



Accessibility Research Group  
Digital Geography Lab



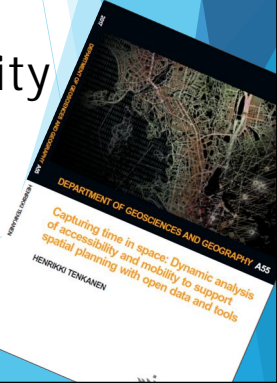
Dynamic cities: Location-based accessibility modelling as a function of time (Applied Geography)

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# Digital Geography Lab



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Supporting sustainable spatial planning using digital data and novel methods

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## Objectives

- How to fully incorporate time to location-based accessibility modelling?
- Present a generic framework for dynamic accessibility modelling
- Conduct a systematic analysis of the importance of time into different components of accessibility

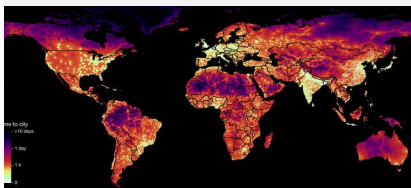
## Accessibility ...



## Time in accessibility modelling?

### Location-based models

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

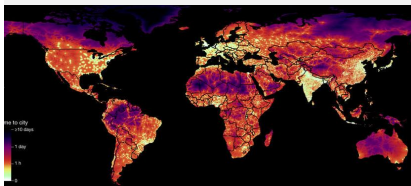


Weiss et al. (2018). *Nature*.

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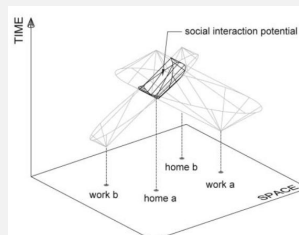


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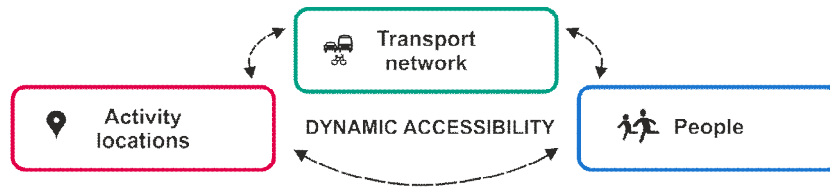
### Person-based models

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

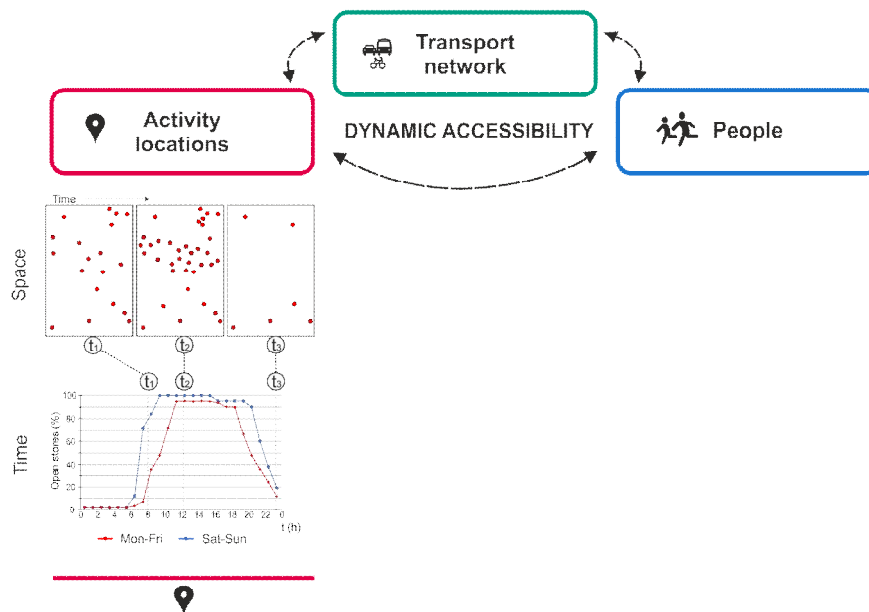


Farber et al. (2013). *Ann. of AAG*.

