



Aalto University  
School of Engineering

# A place-based model of activity spaces: Individual mobility behavior and its centrality in Helsinki area

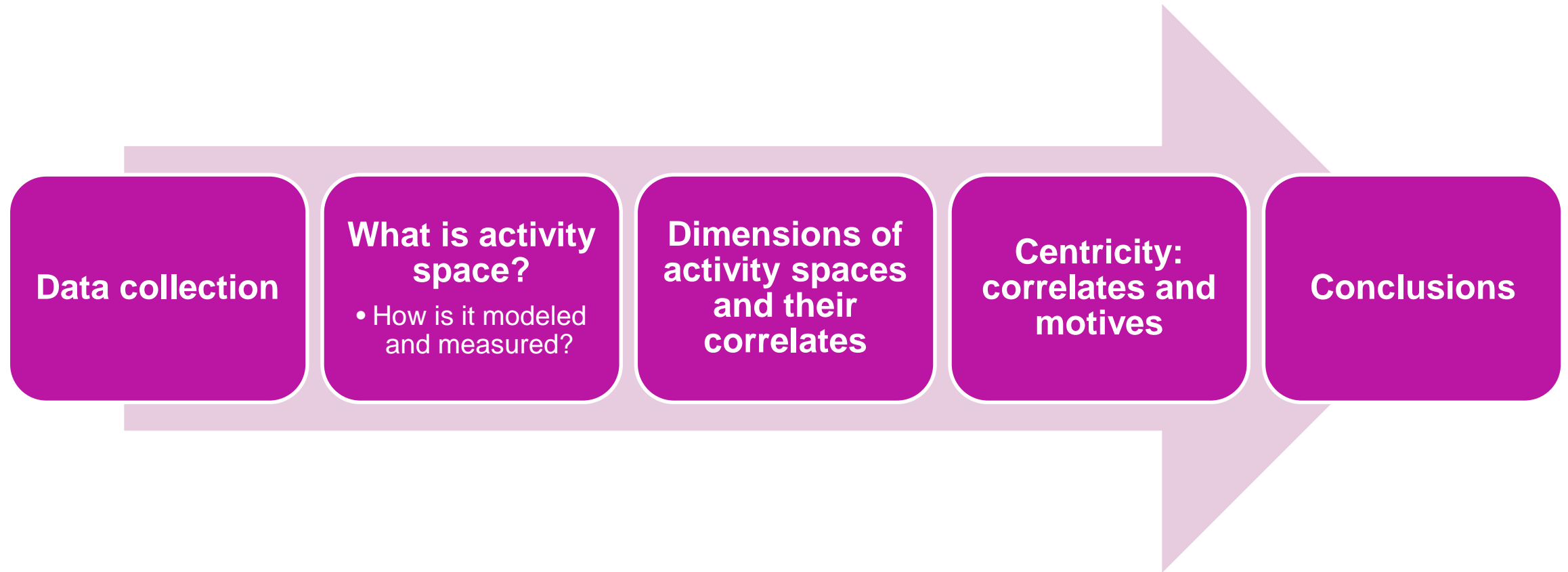
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# In this presentation



# Place-based approach → PPGIS method → Maptionnaire tool

**Mark your everyday places on the map**  
Think about your typical week and mark on the map all sorts of EVERYDAY PLACES you visit during the week.

- Shopping**  
E.g. department store, supermarket, shopping center, market, special store
- Offices, bureaus, businesses**  
E.g. bank, post office, medical center, hairdresser
- Outdoor and sports facilities**  
E.g. park, outdoor sports facility, stadium, sport field, playground
- Leisure and recreational places**  
Yhti (friends or relatives, restaurant, cafe, library, church, gallery, museum, adult education, summer cottage)

Choose the neighborhood

**Where do you do groceries?**

Outdoor and sports facilities

Choose the neighborhood

How do you go there?

**Personal goals 1/3**  
Which of the following personal goals are important to you?

People have, at different stages of their life, a variety of areas of interests, projects and objectives. These interests or objectives might be related to any area of your life, such as to yourself, hobbies, everyday life, health, relationships, children, or friends. We ask you now to think about which of the following objectives, projects and interests describe you at the moment.

