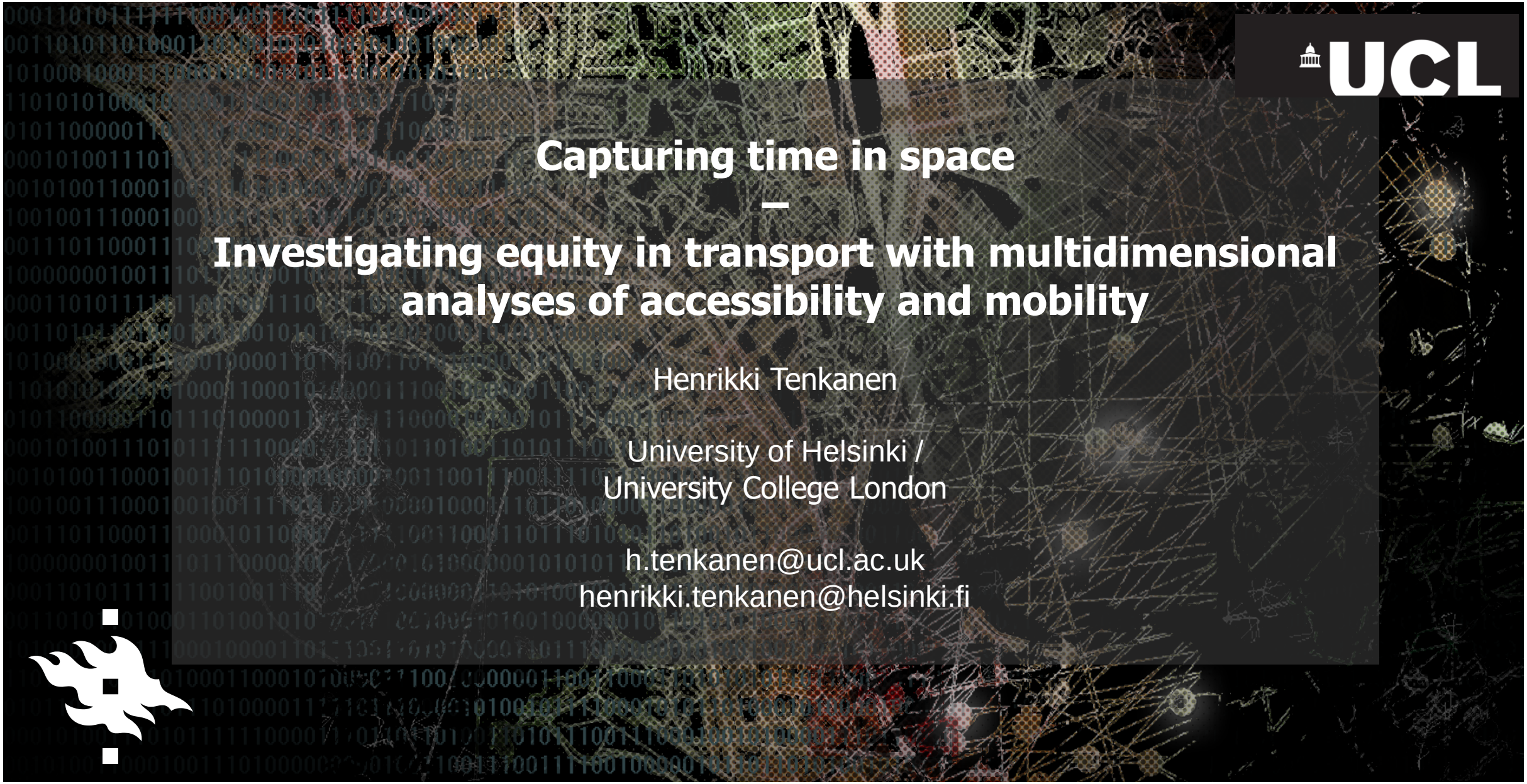


Capturing time in space
–
Investigating equity in transport with multidimensional analyses of accessibility and mobility

Henrikki Tenkanen

University of Helsinki /
University College London

h.tenkanen@ucl.ac.uk
henrikki.tenkanen@helsinki.fi

HELSINGIN YLIOPISTO
HELSINGFORS UNIVERSITET
UNIVERSITY OF HELSINKI

CASA Seminar 23rd January 2019, London

WHO? IN A NUTSHELL

Henrikki Tenkanen

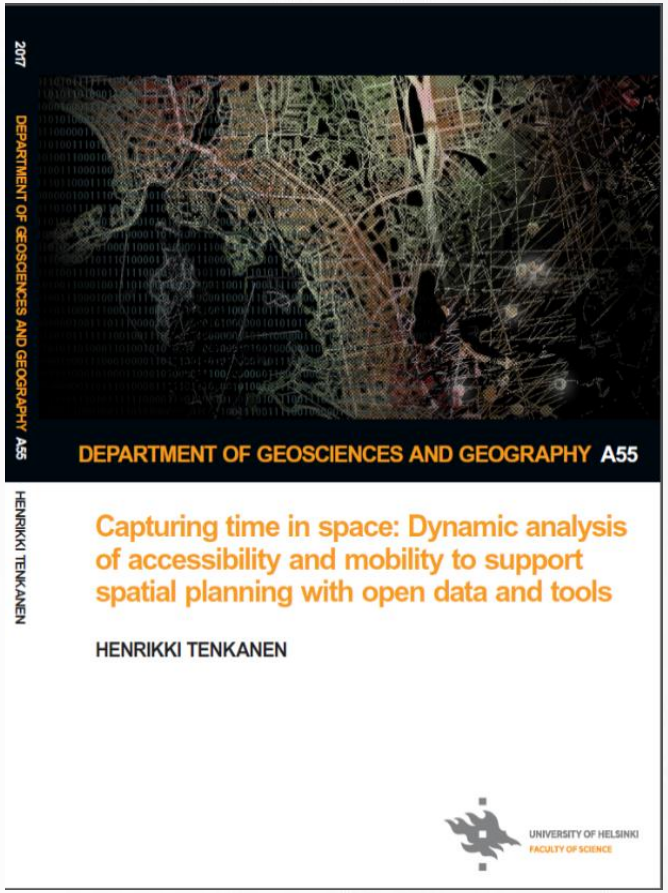
Geographer / geodata scientist

Affiliate academic at Dept. Geography, UCL running own project (2019 -)

PhD from Uni. Helsinki in 2017

Co-founder of Mapple Analytics Oy

Python GIS educator



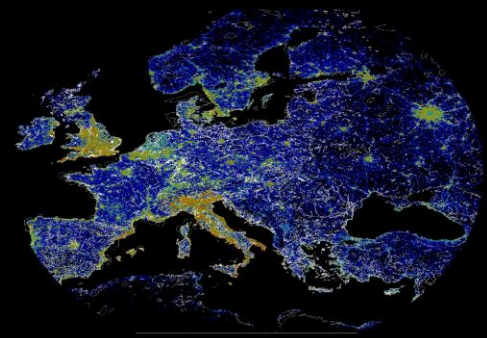
GEO PYTHON

```
print("Hello, world!")
```

geo-python.github.io

OPEN SOURCE PYTHON COURSES FOR GEOGRAPHERS (basics of programming + GIS)

Automating GIS processes



autogis.github.io

DIGITAL GEOGRAPHY LAB

Tuuli Toivonen

Enrico Di Minin

Olle Järv

Henrikki Tenkanen

Tuomo Hiippala

Anna Hausmann

Vuokko Heikinheimo

Christoph Fink

Maria Salonen

Gonzalo Cortés Capano

Joel Jalkanen

Johanna Eklund

Jeison Londoño

Elias Willberg

Supporting sustainable spatial planning using digital data and novel methods

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HELSINGFORS UNIVERSITET
UNIVERSITY OF HELSINKI

www.helsinki.fi/digital-geography

Matemaattis-luonnontieteellinen tiedekunta

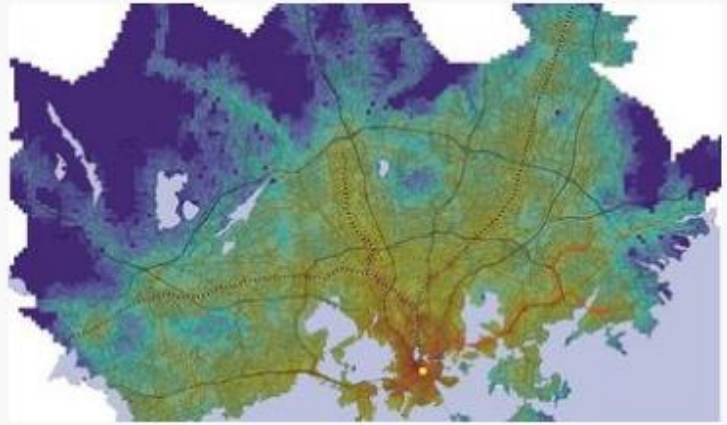
RESEARCH THEMES

MOBILITY & ACCESSIBILITY

Urban patterns, cross-border flows and global networks of people, goods and information

NATURE CONSERVATION

Conservation planning, nature-based tourism and wildlife trade



NOVEL DATA AND METHODS

Developing open source data and methods for spatio-temporal analysis

frontiers in Environmental Science

PERSPECTIVE
published: 09 September 2015
doi: 10.3389/fenvs.2015.00063

OPEN ACCESS

Prospects and challenges for social media data in conservation science

Enrico Di Minin[1,2*†], *Henrikki Tenkanen*[3] *and Tuuli Toivonen*[1,3*†]

[1] Finnish Centre of Excellence in Metapopulation Biology, Department of Biosciences, University of Helsinki, Helsinki, Finland, [2] School of Life Sciences, University of KwaZulu-Natal, Durban, South Africa, [3] Department of Geosciences and Geography, University of Helsinki, Helsinki, Finland

Social media data have been extensively used in numerous fields of science, but examples of their use in conservation science are still very limited. In this paper, we propose a framework on how social media data could be useful for conservation science and practice. We present the commonly used social media platforms and discuss how their content could provide new data and information for conservation science. Based on this, we discuss how future work in conservation science and practice would benefit from social media data.

Keywords: social media, Twitter, instagram, Facebook, biodiversity conservation, management, big data, national parks

Edited by: Krithi K. Karanth, Wildlife Conservation Society, India

Reviewed by: Margaret Buck Holland, University of Maryland, Baltimore County, USA; James Michael Gibbons, Bangor University, UK

***Correspondence:** Enrico Di Minin, Finnish Centre of Excellence in Metapopulation Biology, Department of Biosciences, Biocenter 3, University of Helsinki, PO Box 65 (Viikinkaari 1), 00014 Helsinki, Finland; School of Life Sciences, Westville Campus, University of KwaZulu-Natal, PO Box 54001, 4 University Road,

isprs International Journal of Geo-Information

MDPI

Article

User-Generated Geographic Information for Visitor Monitoring in a National Park: A Comparison of Social Media Data and Visitor Survey

Vuokko Heikinheimo [1,*], Enrico Di Minin [1,2], Henrikki Tenkanen [1], Anna Hausmann [1,2], Joel Erkkonen [3] and Tuuli Toivonen [1]

1 Department of Geosciences and Geography, University of Helsinki, 00014 Helsinki, Finland;

Conservation Biology

Diversity

A framework for investigating illegal wildlife trade on social media with machine learning

Enrico Di Minin [1,2,3*] Christoph Fink [1,2] Tuomo Hiippala [1,2,4] and Henrikki Tenkanen [1,2]

[1]Digital Geography Lab, Department of Geosciences and Geography, University of Helsinki, Helsinki, FI 00014, Finland
[2]Helsinki Institute of Sustainability Science, University of Helsinki, Helsinki, FI 00014, Finland
[3]School of Life Sciences, University of KwaZulu-Natal, KwaZulu-Natal, Durban 4000, South Africa
[4]Department of Languages, University of Helsinki, Helsinki, FI 00014, Finland

Conservation Letters
A journal of the Society for Conservation Biology
Open Access

LETTER

Social Media Data Can Be Used to Understand Tourists' Preferences for Nature-Based Experiences in Protected Areas

Anna Hausmann[1], Tuuli Toivonen[2], Rob Slotow[1,3], Henrikki Tenkanen[2], Atte Moilanen[4], Vuokko Heikinheimo[2], & Enrico Di Minin[1,2]

[1] Amarula Elephant Research Programme, School of Life Sciences, University of KwaZulu-Natal, Durban 4041, So
[2] Department of Geosciences and Geography, University of Helsinki, FI-00014 Helsinki, Finland
[3] Department of Genetics, Evolution and Environment, University College, London, WC1E 6BT, UK
[4] Finnish Centre of Excellence in Metapopulation Research, Department of Biosciences, University of Helsinki, 00

Keywords
Biodiversity conservation; conservation marketing; ecotourism; Flickr; Instagram; social media.

Correspondence
Anna Hausmann, Amarula Elephant Research Programme, School of Life Sciences, University of KwaZulu-Natal, Durban 4041, South Africa.
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E-mail: anna.hausmann87@gmail.com

Received
21 June 2016
Revised
14 December 2016
Accepted
15 January 2017

Abstract

Can social media data be used as an alternati
derstand tourists' preferences for nature-based
We explored this by comparing preferences fo
traditional survey conducted in Kruger Nation
served preferences assessed from over 13,600 pi
Flickr by tourists visiting the park in the same p
difference between the preferences of tourists
preferences revealed by social media content.
were found to be the favorite group, both in t
platforms. However, Flickr was found to bette
less-charismatic biodiversity. Our findings sug
can be used as a cost-efficient way to explore,
itoring of, preferences for biodiversity and hum

UNIVERSITY OF HELSINKI

Ma

SCIENTIFIC REPORTS

OPEN

Instagram, Flickr, or Twitter: Assessing the usability of social media data for visitor monitoring in protected areas

Received: 24 July 2017
Accepted: 5 December 2017
Published online: 14 December 2017

Henrikki Tenkanen, Enrico Di M
Marna Herbst, Liisa Kajala & Tuu

SCIENTIFIC REPORTS

OPEN

Social media reveal that charismatic species are not the main attractor of ecotourists to sub-Saharan protected areas

Received: 12 December 2016
Accepted: 15 March 2017
Published online: 10 April 2017

Anna Hausmann[1], Tuuli Toivonen[2], Vuokko Heikinheimo[2], Henrikki Tenkanen[2], Rob Slotow[1,3] & Enrico Di Minin[1,2]

Charismatic megafauna are arguably considered the primary attractor of ecotourists to sub-Saharan African protected areas. However, the lack of visitation data across the whole continent has thus far prevented the investigation of whether charismatic species are indeed a key attractor of ecotourists to protected areas. Social media data can now be used for this purpose. We mined data from Instagram, and used generalized linear models with site- and country-level deviations to explore which socio-economic, geographical and biological factors explain social media use in sub-Saharan African protected areas. We found that charismatic species richness did not explain social media usage. On the other

correspondence

Machine learning for tracking illegal wildlife trade on social media

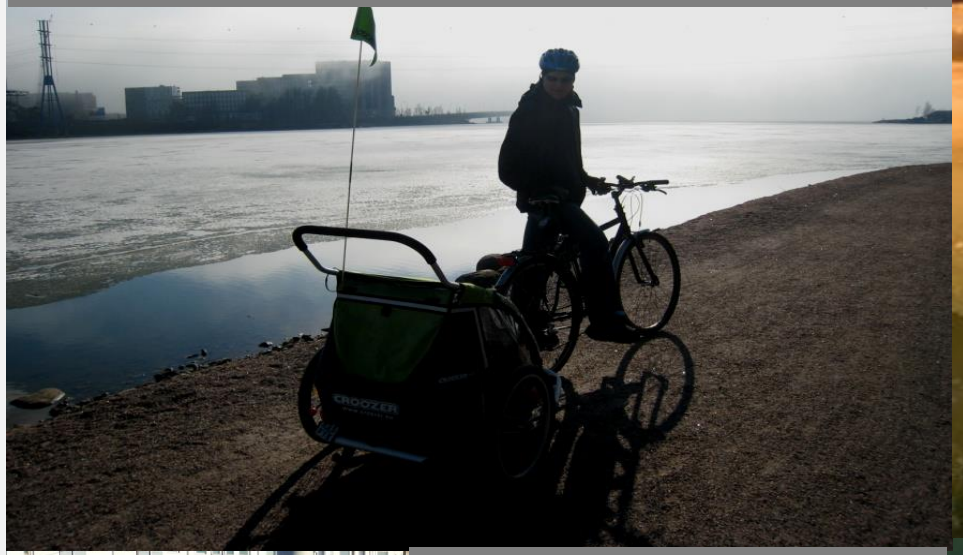
To the Editor — Illegal trade in wildlife is booming on e-commerce platforms[1], the 'dark web'[2] and social media[1,3]. The ease of

techniques to social media data allows human behaviour to be investigated on an unprecedented scale. Yet these techniques

species by their songs and calls, as well as interrogating the image stream. Natural language processing can be used to infer