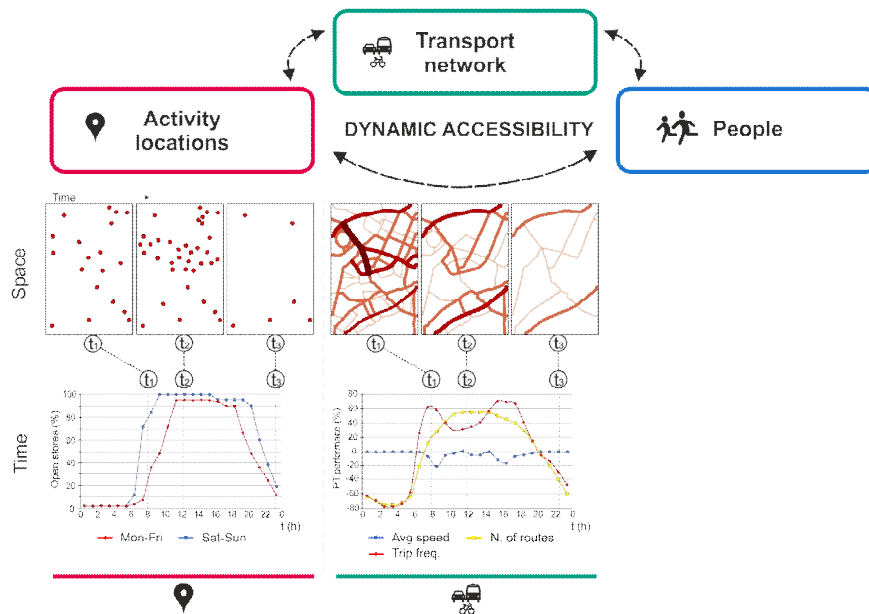
## Components of dynamic accessibility



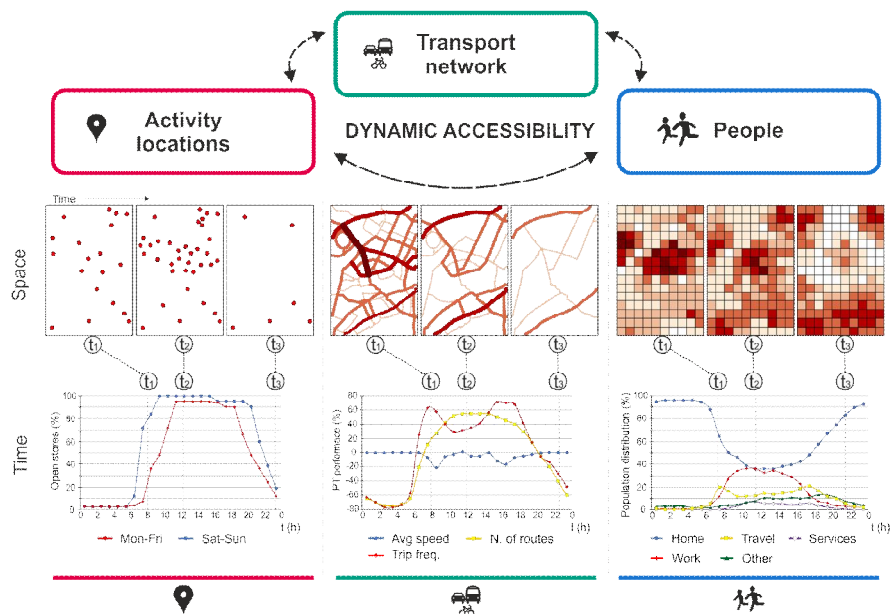
## Components of dynamic accessibility



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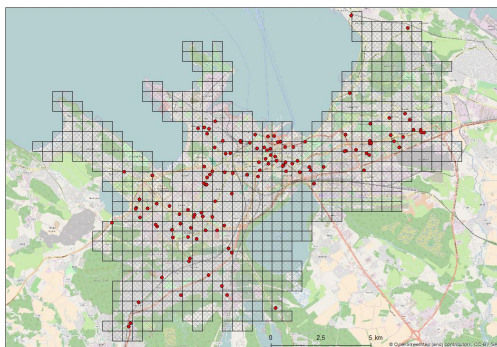




