Aalto University
School of Engineering

Analyzing and understanding human spatial behavior using PPGIS

Geoinformatics Research Days 8.5.2019

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Varying behavior in and experiences of the environment

Spatially referenced human perceptions, everyday habits, favorite places, daily routes, housing preferences…

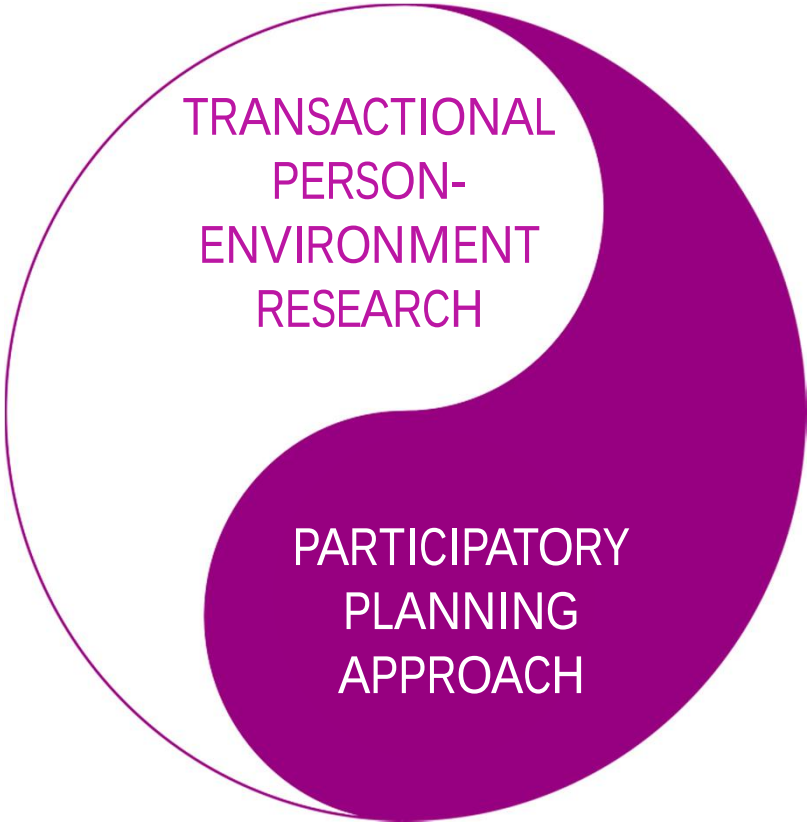
The localisation of human experiences

The Soft geographical information system

The geographical information system

The Soft Geopraphical Information Systems

The analysis of ”soft” geographical information together with ”hard” GIS knowledge



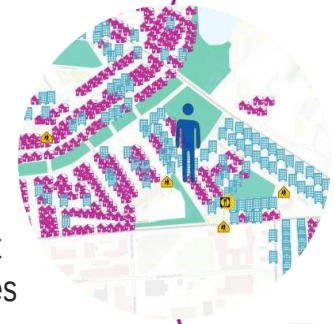
Linking the user knowledge to planning and design solutions

Planning support systems

The use of softGIS in research and participatory planning practice

VARIOUS THEMES
- Social sustainability
- Urban densification
- Ecosystem service accessibility
- Active living research
- Perceived safety
- Environmental memories
- Everyday service network
- Mobility
- Travel behavior
- Ecolgical footprint related to lifestyles
- Etc.

