Cartography M.Sc.

Investigating the effects of mobile navigation services and paper maps on the spatial knowledge acquisition of pedestrians in an indoor environment

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Outline

- Introduction and Motivation
- Research Objectives and Questions
- Research Hypotheses
- Methodology
- Research Findings
- Conclusions

Introduction and Motivation

Studies show that

- Mobile navigation services (MNS) are better for navigating faster than paper maps (Hergan & Umek, 2017)

- Paper maps (PM) are better for acquiring spatial knowledge than MNS (Ishikawa et al., 2008)

- *These studies were done in the outdoor environment*
- *Can the findings in the outdoor environment be true for the indoor environment?*

Research Objectives and Questions

O1. To explore the efficiency of pedestrian navigation with paper map and mobile navigation services.

Q1. How do paper maps and mobile navigation services affect the efficiency of pedestrian navigation?

O2. To explore the influence of paper maps and mobile navigation services on spatial knowledge acquisition.

Q2. How do paper maps and mobile navigation services influence the spatial knowledge acquisition of pedestrians?

Research Hypotheses

i) Navigating with mobile navigation services is more time efficient than paper maps.

ii) Pedestrians who use paper map to navigate once can navigate faster than those who used mobile navigation services.

iii) Paper map enables better spatial knowledge acquisition than mobile navigation services.

Methodology

- ***Study Area*** – Centrum Galerie, Dresden, Germany

- ***Selection of Participants*** – 20 participants who had little or no knowledge about the study area

- ***Procedure of experiment*** – two-way navigation exercise:

  a) Navigation with map

  b) Navigation without map

Methodology (cont'd)

Procedure of experiment - **template**

1			PAPER MAP								MOBILE NAVIGATION SERVICE								
2		With map				Without map					with map				without map				
3	SN	start time	end time	total minut	No. of stops	start time	end time	total minutes	No. of stops		SN	start time	end time	total minut	No. of sto	start time	end time	total minut	No. of stops
4	p1										pI								
5	p2										pII								
6	p3										pIII								
7	p4										pIV								
8	p5										pV								
9	p6										pVI								
10	p7										pVII								
11	p8										pVIII								
12	p9										pIX								
13	p10										pX								
14																			
15	Total										Total								
16	Average										Average								
17																			
18																			
19	p = participant										p = participant								
20																			

Methodology (cont'd)

- ***Test for Spatial Knowledge* –** method

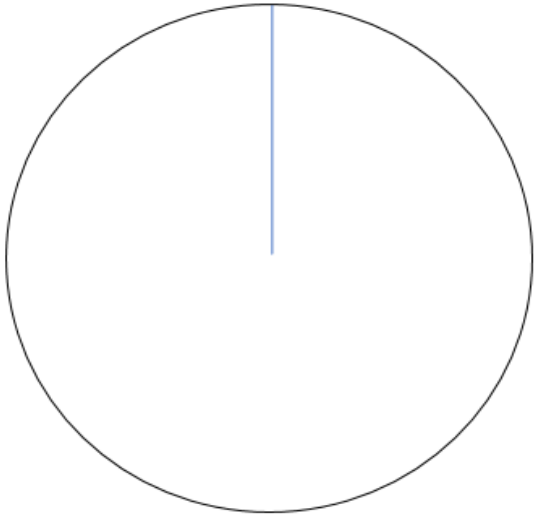
a) Pointing task
b) Landmark recognition exercise
c) Estimation of landmark location

Pointing task

Group Name: …… **Participant ID:** ……

The line in the circle indicates the direction you are facing.

Please draw a line from the centre of the circle to the circumference indicating the direction to the starting point.