## A systematic comparison between static and dynamic accessibility

### Methods

- u Accessibility measured as travel time by public transport
  - u Origins: 500 m grid cell centroids
  - u Destinations: open grocery stores at given time



### Data

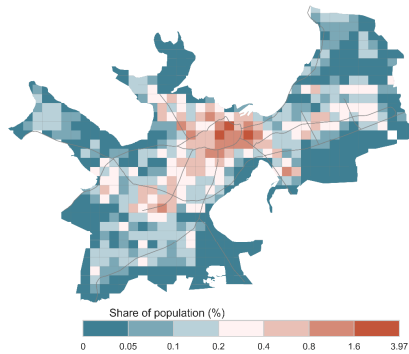
People: Call Detail Records (CDR)  
 Transport: GTFS schedule data  
 Activity locations: Grocery store data (web)

	People	Transport	Activity locations
Model 1	Static	Static	Static
Model 2	Dynamic	Static	Static
Model 3	Static	Dynamic	Static
Model 4	Static	Static	Dynamic
Model 5	Dynamic	Dynamic	Dynamic

## Dynamism in food accessibility

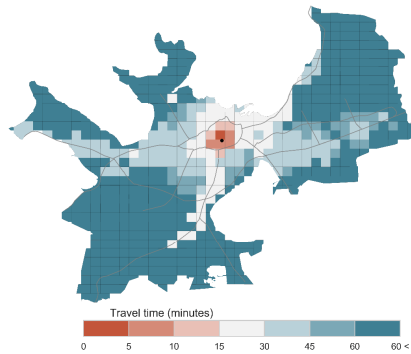
Population distribution in Tallinn  
based on mobile phone data

00:00



Travel time to closest  
grocery store in Tallinn

00:00 Stores: 1

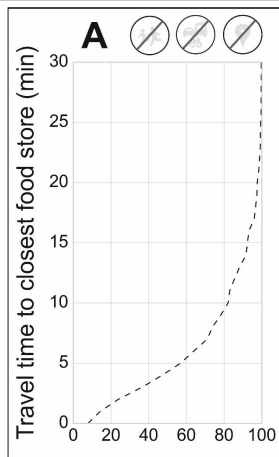


MFD - interpolation  
(Järv et al. 2017 IJGS)

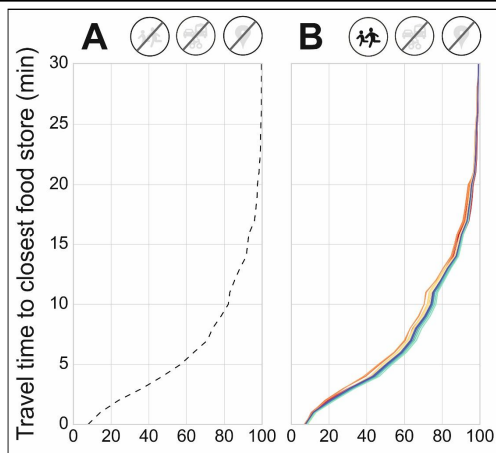
## Does time matter?

### Adding one dynamic element at a time

What is the share of population that reaches their closest grocery store within given travel time?



