AGEING SMART
Räume intelligent gestalten

Carl Zeiss Stiftung

RPTU Rheinland-Pfälzische Technische Universität Kaiserslautern Landau

Linking Survey Data with Limited Localisation with Address-level Data on Accessibility

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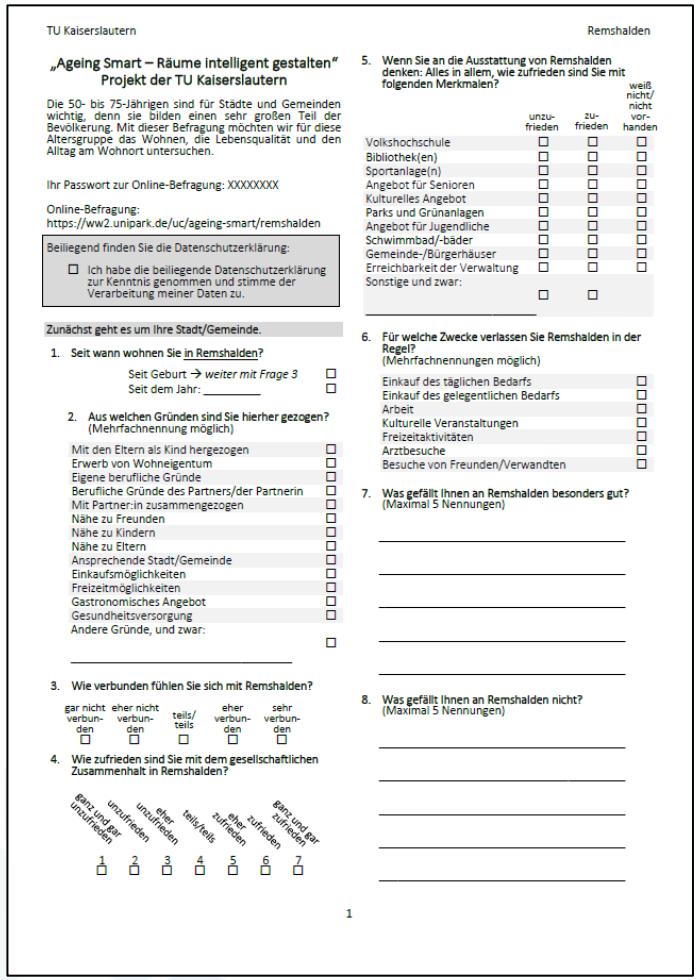
Background

The “Ageing Smart” project focuses on baby boomers, born between 1955 and 1969. It is developing a thematic data-driven decision support system for local authorities.

As the (exceptionally large) baby boomer cohorts begin to reach retirement age,
local authorities are increasingly called upon to provide an age-appropriate living environments.

→ Local provision of essential goods, the quality of and satisfaction with the urban environment, and mobility chances are key issues.

Older Adults: Survey in 2022



TU Kaiserslautern — Remshalden

„Ageing Smart – Räume intelligent gestalten" Projekt der TU Kaiserslautern

Die 50- bis 75-Jährigen sind für Städte und Gemeinden wichtig, denn sie bilden einen sehr großen Teil der Bevölkerung. Mit dieser Befragung möchten wir für diese Altersgruppe das Wohnen, die Lebensqualität und den Alltag am Wohnort untersuchen.

Ihr Passwort zur Online-Befragung: XXXXXXXX

Online-Befragung: https://ww2.unipark.de/uc/ageing-smart/remshalden

Beiliegend finden Sie die Datenschutzerklärung:

☐ Ich habe die beiliegende Datenschutzerklärung zur Kenntnis genommen und stimme der Verarbeitung meiner Daten zu.

Zunächst geht es um Ihre Stadt/Gemeinde.

1. Seit wann wohnen Sie in Remshalden?
   - Seit Geburt → *weiter mit Frage 3* ☐
   - Seit dem Jahr: _____ ☐

2. Aus welchen Gründen sind Sie hierher gezogen? (Mehrfachnennung möglich)

Mit den Eltern als Kind hergezogen	☐
Erwerb von Wohneigentum	☐
Eigene berufliche Gründe	☐
Berufliche Gründe des Partners/der Partnerin	☐
Mit Partner:in zusammengezogen	☐
Nähe zu Freunden	☐
Nähe zu Kindern	☐
Nähe zu Eltern	☐
Ansprechende Stadt/Gemeinde	☐
Einkaufsmöglichkeiten	☐
Freizeitmöglichkeiten	☐
Gastronomisches Angebot	☐
Gesundheitsversorgung	☐
Andere Gründe, und zwar:	☐

_____

3. Wie verbunden fühlen Sie sich mit Remshalden?

gar nicht verbunden	eher nicht verbunden	teils/teils	eher verbunden	sehr verbunden
☐	☐	☐	☐	☐

4. Wie zufrieden sind Sie mit dem gesellschaftlichen Zusammenhalt in Remshalden?

ganz und gar unzufrieden	unzufrieden	eher unzufrieden	teils/teils	eher zufrieden	zufrieden	ganz und gar zufrieden
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

5. Wenn Sie an die Ausstattung von Remshalden denken: Alles in allem, wie zufrieden sind Sie mit folgenden Merkmalen?

	unzufrieden	zufrieden	weiß nicht/ nicht vorhanden
Volkshochschule	☐	☐	☐
Bibliothek(en)	☐	☐	☐
Sportanlage(n)	☐	☐	☐
Angebot für Senioren	☐	☐	☐
Kulturelles Angebot	☐	☐	☐
Parks und Grünanlagen	☐	☐	☐
Angebot für Jugendliche	☐	☐	☐
Schwimmbad/-bäder	☐	☐	☐
Gemeinde-/Bürgerhäuser	☐	☐	☐
Erreichbarkeit der Verwaltung	☐	☐	☐
Sonstige und zwar:	☐	☐	

_____

6. Für welche Zwecke verlassen Sie Remshalden in der Regel? (Mehrfachnennungen möglich)

Einkauf des täglichen Bedarfs	☐
Einkauf des gelegentlichen Bedarfs	☐
Arbeit	☐
Kulturelle Veranstaltungen	☐
Freizeitaktivitäten	☐
Arztbesuche	☐
Besuche von Freunden/Verwandten	☐

7. Was gefällt Ihnen an Remshalden besonders gut? (Maximal 5 Nennungen)

_____
_____
_____
_____
_____

8. Was gefällt Ihnen an Remshalden nicht? (Maximal 5 Nennungen)

_____
_____
_____
_____
_____

1

Target population

- 50 to 75 years old (born 1947 to 1972)
- In focus: baby boomers, born 1955 to 1969

In 7 pilot municipalities in Germany

- Jena, Mannheim, Kaiserslautern (urban)
- Nieder-Olm, Remshalden (suburban)
- Geisaer Land, VG Kusel-Altenglan (rural)

Semi-standardized survey: online- or paper

- Living conditions, relocation behaviour, leisure time and lifestyle, digitalisation, socio-demographics
- Sample from the population register
- 20,422 questionnaires