ACCESSIBILITY …

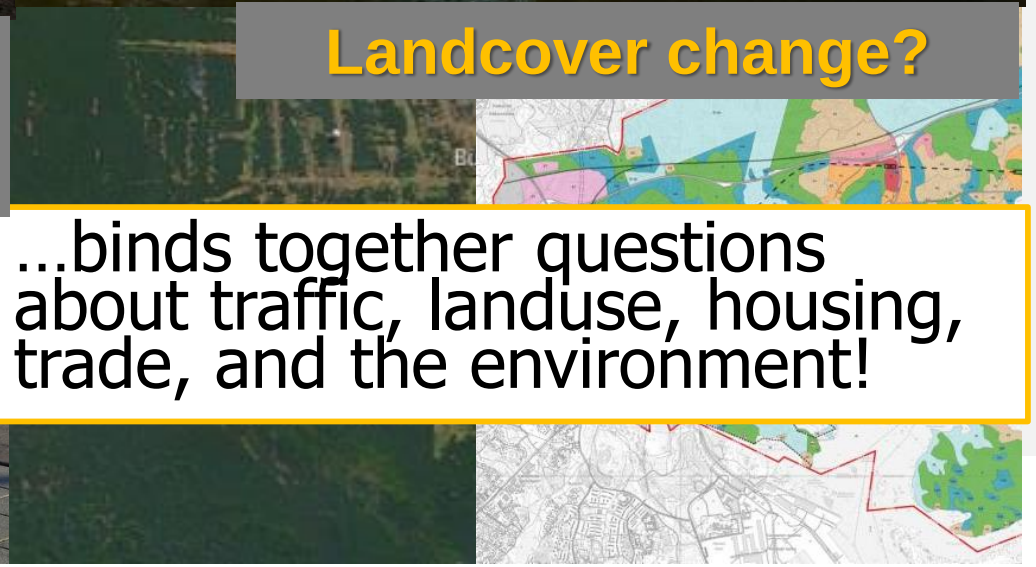
Car, bus or bike?



Sustainable cities?

Carbon footprint?

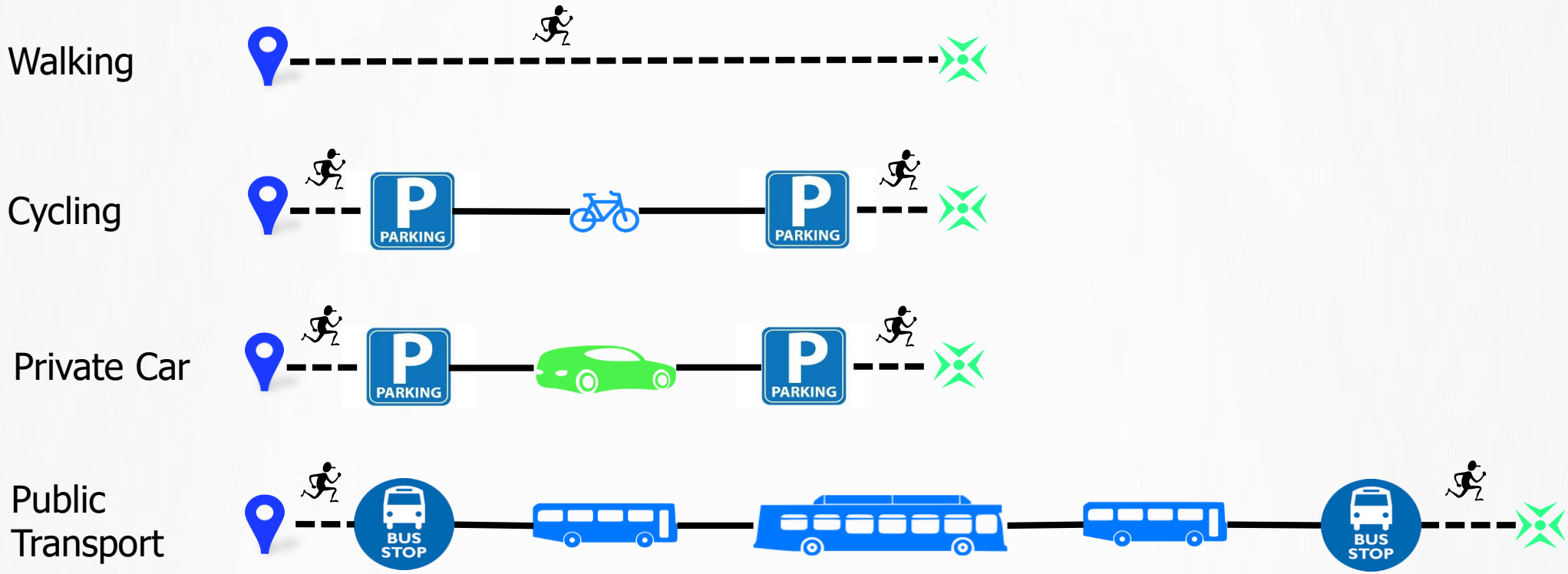
Landcover change?



…binds together questions about traffic, landuse, housing, trade, and the environment!

NEED FOR COMPARABLE MEASURES OF ACCESSIBILITY

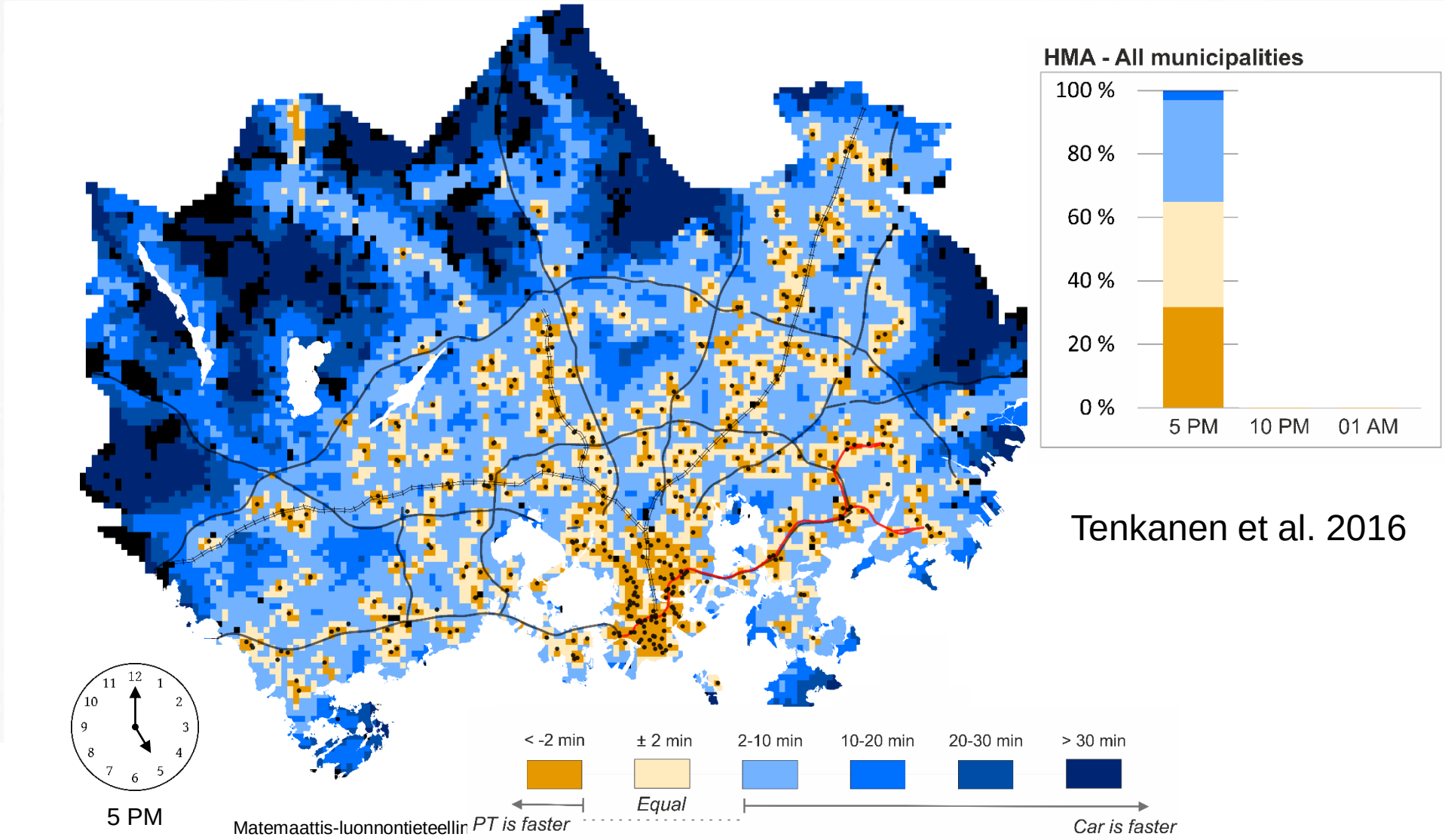
COMPARABLE MEASURES WITH DOOR-TO-DOOR APPROACH



Salonen & Toivonen (2013)