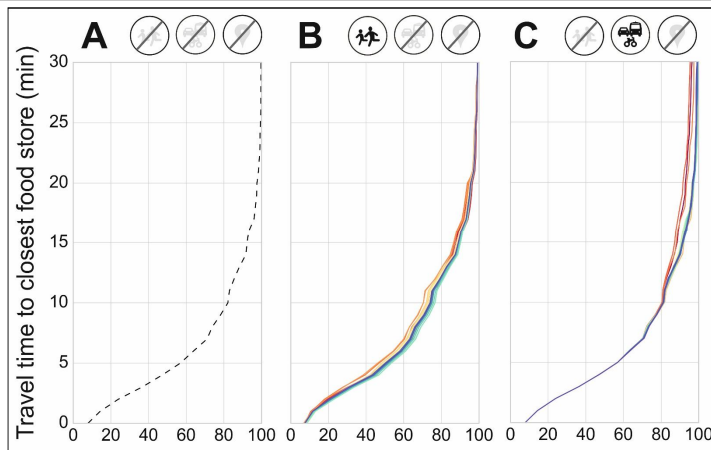
A Fully atemporal model



A Fully atemporal model

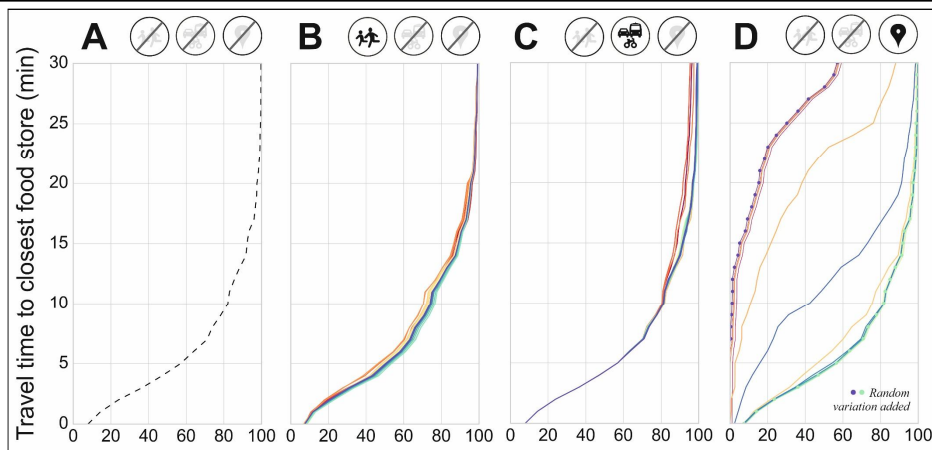
B Only people dynamic





