Cartography M.Sc.

Fill the map: Integrating objective data and citizen knowledge for Participatory Urban Planning

A Superblock project in Vienna

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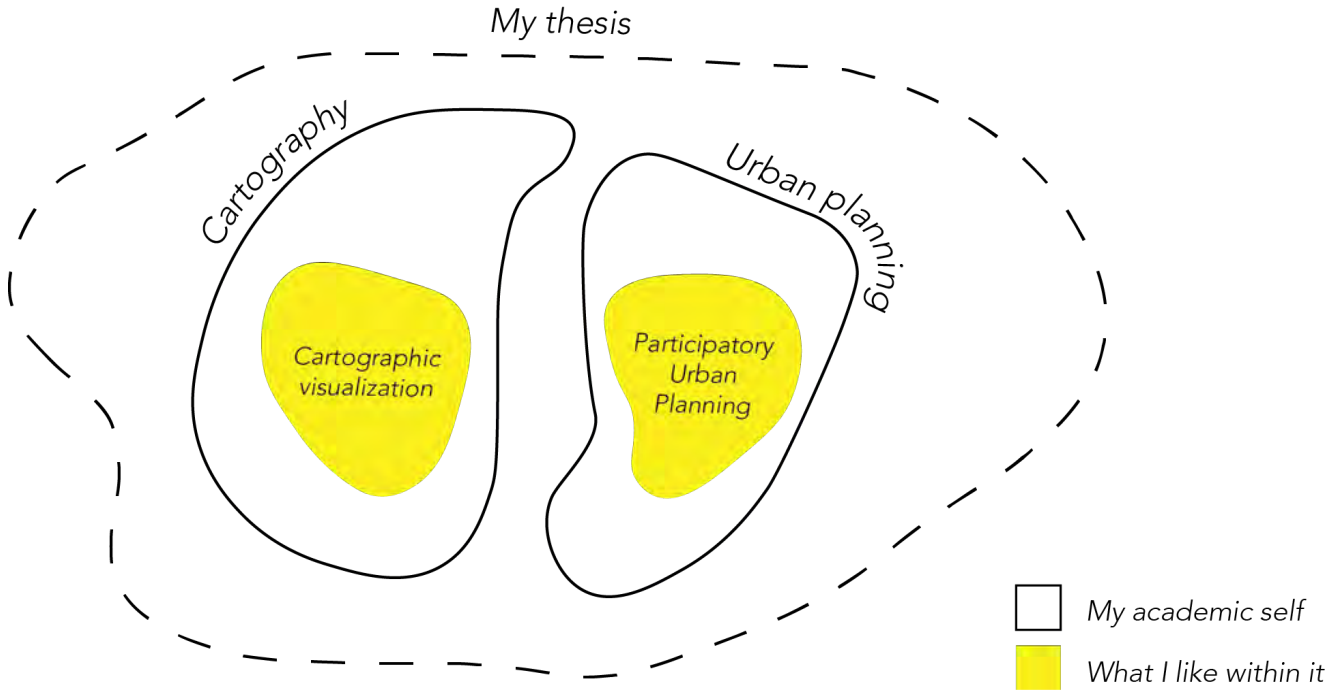
25th September 2023

Fill the map: Integrating objective data and citizen knowledge for Participatory Urban Planning

MOTIVATION

Fill the map: Integrating objective data and citizen knowledge for **Participatory Urban Planning**


My thesis
Cartography
Urban planning
Cartographic visualization
Participatory Urban Planning
My academic self
What I like within it

MOTIVATION

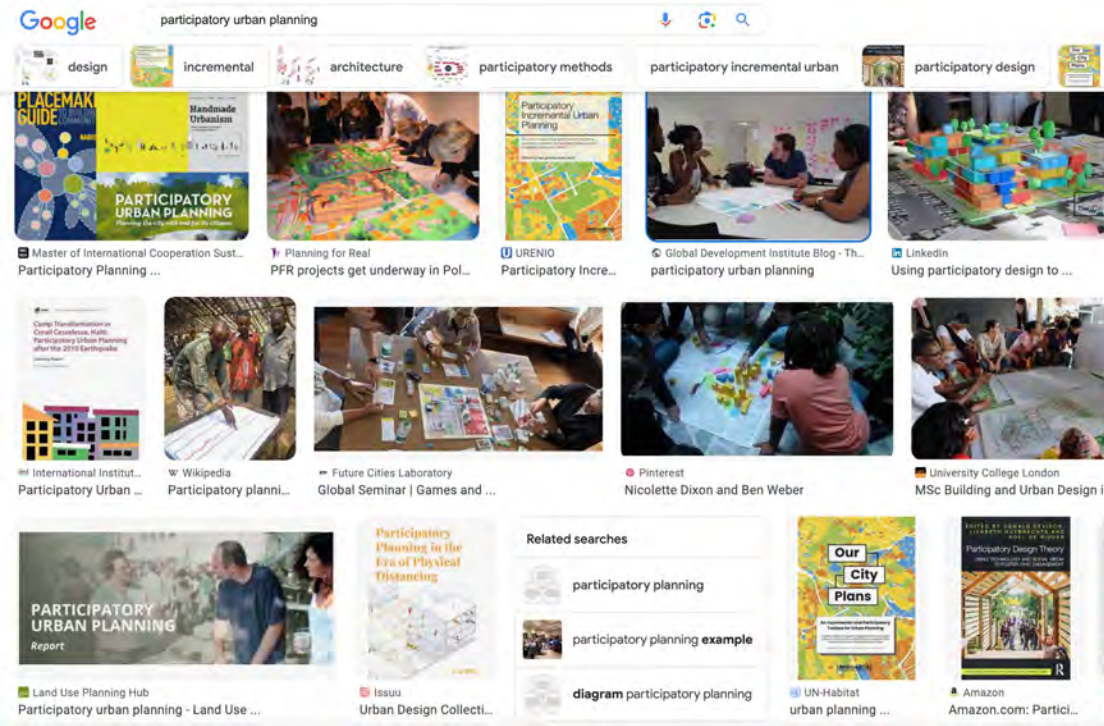
WHAT IS
PARTICIPATORY URBAN PLANNING?

Urban planning approach that started in 1950.

Involves the community in the planning process.

WHAT IS THE **ROLE OF CARTOGRAPHY** IN PARTICIPATORY URBAN PLANNING?

Maps as tools for dialogue



WHAT IS THE **ROLE OF CARTOGRAPHY** IN PARTICIPATORY URBAN PLANNING?

Maps as tools for dialogue

Maps incluiding citizen knowledge data in a spatial format.

WHAT IS THE **ROLE OF CARTOGRAPHY** IN PARTICIPATORY URBAN PLANNING?

Maps as tools for dialogue

Maps including **citizen knowledge data** in a spatial format.

information and insights about a place or community based on personal experiences and perspectives.