VARIOUS USER GROUPS
Children, adults, elderly
Urban tribes

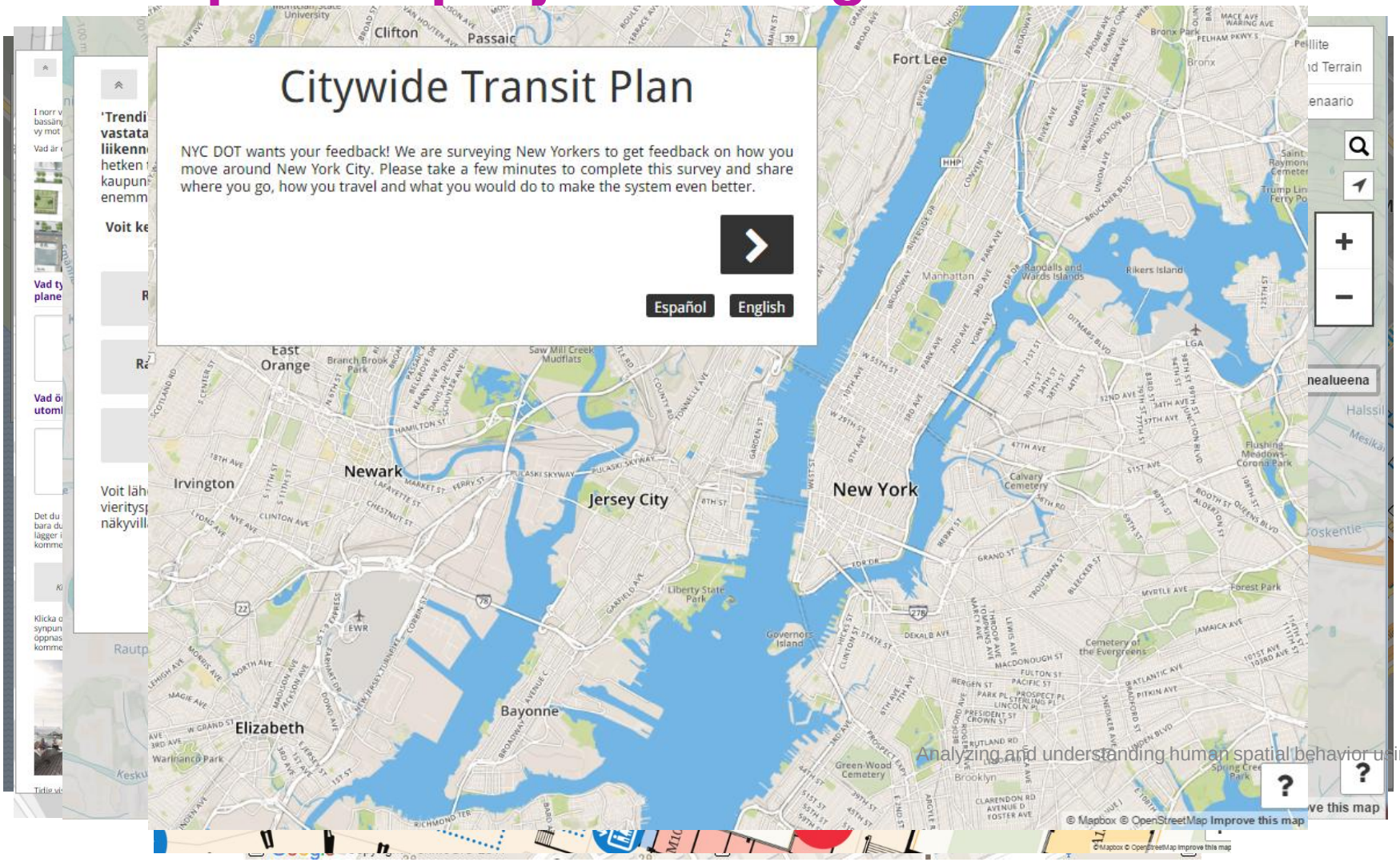


VARIOUS PLANNING PHASES
Initiation, Formulation, Decision making, Implementation, Evaluation…

VARIOUS SCALES
From indoor spaces to neighbourhoods, cities and regions

VARIOUS PLANNING APPROACHES
Knowledge-informed planning
Participatory planning
Self-organized participation

