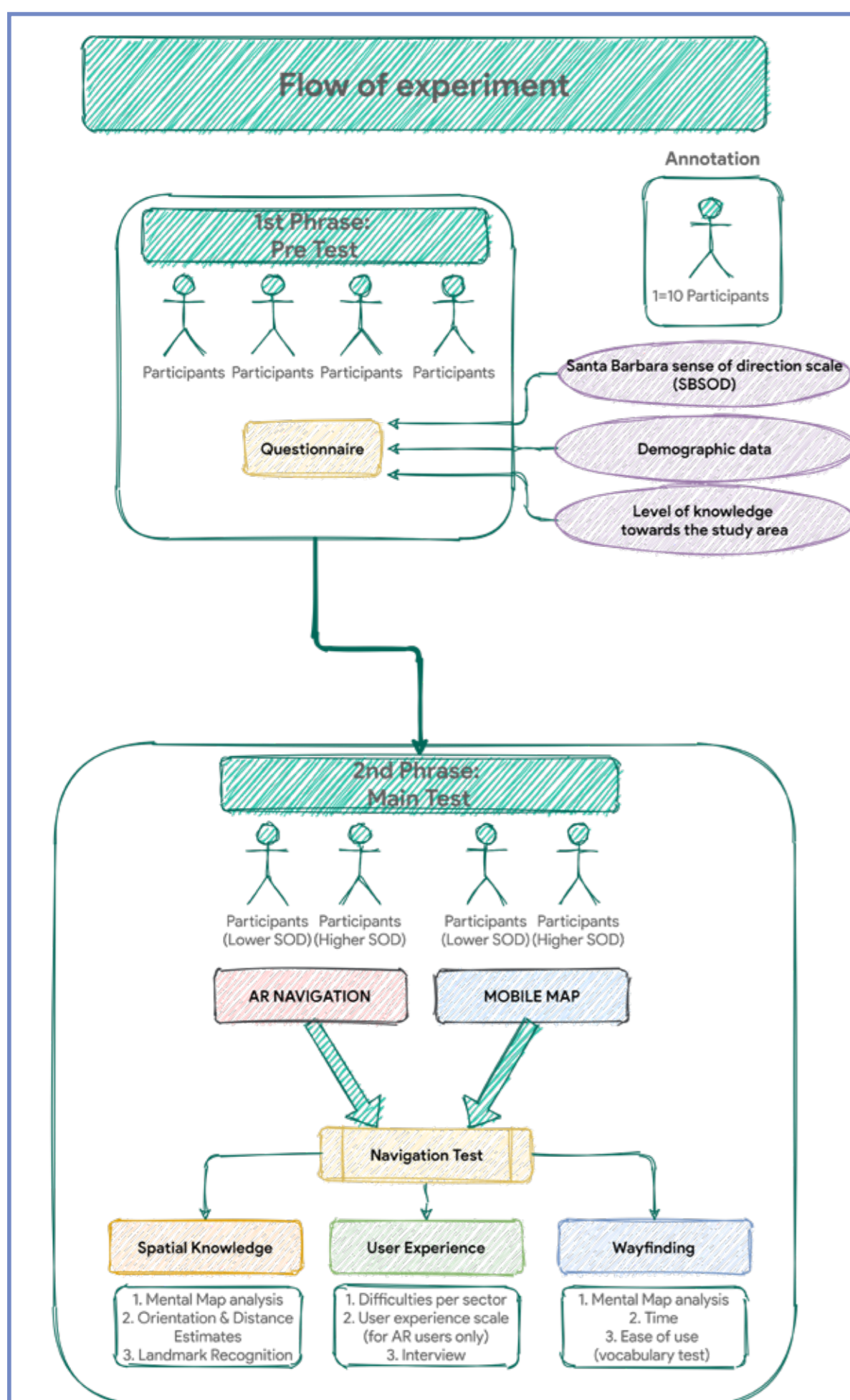
## Existing Research Gap

- There is no literature related to augmented reality navigation before the millennium
- Previous research mainly based on using the prototype AR navigation system
- No research have ever done in Hong Kong hilly streetscape urban form.