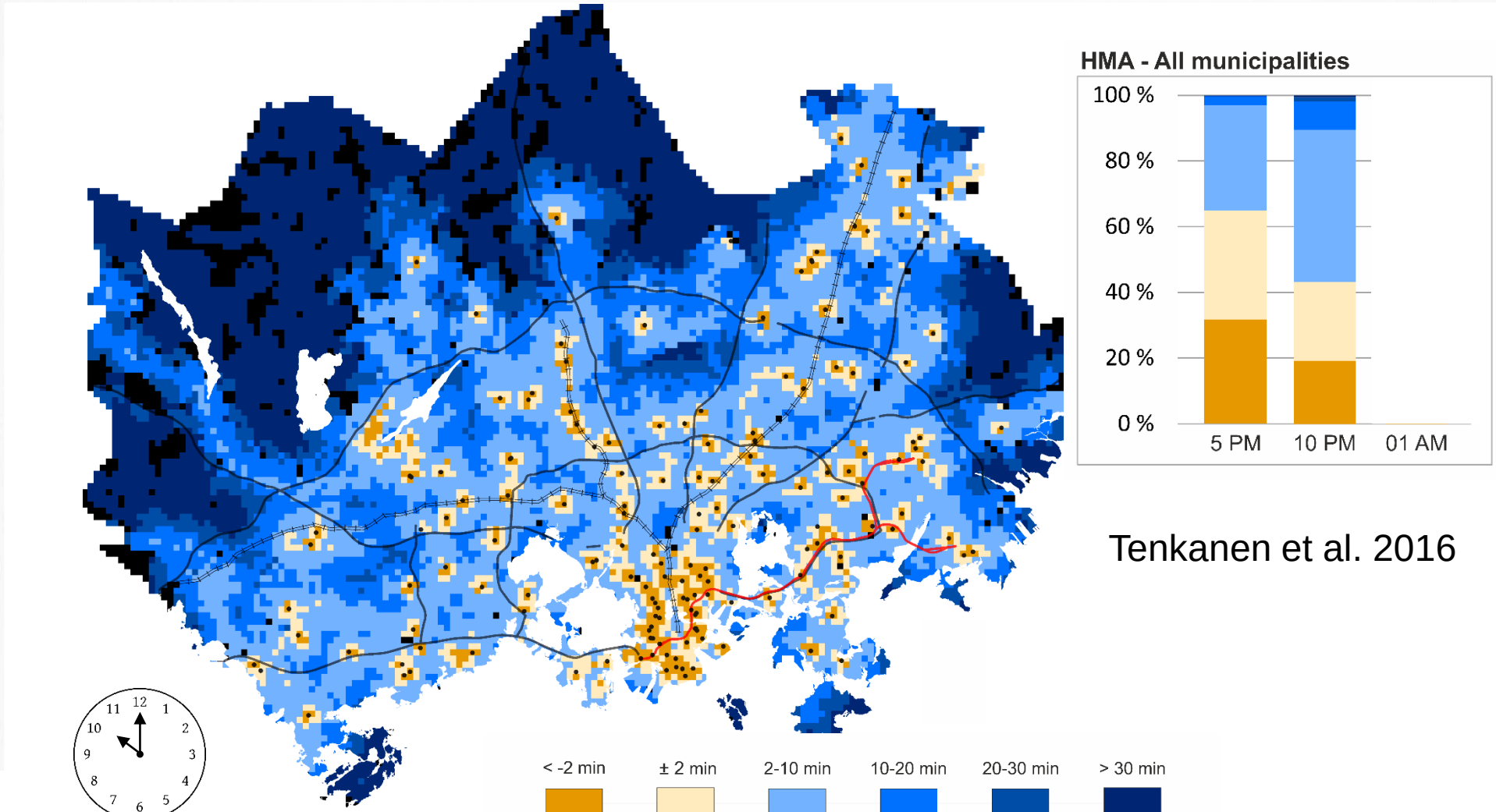
http://www.iconsdb.com

TRIP TO CLOSEST FOOD STORE AT 5 PM
DIFFERENCE BETWEEN TRANSIT AND CAR



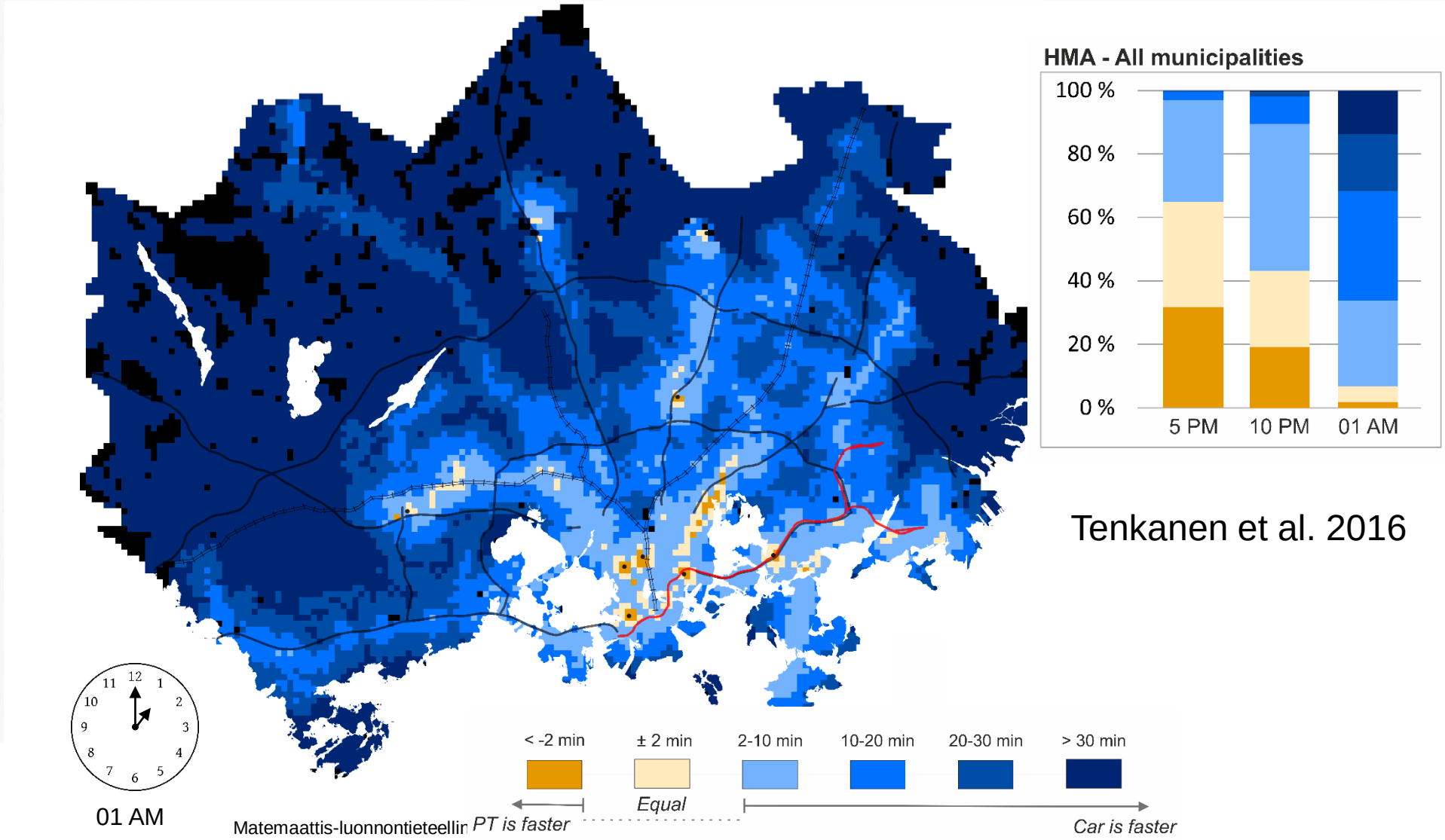
Tenkanen et al. 2016

TRIP TO CLOSEST FOOD STORE AT 10 PM
DIFFERENCE BETWEEN TRANSIT AND CAR



Tenkanen et al. 2016

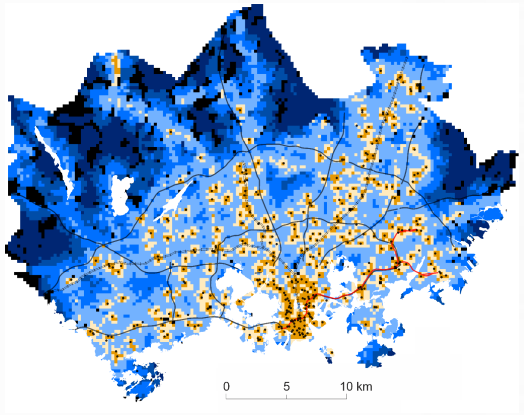
TRIP TO CLOSEST FOOD STORE AT 01 AM
DIFFERENCE BETWEEN TRANSIT AND CAR

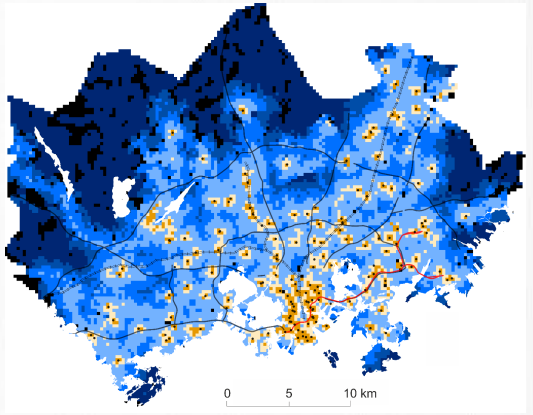


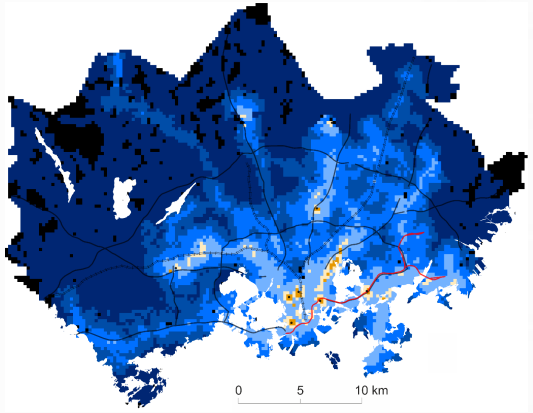
Tenkanen et al. 2016

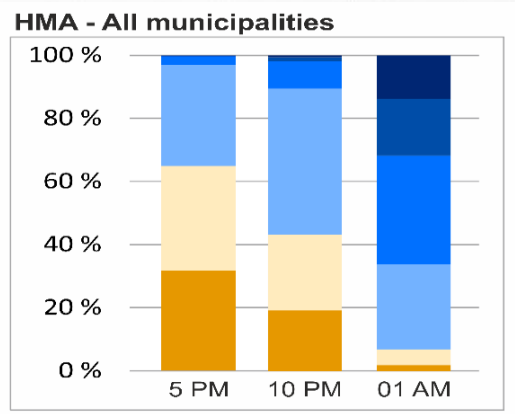
The competetiveness of specific travel mode is time dependent

The problem in here?





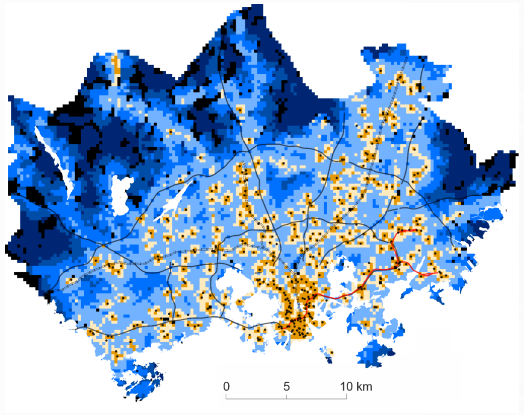


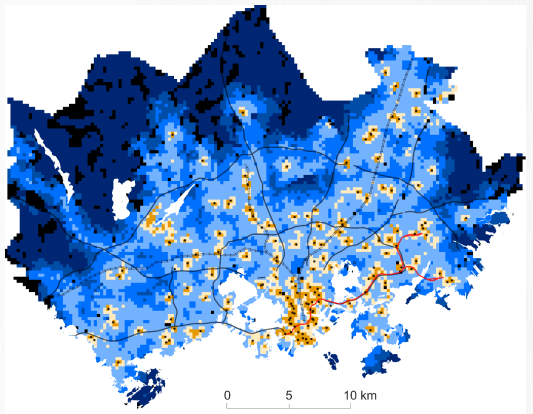


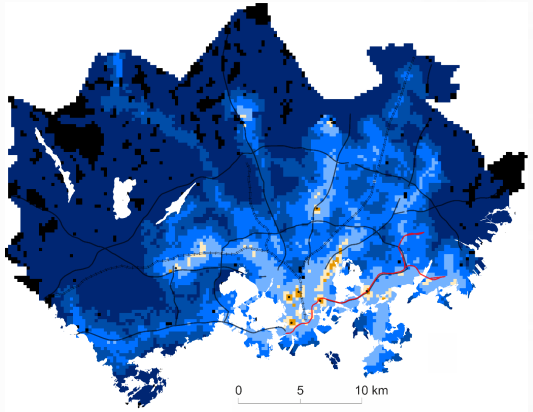
The competetiveness of specific travel mode is time dependent

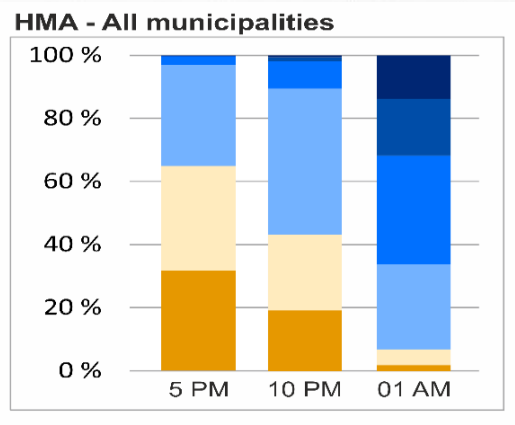
The problem in here?

We assume that people are where they sleep.







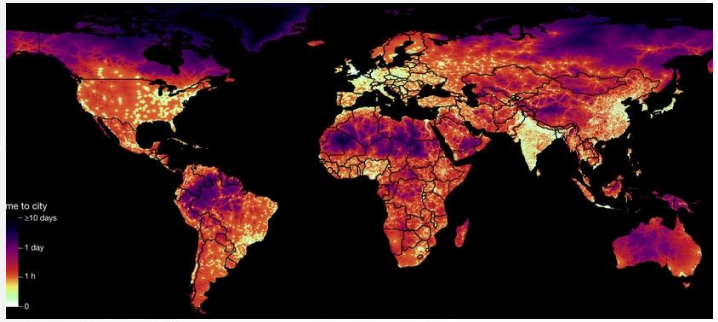


HOW TO CONDUCT "FULLY DYNAMIC" ANALYSES OF ACCESSIBILITY?

TIME IN ACCESSIBILITY MODELLING?

Location-based models

- Focus in understanding large- and regional scale patterns
- Mostly analyzed in static terms

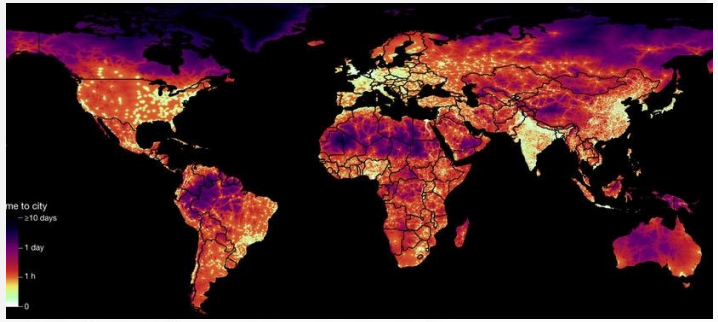


Weiss et al. (2018). *Nature.*

TIME IN ACCESSIBILITY MODELLING?

Location-based models

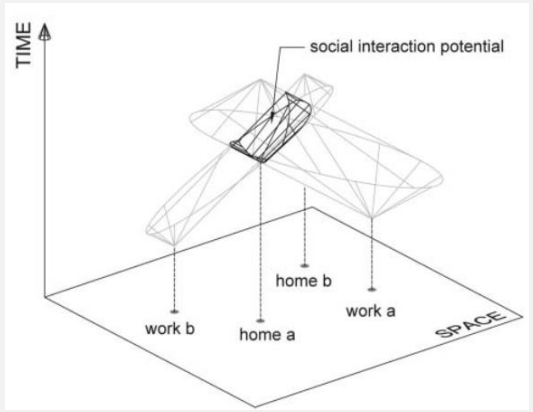
- Focus in understanding large- and regional scale patterns
- Mostly analyzed in static terms