Examples of projects using SoftGIS methods



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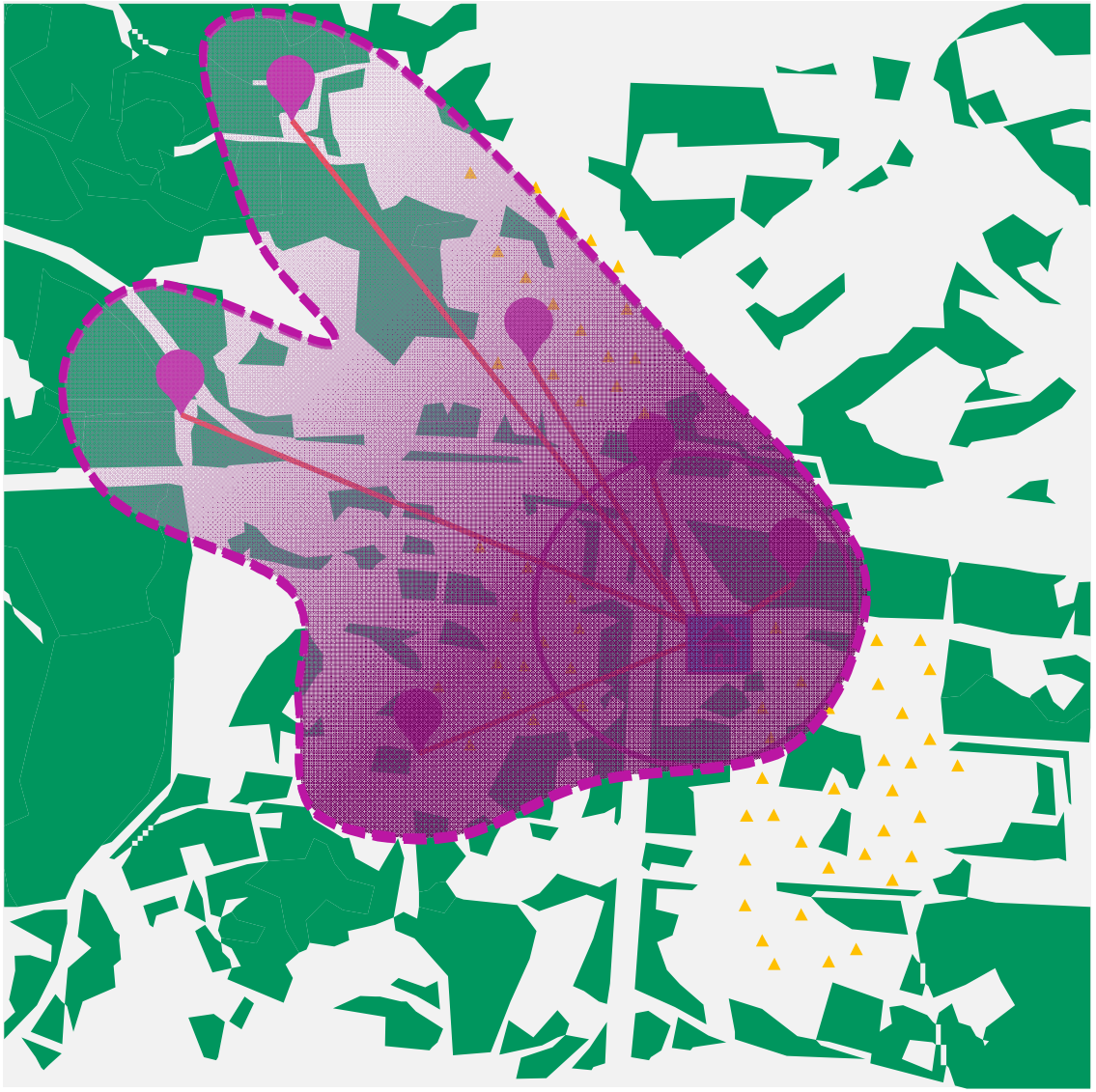
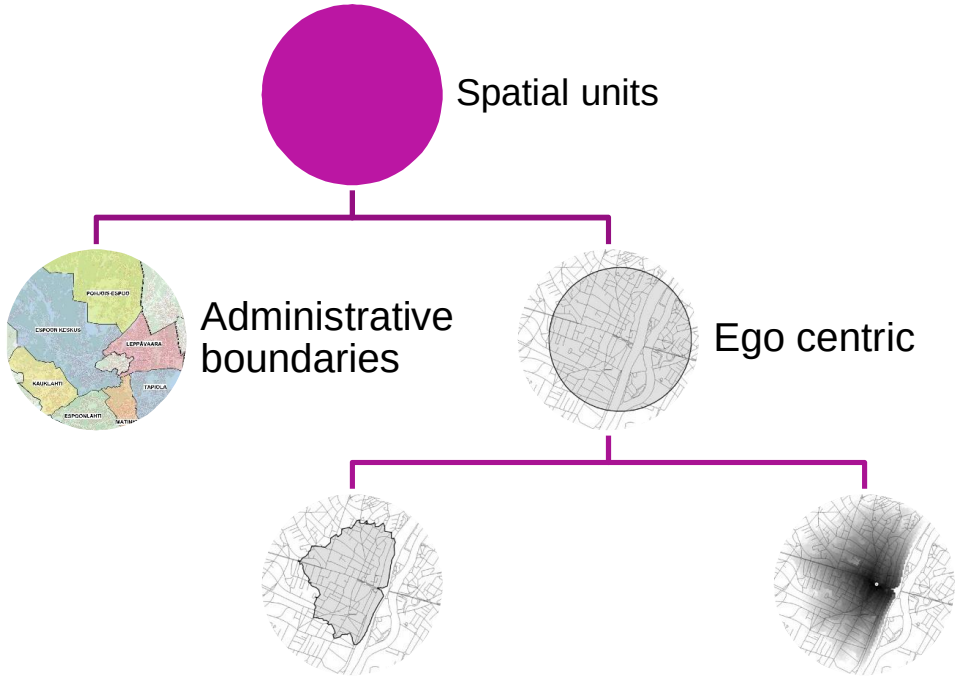
With PPGIS we study the human behavior and preferences in their geographical context.