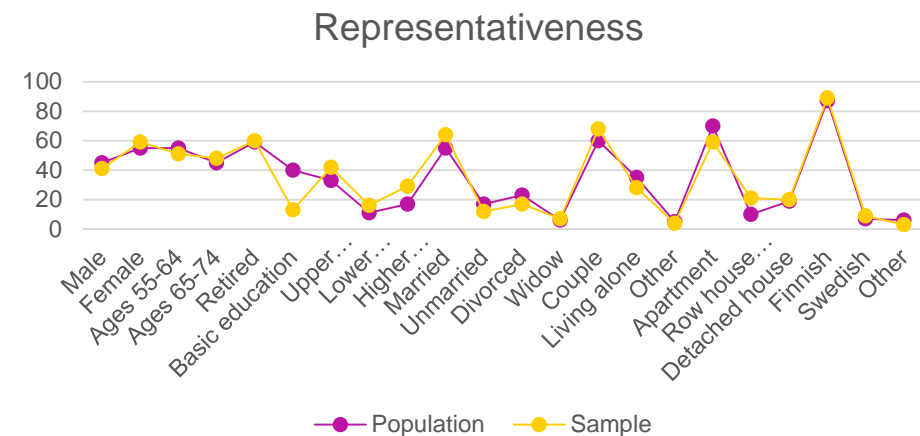
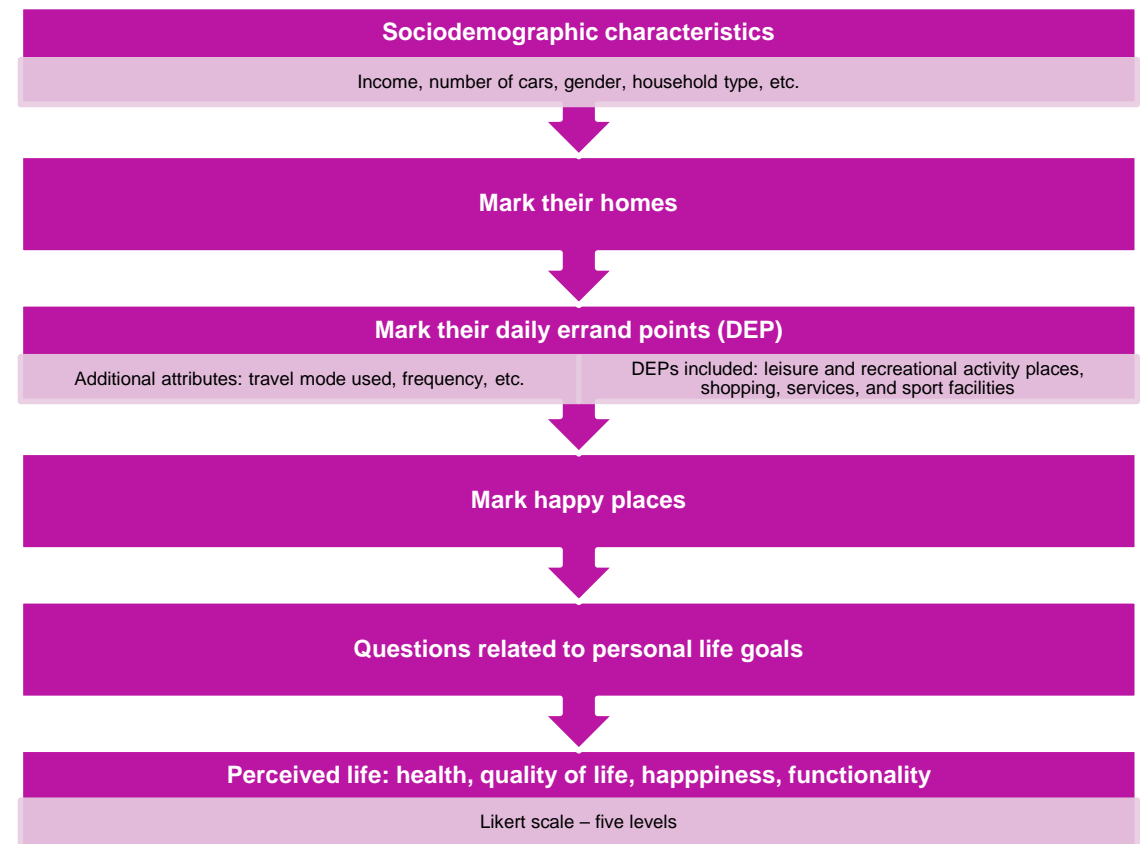
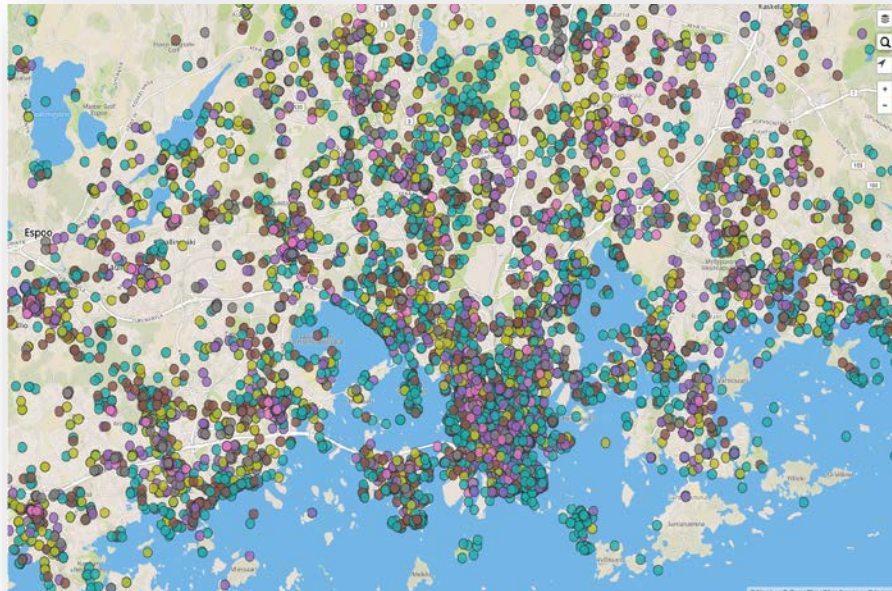
Evaluate the importance of the objectives mentioned here below on a scale from zero to six.  
0 = Not important... 6 = very important.

