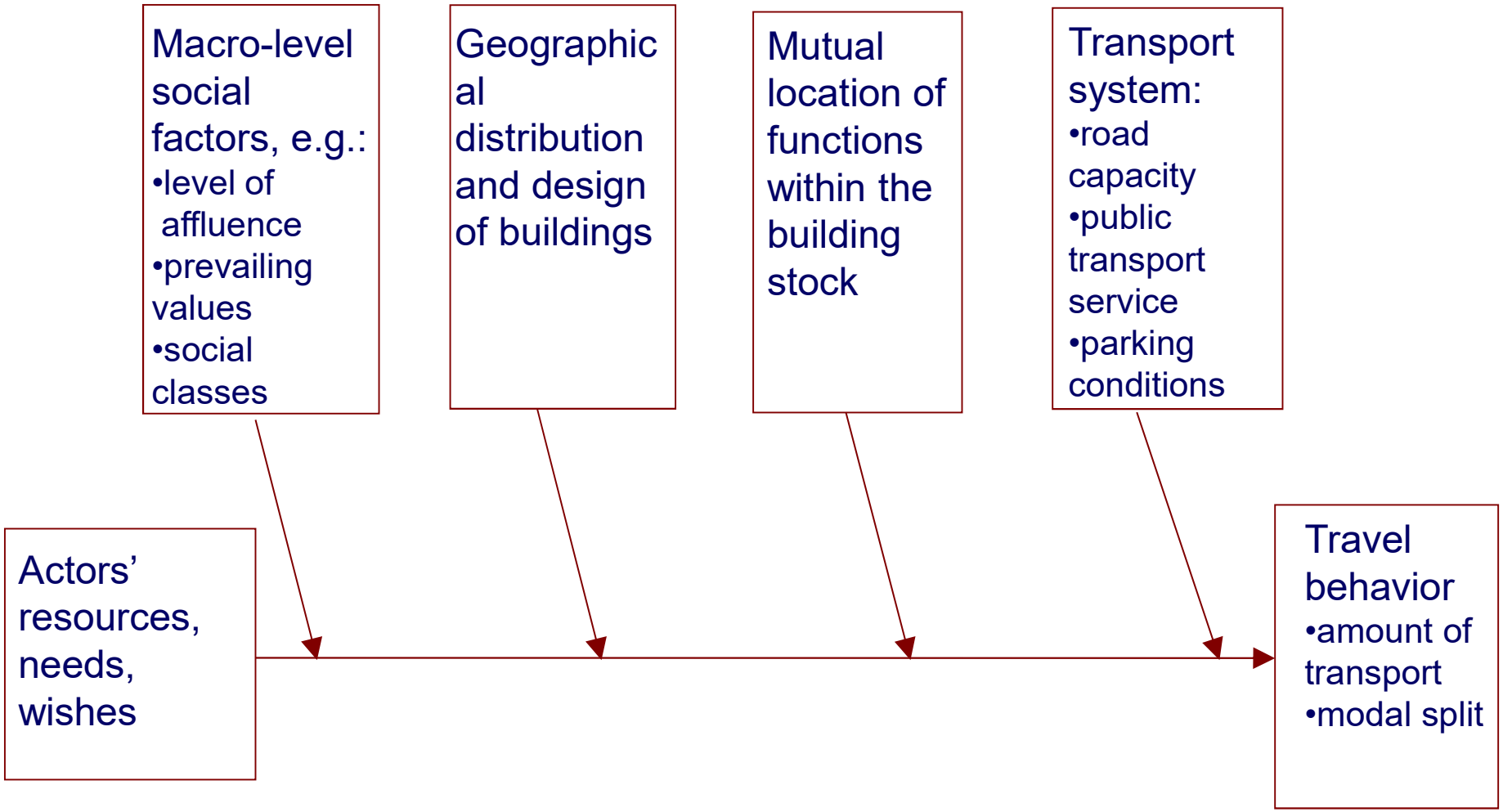
How and **why** do **residential** and **workplace location** in metropolitan areas influence **travel behavior?**

Aalborg Athens Atlanta Austin
Bergen Boston Copenhagen Dutch Randstadt
Frederikshavn Gothenburg Hangzhou Kunming
Lisbon London Melbourne New York Oslo Paris
Reykjavik San Francisco Bay Santiago de Chile
Stavanger Trondheim