But what is the right context?



In literature…

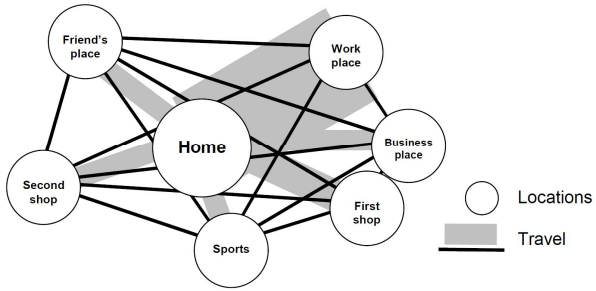


Examples:

- **Administrative boundaries:**
  - **Postal areas**
  - **Census tracts**
- **Ego centric**
  - **Home buffers, Road network buffers, Kernel density estimation, standard deviational ellipses etc.**

What is activity space (AS)?

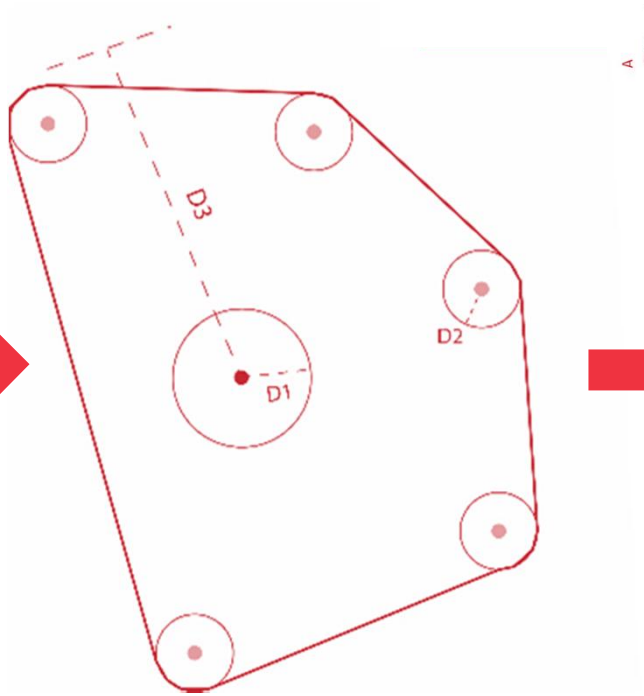
- **Activity space is a set of geographically distributed locations which are physically contacted by individuals** (Reynolds, 1971)
- First introduced in zoology (Burt, 1943)
- **AS Can help us:**
  - Assess mobility patterns
    - *Transportation research*
    - *Active living and health research*
    - *Estimate environmental exposure and impact*
    - *...*



Schönfelder and Axhausen (2002)