| Current interests or targets and goals:                          | 0                     | 1                     | 2                     | 3                     | 4                     | 5                     | 6                     |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Independent living, the preservation of an independent lifestyle | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Diet / weight loss / physical appearance                         | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Everyday physical activities (e.g. walking, biking)              | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Managing with a disease  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Self development   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Maintaining memory capacities                                    | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Maintaining health and functional capacity of the body           | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Sports or dance hobby  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Choose the neighborhood

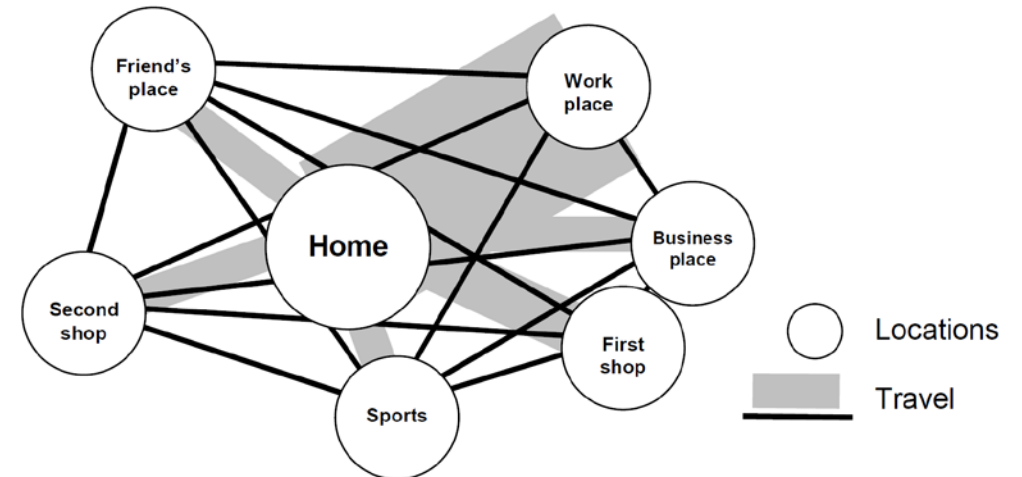
# Data

- A random sample of 5000 residents of Helsinki metropolitan area, aged between 55 and 75 (Oct 2015)
- Participation rate ~ 23 %
- General consistency with the Statistics Finland on socio-demographics