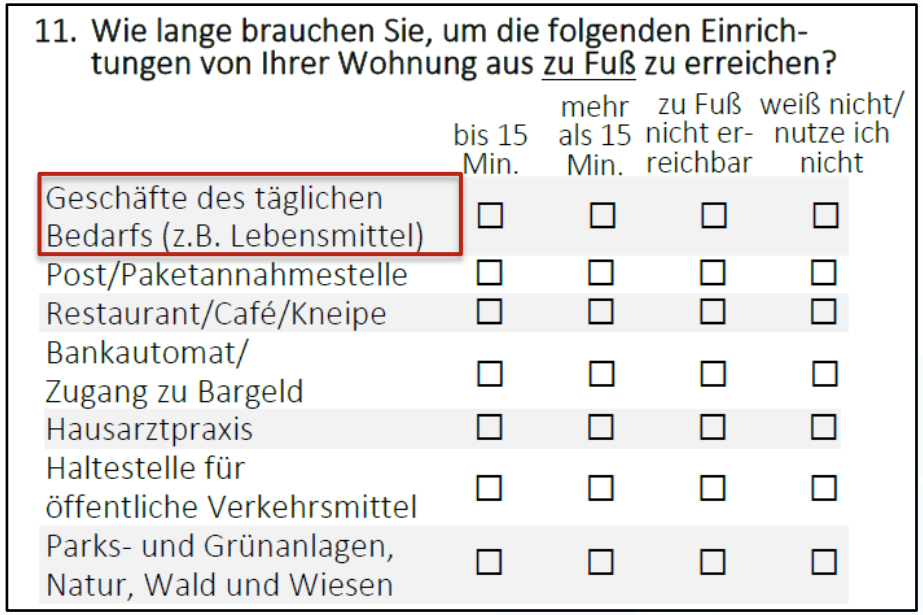
➔ n = 5,059 (25% response rate), 3,099 baby boomers

Accessibility to Key Facilities

One research topic:
Accessibility to and satisfaction with local everyday facilities.

Limitation:
Only rudimentary questions about accessibility,
E.g.: walking time under or over 15 minutes.

Are these questions
… valid in terms of actual distances?
… meaningful in terms of explanatory potential, e.g. for individual satisfaction?



11. Wie lange brauchen Sie, um die folgenden Einrichtungen von Ihrer Wohnung aus zu Fuß zu erreichen?

	bis 15 Min.	mehr als 15 Min.	zu Fuß nicht erreichbar	weiß nicht/ nutze ich nicht
Geschäfte des täglichen Bedarfs (z.B. Lebensmittel)	☐	☐	☐	☐
Post/Paketannahmestelle	☐	☐	☐	☐
Restaurant/Café/Kneipe	☐	☐	☐	☐
Bankautomat/ Zugang zu Bargeld	☐	☐	☐	☐
Hausarztpraxis	☐	☐	☐	☐
Haltestelle für öffentliche Verkehrsmittel	☐	☐	☐	☐
Parks- und Grünanlagen, Natur, Wald und Wiesen	☐	☐	☐	☐

Comparison with Objective Distance Measures

For data protection reasons, respondents can only be located within city districts
→ Objective measures of distance need to be aggregated within these areas.

But what exactly is to be aggregated?
In theory, accessibility is a property of ego-centred action areas
starting from the individual addresses, which exceed district boundaries.
→ Again, addresses are not available.

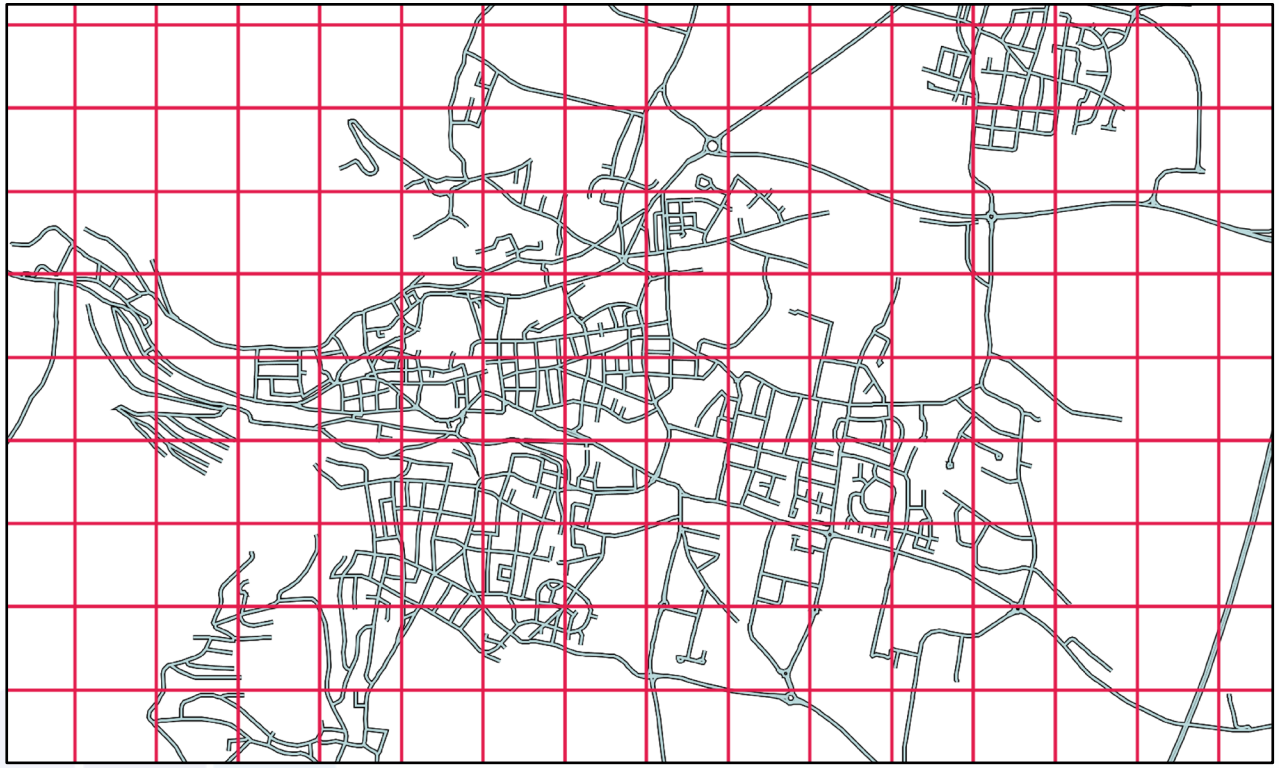
Solution:

- **Define pseudo-addresses**
- **Distribute them with respect to target population density**
- **Calculate individual distances on this basis**
- **Aggregate and link with survey data**