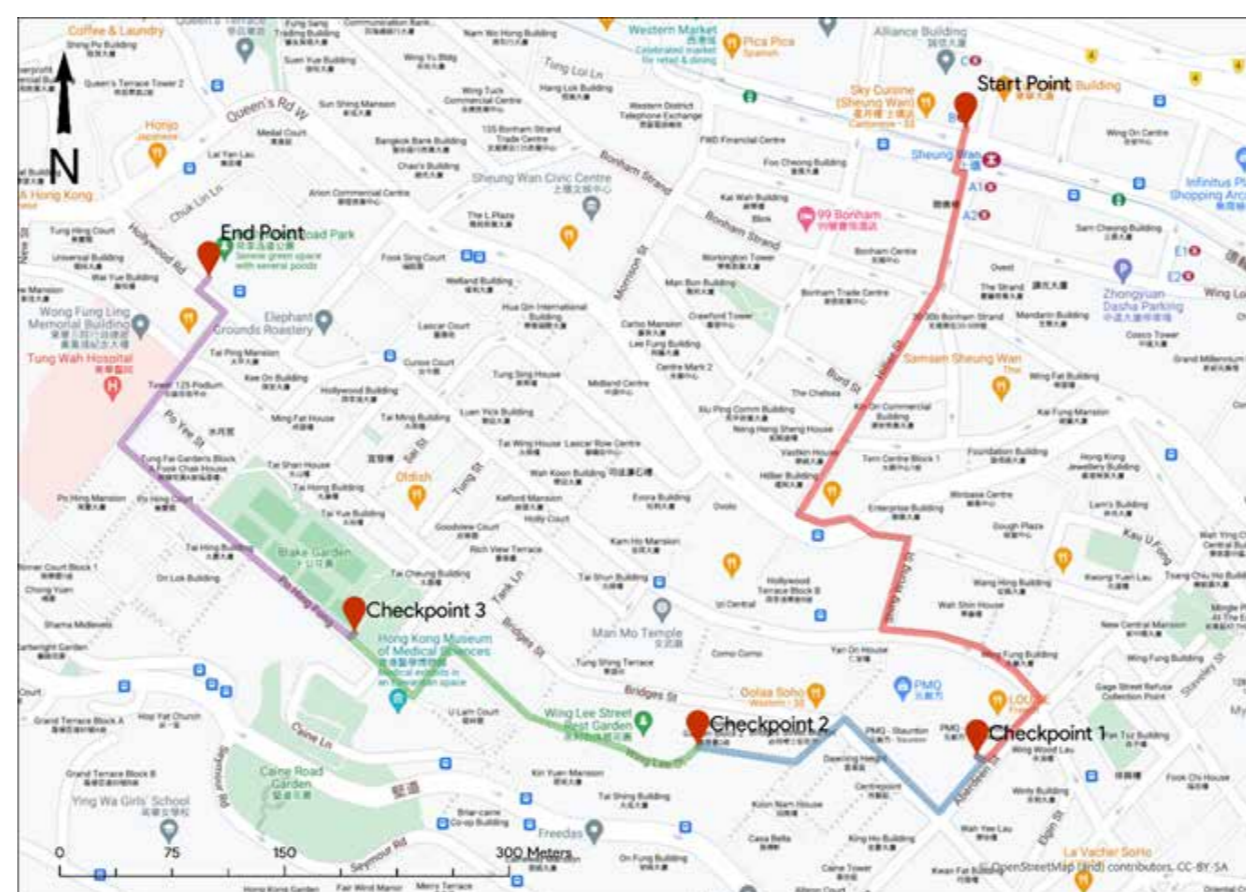
## Research Questions

1. What are the differences in spatial knowledge acquisition between AR navigation and 2D mobile maps in the urban environment?
2. What are the differences in wayfinding performance between AR navigation and 2D mobile maps in the urban environment?
3. Do different types of urban form scenario affect the wayfinding performance of navigation software?
4. Does AR navigation improve the ease of wayfinding?