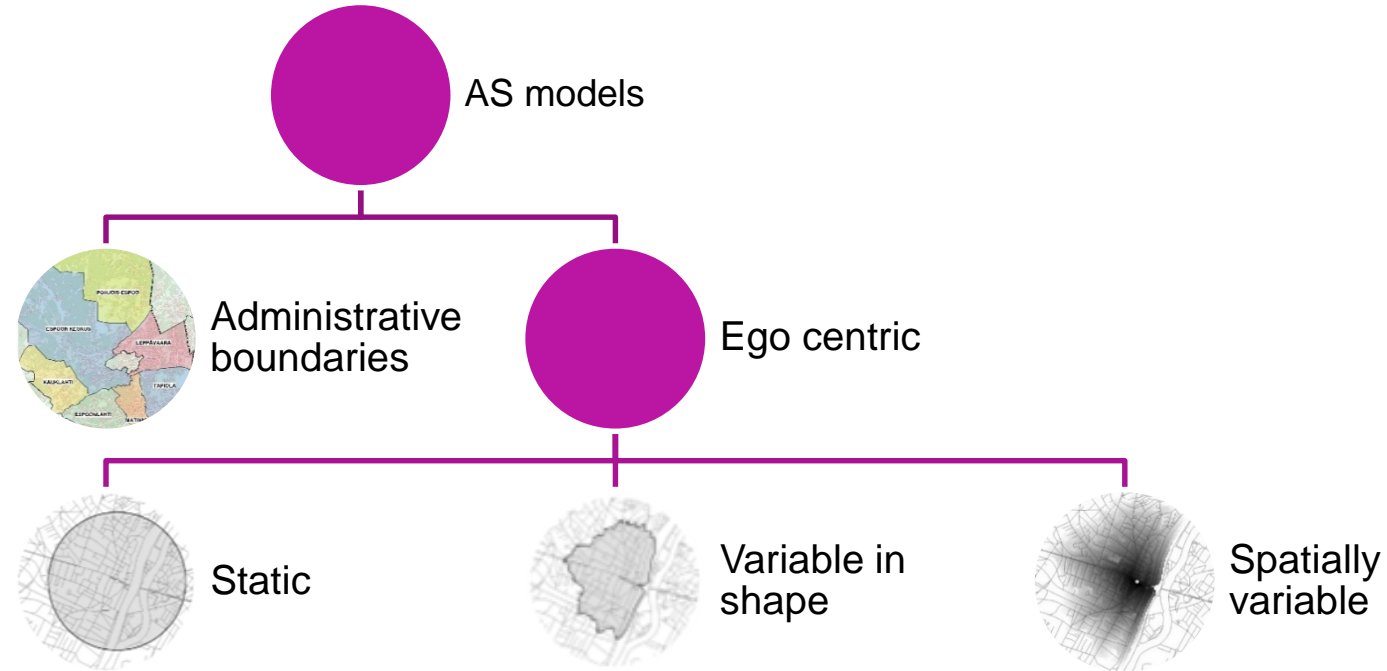
# What is activity space (AS)?

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

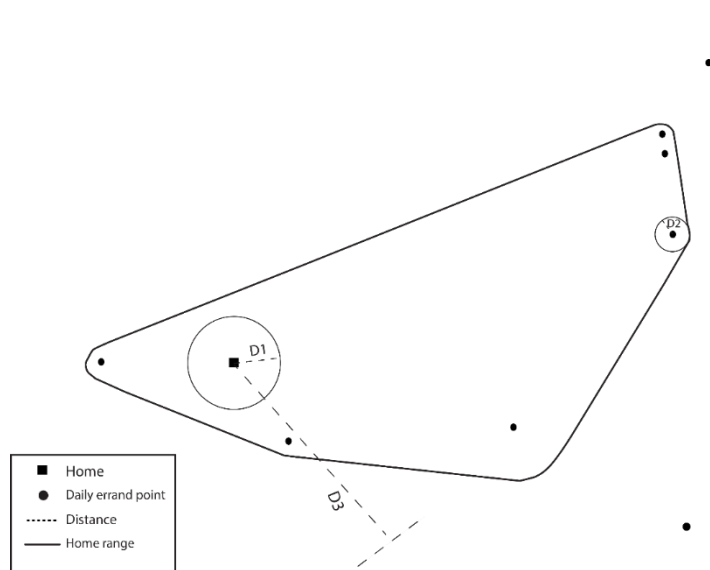


Schönfelder and Axhausen (2002)