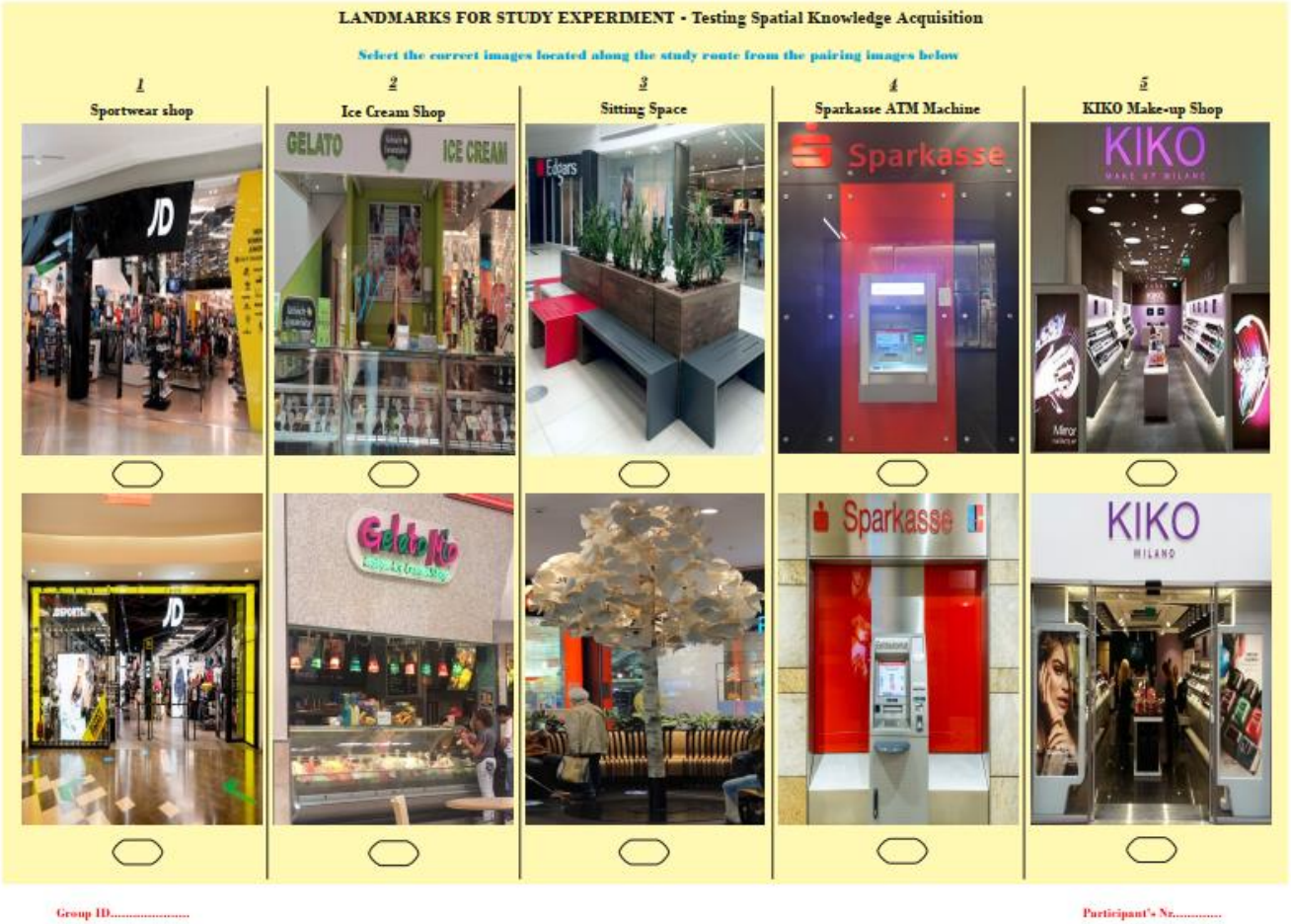


Original angle: ……

Participant angle: ……

Angle difference: ……

Landmark recognition exercise



Estimation of landmark location

Group:

Participant ID:

No. of correct match:

SELECTED LANDMARKS IN CENTRUM GALERIE - Dresden

LEGEND

Match the landmarks with their respective markers by considering their locations on the map

- Sitting Space
- Gelato Ice Cream Shop
- JD Shop
- Sparkasse ATM Machine
- KIKO Make-up Shop

POINTS OF INTEREST FOR ROUTE SELECTION ⇨

1 - Eiscafe

2 - SportScheck

3 - L'OCCITANE

4 - Marc O'Polo

Data analysis

- Mixed Method

  1) Qualitative data

  2) Quantitative data

Research Findings

Demographic characteristics of participants

Age	15 – 19	9	45%
	20 – 24	8	40%
	25 – 29	3	15%
	30 - 34	-	-
Gender	Male	12	60%
	Female	8	40%
Education	Basic School	-	-
	High School	-	-
	University (BSc, MSc, PhD, etc.)	20	100%
City	Freiberg	12	60%
	Leipzig	8	40%
Occupation	Student	20	100%
	Others	-	-