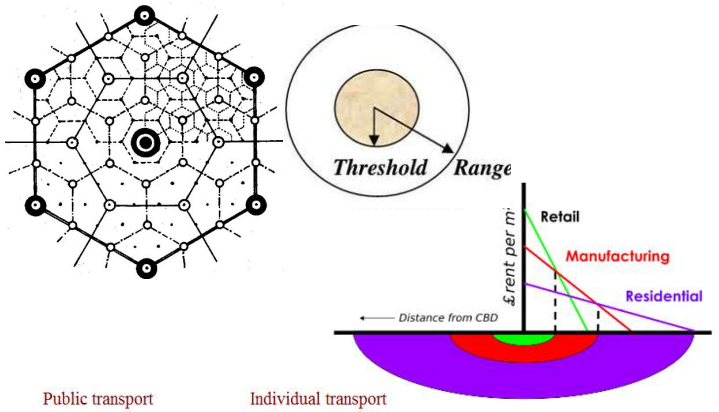
Guest lecture at the University of Iceland, 3 June 2019, Reykjavik
Petter Næss
Professor in Planning in urban regions
Norwegian University of Life Sciences
Head of the Urban Sustainability research group

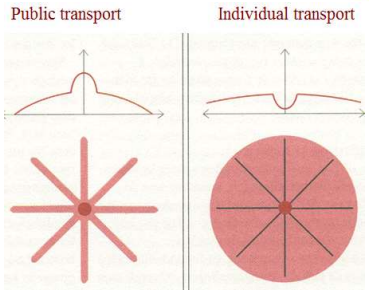
Influences of urban spatial structures on travel

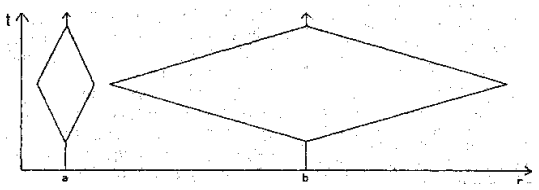


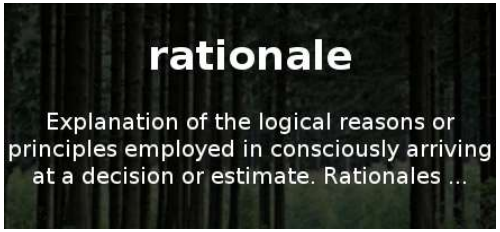
Theories that can inform our understanding of how urban built environments influence travel

- Location theory: The necessary sizes of catchment areas for specialized and non-specialized facilities
- Bid-rent theory and cultural theories on suburbia: Why densities tend to be lower in suburbs than in the inner city
- Urban spatial theories about accessibility by different travel modes in central and peripheral parts of cities
- Time geography: The need for people to be at certain places at certain times, and the need for fast needs of transportation if distances between activities are long
- Sociological theories on people's rationales for behavior