# How are activity spaces modeled?

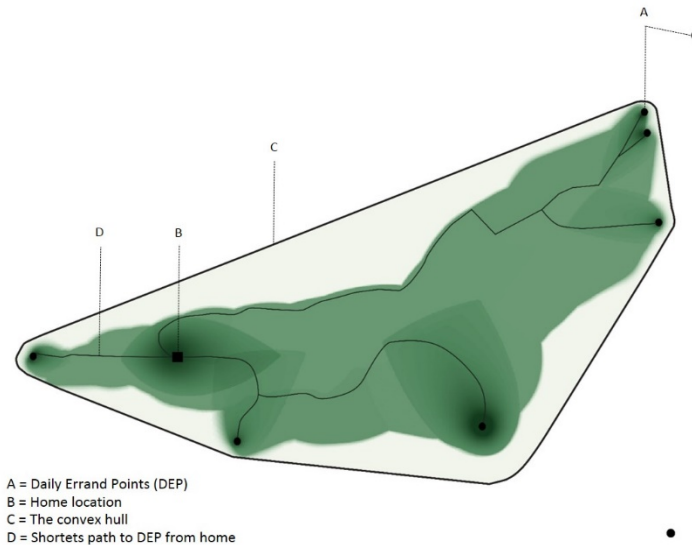


# Improved activity space models



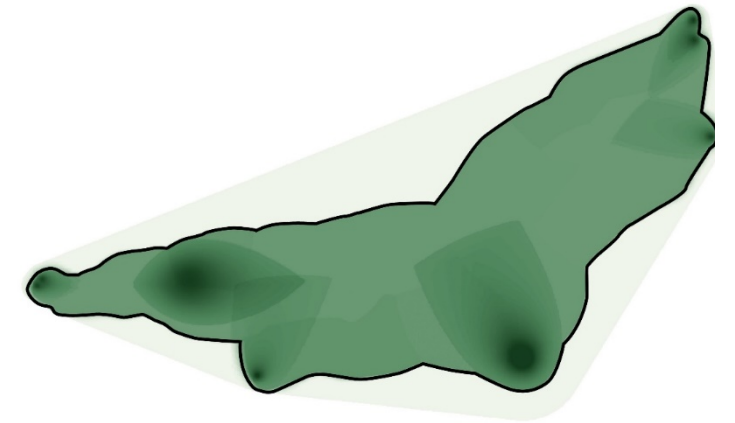
Dynamic home range

(Hasanzadeh, et al. 2017)



Individualized residential exposure model (IREM)

(Hasanzadeh, et al. 2018)