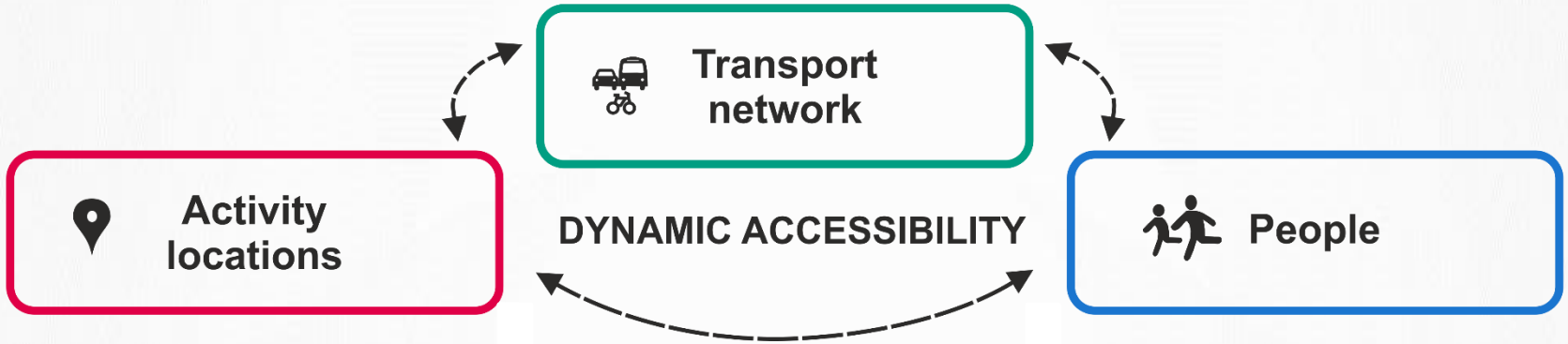
Weiss et al. (2018). *Nature.*

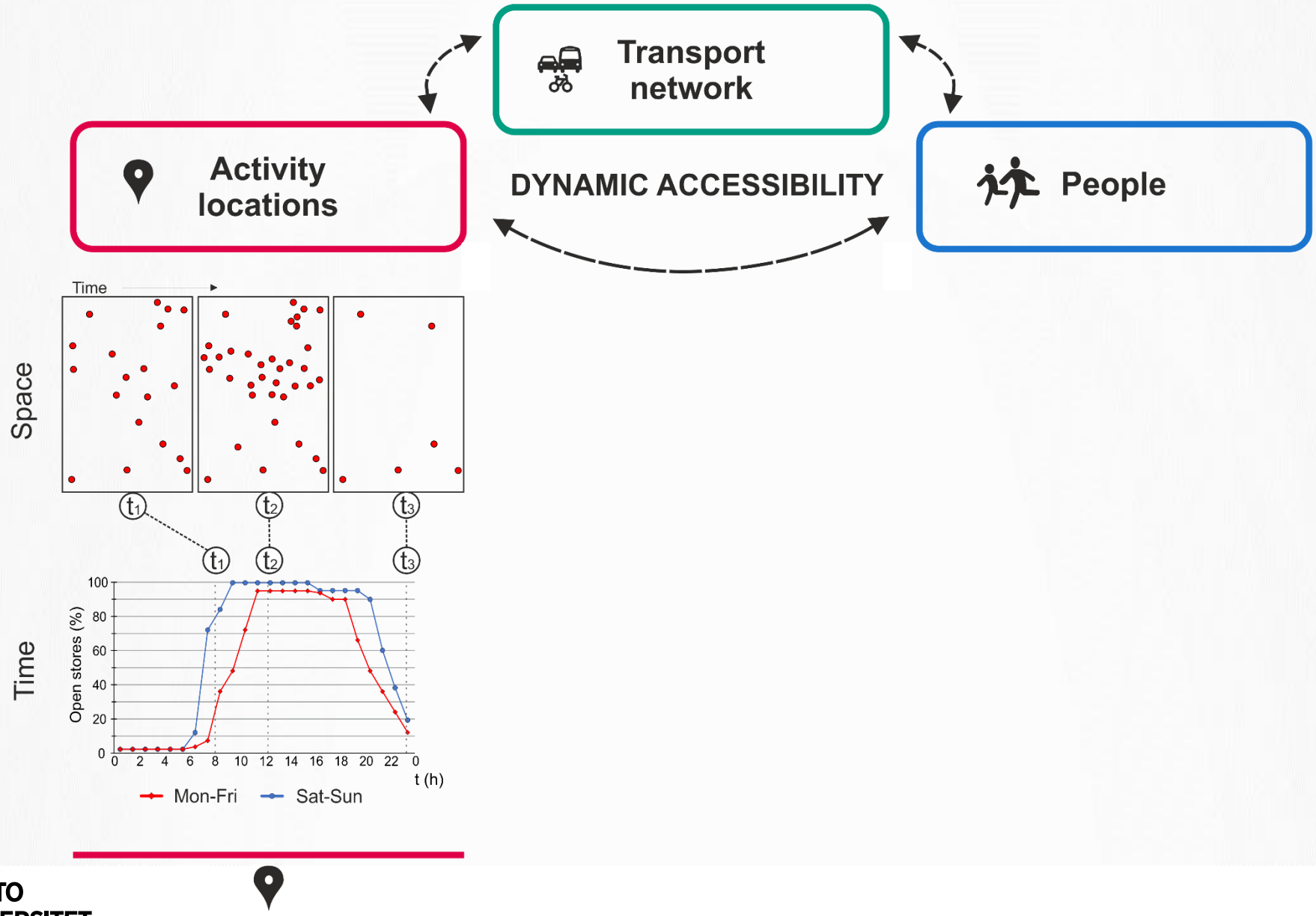
Person-based models

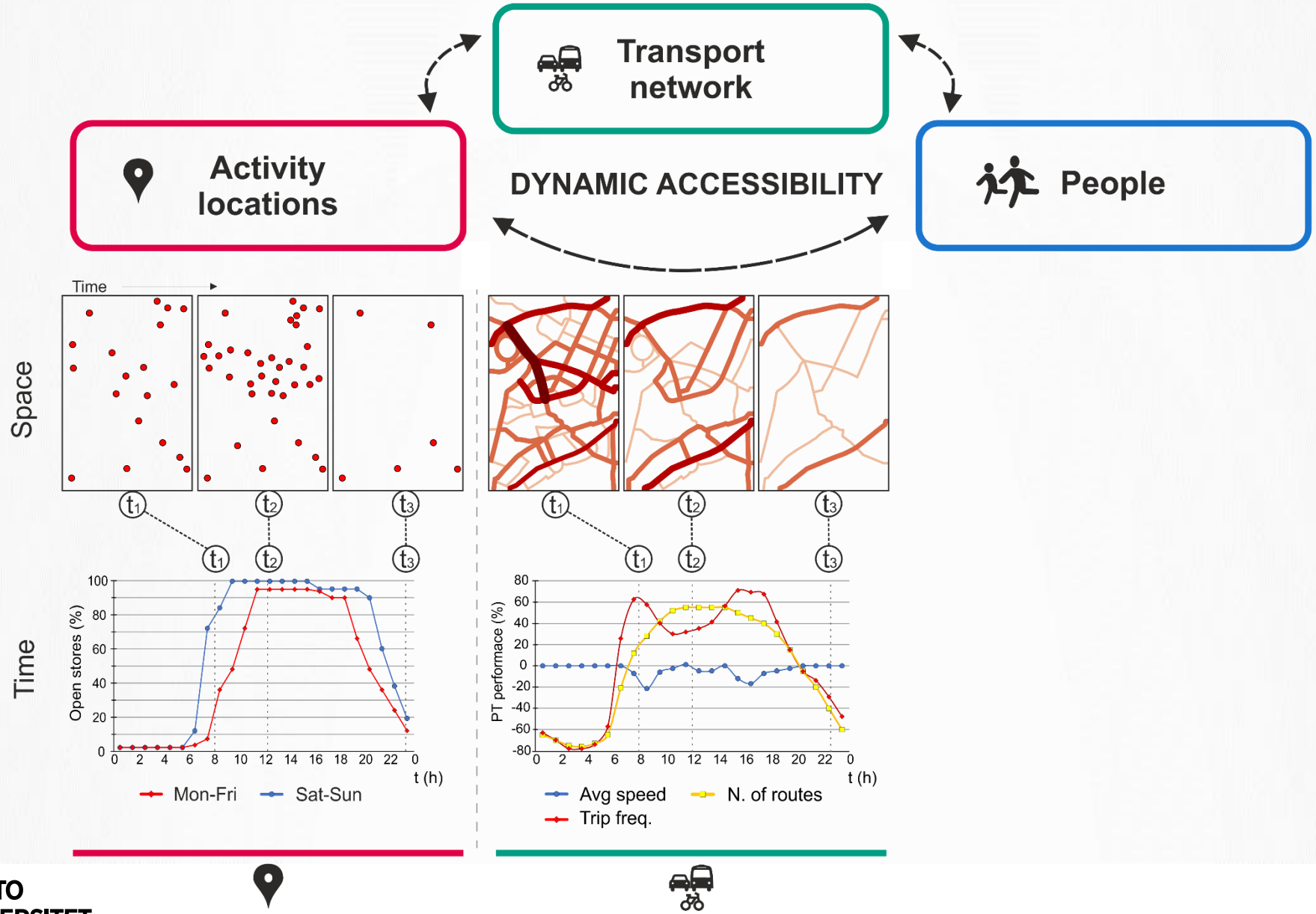
- Focus in understanding small(er) scale patterns
- Time has been incorporated already for long (Hägerstand 1970; Miller 1991; Kwan 1998)

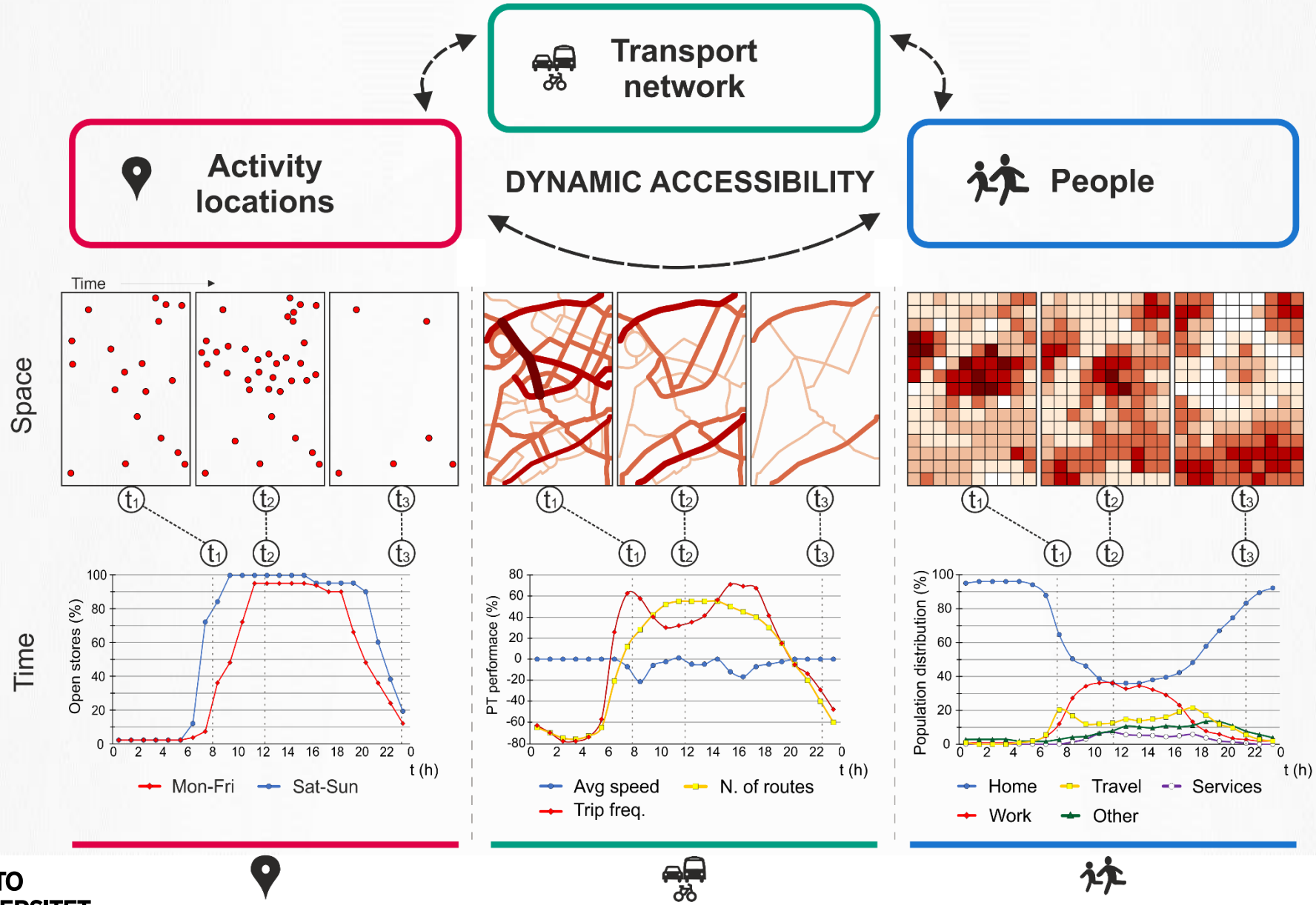


Farber et al. (2013). Ann. of *AAG.*

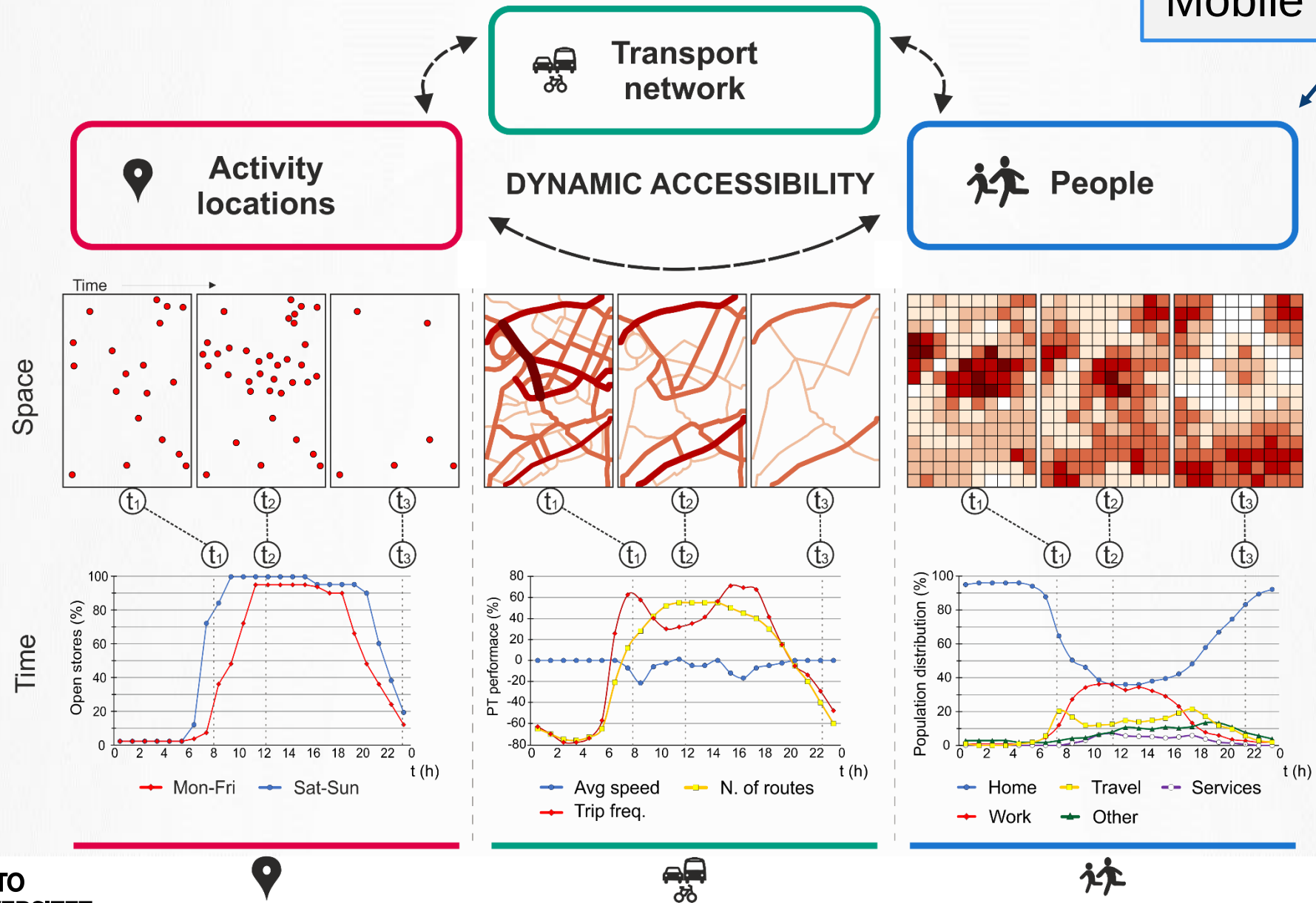

Transport network
Activity locations
DYNAMIC ACCESSIBILITY
People


Transport network
Activity locations
DYNAMIC ACCESSIBILITY
People
Time
Space
Time
Open stores (%)
100
80
60
40
20
0
0 2 4 6 8 10 12 14 16 18 20 22 0
t (h)
Mon-Fri
Sat-Sun


Transport network
Activity locations
DYNAMIC ACCESSIBILITY
People
Time
Space
Time
Open stores (%)
t (h)
Mon-Fri
Sat-Sun
PT performace (%)
t (h)
Avg speed
N. of routes
Trip freq.


Transport network
Activity locations
People
DYNAMIC ACCESSIBILITY
Time
Space
Time
Open stores (%)
t (h)
Mon-Fri
Sat-Sun
PT performace (%)
Avg speed
N. of routes
Trip freq.
Population distribution (%)
Home
Travel
Services
Work
Other

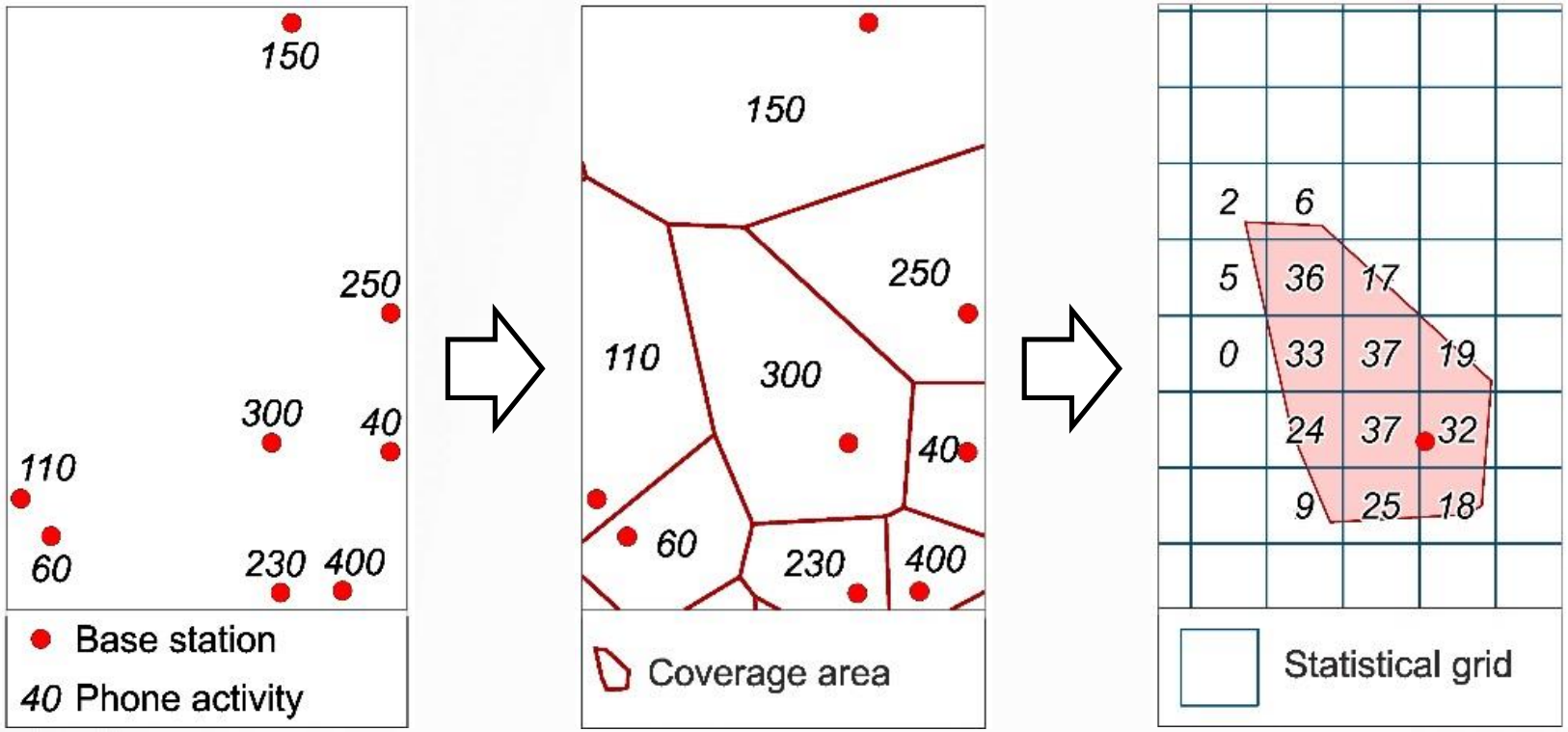
Mobile phone data



HOW TO HARMONIZE MOBILE PHONE DATA?