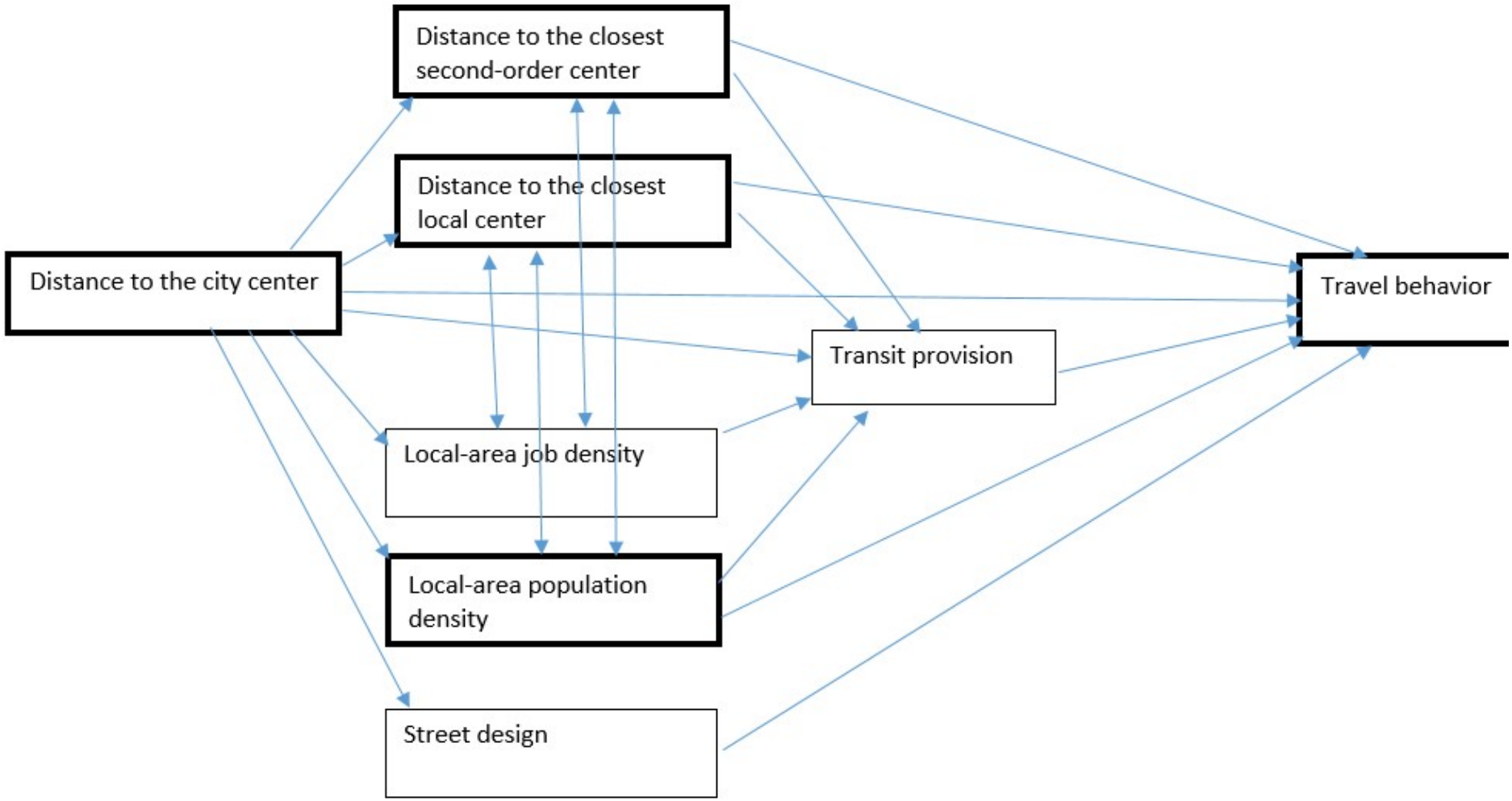
Some typical differences between inner city and suburb

Inner city:

- High density,
- Mixed land use,
- High concentration of jobs, non-food stores, restaurants, cultural and entertainment facilities,
- Generally wide range of specialized facilities,
- High transit accessibility,
- Low car accessibility,
- Often high score on ‘urban atmosphere’