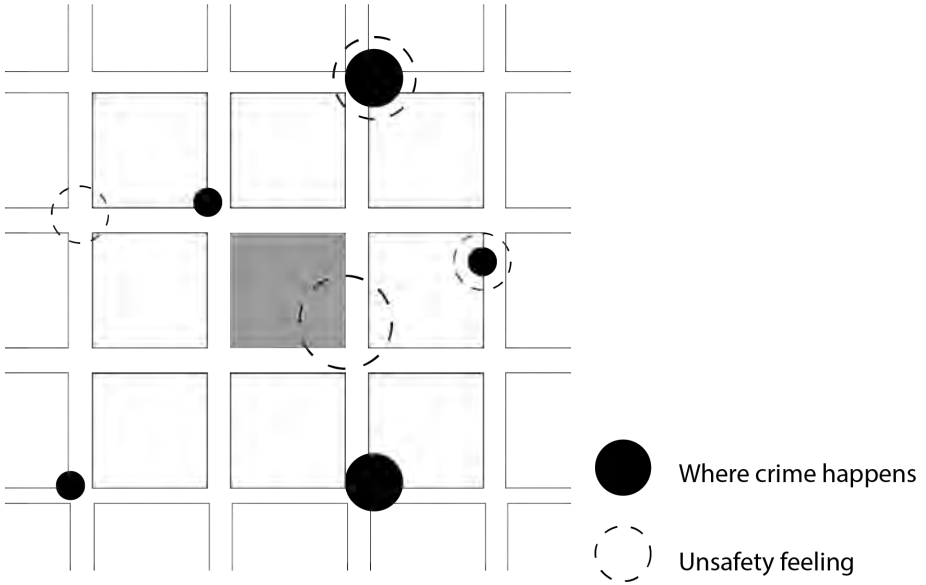
WHAT IS THE **ROLE OF CARTOGRAPHY** IN PARTICIPATORY URBAN PLANNING?

Maps as tools for dialogue

Maps including **citizen knowledge data** in a spatial format.

Fill the map: **Integrating objective data and citizen knowledge** for Participatory Urban Planning

WHY **INTEGRATING OBJECTIVE DATA AND CITIZEN KNOWLEDGE**?



Godwin, A. & Stasko, J.T. (2017)

So, if we already know that Cartography is part of Participatory Urban Planning and that is important to integrate objective data and citizen knowledge,

WHAT IS THE FOCUS OF MY RESEARCH?

Making visualizations effective for all stakeholders to understand the urban issues and engage them in the decision-making process

RESEARCH GAP

To identify optimal **cartographic visualization strategies** that combine **objective data and citizen knowledge**, thereby serving as decision-making tools within the framework of **participatory urban planning**.

RESEARCH OBJECTIVE

REFERENCES FOR DESIGNING

1 To analyze and create a catalog of urban data visualizations.

DESIGNING THE MAPS

2 To create suitable visualization strategy to combine citizen knowledge and objective data.

TESTING THE MAPS

3 To understand the effectiveness of the created cartographic visualizations, making diverse stakeholders interpret, make connections, and make sense of different data types.

RESEARCH SUB-OBJECTIVE

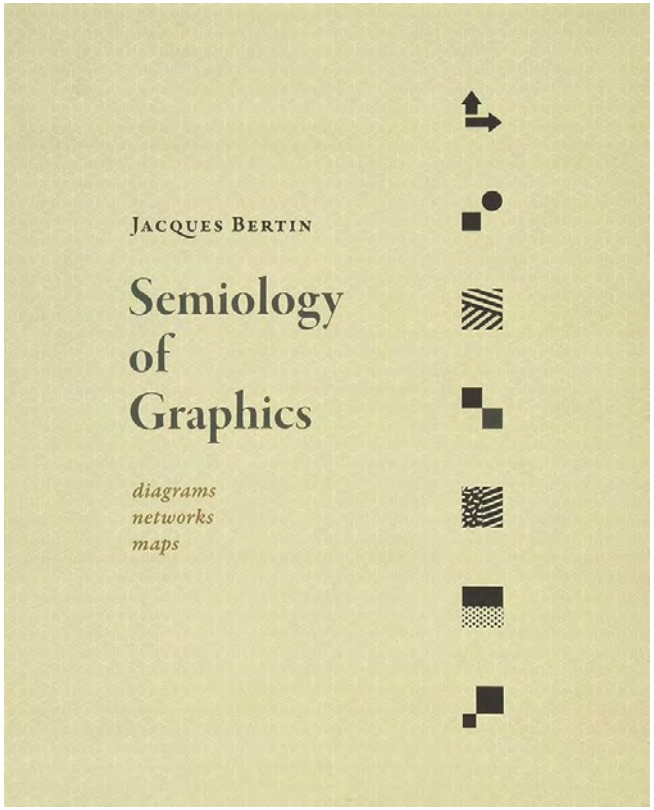
RQ1a

What elements and categorizations, such as visual variables and design elements stated by Jacques Bertin (1967), have been used and can be included as **parameters for analyzing the visualizations**?

RQ1b

How are urban visualizations, those integrating objective data and citizen knowledge and those visualizing them separately, **aligned with the selected analysis parameters**?

RO1 - RESEARCH QUESTIONS 1



Visual variables

Elements representing geographic features: POINTS, LINES, or AREAS.

Design elements

Attributes applied to the visual variables to make layers readable: COLOR, SHAPE, TEXTURE, etc.

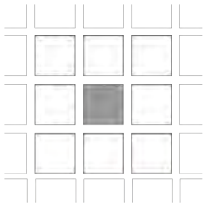
Generalization

Spatial equivalent of simplification.

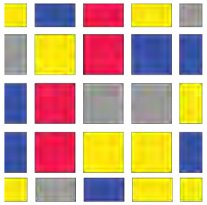
Complexity levels

Low, medium and high depending on the number of components and interactivity.

Components

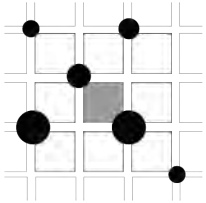


Geographic
spatial dimension of the data:
location of parks.



Qualitative
categorical or qualitative data:
land use.

Quantitative
numerical data associated with geographic locations:
population density.



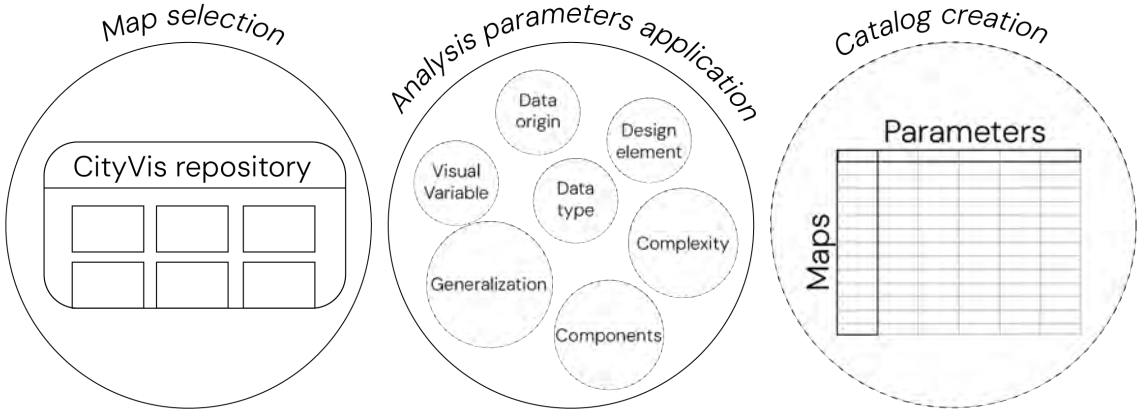
Ordered
numerical data with an equal distance between categories:
number of people crossing in each intersection.