Localisation of the Pseudo-addresses

Roads and routes map from OpenStreetMaps

Localisation of the Pseudo-addresses



Roads and routes map from OpenStreetMaps +

Administrative raster data for the age-specific population

In this case: Zensus 2011;
100*100 metres;
Baby boomer birth years

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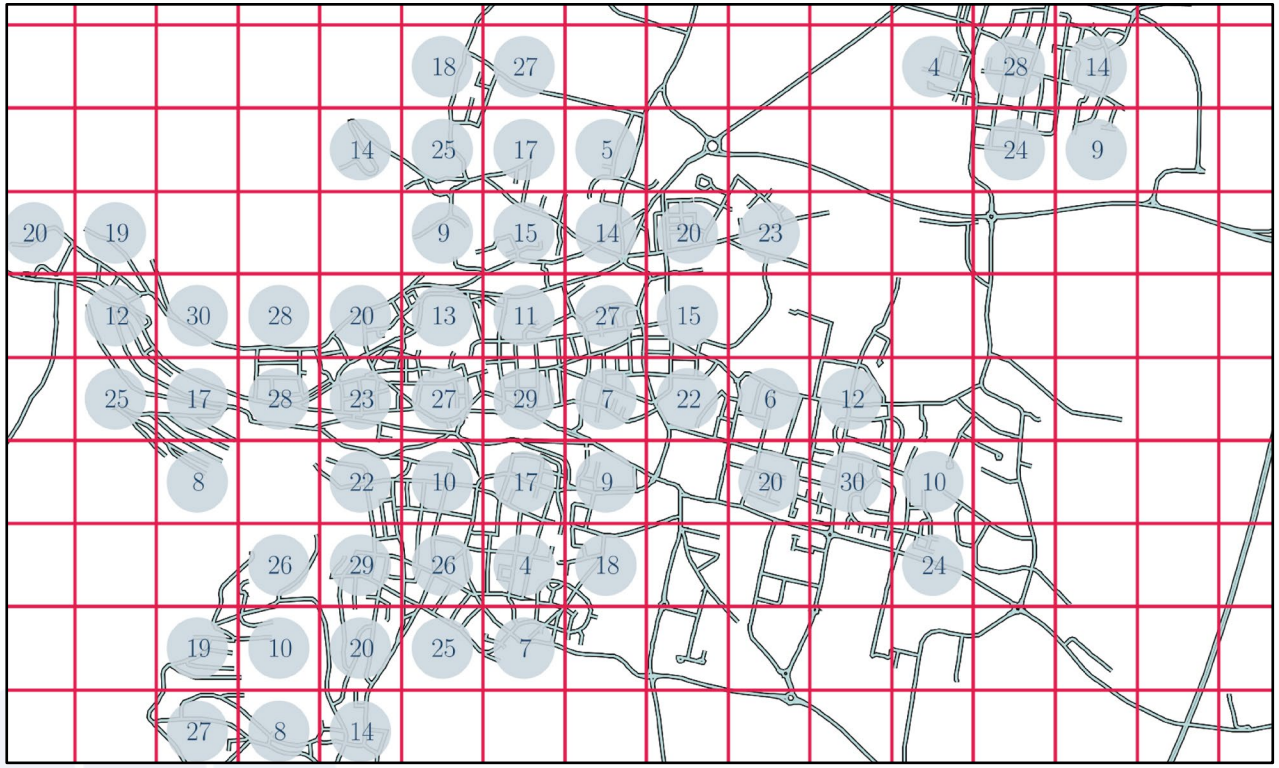

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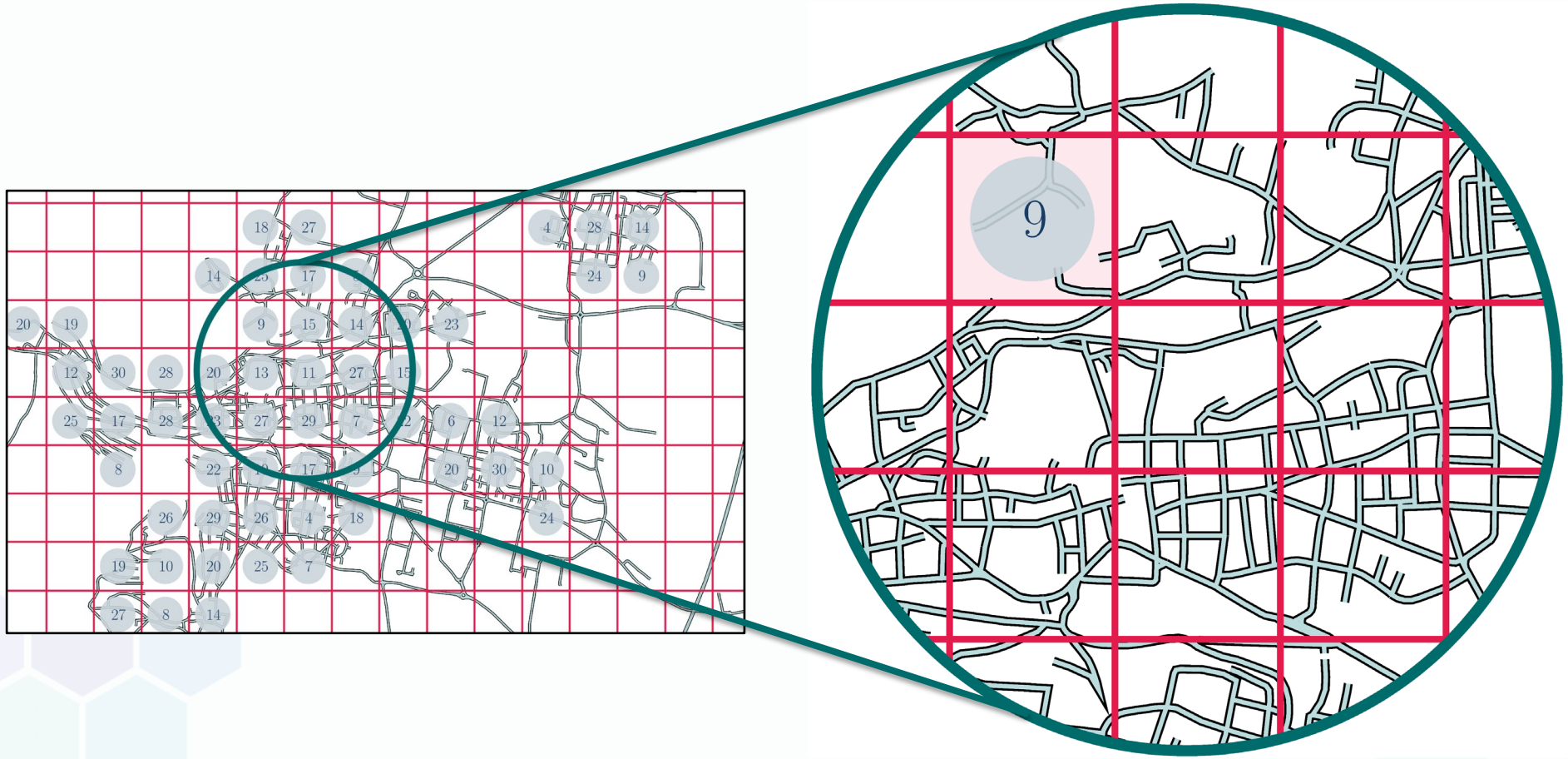