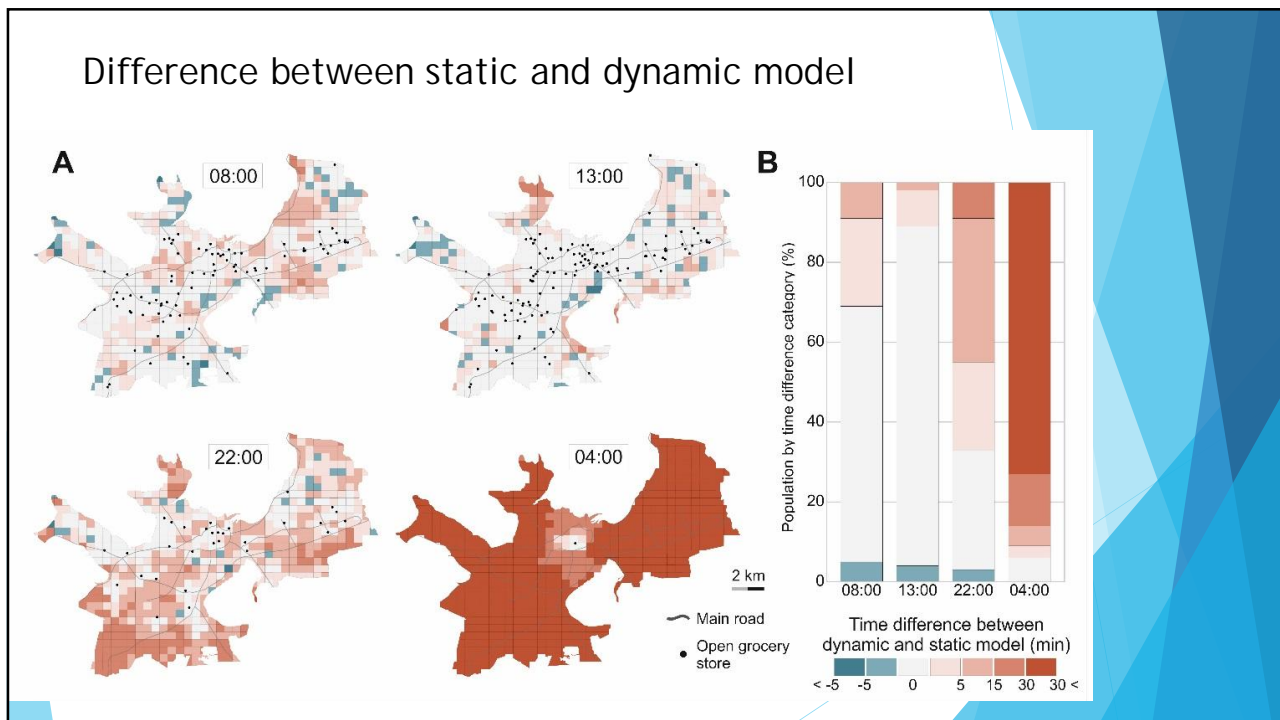
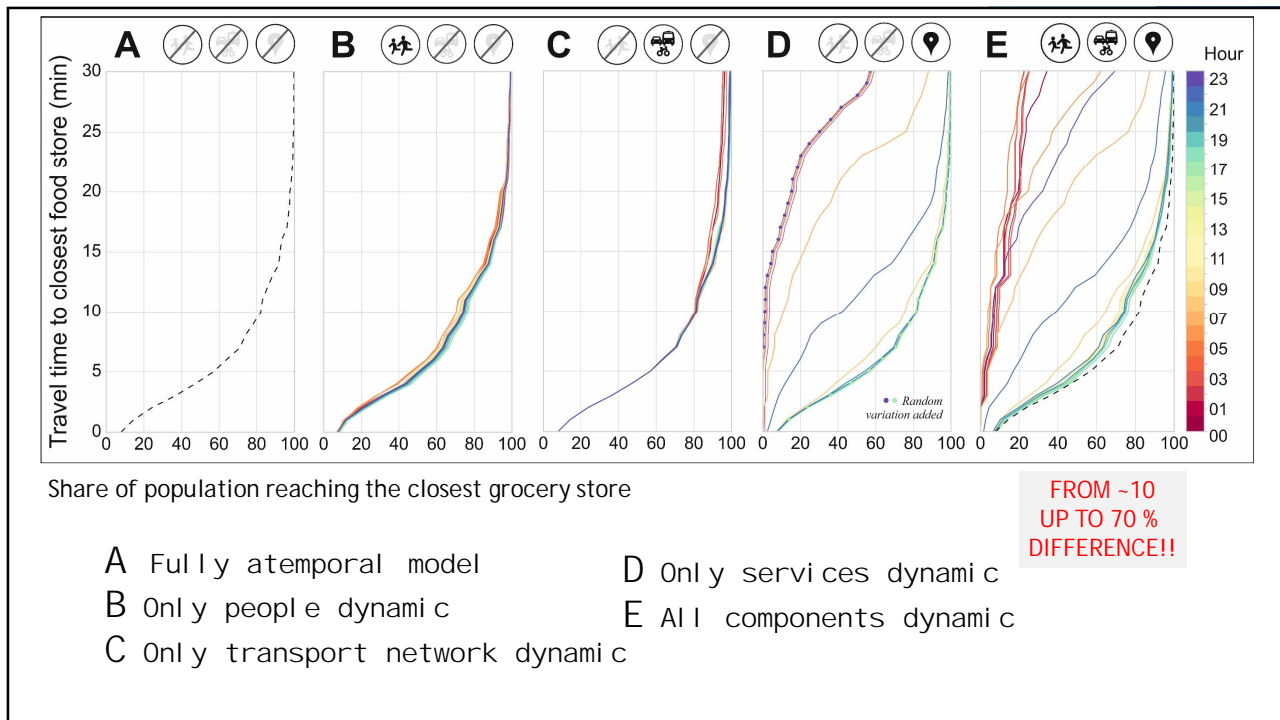
Share of population reaching the closest grocery store