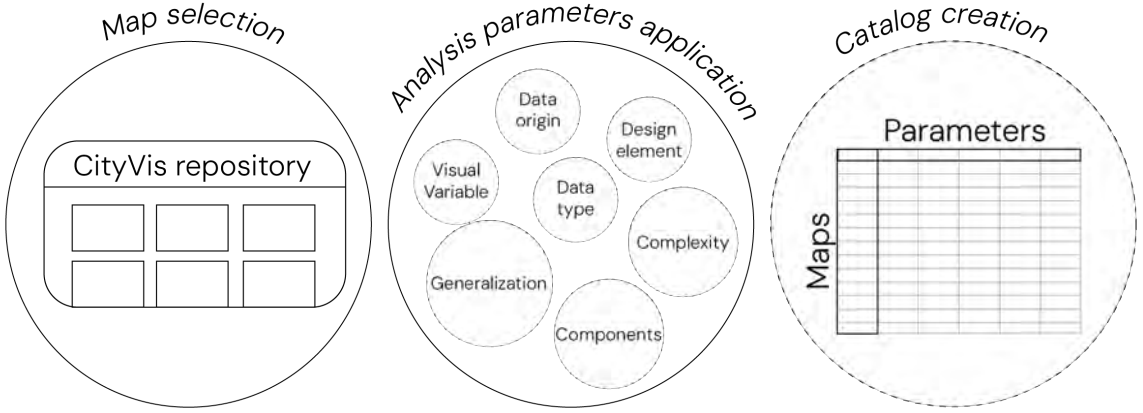
Low complexity
2 components, no or low interactivity

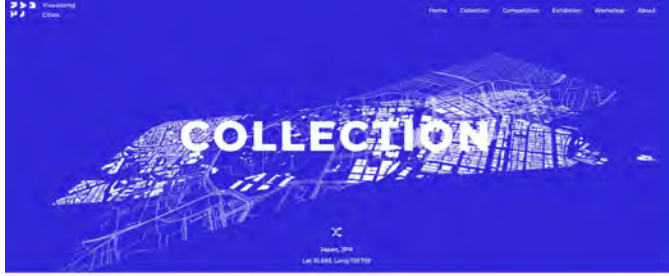
Medium complexity
3 components, no or low interactivity

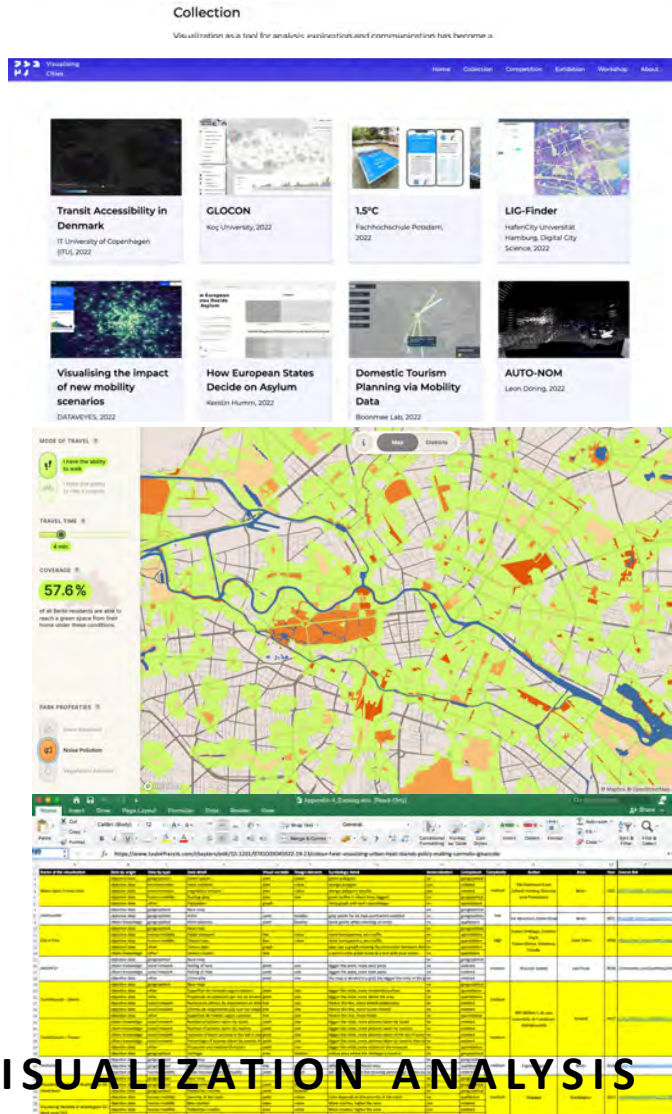
High complexity
3 components, high interactivity

PARAMETERS SELECTION – Complexity levels


Map selection
CityVis repository
Analysis parameters application
Data origin
Design element
Visual Variable
Data type
Complexity
Generalization
Components
Catalog creation
Parameters
Maps







RQ1b – VISUALIZATION ANALYSIS

1st Outcome:

The catalog

Name of the visualization	Data by origin	Data by type	Data detail	Visual variable	Design element	Symbology detail	Generalization	Component	Complexity	Author	Area	Year	Source link
[illegible]	objective data	geographical	Green spaces	area	colour	green polygons	no	geographical	medium	[illegible]	[illegible]	2021	[illegible]
	objective data	environmental	noise pollution	area	value	orange polygon	yes	ordered					
	objective data	environmental	vegetation amount	area	value	orange polygons opacity	yes	ordered					
	objective data	human mobility	Routing data	area	size	green buffer (+ travel time, bigger)	no	geographical					
	objective data	other	Population	graph		Extra graph with text + percentage	no	quantitative					
[illegible]	objective data	geographical	Base map				no	geographical	low	[illegible]	Berlin	2021	[illegible]
	objective data	geographical	Artist	point	location	gray points for all, blue point when selected	no	geographical					
	citizen knowledge	geographical	Artist relations	point	location	black points when selecting an artist	no	qualitative					
City in Flux	objective data	geographical	Base map				no	geographical	high	[illegible]	Cape Town	2018	[illegible]
	objective data	human mobility	Public transport	line	value	more transparency, less traffic	no	quantitative					
	objective data	human mobility	Shared taxis	line	value	more transparency, less traffic	no	quantitative					
	objective data	other	Census data	graph		pops up a graph showing the connection between dem	no	quantitative					
	citizen knowledge	other	random stories	text		a point on the graph leads to a text with local stories	no	qualitative					
AMOR SP	objective data	geographical	Base map				no	geographical	medium	Maycon Sedrez	Sao Paulo	2018	[illegible]
	citizen knowledge	social network	feeling of love	point	size	bigger the point, more love posts	no	ordered					
	citizen knowledge	social network	feeling of hate	point	size	bigger the point, more hate posts	no	ordered					
	objective data	other	Criminality	point	size	the map is divided in a grid, the bigger the circle in the g	no	ordered					
Turistificación - Dormir	objective data	geographical	Base map				no	geographical	medium	[illegible]	Madrid	2017	[illegible]
	objective data	other	Superficie de vivienda según catastro	point	size	bigger the circle, more residential surface	no	quantitative					
	objective data	other	Proporción de población por m2 de viviend	point	size	bigger the circle, more dense the area	no	quantitative					
	objective data	social network	Numero de ofertas de alojamiento en Airb	line	size	thicker the line, more airbnb publications	no	ordered					
	objective data	social network	Ofertas de alojamiento p2p que han alojad	line	size	thicker the line, more tourist hosted	no	ordered					
	objective data	other	Superficie de hoteles según catastro	line	size	thicker the line, more hotels	no	quantitative					
Turistificación - Pasear	citizen knowledge	social network	Number of pictures taken by locals	point	size	bigger the circle, more pictures taken by locals	no	ordered	medium				
	citizen knowledge	social network	Number of pictures taken by tourists	point	size	bigger the circle, more pictures taken by tourists	no	ordered					
	citizen knowledge	social network	Increase of taken pictures in the last 4 yea	point	size	bigger the circle, more pictures taken in the last 4 years,	no	ordered					
	citizen knowledge	social network	Percentage of pictures taken by tourists in	point	size	bigger the circle, more pictures taken by tourists than lo	no	ordered					
	objective data	other	Museums and number of visitors	point	size	bigger the circle, more visitors in the museum	no	quantitative					
	objective data	geographical	Heritage	area	location	yellow area where the heritage is located	no	geographical					
[illegible]	objective data	geographical	Base map				no	geographical	medium	Tagesspiegel	Berlin	[illegible]	[illegible]
	objective data	geographical	public transport network	line	colour	different colors, different lines	no	qualitative					
	objective data	human mobility	public transport line punctuality	point	graph	pie charts along the line showing percentage of how ea	no	ordered					
Visualizing fatalities in Washington DC street level	objective data	geographical	Base map				no	geographical	medium	Mapbox	Washington	2017	[illegible]
	objective data	geographical	Bike crashes	point	location		no	geographical					
	objective data	geographical	Pedestrian crashes	point	location		no	geographical					
	objective data	human mobility	Severity of the crash	point	colour	Color depends on the severity of the crash	no	qualitative					
Visualizing fatalities in Washington DC block level (3D)	objective data	human mobility	Bike crashes	area	value	More crashes, higher the area	yes	ordered					
	objective data	human mobility	Pedestrian crashes	area	value	More crashes, higher the area	yes	ordered					
	objective data	human mobility	Severity of the crash	area	colour	Color depends on the severity of the crash	no	qualitative					
[illegible]	objective data	geographical	Base map				no	geographical	low	Universidade Católica do [illegible]	Rio de Janeiro	[illegible]	[illegible]
	objective data	other	Urban projects constructed from 2009 to 2	area	value	The higher the mountain the more projects that where c	yes	ordered					
Mapping Ethnic Communities in Brussels	objective data	geographical	Base map				no	geographical	medium	[illegible] of Architecture, Univers	Brussels	[illegible]	[illegible]
	citizen knowledge	social network	Ethnicity	point	colour	Different colors, different ethnic	no	qualitative					

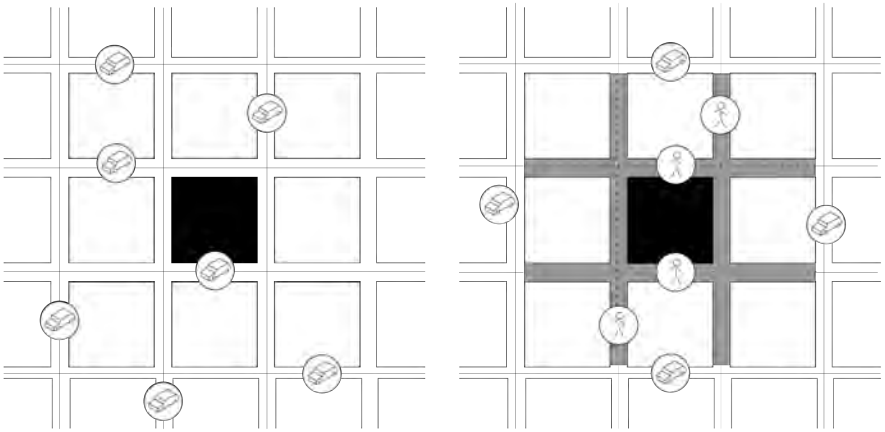
RQ2a

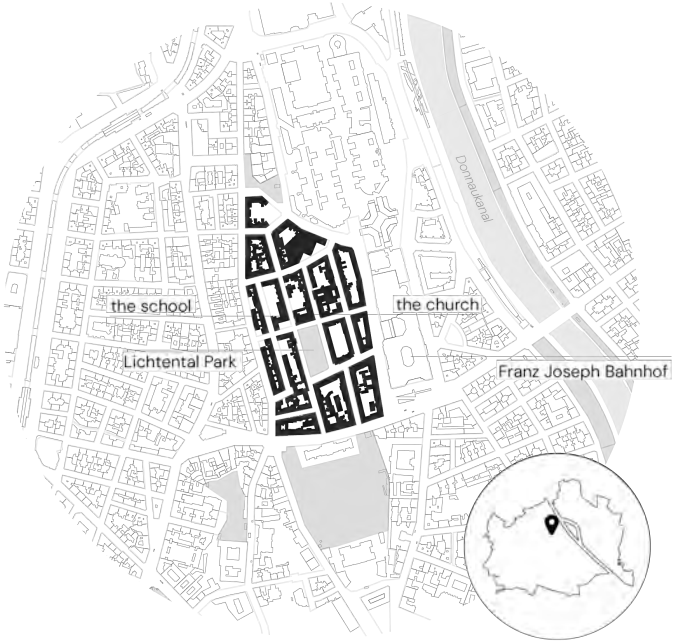
Which visual variables and design elements are suitable to show the selected data? Should objective data and citizen knowledge be visually differentiated?

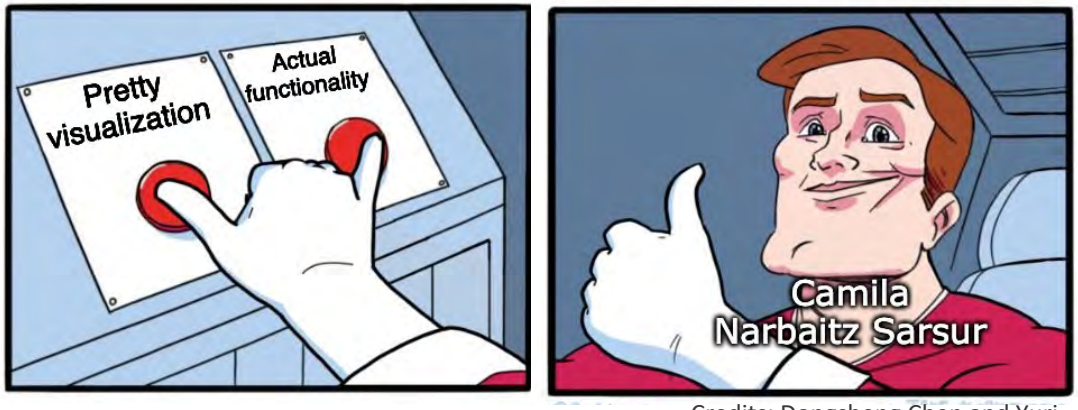
RQ2b

How can cartographic generalization techniques be employed to create a simplified visualization that still conveys the underlying data patterns?