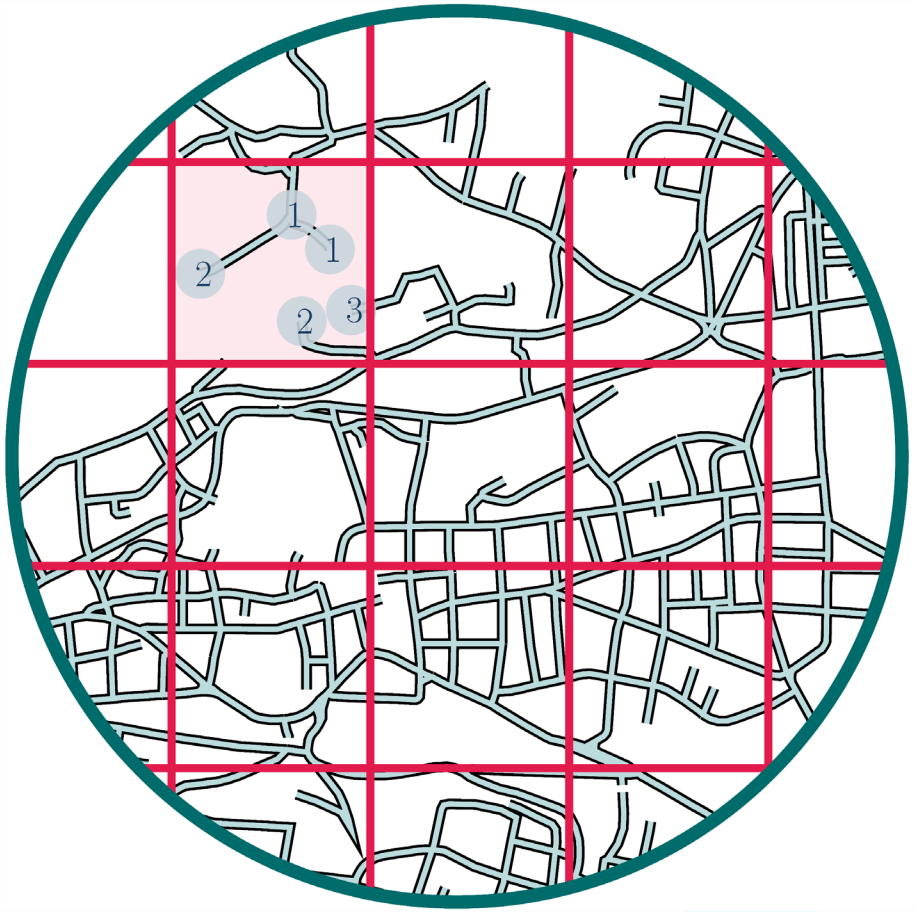
Localisation of the Pseudo-addresses

We know that (approx.) nine baby boomers live in this cell.

They will be randomly distributed within the cell, along the streets.

For technical reasons, only crossroads and street ends (=nods) are considered.

The process is carried out for all cells.



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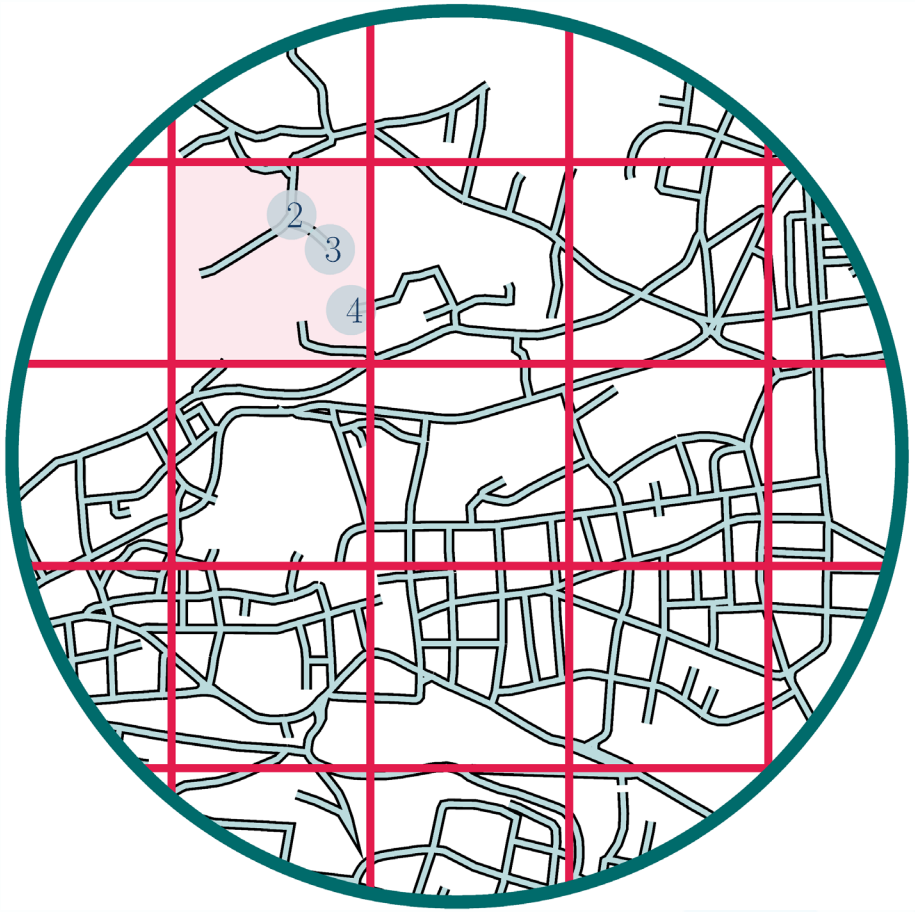