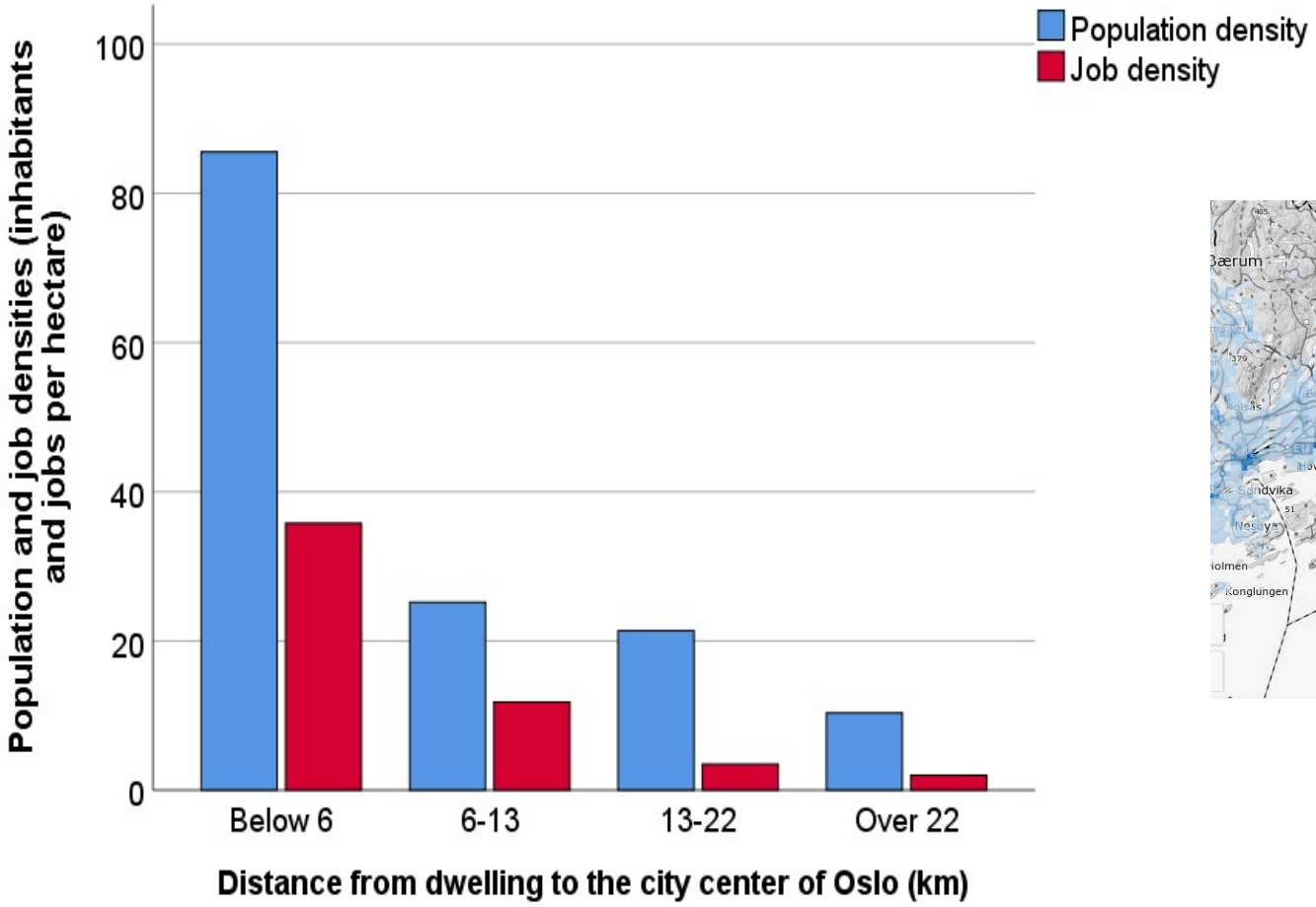
Suburb:

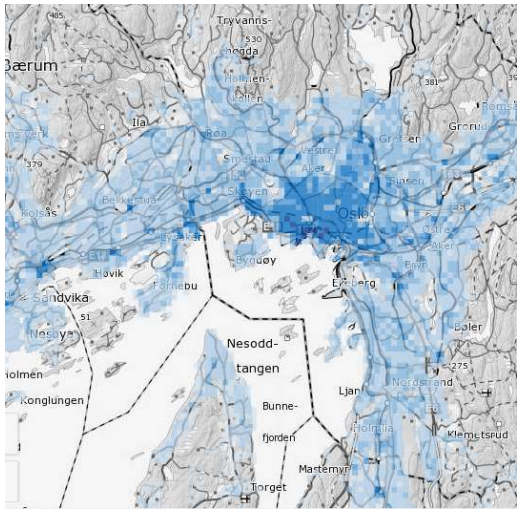
- Low density,
- Often mono-functional land use,
- Low concentration of jobs,
- Few specialized stores and service facilities,
- Low transit accessibility,
- High car accessibility,
- High availability of open space,
- Longer distances between local facilities



Assumed causal relationships between different built environment characteristics and travel behavior. Characteristics included in the statistical analyses of the RESACTRA project are shown with bold outline.