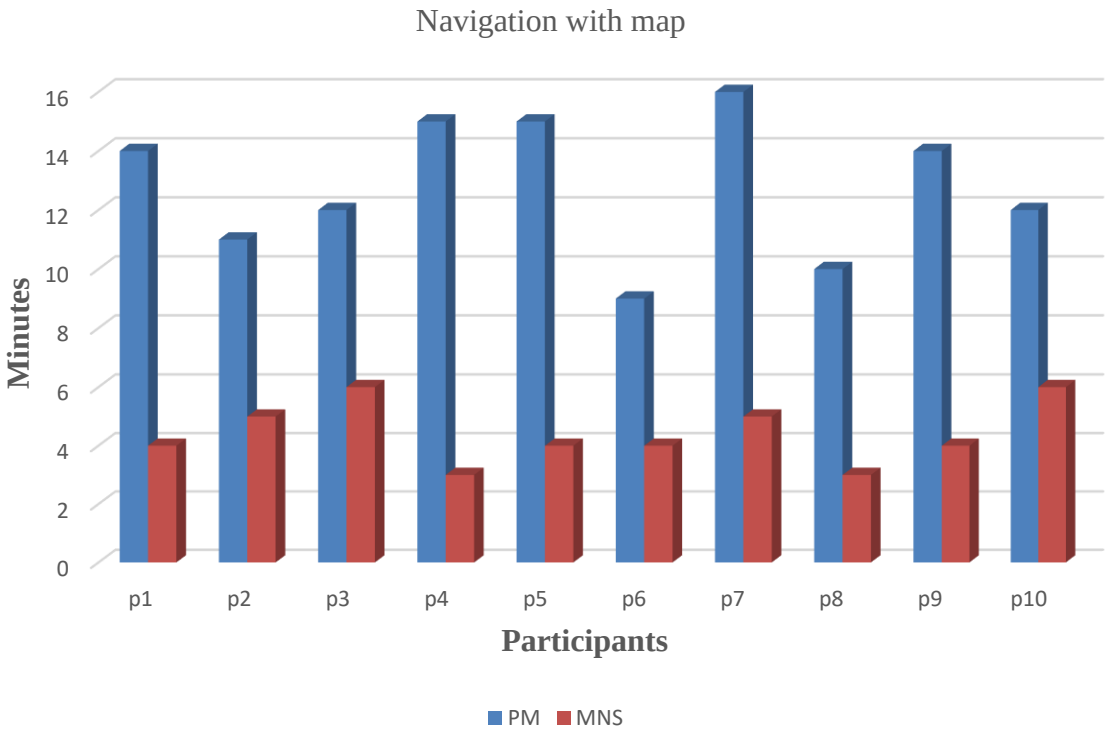
*Source: **Pre-experiment survey by Julius Nyonyo, 2022***

Research Findings – Question 1

- *Q1. How do paper maps and mobile navigation services affect the efficiency of pedestrian navigation?*

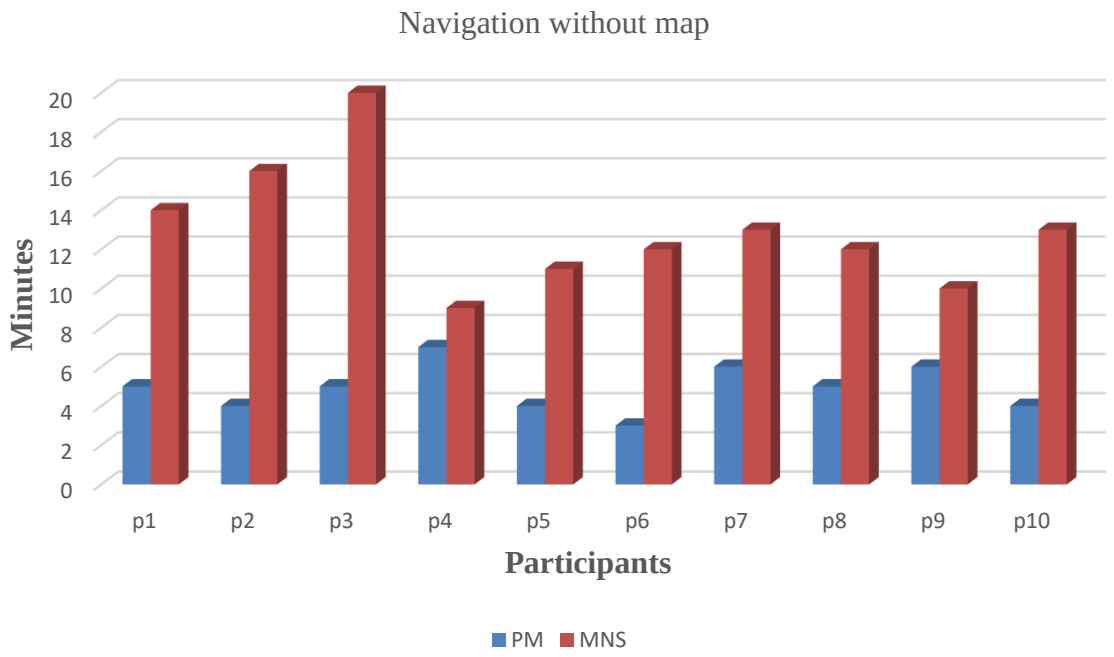
Research Findings – Question 1 (cont'd)