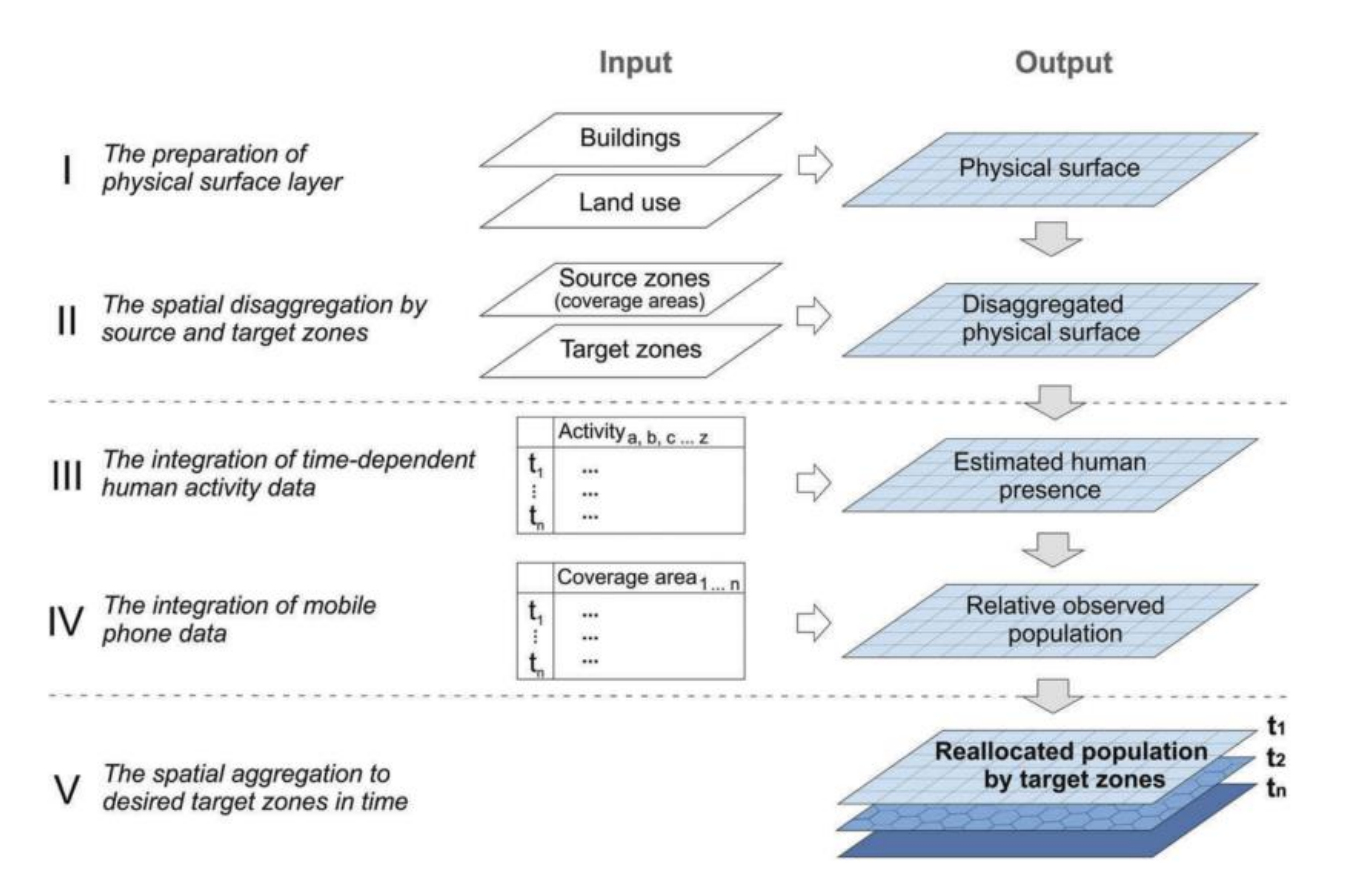
Uneven spatial configuration

Harmonized standardized grid



Järv, Tenkanen & Toivonen (2017), IJGS

Improving accuracy of mobile phone based data



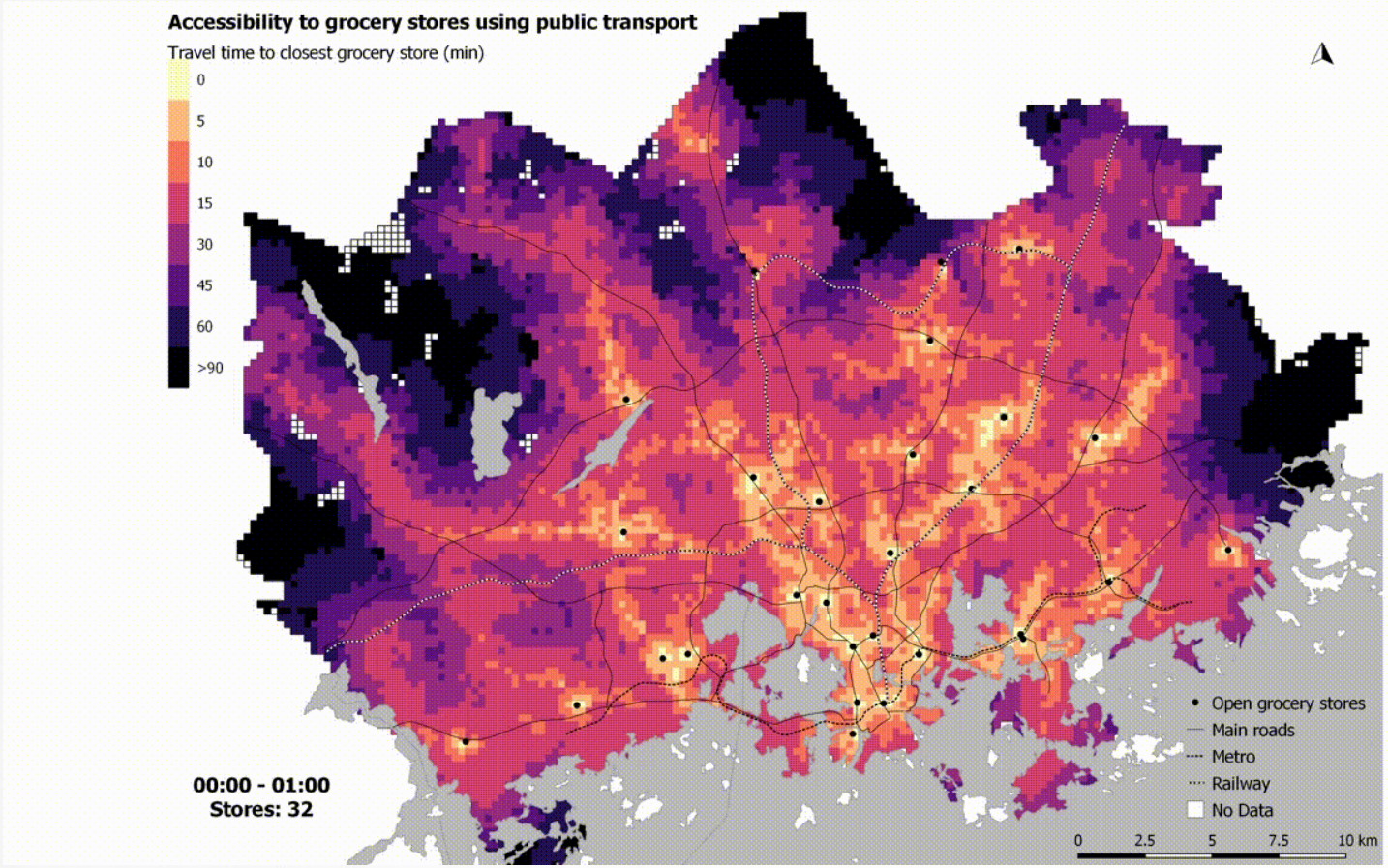
Data fusion and harmonization model increase the quality of the data

(Järv, Tenkanen & Toivonen 2017, IJGS)

24H CITY
How much time influences accessibility?

People – Transport System – Activity locations

24H ACCESSIBILITY

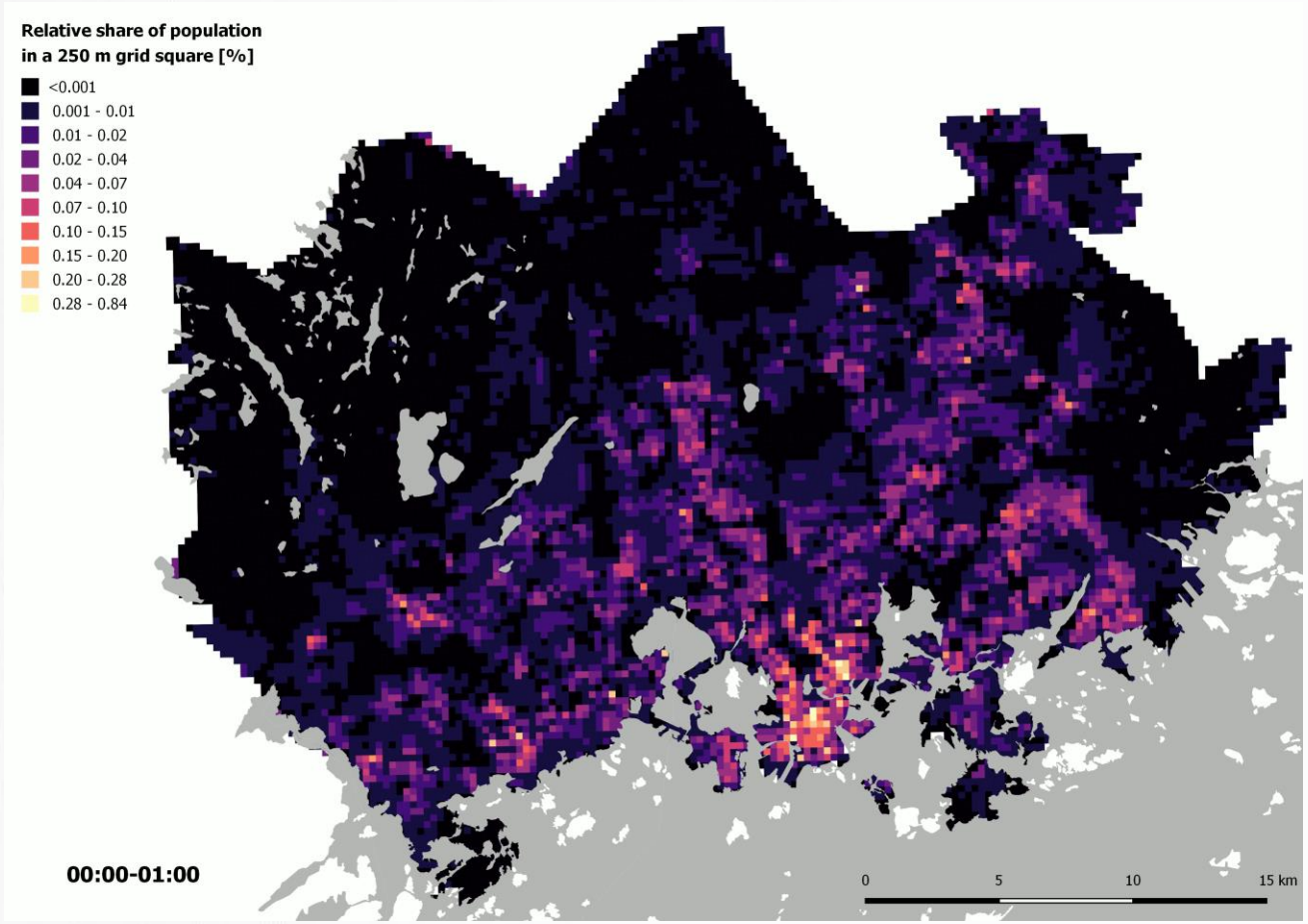


Travel times to closest open grocery store at each hour of the day – Jan 2018

MSc thesis work of Claudia Bergroth

(see also Järv, Tenkanen, Salonen, Ahas & Toivonen 2018)

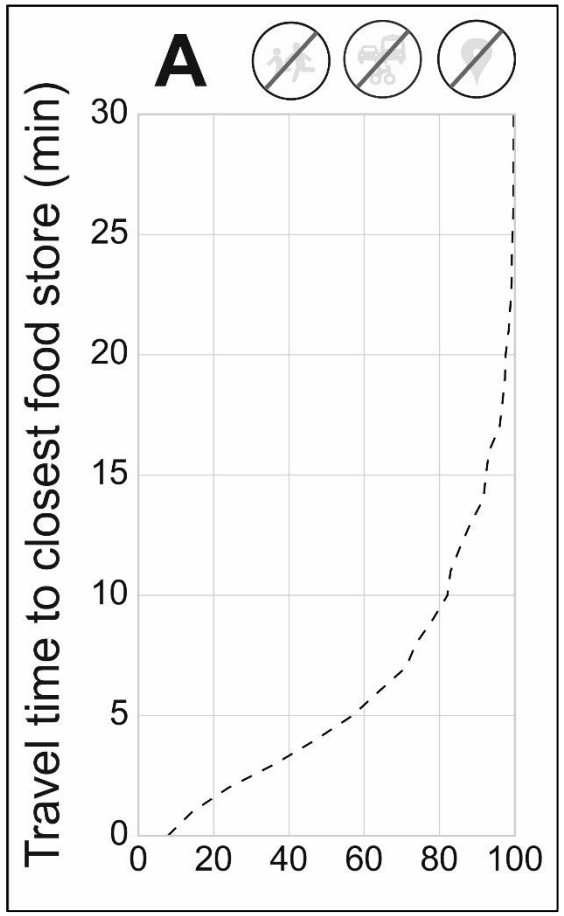
24H MOBILITY



Relative distribution of people at each hour of the day

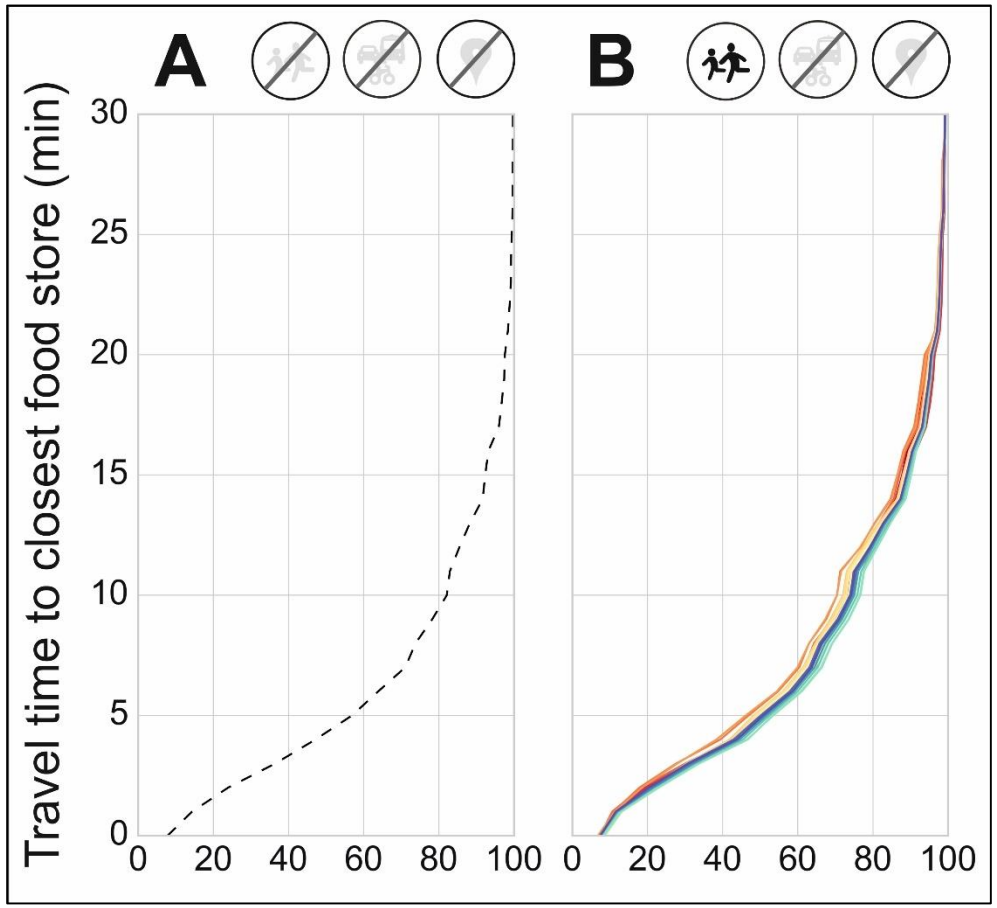
(based on model by:
Järv, Tenkanen & Toivonen 2017)