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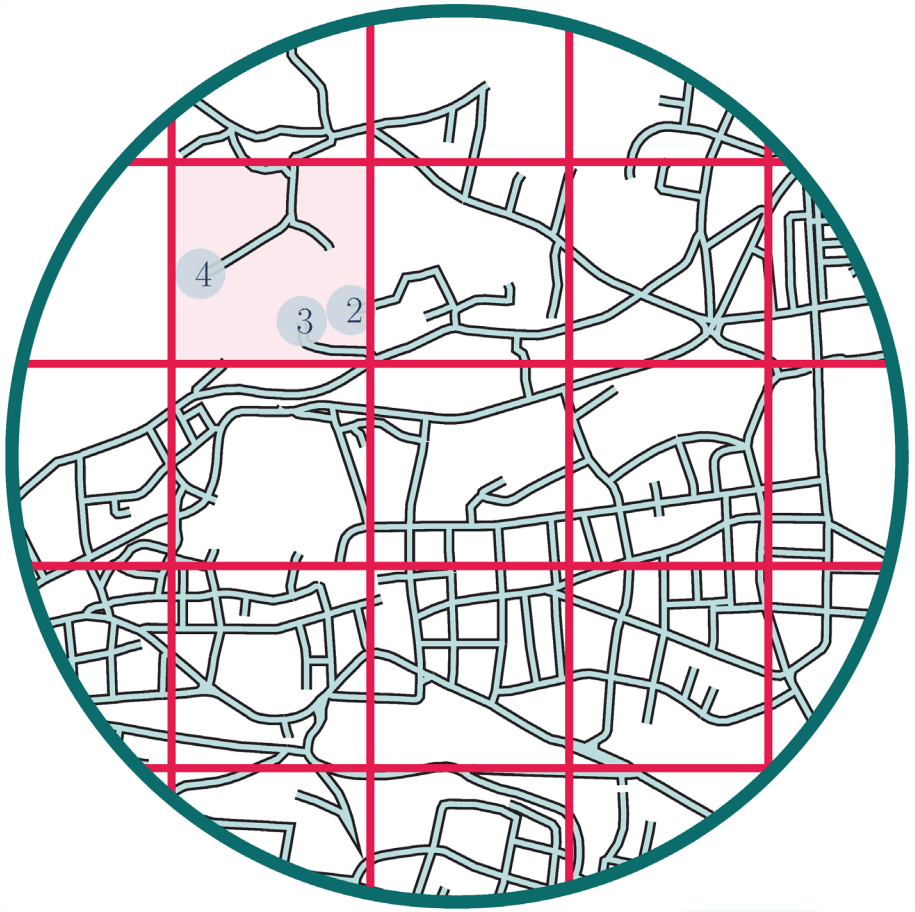
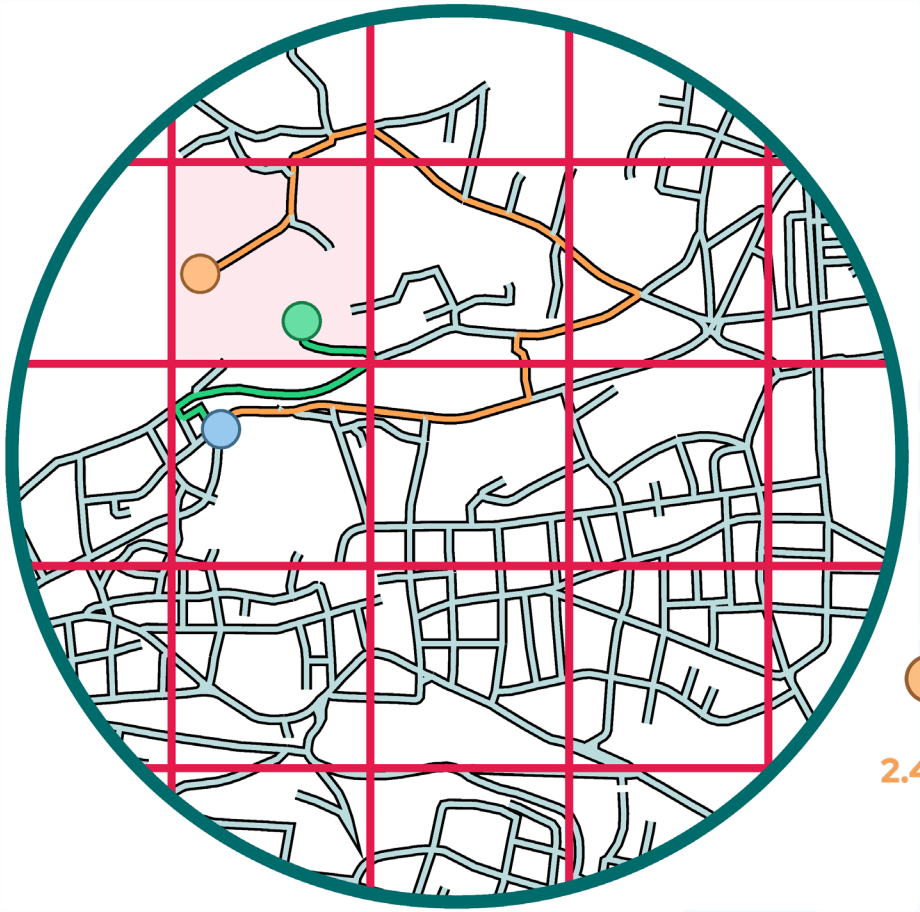


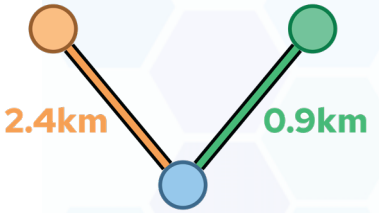
Determining Objective Accessibility

A mathematical accessibility model determines optimal distances between nodes. Road routing is taken into account.

The model adapts Dijkstra's shortest path algorithm in combination with automata theory.

The model can determine the shortest path given different modes of transportation (car, bicycle). Here we only consider walking.