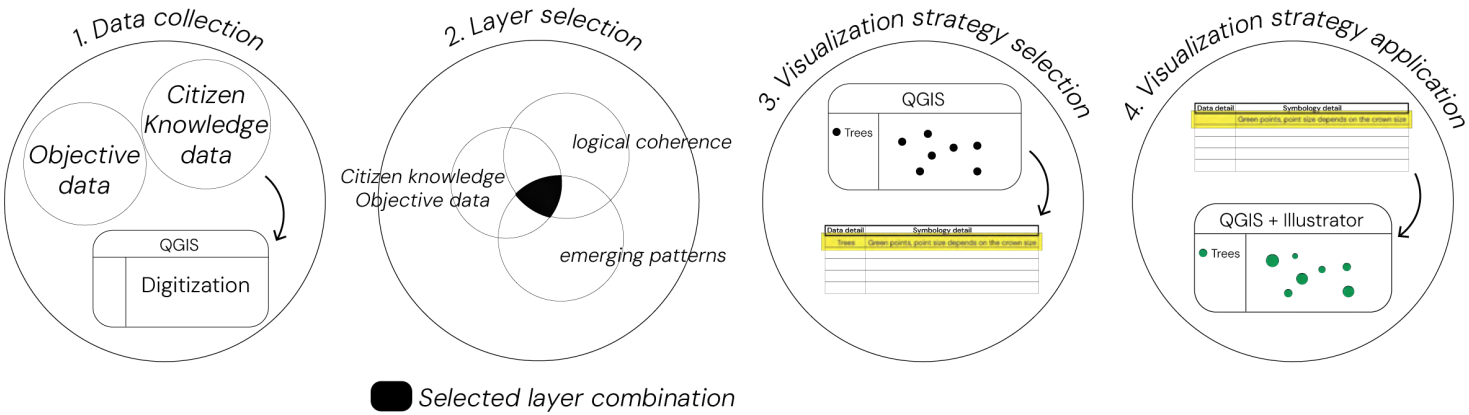
Superblock project in Lichtental, Vienna.



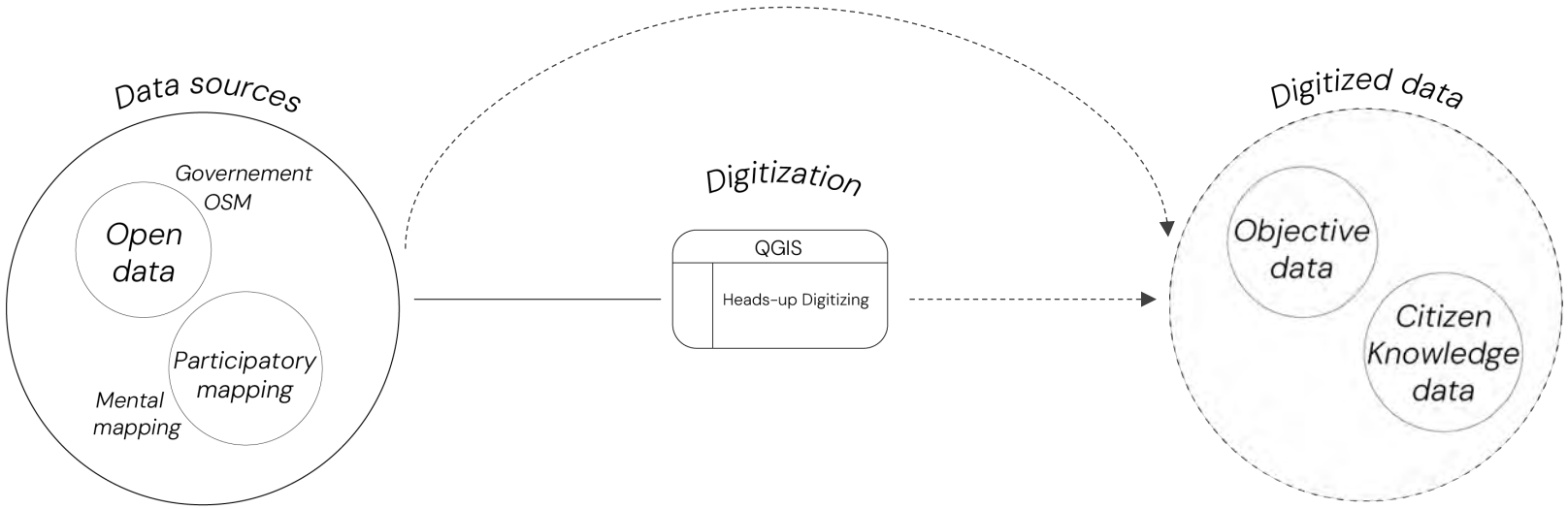




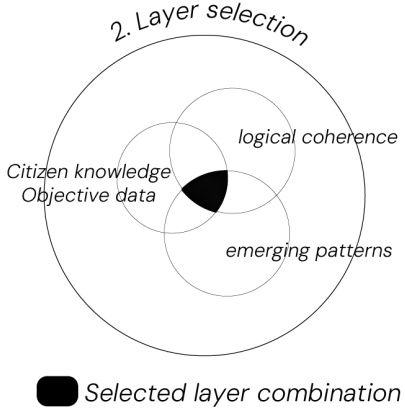
Credits: Dongsheng Chen and Yuri

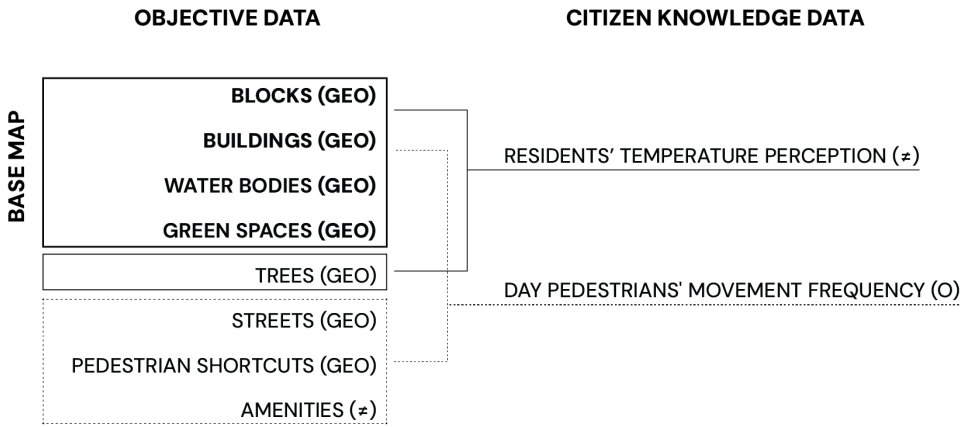


RQ2 - Methodology



Methodology – Data collection

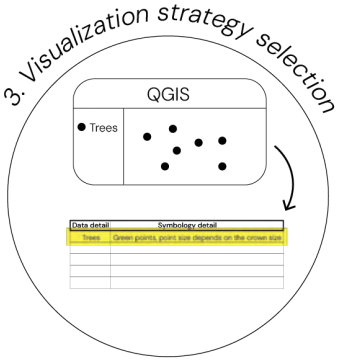




Combination 1: Residents temperature perception and green infrastructure.