MSc thesis work of Claudia Bergroth



Share of population reaching the closest grocery store

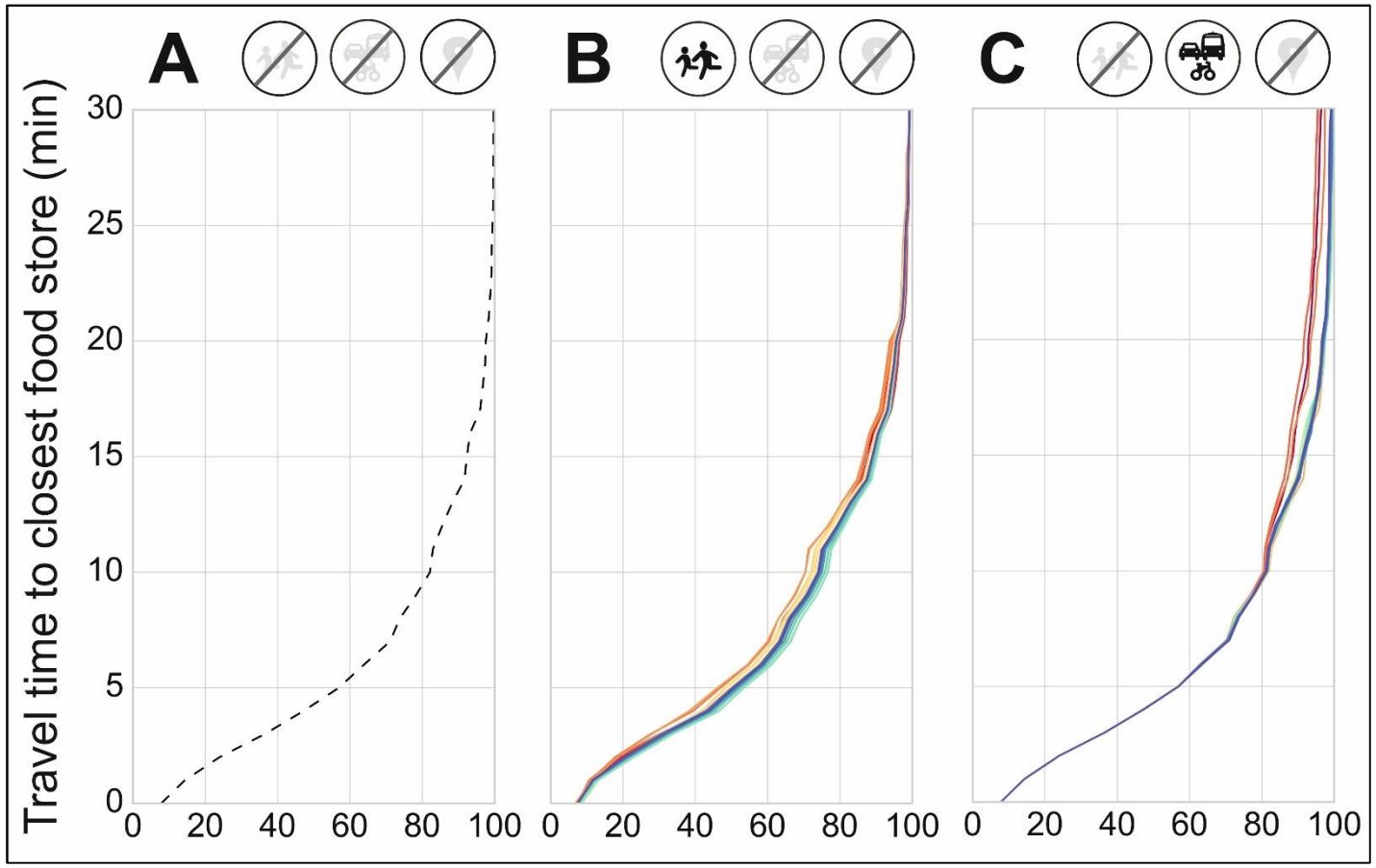
A Fully atemporal model



Share of population reaching the closest grocery store

A Fully atemporal model

B Only people dynamic

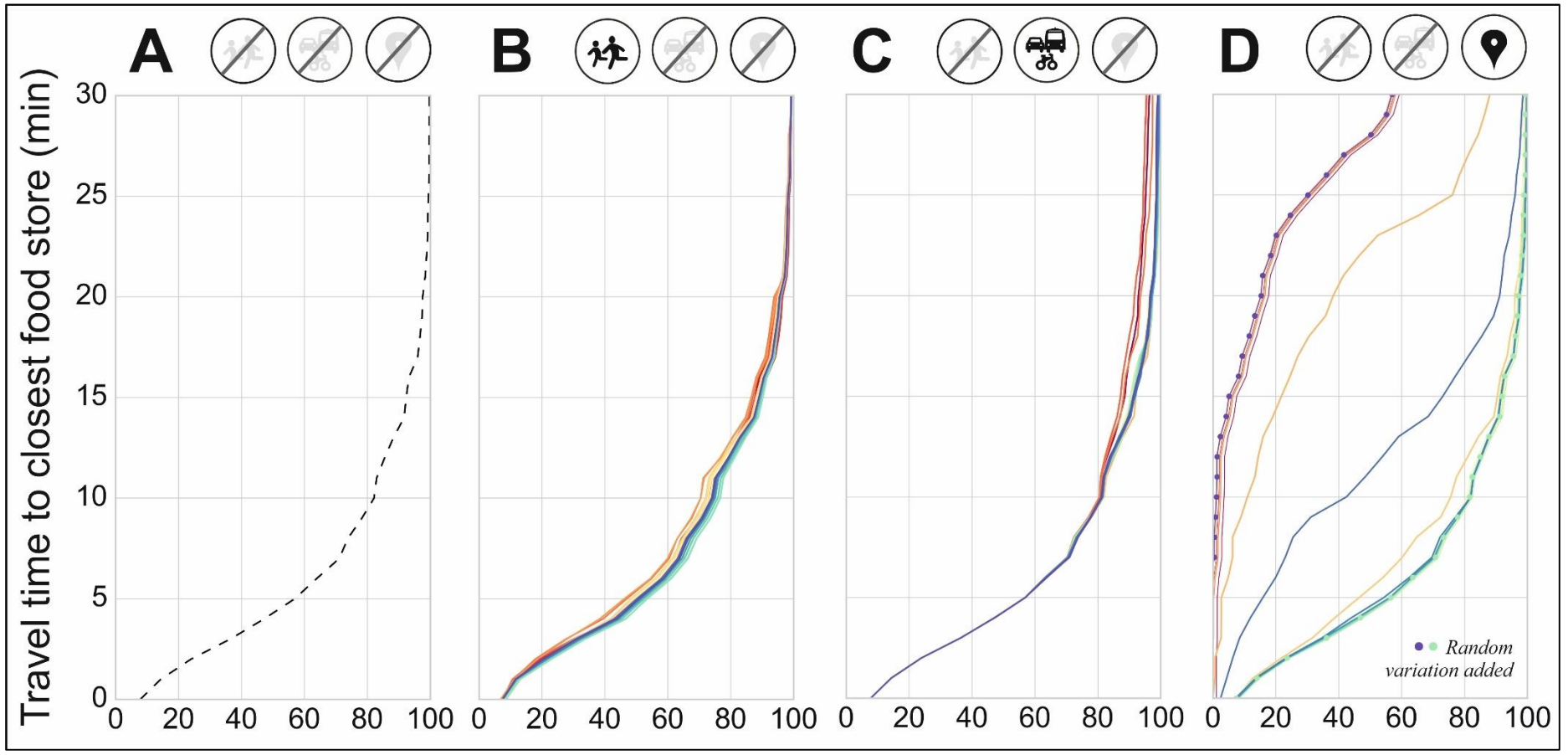


Share of population reaching the closest grocery store

A Fully atemporal model

B Only people dynamic

C Only transport network dynamic



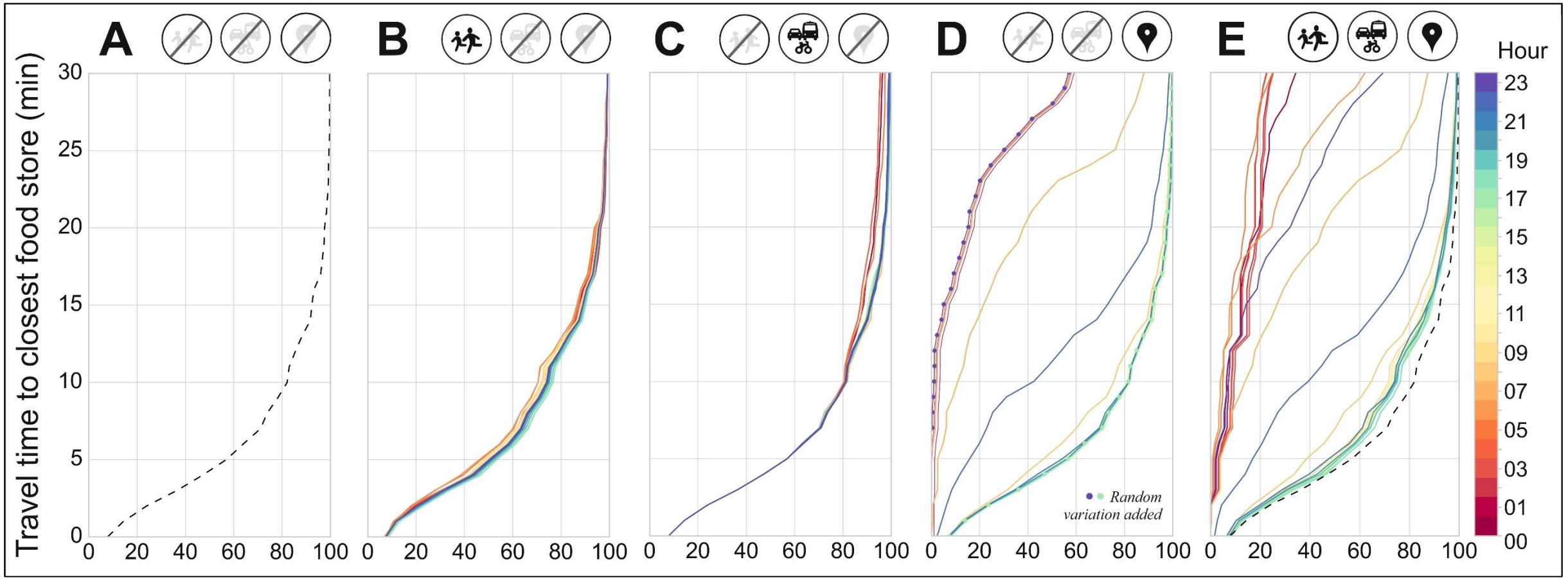
Share of population reaching the closest grocery store