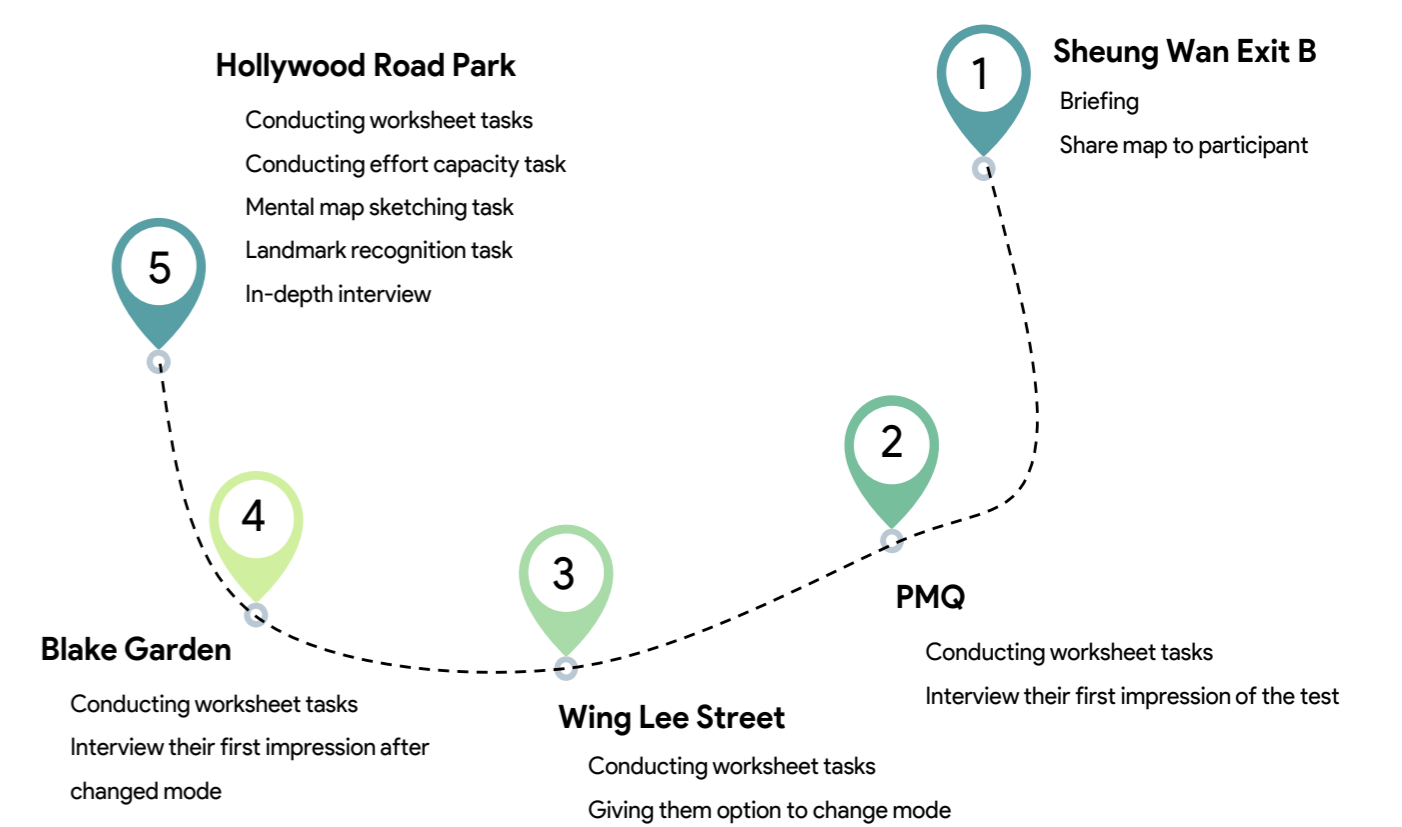
## Flow of experient



## Route



## Procedure



## Sector Data & characteristics

Sector	1	2	3	4
Distance	615m	250m	297m	350m
Turn	7	3	3	4
Elevation	+40m	+7m	-9m	-30m
Level of road types	Main Roads, Stairways	Minor Roads, Pavement Stairways	Pavement, Stairways	Main Roads,
Complexity	Medium	Low	High	Low
Visual accessibility	Medium-Low	Medium	Low	High
GPS Signal Reception	High	Low	Medium	High
Busyness	High	Low	Low	Low

## Received Data

Independent	Dependent	Received Raw data	Control Variable
Mode (AR, 2D)	Wayfinding	Time	Sense of direction
		Stop	Locational knowledge
		Stop >30s	
		Pickup	
		Wrong-Way	
Mode (AR, 2D)	Spatial Knowledge	The score for Mental Map	Sense of direction
		Distance Deviation	Locational knowledge
		Direction Accuracy	
Mode (AR, 2D)	User Experience	Landmark Accuracy	
		Distraction	Sense of direction
		Difficulties	Locational knowledge

## Result and Discussion

### Spatial Knowledge Acquisition

- Mode is not significant to affect the spatial knowledge of participants
- Only the estimated distance deviation indicator shows the level of significance to the mode of navigation
- 2D users shows better performance than AR users
- Shows level of significance to participant's individual's level of sense of direction.

### Wayfinding Performance

- 2D users shows more efficient wayfinding performance than AR users
- "stop and go" nature of AR navigation reduce the wayfinding speed
- Different urban form scenarios shows inter-relationship to the mode of use
- Sector 3 shows the most extreme setting out of all sectors.
  - because of the complex urban environment and distance away from main road
- The further away from the main road, the lower accuracy of AR navigation.

### User Experience

- When accounting for all user experience indicators and qualitative interviews with the users, the answer to this research question would be, it depends.
- Statistically, AR navigation does not improve the ease of wayfinding, as it requires more steps and effort for the users to stop and scan the environment
- Combining both statistical indicators and qualitative interviews findings, the ease of use of AR navigation depends on the pedestrian's navigation purpose, level of sense

## Suggestion

- Improve the clarity of the instruction in inner streets and stairs area
- Allow user to scan the environment without comes to a complete stop
- Include different non navigation elements into

## Conclusion

- AR Navigation still have a long way to improve its performance
- The performance of AR navigation is still not as efficient as 2D navigation
  - However, It comes in handy in various condition ( Foreign cities, unfamiliar environment) comes in handy for lower sense of direction users.
- There's small relationship between navigation mode and spatial knowledge acquisition
  - Relies on the user's habit, and purpose of wayfinding and navigation
- The more complex urban scenario; futher away the form main road
  - The lower accuracy of AR navigation in the environment