High exposure areas

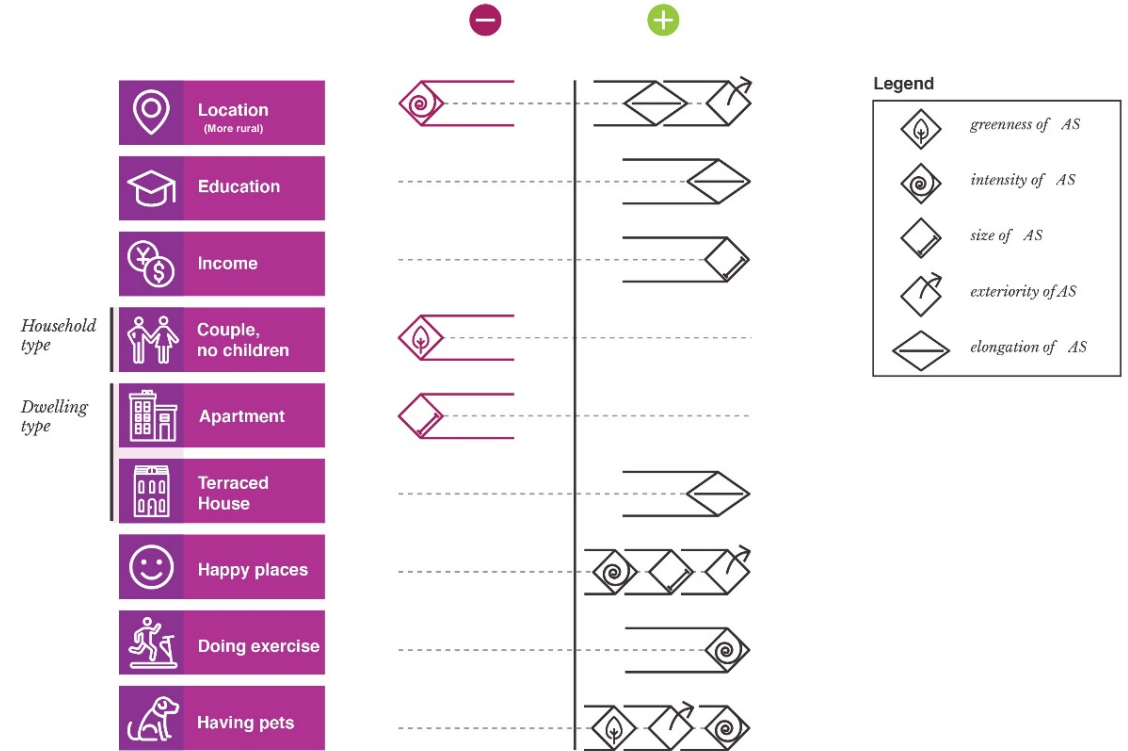
(Hasanzadeh, 2018)

# IREM: Multi-dimensionally analyzed

- **Complexity is inherent to human behavior**
- **Activity spaces are multidimensional constructs** (Perchoux et. al., 2014)
  - A comprehensive understanding requires a multidimensional approach
    - *Physical properties (size, elongation, orientation, centricity, etc.)*
    - *Activity characteristics (type, diversity, intensity, etc.)*
    - *Mobility behavior (volume, travel mode, destination choice, exteriority, etc.)*
    - *Structural characteristics (greenness, proximity to water, density, etc.)*

# Descriptive dimensions of IREM

|   | Size<br>30% | Greenness<br>22% | Exteriority<br>21% | Intensity<br>11% | Elongation<br>7% |
|---|-------------|------------------|--------------------|------------------|------------------|
| Surface   | .981*       | -                | -                  | -                | -                |
| Perimeter                                       | .914*       | -                | -                  | -                | .342             |
| Total exposure                                  | .956*       | -                | -                  | -                | -                |
| Major to minor axis ratio                       | -           | -                | -                  | -                | .964*            |
| Green area percentage                           | -           | .910*            | -                  | -                | -                |
| Green exposure ratio                            | -           | .972*            | -                  | -                | -                |
| Average green exposure                          | -           | .959*            | -                  | -                | -                |
| Average distance to DEP                         | -           | -                | .955*              | -                | -                |
| Maximum distance to DEP                         | -           | -                | .931*              | -                | -                |
| Percentage of DEPs inside neighborhood boundary | -           | -                | -.857*             | -                | -                |
| Number of visits to DEPs per month              | -           | -                | -                  | .899*            | -                |
| Number of DEPs                                  | .377        | -                | -                  | .818*            | -                |
| Average exposure                                | -           | -                | -                  | .853*            | -                |