- A Fully atemporal model
- B Only people dynamic
- C Only transport network dynamic

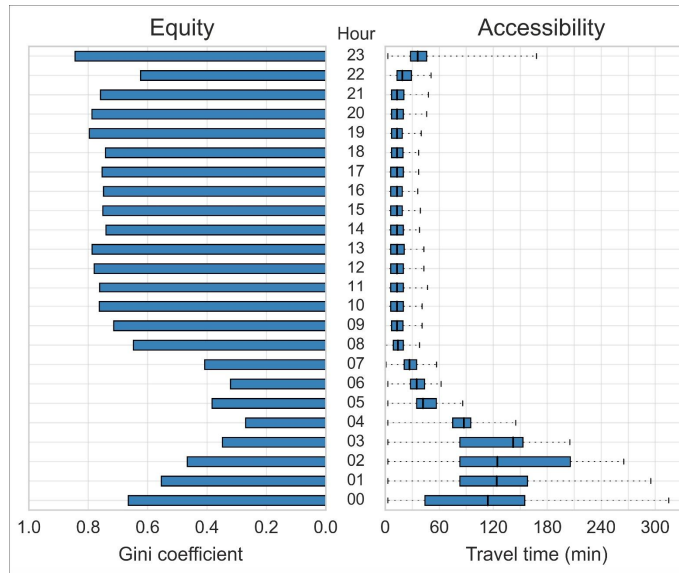


Share of population reaching the closest grocery store

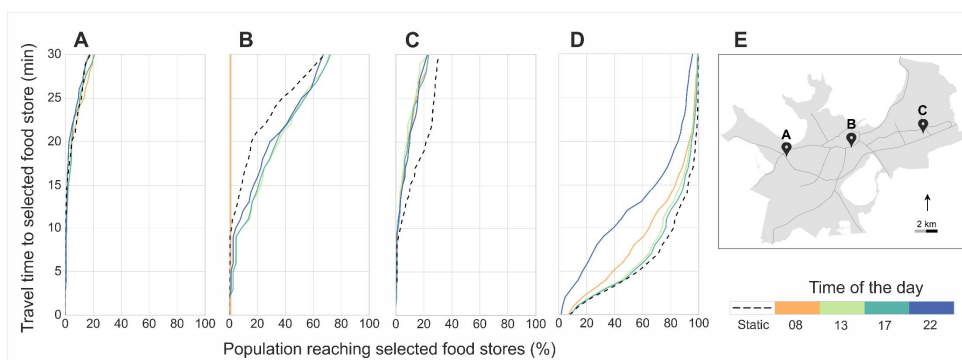
- A Fully atemporal model
- B Only people dynamic
- C Only transport network dynamic
- D Only services dynamic



## Effect on equity?



## The significance of dynamism is network / location specific



## Conclusions

- u Time makes a difference (e.g. Tenkanen et al. 2016; Widener et al. 2017; Kujala et al. 2018)
  - u Static model tends to overestimate accessibility (case specific)
- u Data and tools for handling temporality (and multimodality) in location-based accessibility analyses are increasingly available

## Conclusions

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### Location-based models

- u Large scale analyses possible
- u Data intensive
  - u Getting access to transport and activity location data is easy
  - u Getting access to data about whereabouts of people can be difficult (e.g. CDR)
    - à Social media as an alternative data source?



### Person-based models

- u Small(er) samples
- u Detailed in-depth information
- u More difficult to generalize

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Thanks!

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