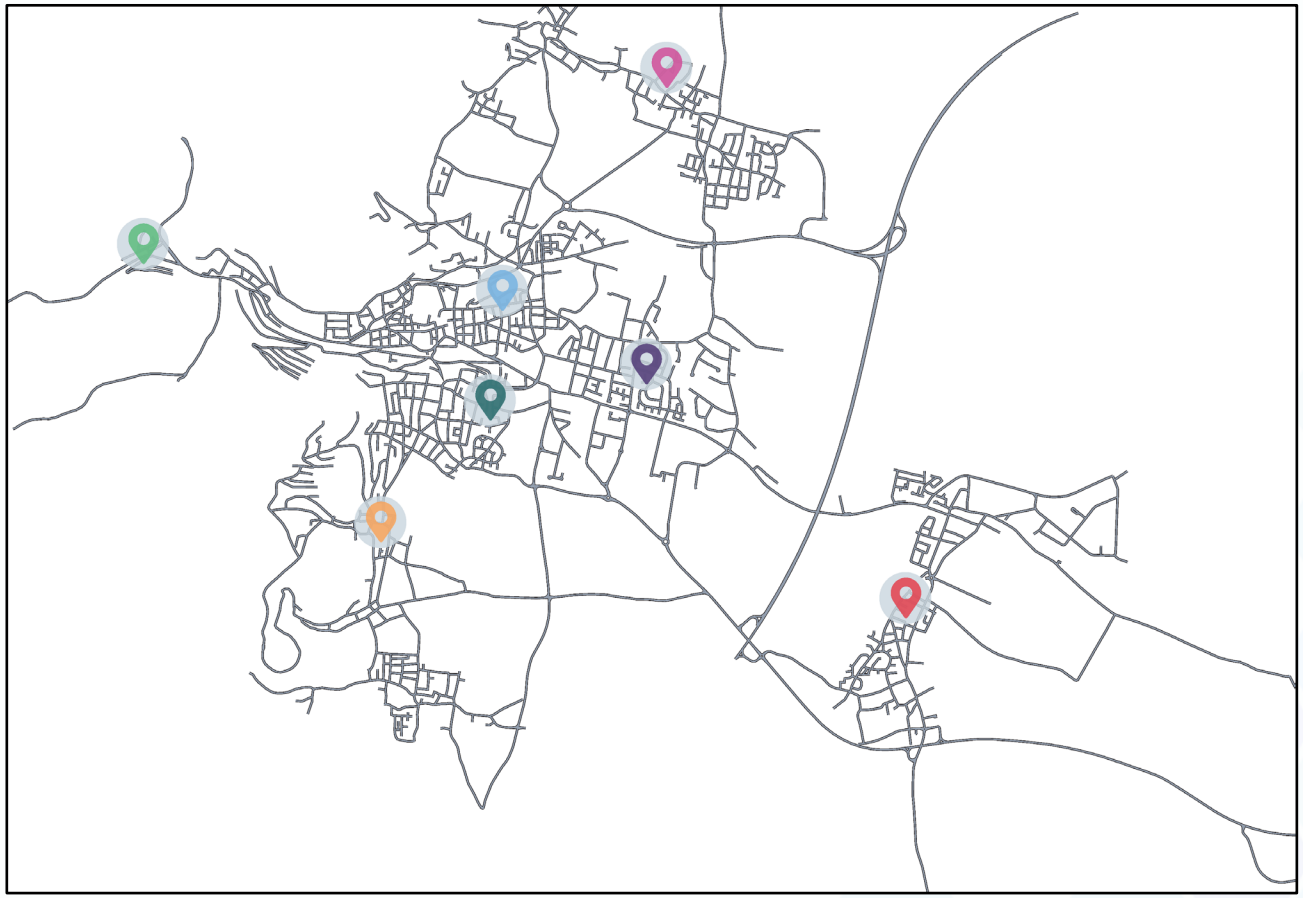




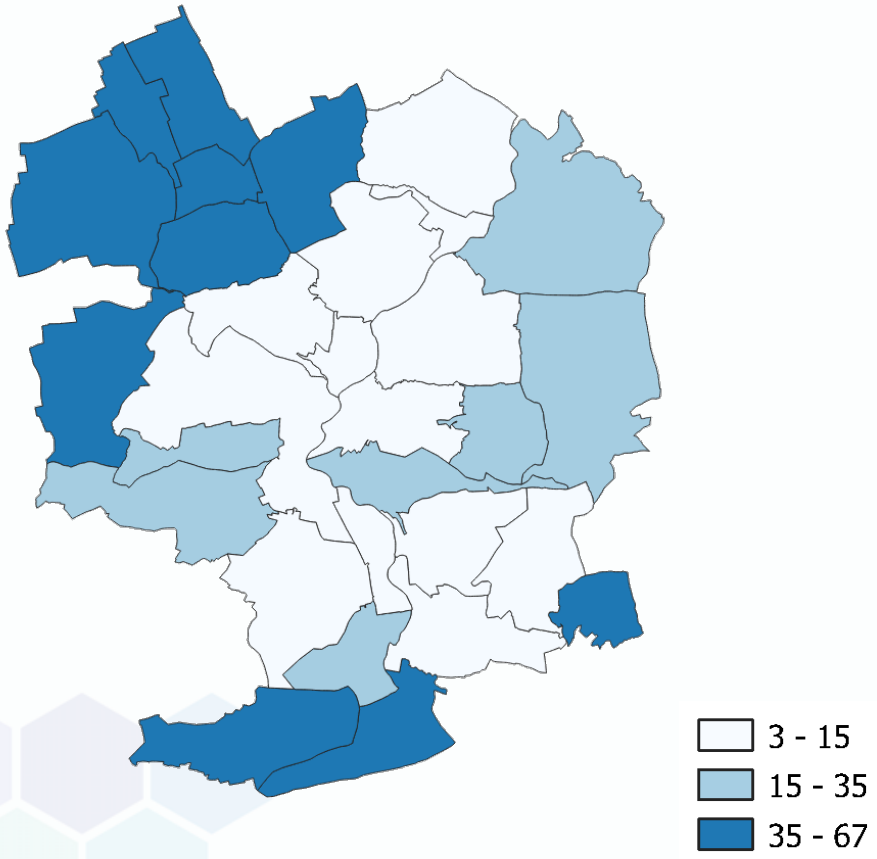
Determining Objective Accessibility

We are interested in distances between baby boomers and points of interest. Here, nearest supermarket.

These distances are calculated for all pseudo-addresses.



Results from the Accessibility Model

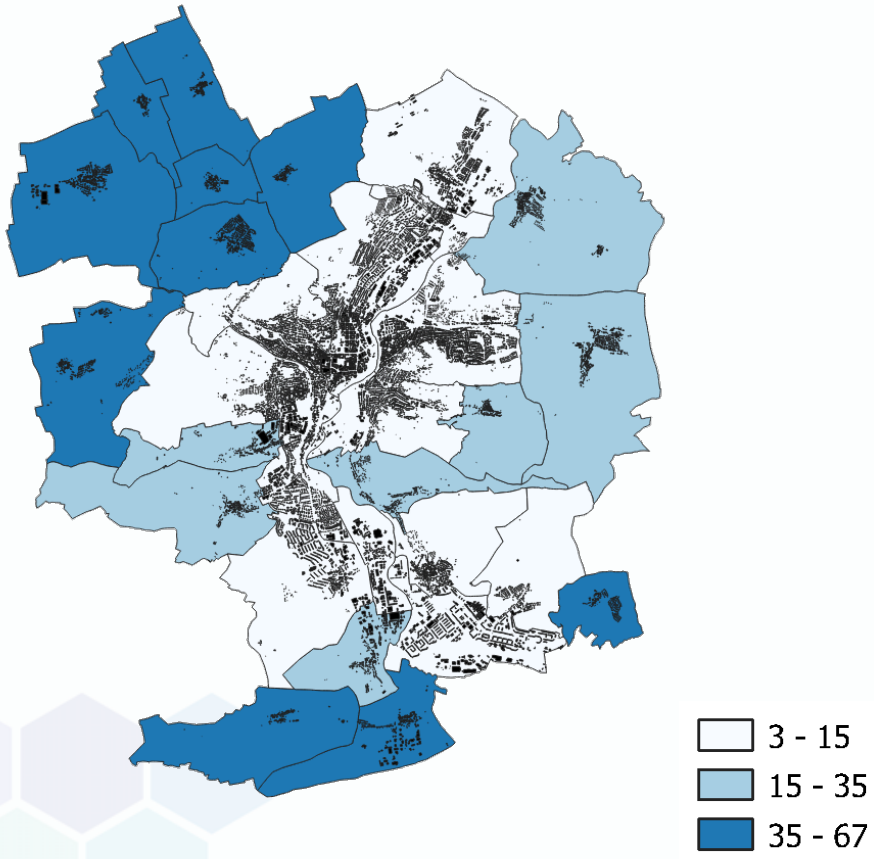


Average walking minutes to the nearest supermarket; Jena, city districts;
SD per district: 1 – 5.5; assumed walking speed: 4.5 km/h

These “individual” distances are then aggregated within city districts (=average). Currently, only for the city of Jena.

The district codes can be used to link aggregated values to survey respondents.

Results from the Accessibility Model



Average walking minutes to the nearest supermarket. Jena, city districts; assumed walking speed: 4.5 km/h; buildings

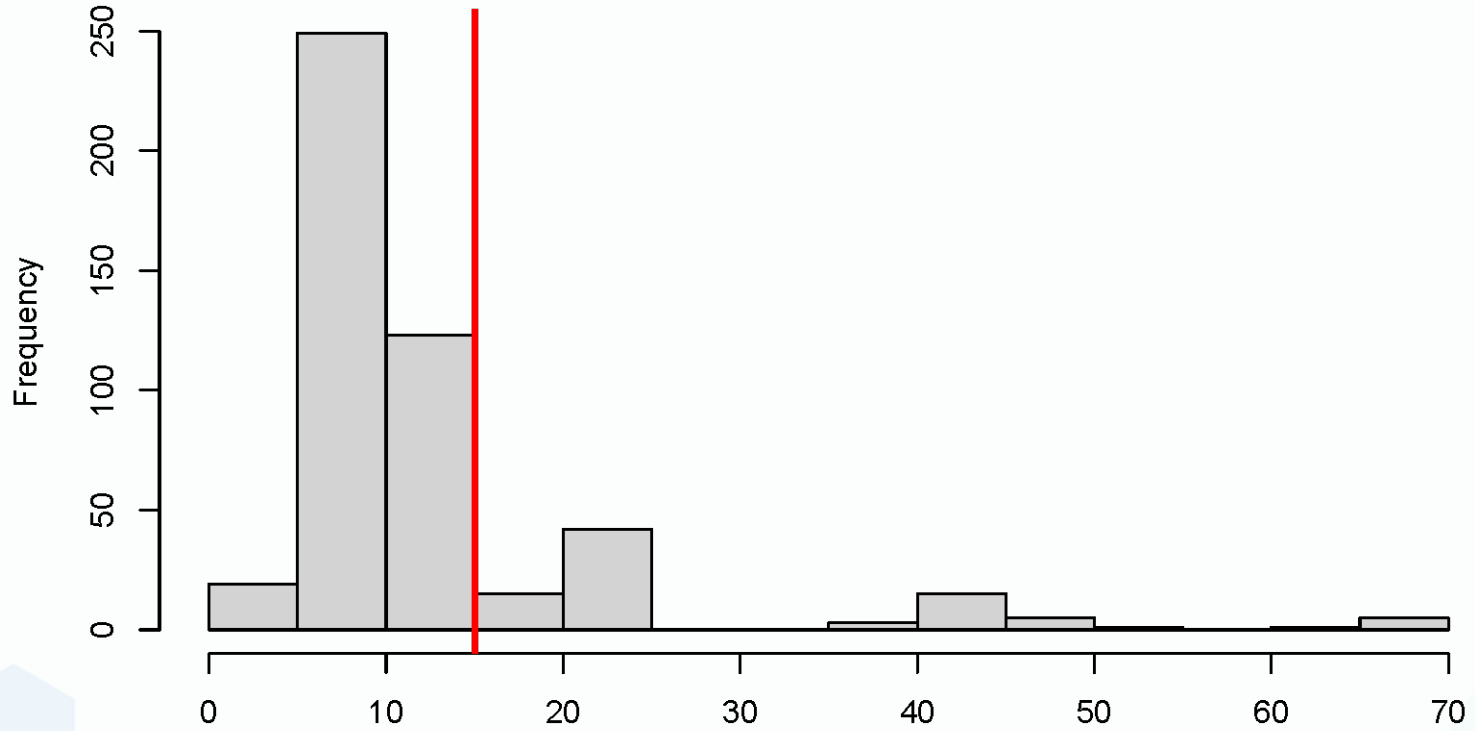
The distances to the nearest supermarket are calculated for all pseudo-addresses.