A Fully atemporal model

B Only people dynamic

C Only transport network dynamic

D Only services dynamic



Share of population reaching the closest grocery store

A **Fully atemporal model**

B **Only people dynamic**

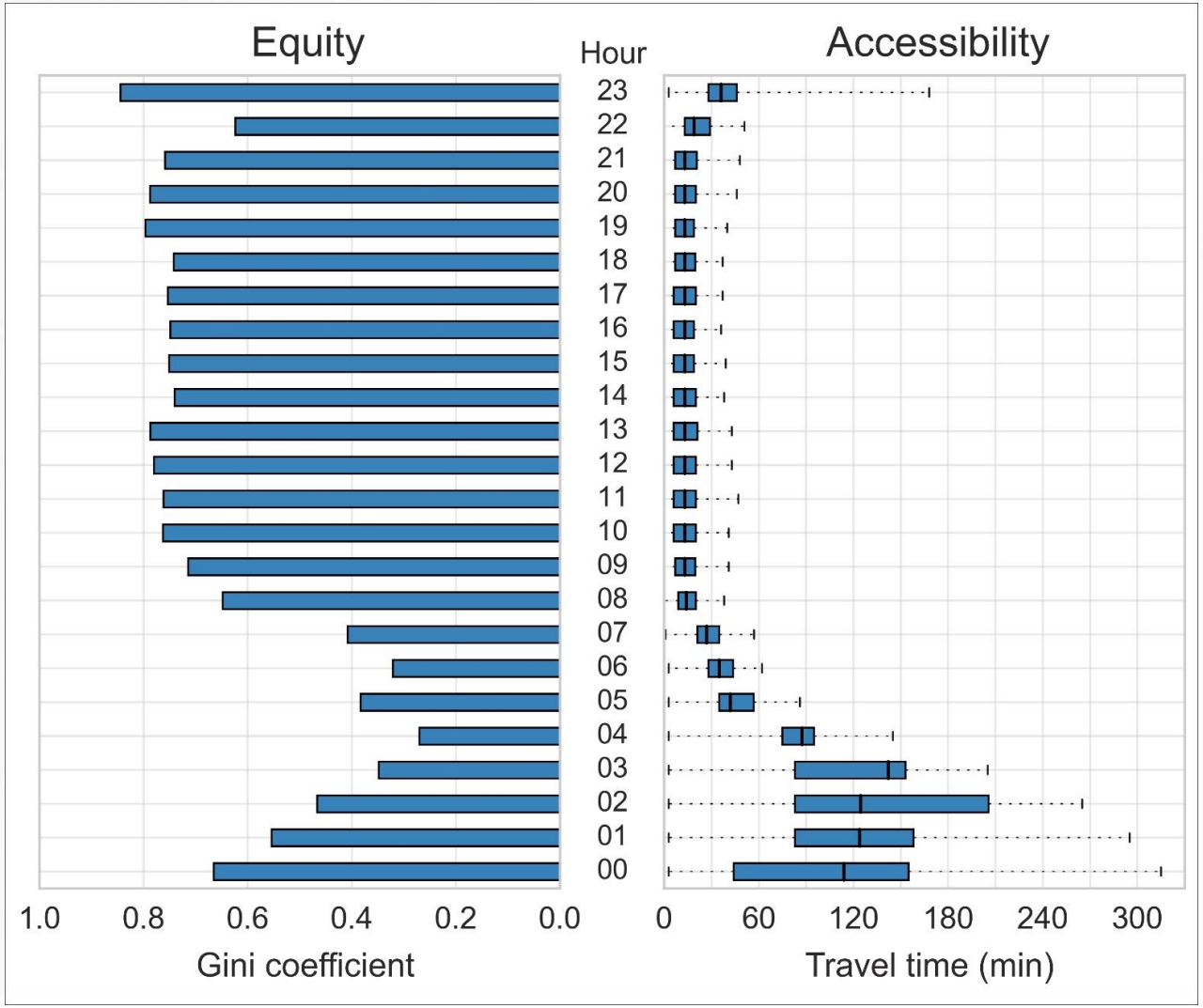
C **Only transport network dynamic**

D **Only services dynamic**

E **All components dynamic**

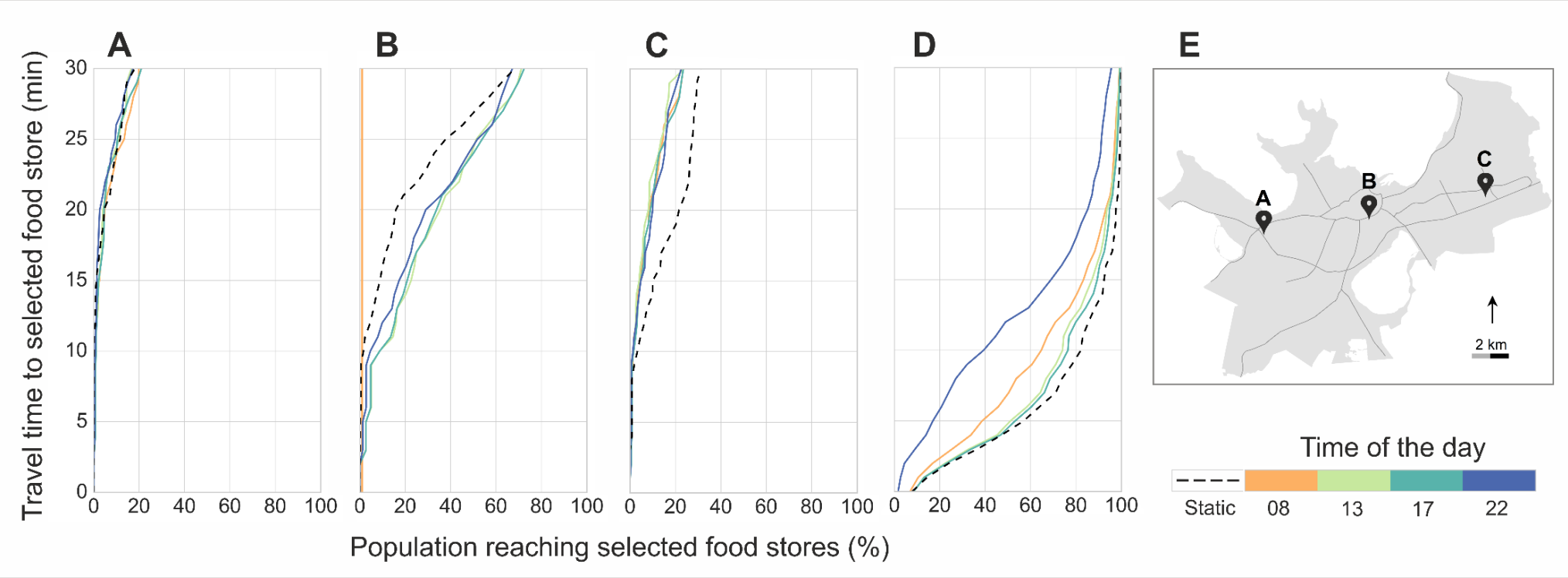
FROM ~10
UP TO 70 %
DIFFERENCE!!

Effect of temporal variation in accessibility on equity?



Spatial equity
on access to grocery
stores varies in time

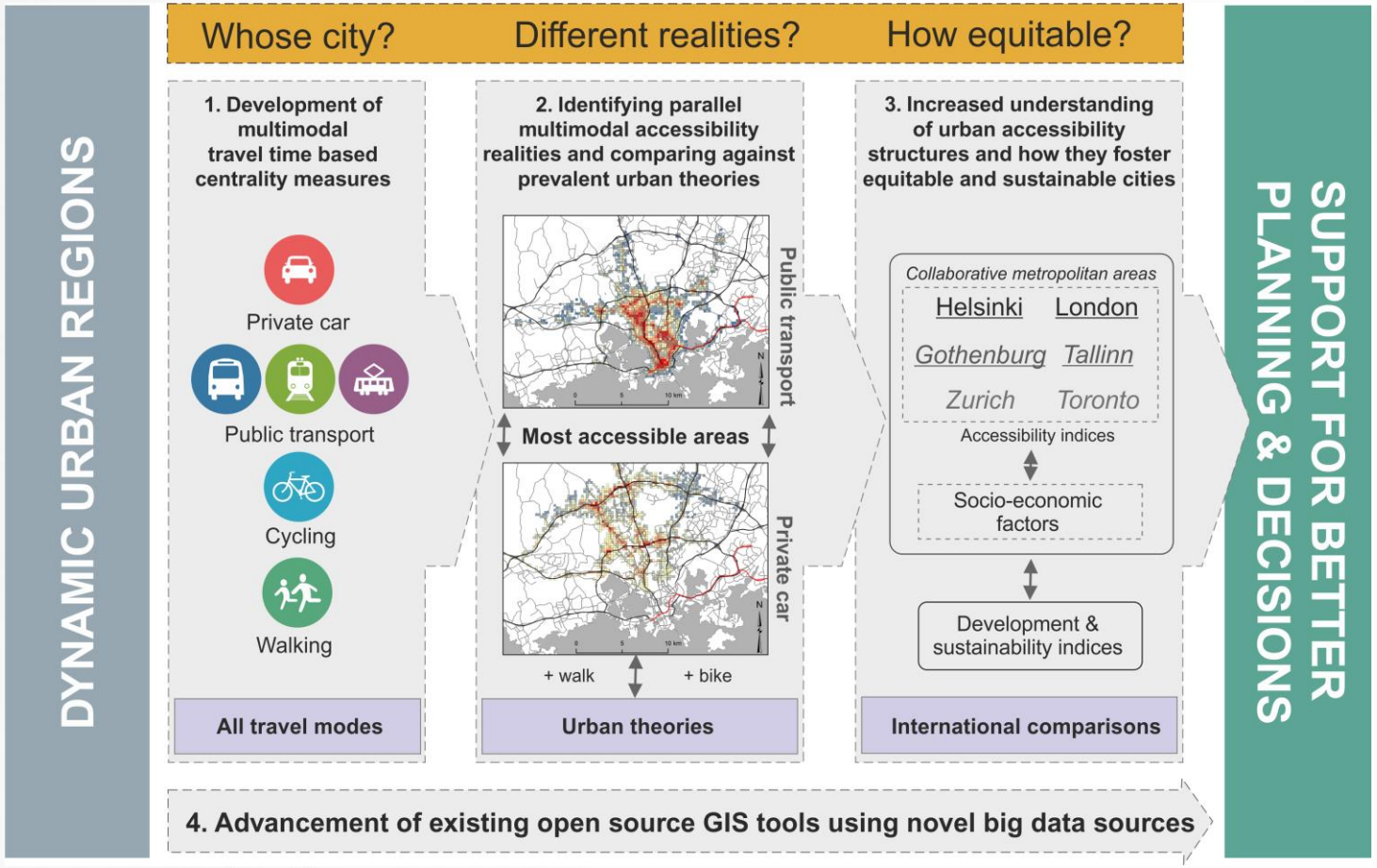
The significance of dynamism is network / location specific



ANALYZING MODAL EQUITY IN TRANSPORT USING BIG DATA?

Project running 2019 -

PROJECT / STUDY DESIGN

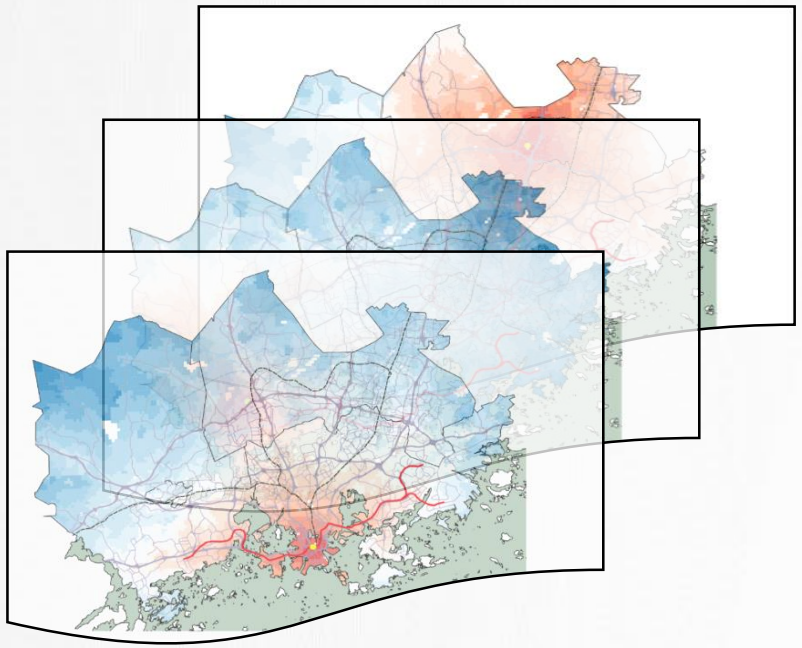


Car vs Public transport

- Do the ” realities of accessibility” differ in cities based on mode of transport?
- Where are the ”city centers” of a city? → Centrality
- Influence on modal equity

METHODS – MULTIMODAL CENTRALITY

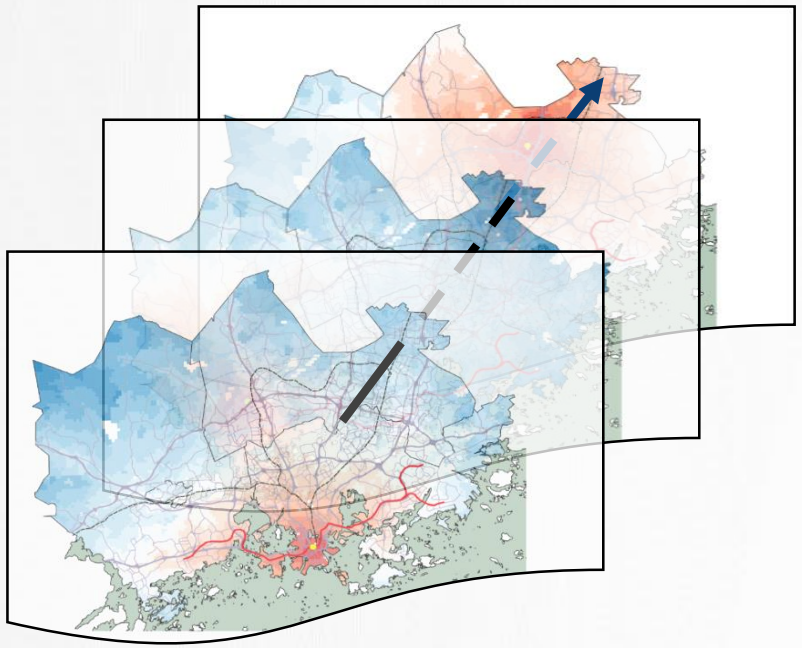
INPUT



As input we have travel time layers to all locations in the study region

METHODS – MULTIMODAL CENTRALITY

INPUT



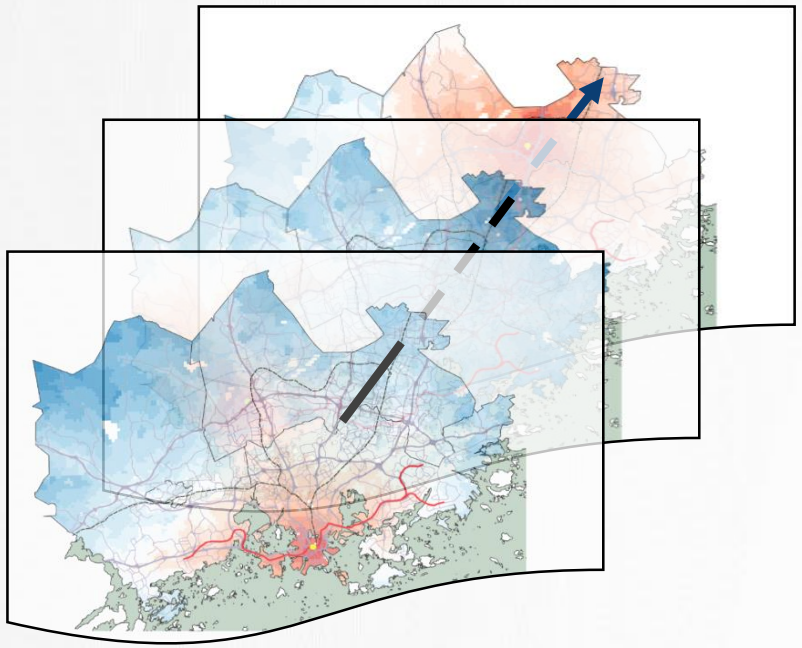
As input we have travel time layers to all locations in the study region.

ANALYSIS

Calculation of **Median Travel Times as a cross-section** of all layers with different travel modes using door-to-door approach

METHODS – MULTIMODAL CENTRALITY

INPUT

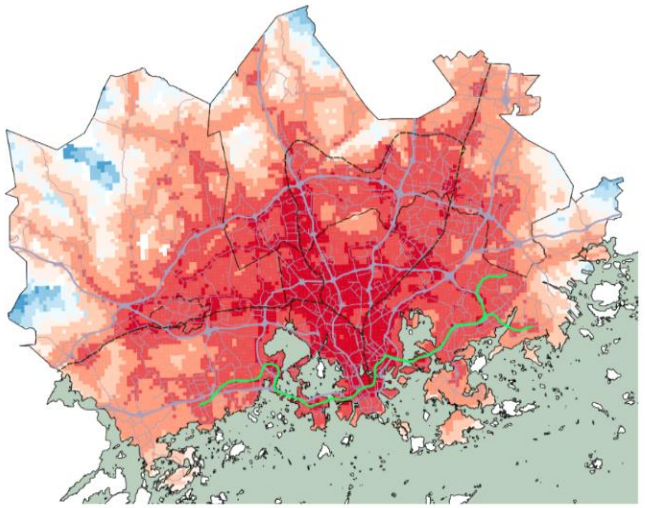


As input we have travel time layers to all locations in the study region

ANALYSIS

Calculation of **Median Travel Times as a cross-section** of all layers with different travel modes using door-to-door approach

RESULT (centrality layer)