Combination 2: Day pedestrians' movement frequency and activity patterns

Methodology – Layer selection



The invisible forest map (Density Design Research Lab, 2017).

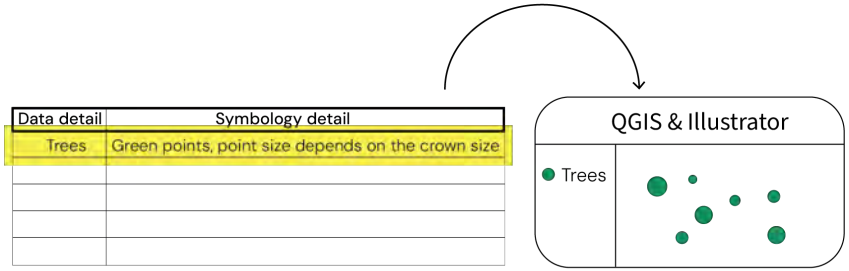
Residents temperature perception and **green infrastructure.**

Visual heatmap style

Activity map. A sense of place report (SPIN unit, 2015).

Day pedestrians' movement frequency and **activity patterns**

Activity analysis

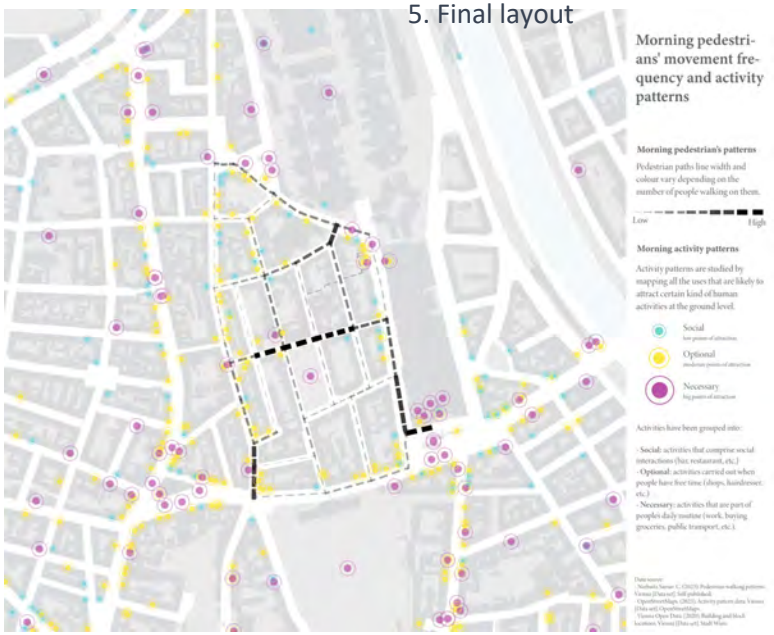


QGIS

1. Data import
2. Data retrieval (if necessary)
3. Spatial processing
4. Initial symbology
5. Initial layer ordering

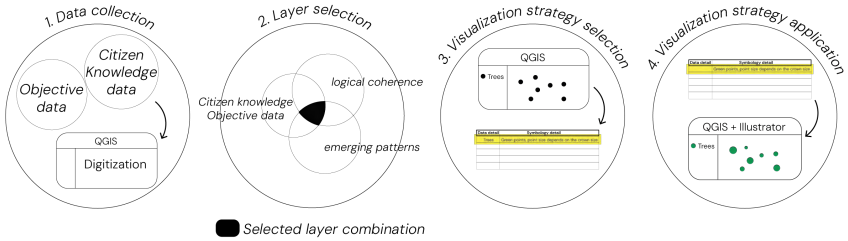
Illustrator

1. Refining details
2. Applying color palette
3. Symbology test
4. Final symbology
5. Final layout



2nd Outcome:

Methodology framework



RQ3a

Is there a difference in the assumptions made by stakeholders with and without expertise? Do stakeholders without expertise need other kinds of features more than map symbology (texts, pop-ups, graphs) to interpret and make sense of data?

RQ3b

Does modifying the symbology improve the intuitive interpretation of data patterns?

RQ3c

Are there distinct visualization preferences among stakeholders with and without expertise?