These “individual” distances are then aggregated within city districts (=average). Currently, only for the city of Jena.

The district codes can be used to link aggregated values to survey respondents.

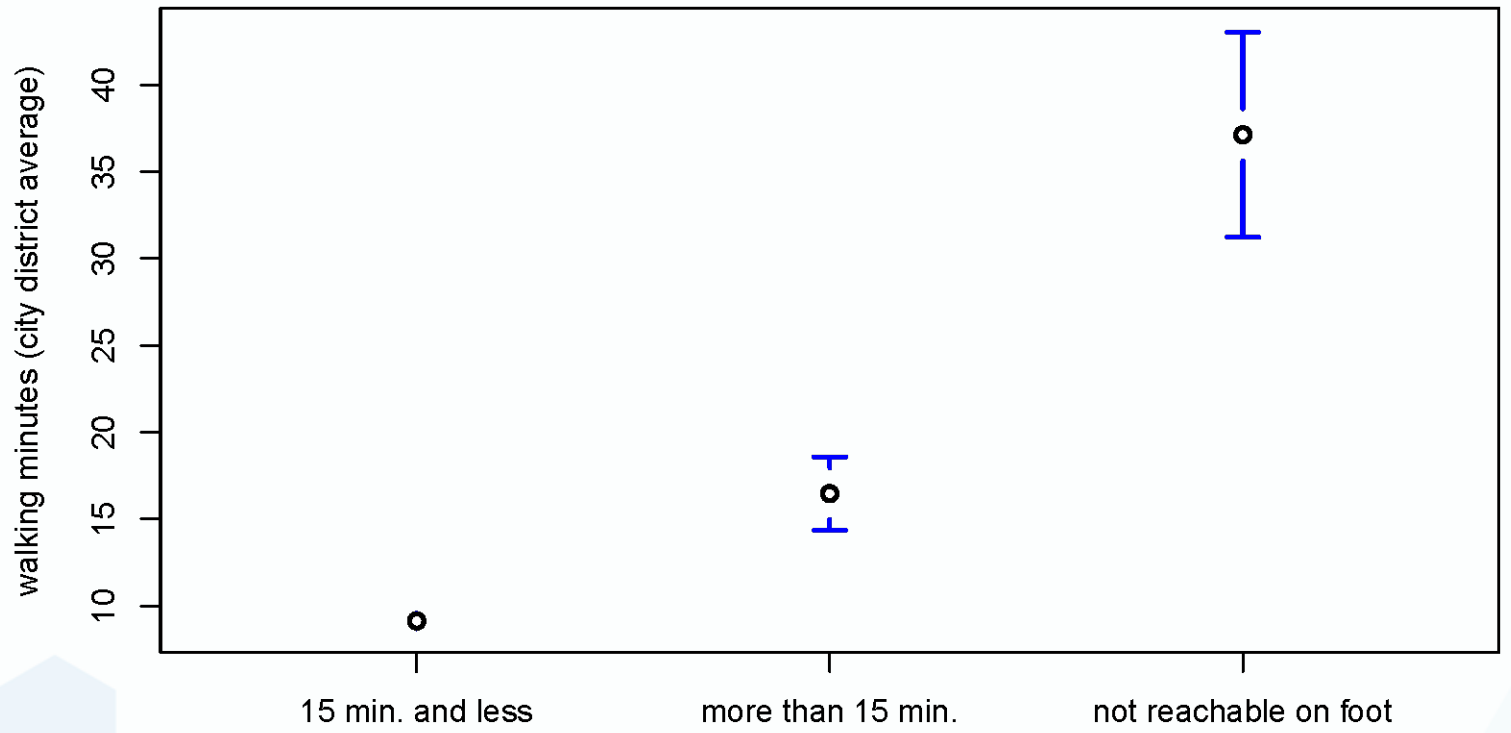
→ The majority of city's inhabited area (contains 80 % of the survey respondents) shows very good accessibility.

Results from the Accessibility Model



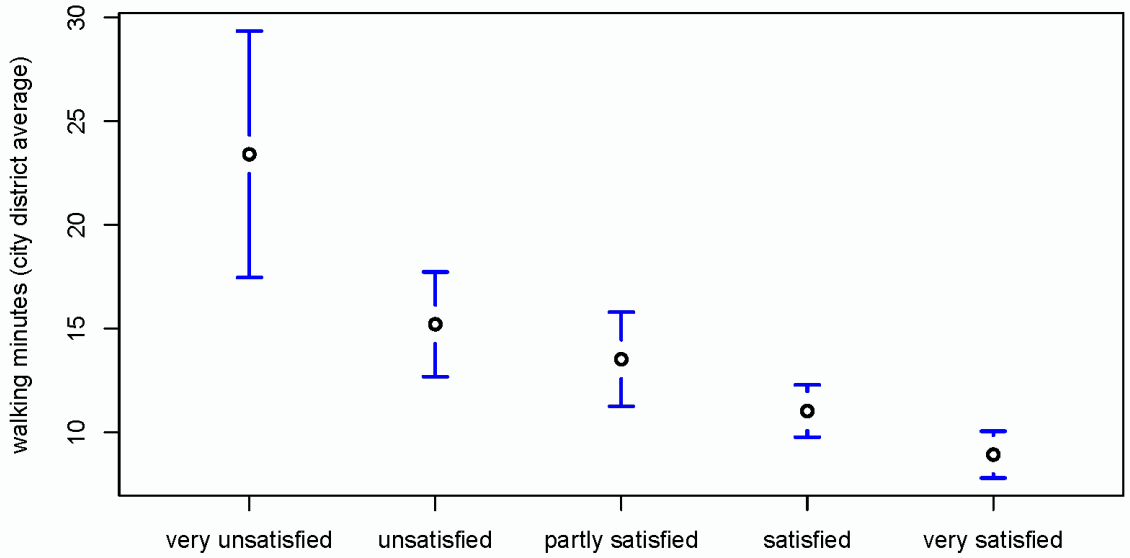
Walking minutes to the nearest supermarket, approximated by the accessibility model; distribution along survey participants in Jena, N=468; red x-line = 15 min.; assumed walking speed: 4.5 km/h