- Efficiency with map: Comparing PM and MNS



Research Findings – Question 1 (cont'd)

- Efficiency without map: comparing PM and MNS



Research Findings – Question 2

- *Q2. How do paper maps and mobile navigation services influence the spatial knowledge acquisition of pedestrians?*

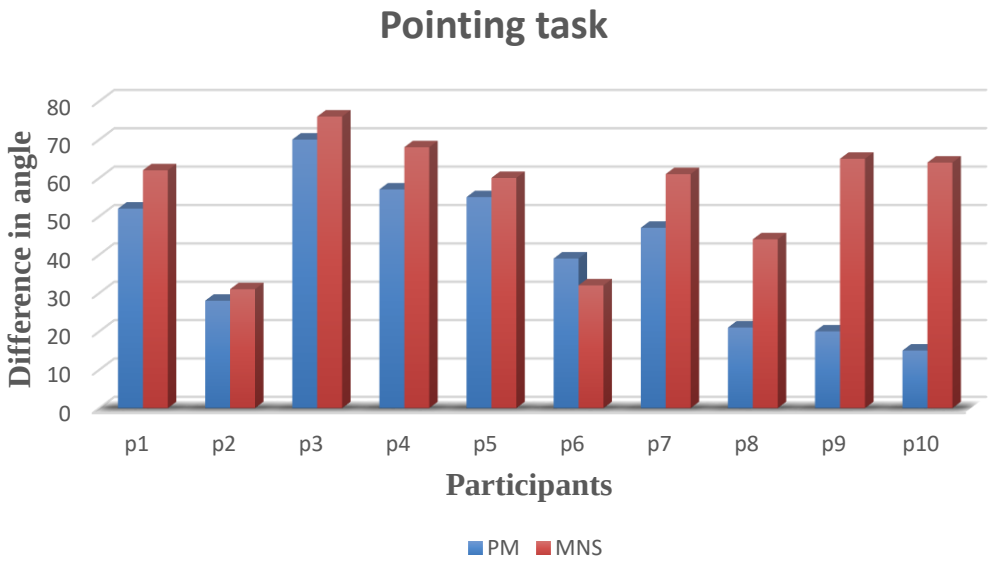
Research Findings – Question 2 (cont'd)

- Methods

  - Pointing task
  - Landmark recognition
  - Location estimation of landmarks

Research Findings – Question 2 (cont'd)