Densities are higher in the inner parts of the metropolitan area





Distances to facilities depend on residential location

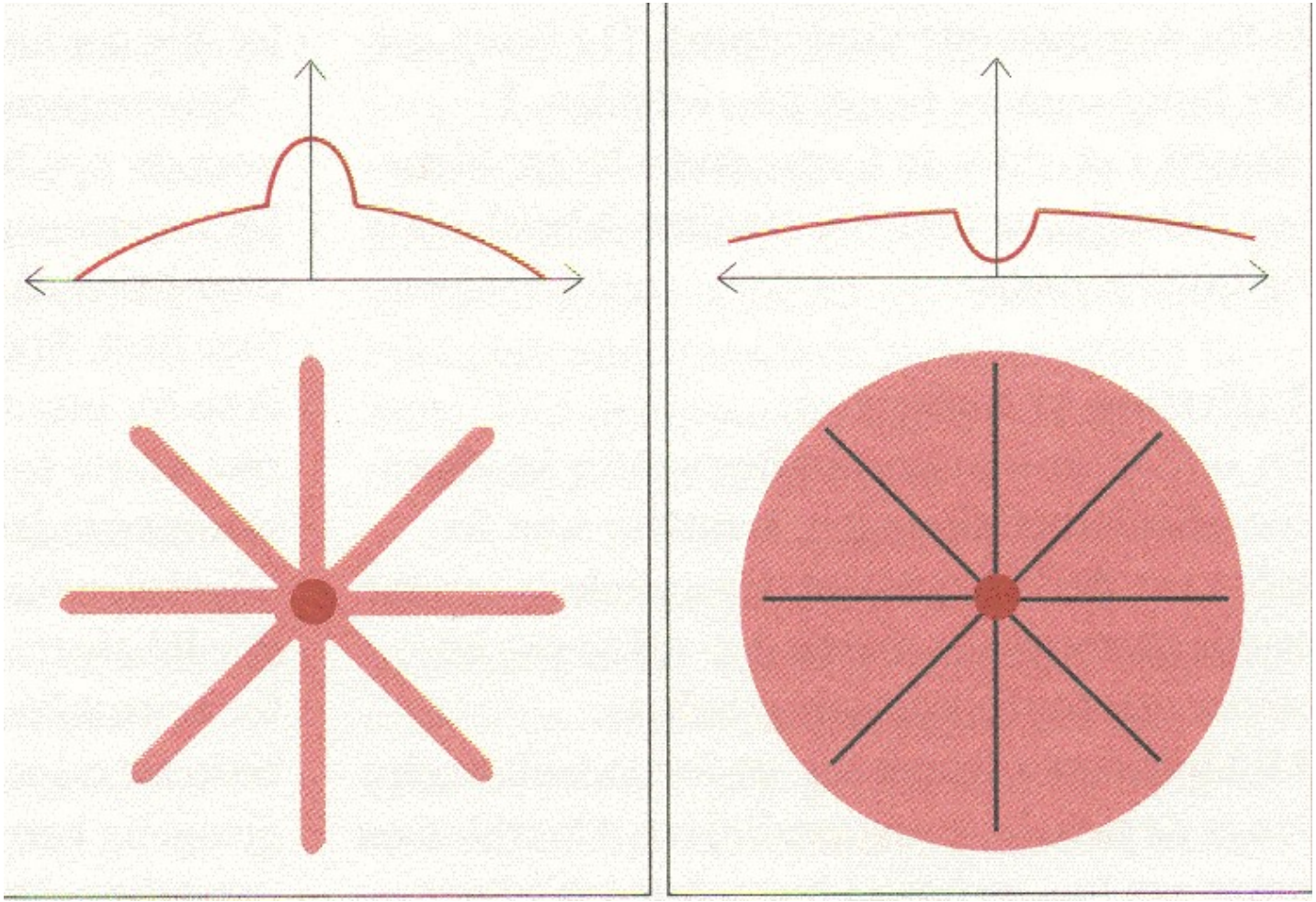
Mean values for selected geographical characteristics of the respondents' dwellings v
four distance belts from the city center of Copenhagen

Geographical characteristics	Distance belt from the city center of Copenhagen			
	below 6 km	6 - 15 km	15 - 28 km	over 28 km
Distance to the closest urban rail station (km)	1.4	2.3	3.0	11.2
Population density within the local area (pers./ha)	85	24	14	10
Workplace density within the local area (jobs/ha)	66	11	7	5
Number of special commodity stores within 1,5 km distance	218	16	15	15
Distance to the closest grocery store (km)	0.13	0.51	0.97	0.68
Distance to the closest primary school (km)	0.51	0.85	1.50	1.20
Distance to the closest kindergarten (km)	0.31	0.52	0.65	0.77
Distance to the closest town hall (km)	2.8	2.8	4.0	3.7

Accessibility by different travel modes in central and peripheral parts of cities

Public transport

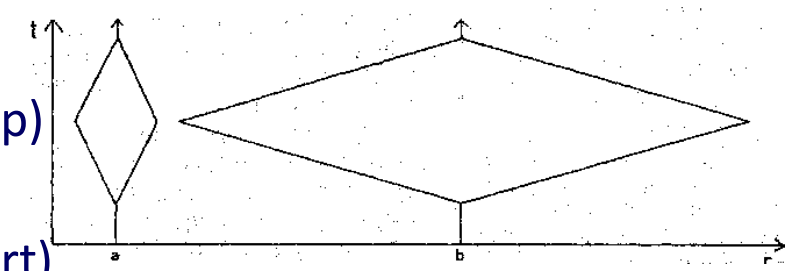
Individual transport



Time-geographical constraints

(Hägerstrand, 1970)