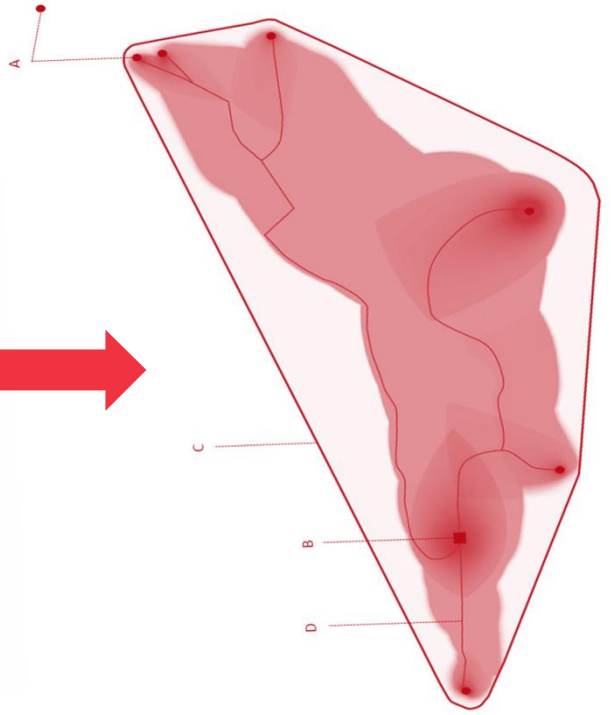
Our journey in one glance

Static buffer around home



Home range model

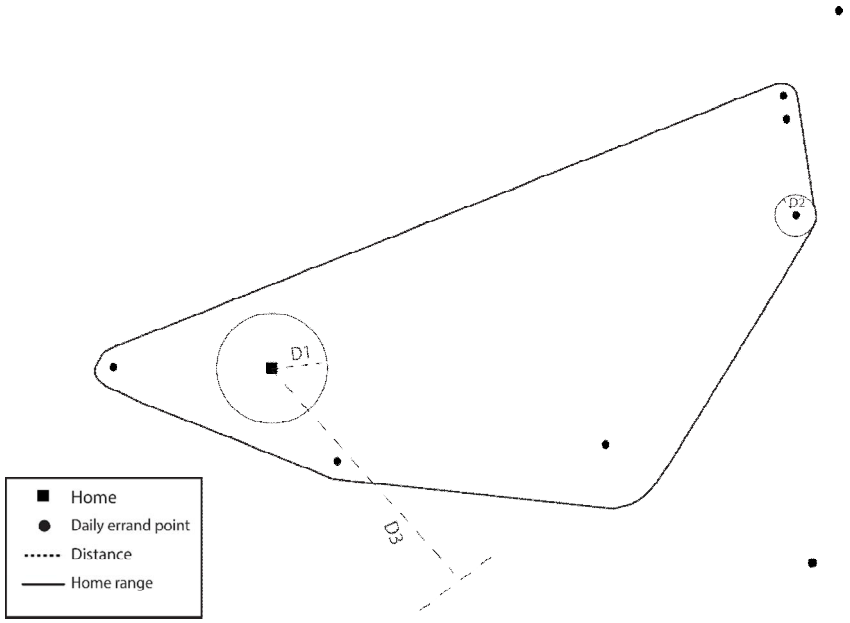
(Hasanzadeh, Broberg, Kyttä, 2017)



Individualized residential exposure model (IREM)

(Hasanzadeh, Laatikainen, Kyttä, 2018)

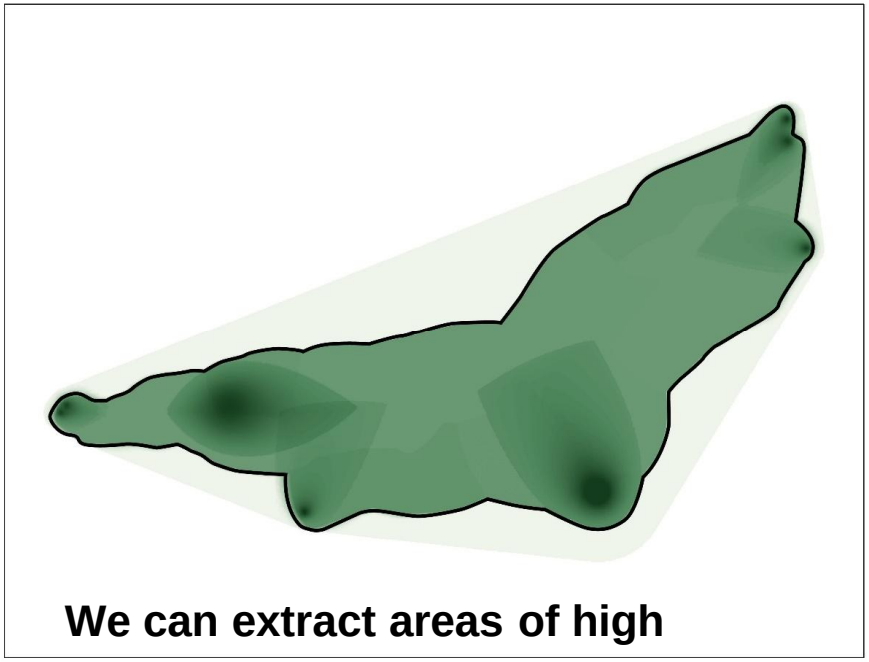
Improved models (I): Home range



- An individualized parametric model:
  - D1: Immediate home exposure
  - D2: Exposure around activity points
  - D3: a threshold to leave out very distant activity points
    - Determined using an optimization method
- Are all areas equally accessible?
- Are we equally exposed to all areas within our home range?

Hasanzadeh, K., Broberg, A. & Kyttä, M. (2017). Where is my neighborhood? A dynamic individual-based definition of home ranges and implementation of multiple evaluation criteria. *Applied Geography*, *84*, 1-10.