Objective vs. Reported Accessibility



Distances to the nearest supermarket: self-reported (x-axis) and as result of the accessibility model (y-axis); 95%-CI; Jena, N=468; assumed walking speed: 4.5 km/h

Accessibility and Satisfaction



	very unsatisfied	un-satisfied	partly satisfied	satisfied	very satisfied
15 min. and less	3 %	9 %	17 %	**46 %**	25 %
more than 15 min.	12 %	26 %	29 %	29 %	4 %
not reachable on foot	**39 %**	18 %	18 %	21 %	4 %

Satisfaction with local shopping opportunities (x-axis) and the distances to the nearest supermarket from accessibility model (y-axis); 95%-CI; Jena, N= 468; assumed walking speed: 4.5 km/h

Satisfaction with local shopping opportunities (columns) and the self-reported distances to the supermarket (rows); Jena, N= 468.

Accessibility and Satisfaction

In a model-based approach, both objective and subjective measures predict satisfaction to a similar extent.

Around 70% of entries can be correctly predicted by one of the two indicators alone.

Interestingly, the relationship between measured or reported accessibility and satisfaction remains the same for all socio-economic groups (in terms of gender, education, income, migration background).

The only significant moderating factor is the car usage. For intensive car users, distance is much less important.

Summary

Aggregation based on pseudo-addresses offers a comparatively easy-to-implement procedure that considers theoretical mobility patterns and at least partially overcomes the problem of inadequate localisation in surveys.

Reported distances to a supermarket correspond closely with actual distances. Both can be used to predict satisfaction with shopping situation.
→ Facilities that are used less intensively should provide weaker correlations (to be continued).

In the applied case, accessibility measure strongly reflects the division between inner city and outer districts.
→ Examples with greater variation are needed to further verify the results.

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Thank you!

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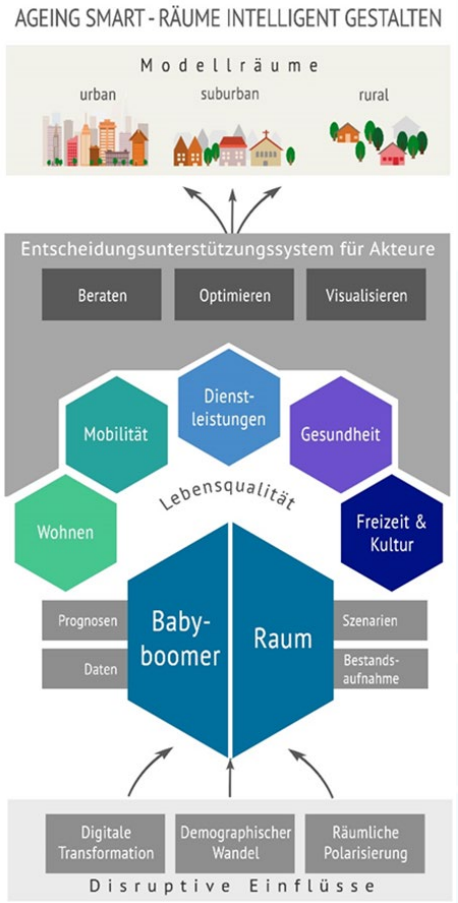

Survey Descriptives, Jena

	Mean (SD)/%
Age	60 (4)
Female	58 %
Male	42 %
Montl. income (in Euro)	3,490 (2,190)
Higher education	48.6 %
Retired	20 %
Unemployed	3 %
German citizen	98 %
Flat size (in square meters)	95.1 (39.0)
Household size	2.1 (0.8)

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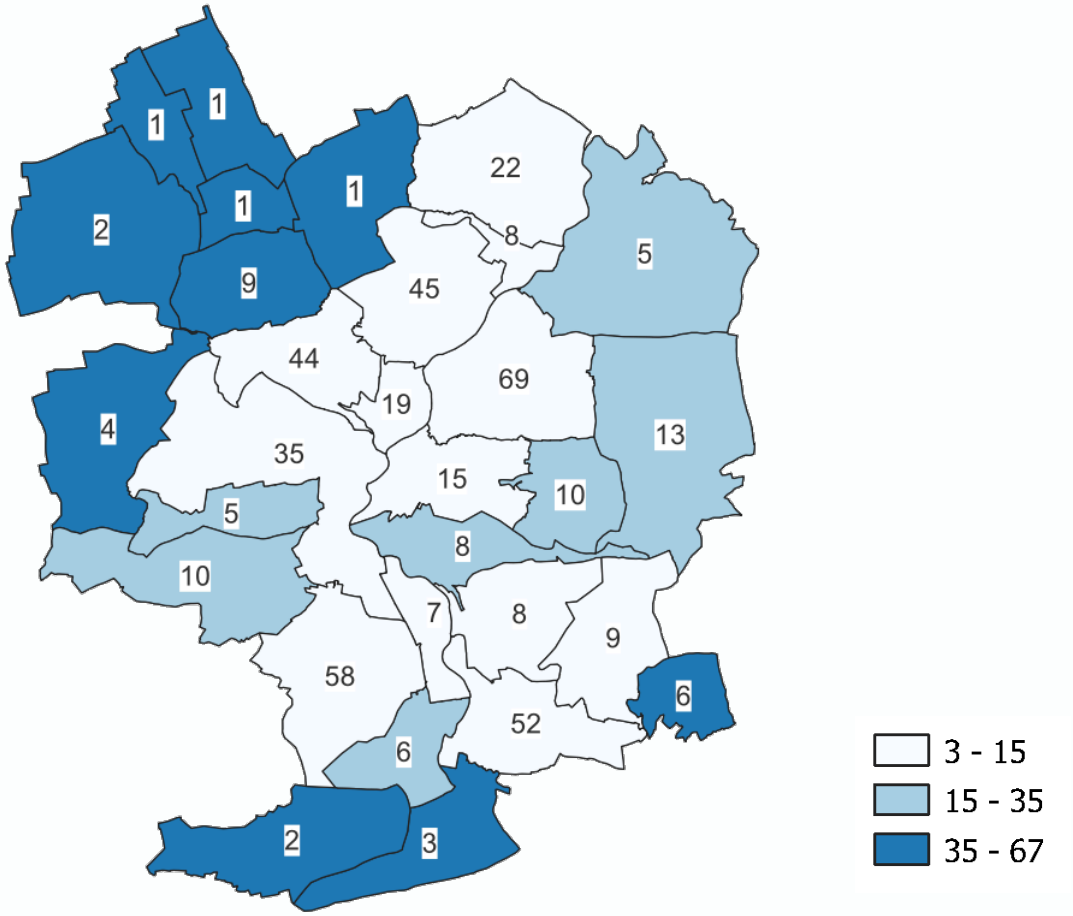
Survey Case Numbers, Jena



Survey case numbers + results form the accessibility model: Average walking minutes to the next two supermarkets; Jena, city districts.