- Pointing task



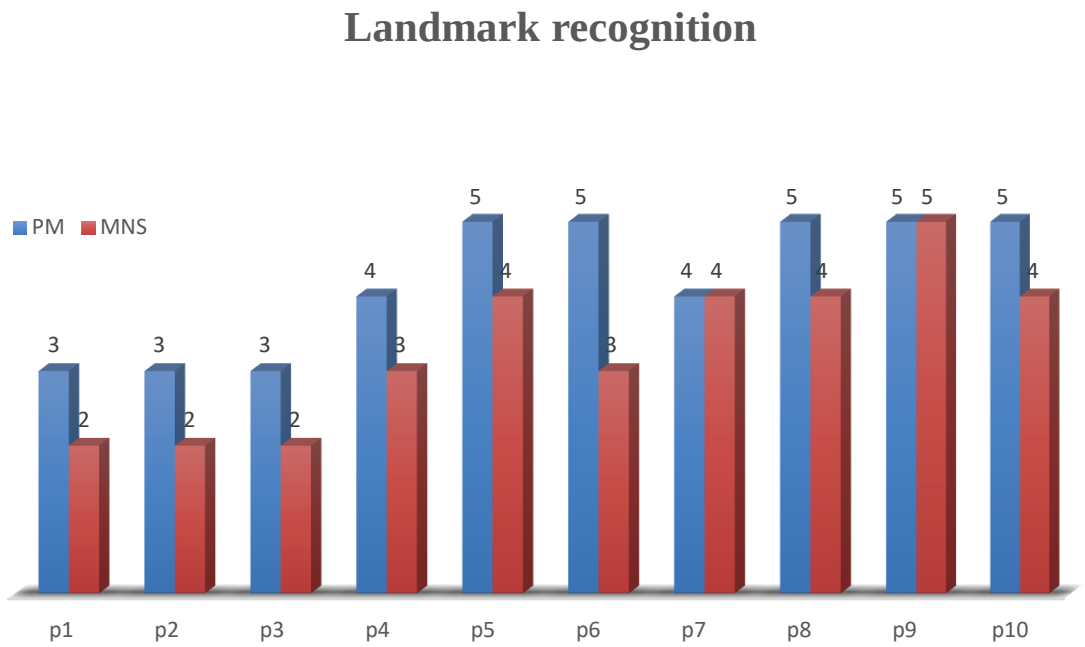
Claim (H1): Paper map enables better spatial knowledge acquisition than mobile navigation services.

Mann Whitney *U* test: *U* = 25.000, P-value = 0.140

No significant difference since p-value > 0.05

Research Findings – Question 2 (cont'd)

- Landmark recognition



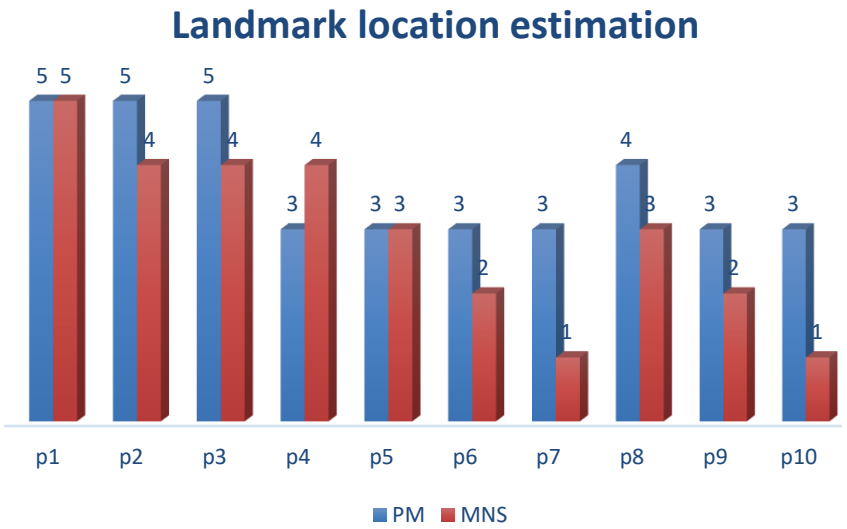
Claim (H1): Paper map enables better spatial knowledge acquisition than mobile navigation services.

Mann Whitney *U* test: *U* = 500, P-value = 0.051

No significant difference since p-value > 0.05

Research Findings – Question 2 (cont'd)

- Location estimation of landmarks



Claim (H1): Paper map enables better spatial knowledge acquisition than mobile navigation services.

Mann Whitney *U* test: *U* = 20, P-value = 0.079

No significant difference since p-value > 0.05

Conclusion

- Research in the outdoor environment showed that:

- Using mobile navigation services to navigate is faster than using paper maps *(*Hergan & Umek, 2017*)*
- Paper maps are better for acquiring spatial knowledge than mobile navigation services *(Ishikawa et al., 2008)*

…….but

Conclusion (cont'd)

- In the indoor environment

➢ There is the tendency of

1) faster navigation with mobile navigation services than paper maps
2) better spatial knowledge acquisition with paper maps than mobile navigation services

References

- Ishikawa, T., Fujiwara, H., Imai, O., & Okabe, A. (2008). Wayfinding with a GPS based mobile navigation system: A comparison with maps and direct experience. Journal of Environmental Psychology, 28(1), 74–82. https://doi.org/10.1016/j.jenvp.2007.09.002.

- ergan, I., & Umek, M. (2017). Comparison of children's wayfinding, using paper map and mobile navigation. *International Research in Geographical and Environmental Education*, *26*(2), 91–106. https://doi.org/10.1080/10382046.2016.1183935

THANK YOU