RO3 - RESEARCH QUESTIONS 3

COMBINATION 1

Simple complexity

MAP A
with fine-granularity

MAP B
with generalization

COMBINATION 2

Medium complexity

MAP A
with fine-granularity

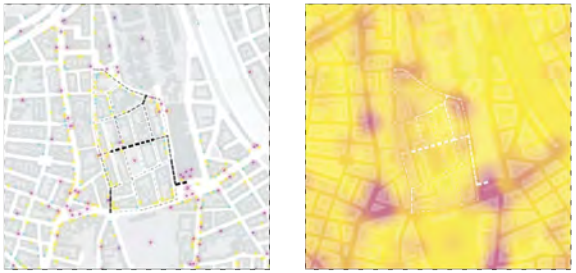
MAP B
with generalization

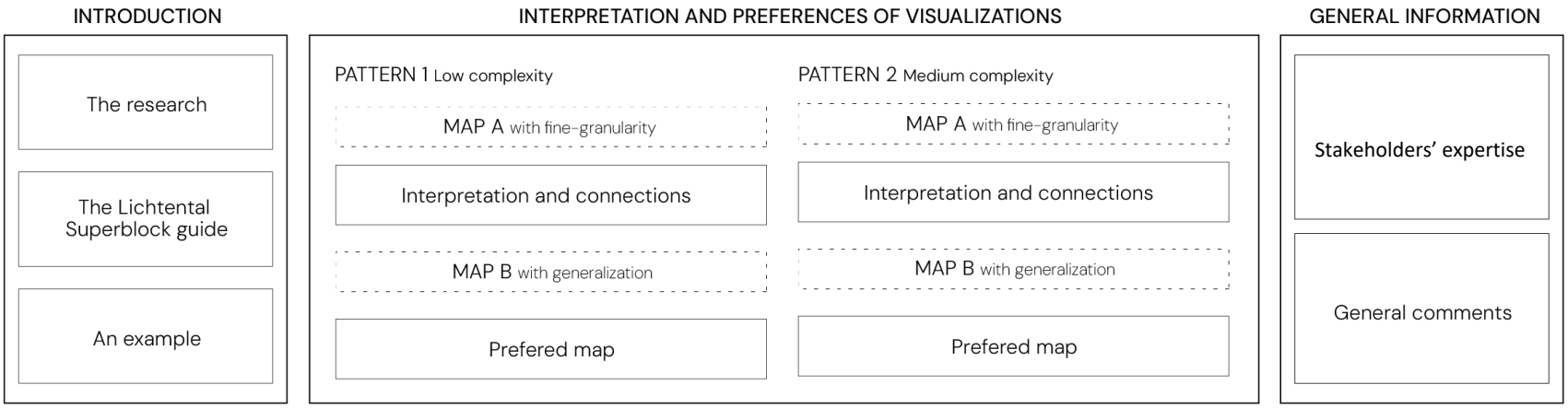
COMBINATION 1

Residents' temperature perception and green infrastructure

COMBINATION 2

Day pedestrians' movement frequency and activity patterns





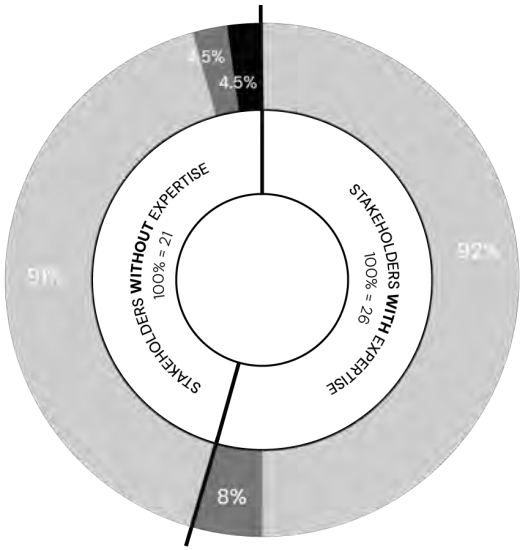
RQ3 – Survey design

PATTERN 1
Residents' temperature perception and green infrastructure

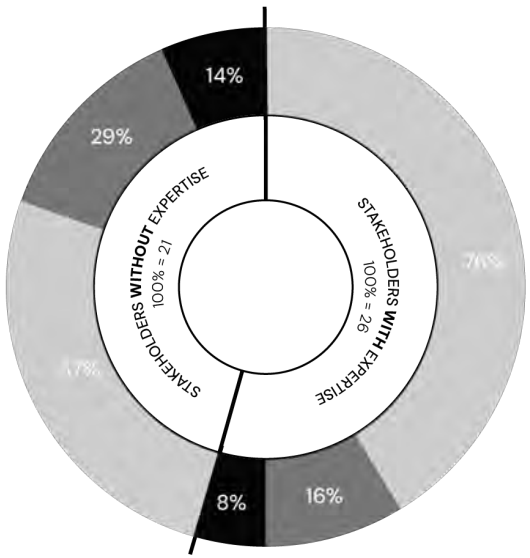
PATTERN 2
Day pedestrians' movement frequency and activity patterns

Can you find patterns in data?

Low complexity

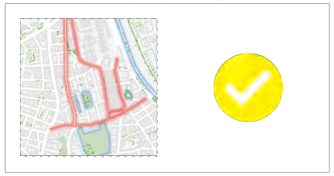


Medium complexity

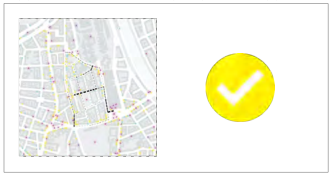


- Yes, I do
- I am not sure / I don't know
- No, I don't

PATTERN 1
Residents' temperature perception and green infrastructure

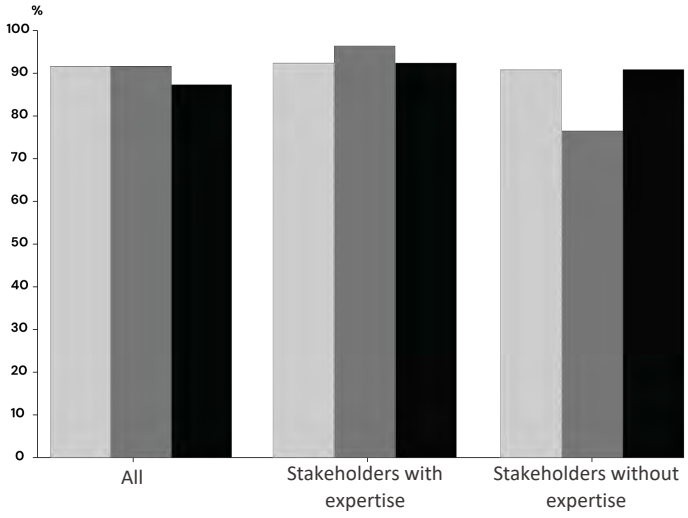


PATTERN 2
Day pedestrians' movement frequency and activity patterns

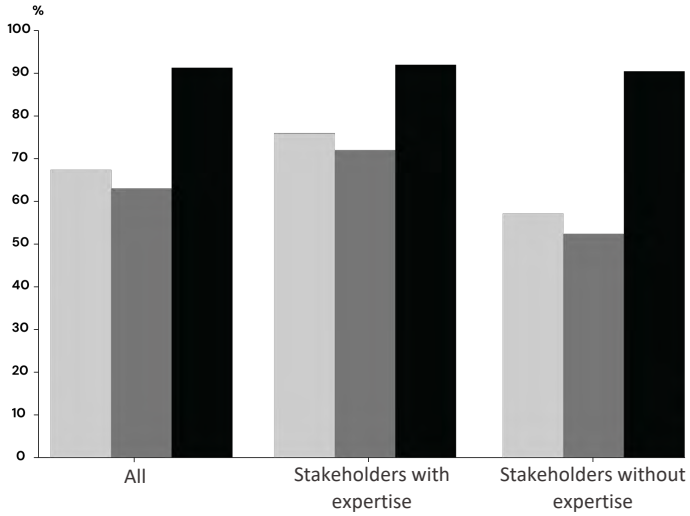


What about if I help you a bit…

Low complexity



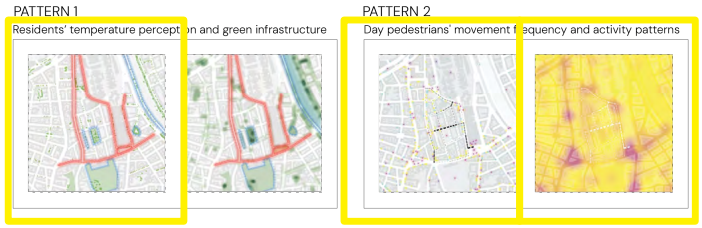
Medium complexity



Participants finding patterns in Q1

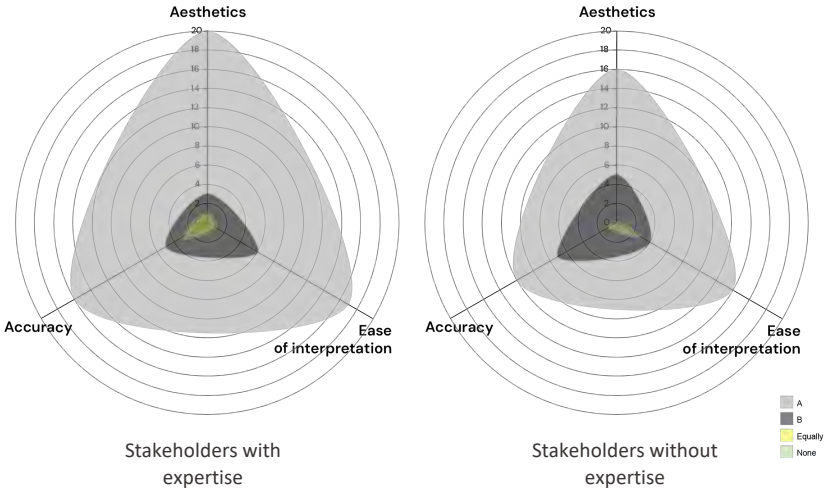
Participants who could explain the found patterns (Q2)