Improved models (II): An individualized residential exposure model (IREM)



We can extract areas of high exposure

- The level of exposure can vary:
  - **Frequency** of visit, **mode** of transportation, **path** taken
- Activity space presented as raster'
  - Weights assigned using the above three factors. Normalized with sigmoid function and distributed using A distance decay function (inverse distance weighting)
  - Spatially sensitive analysis of contextual factors

Hasanzadeh, K., Laatikainen, T. E. & Kyttä, M. (2018). A place-based model of local activity spaces: individual place exposure and characteristics. *Journal of* Geographical Systems, 1, 1-26.

All the tools are available online

- **All the methods implemented in Python**
  - Using ESRI's Arcpy Module

- **Hasanzadeh, K. (2018). IASM: Individualized activity space modeler. *SoftwareX*, *7*, 138-142.**

Capturing exposure in environmental health research

- **Does different residential and activity space units of analysis yield distinct results regarding the association between the built environment and health?**

- **What are the challenges and opportunities of the different spatial units of analysis for environmental health promotion research?**

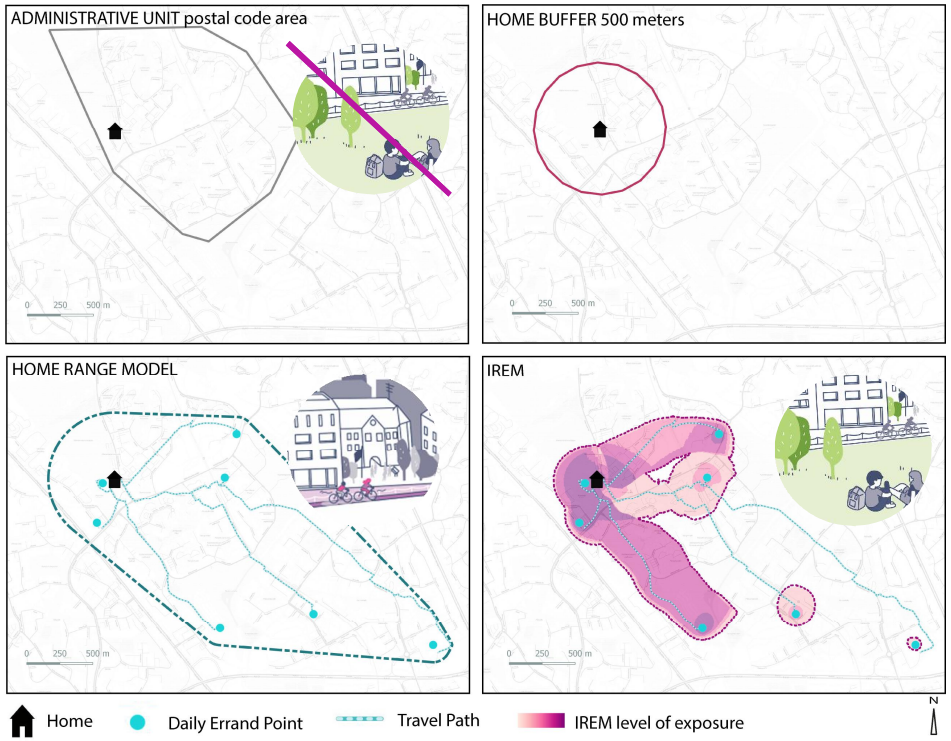
(Laatikainen, Hasanzadeh, Kyttä, 2018)

Laatikainen, T. E., Hasanzadeh, K. & Kyttä, M. (2018). Capturing exposure in environmental health research: challenges and opportunities of different activity space models. *International Journal of health geographics*, *17*(1), 29.

Capturing exposure

	AU	Buffer	IHR	IREM
Administrative Unit	-	66.6	46.5	44.4
Home Buffer 500m	26.5	-	22.4	37.3
Ind. Home Range	78.7	100	-	100
IREM	48.2	67.3	40.4	-

Capturing exposure and the association between the built environment and health



- **All four models yield distinct results: different models result in considerably different measurements of built environment**
- **Different spatial units seem to considerably affect the associations between environment characteristics and wellbeing measures**

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Kamyar defends his thesis on 31.5.2019 at 12:00 in Aalto University!

Tiina defends her thesis on 17.5.2019 at 12:00 in Aalto University!

Thank you!

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With SoftGIS we study the human behavior and preferences in their geographical context