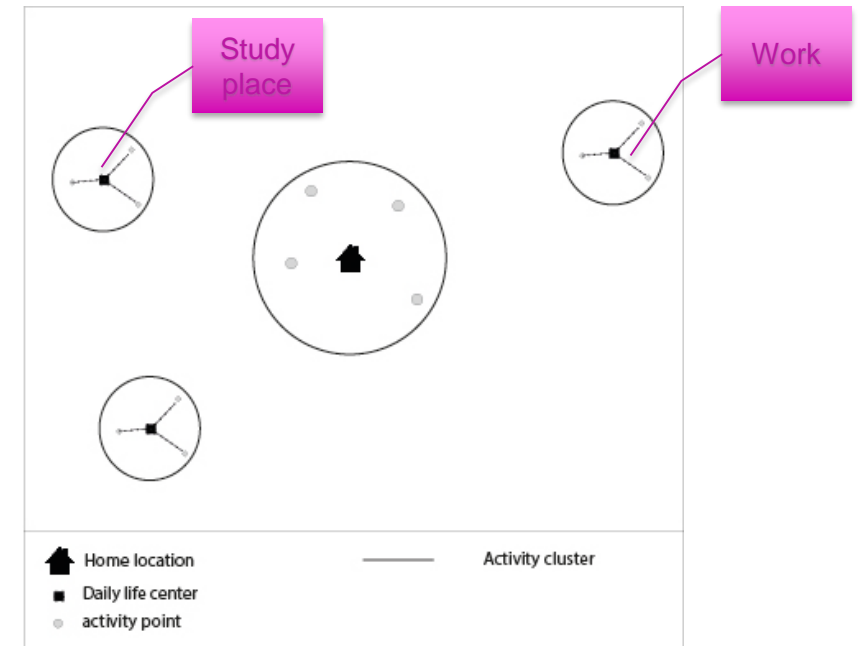


- Size of AS
- Greenness of AS
- Exteriority of AS
- Intensity of AS
- Elongation of AS

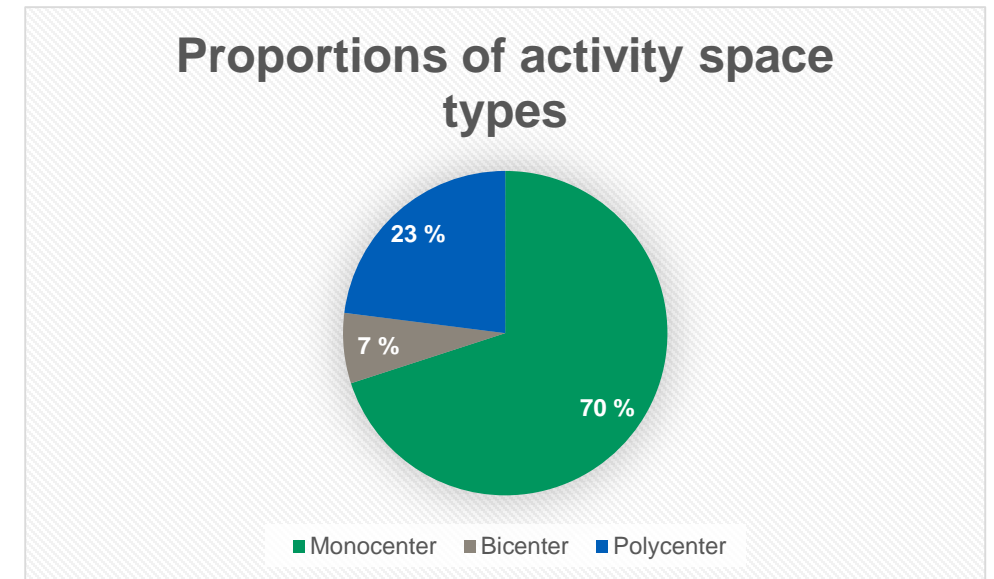
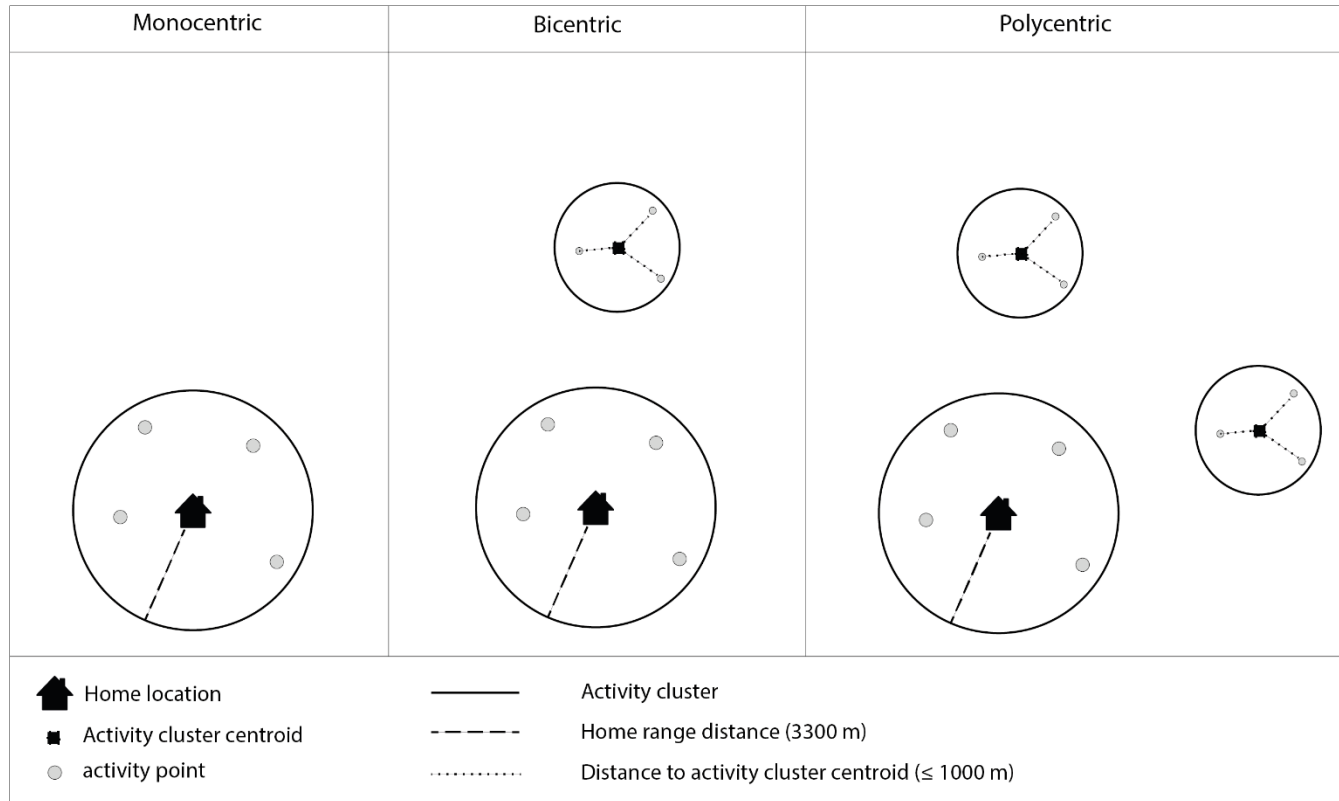
# Centricity of activity spaces