Participants who could identify a pattern with the provided assumptions (Q3)

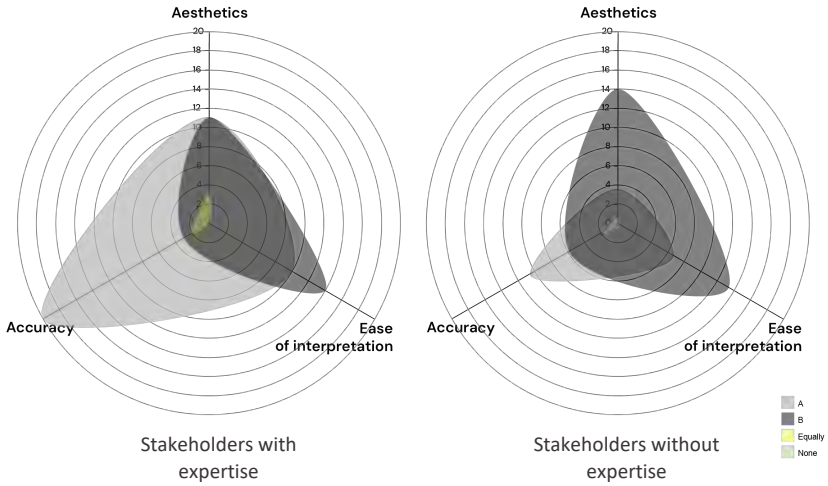


Which map do you prefer in terms of…?

Low complexity



Medium complexity



A
B
Equally
None

This study showed that **the complexity of the visualization influences the pattern interpretation and map preferences** among the two groups of stakeholders.

Low complexity maps showed **that fine-granularity representation was more effective** for supporting decision-making.

Balance between accuracy maximization and minimal effort (Kleinmuntz & Schkade 1993).

Medium complexity maps emphasized the importance of **considering users' needs to provide adaptable solutions** to improve their understanding of visualizations. The **fine-granularity map** was favoured regarding **accuracy**, and the **generalized map** was chosen regarding **ease of interpretation**.

Use of heatmaps for hotspot identification but not for precise data interpretations (Netek et al., 2018).

3rd Outcome:

Set of recommendations

Set 1: Tailoring visualizations considering their complexity levels.

Set 2: Adapting to Workshop Objectives

3rd Outcome:

Set of recommendations

Set 1: Tailoring visualizations considering their complexity levels.

- Low-complexity visualizations → fine-granularity maps → accuracy maximization without overwhelming the user
- Medium complexity → depending on map goal

Set 2: Adapting to Workshop Objectives

- Data Exploration Workshop
- Pattern Conveying Workshop

Survey
- Small participant numbers in the survey.

Data
- Scarcity of citizen knowledge data.
- Limited data was collected through the Mental Mapping workshop.

Map design
- Time limitations.

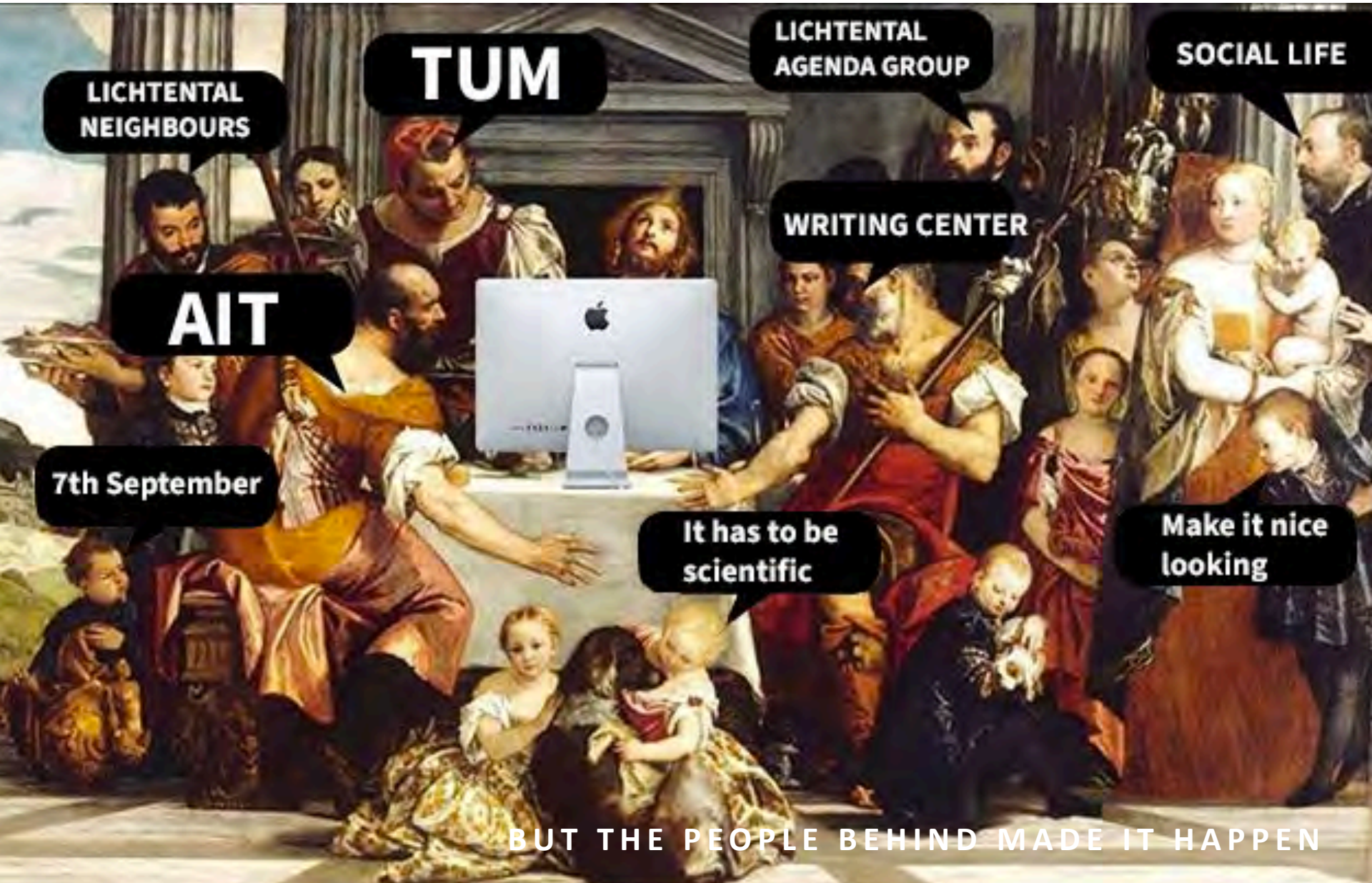
Results and conclusions
- The research is rooted in one specific study case.

- Broader range of cases to increase the reliability and applicability of the results and recommendations.

- Practical implementation of the visualizations as dialogue tools in participatory urban processes.

- Developing interactive platforms that accommodate a variety of data layers and provide users with greater freedom to explore and interact with urban data.

IT WAS NOT EASY TO COORDINATE THIS THESIS



BUT THE PEOPLE BEHIND MADE IT HAPPEN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