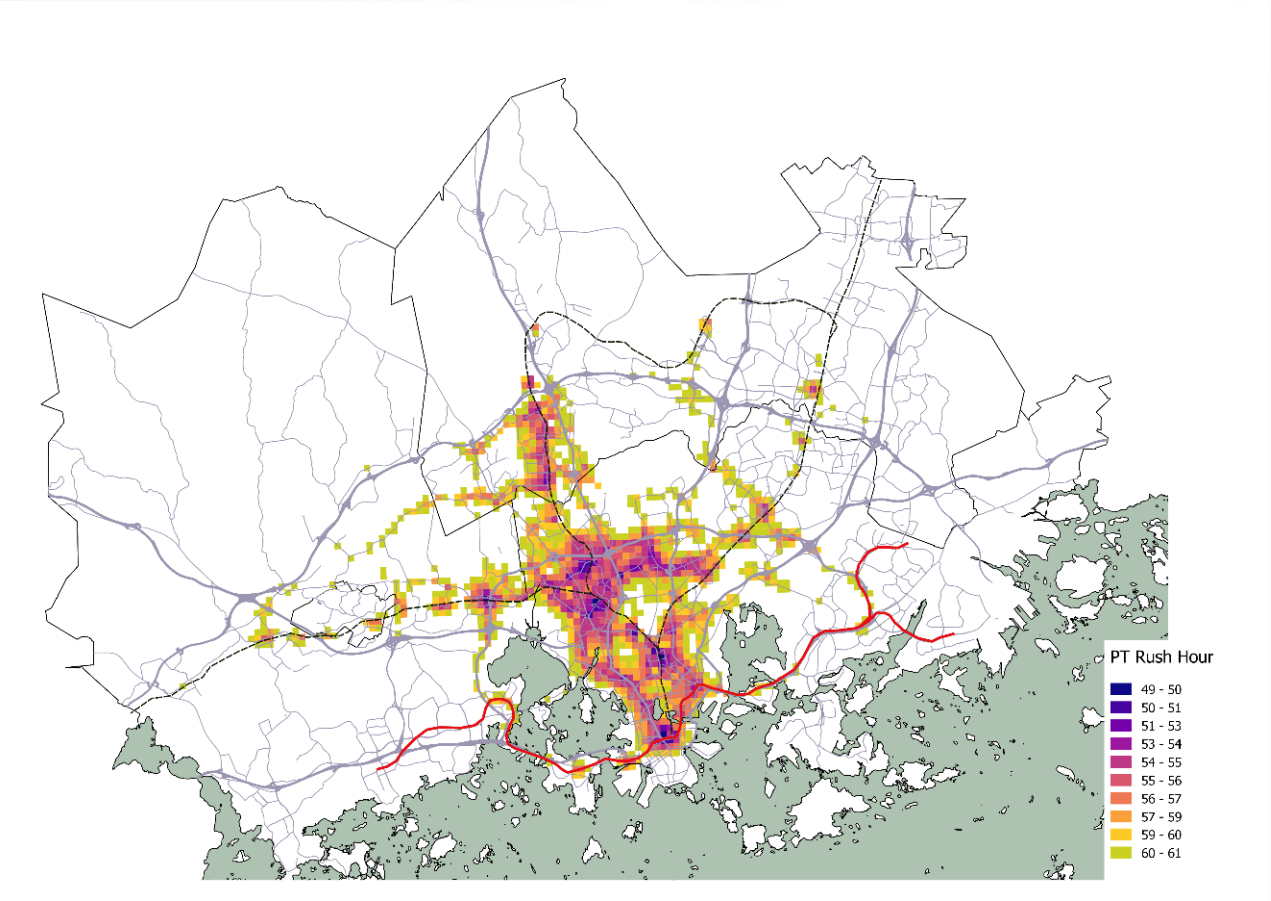


The **more red** the **more central**/lower median time

The **more blue** the **less central**/higher median time

CENTRALITY & MODAL EQUITY

Best 10 % by public transport

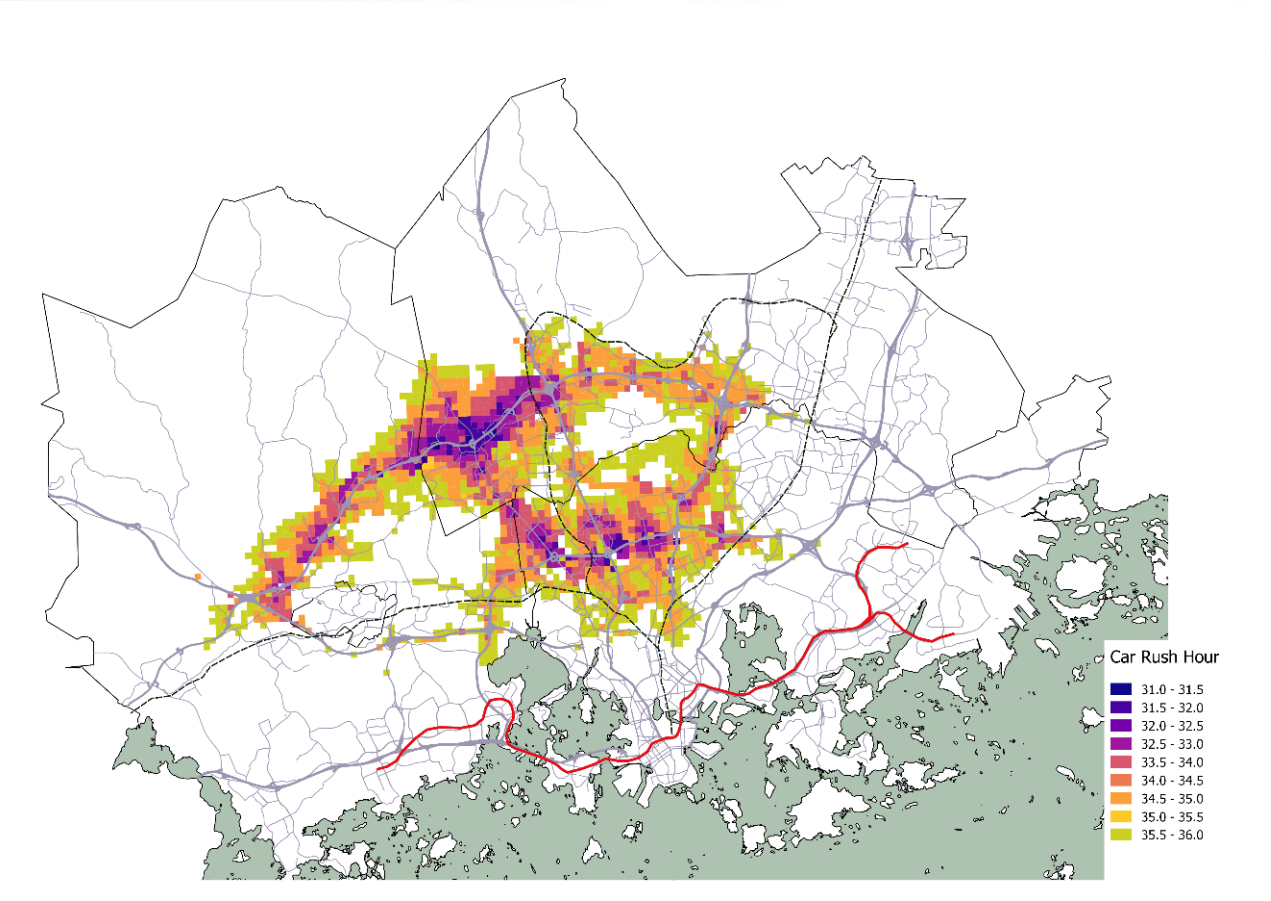


Most central areas in accessibility dy different travel modes differ significantly

Jeison Londoño MSc thesis (2018)

CENTRALITY & MODAL EQUITY

Best 10 % by car



Most central areas in accessibility dy different travel modes differ significantly

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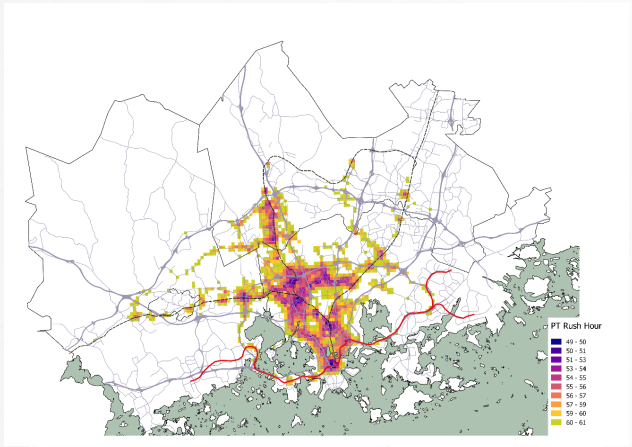
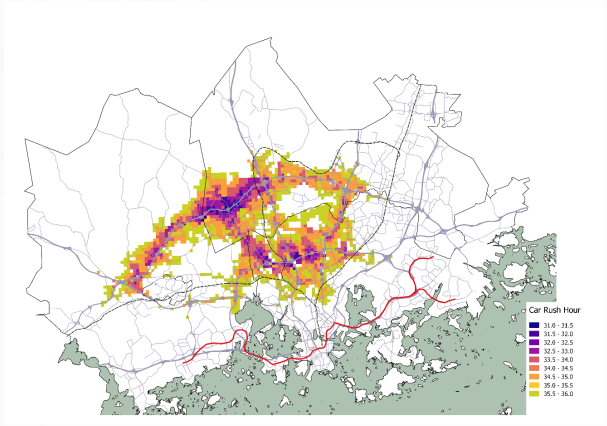
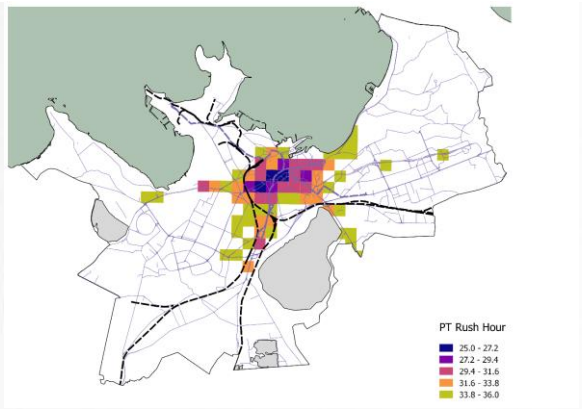
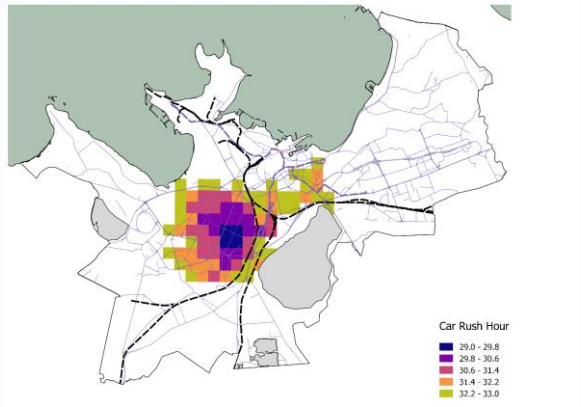
CENTRALITY & MODAL EQUITY





HELSINKI





TALLINN

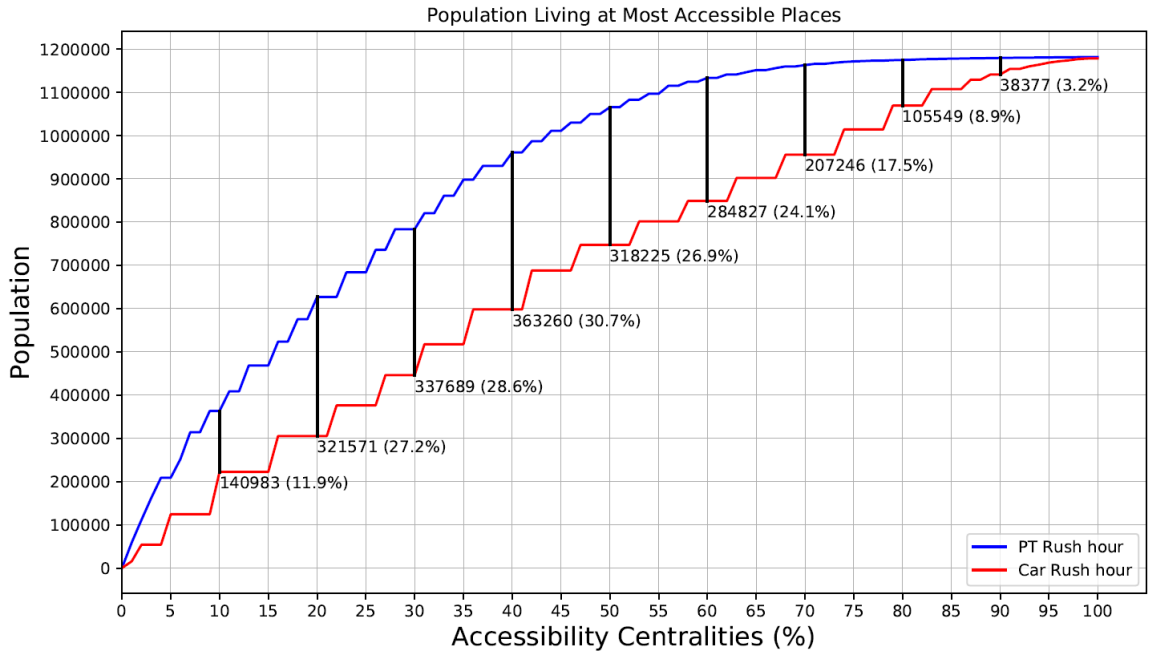
PT

CAR

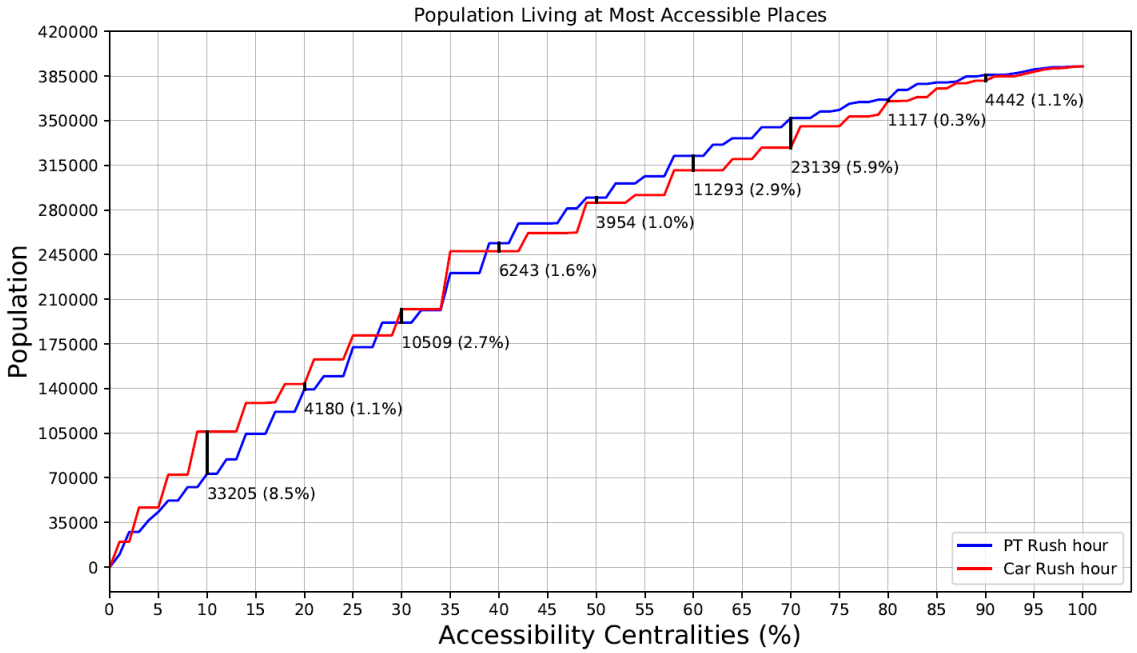
Most central areas in accessibility dy different travel modes differ significantly

Jeison Londoño MSc thesis (2018)

HOW MUCH OF THE POPULATION IS CONCENTRATED IN CAR CENTRIC VS PUBLIC TRANSPORT CENTRIC AREAS?



HELSINKI



TALLINN

Jeison Londoño MSc thesis (2018)

CONCLUSIONS

- Current accessibility and mobility analyses can provide valuable information about the functioning of cities from various perspectives
- Various big data sources and open data has made this possible!
- Time really makes a difference! Both in accessibility and mobility
- Travel mode matters – All modes should be considered when doing decisions

INTERESTED TO LEARN AND COLLABORATE

Experience in:

- Accesssibility and mobility research
- Social media research
- Big data analytics

Would need help with:

- Urban geography
- Sociology

Would be interested to learn:

- Machine learning in transportation research?
- Agent based modelling?

CALL ME! ☺

Kiitos! Thank you!

Any questions?

@tenkahen

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henrikki.tenkanen@helsinki.fi