- **Personal network of usual places** (Flamm and Kaufmann, 2006)
  - Individuals often create clusters of activity points which are usually around individual's life centers
  - These clusters are not typically too large
- **A new dimension to the activity spaces**

*“an ordinal measure of activity centers”*



# Centricity of activity spaces: results



# Centricity: correlates and implications

- **Socio-demographic characteristics**
  - More income ~ higher centricity
  - No statistically significant associations with: marital status, education, home ownership, and gender.
- **Urban structure**
  - Centricity is associated with location in the region
  - Suburban areas: higher centricity
- **Perceived wellbeing**
  - Higher centricity: better quality of life
  - Lower centricity: better health

# Centricity and travel style

- **Choice of destination**

- People with polycentric activity spaces are significantly more 'variety-seeking'

- $T = \frac{N_{\text{unique places visited}}}{N_{\text{total trips}}}$  (Schönfelder and Axhausen, 2004)

- **Choice of transportation mode**

- Highest use of active travel modes in monocentric activity spaces (60%)

# Extra-neighborhood travels: Why & where to?

- **Most frequent activities near home**
- **Most extra-neighborhood travels are made by people residing in less urban areas**
- **Majority of trips are made to urban area**
  - Higher density
  - Less green
- **Blue and green spaces do not seem to be major motives**

# Conclusions

- **Multidimensional analysis of activity spaces**
  - New insights to individual travel behavior
- **Activity space characteristics are associated with travel style and urban form, and socio-demographics**
- **Dense urban areas: most common extra-neighborhood destinations**
  - People rarely travel to distant green and water areas
- **Monocentric activity spaces**
  - Higher use of active travel modes and better perceived health
- Results imply that efforts to increase density, mix, and transit accessibility are valid investments for cities that seek to reduce excessive, environmentally detrimental, or unproductive travel demand.

# Last slide

## But it's not over...

Thank you

**Questions?**

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