- ***Capability constraints:*** limitations to the activities of individuals due to
  - their biological properties (e.g. need for sleep)
  - the capability of the tools that the persons have at their disposal (e.g. means of transport)



- ***Coupling constraints:*** regulations which, for the sake of production, consumption and social activities require individuals, instruments, materials and signs to be coupled together into co-operating groups
- ***Authority/steering constraints***
  - spatial restrictions as to who is entitled to move through or stay in different places
  - temporal restrictions, e.g. the length of the working hours and their location in time

Transport rationales -

a term referring to the basic backgrounds, motives and justifications influencing travel behavior

- Rationales for activity participation
- Rationales for location of activities
- Rationales for choice of travel mode
- Rationales for route choice

ELSEVIER

PROGRESS IN PLANNING

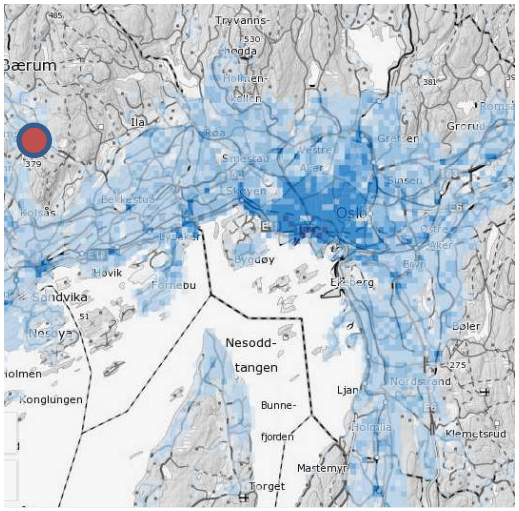
Residential location, transport rationales and daily-life travel behaviour: The case of Hangzhou Metropolitan Area, China

Petter Næss *

Rationales for activity location

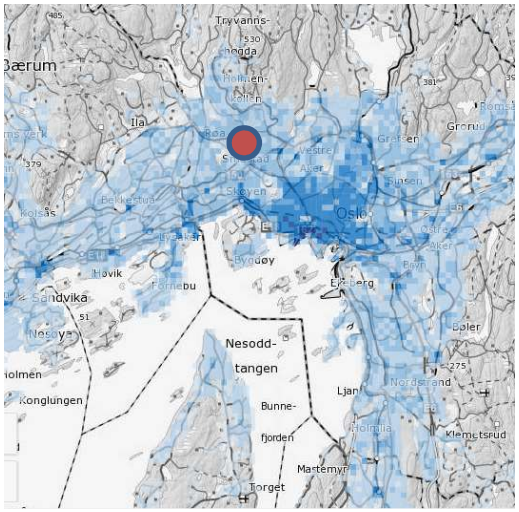
Among 33 interviewees living in the metropolitan areas of Oslo and Stavanger, the following rationales for activity locations were encountered in the interviews:

- **Choosing the best facility** (all interviews)
- **Minimizing the friction of distance** (all interviews)
- **Limiting other travel-related expenses** (a few interviews)
- **Maintaining social contacts** (nearly half of the interviews)
- **Variety-seeking** (several interviews).



Choosing the best facility - an example:

"Ideally, I would like to work here, down at Rud [a local center], in Sandvika or Bekkestua [two second-order centers], or at Østerås [a local center]. This would have been excellent. But you see, wishes and dreams don't always come true when it comes to available jobs. The thing is that there is a greater supply [of jobs matching his qualifications] in Oslo's inner area, and maybe also some at Fornebu [a previous airport now being redeveloped]." (ID160307).



Limiting other travel-related expenses – an example:

"You see, it is quite expensive to drive to downtown Oslo, having to pay toll cordon fee as well as for parking … then it is convenient to go to CC Vest [a suburban shopping mall] or you can go to Skøyen [a second-order center] which is also just outside the cordon." (ID13896).

Rationales for travel mode choice

encountered among the Oslo and Stavanger interviewees:

Main rationales

- Convenience and comfort (all interviewees), including:
  - Avoiding physical efforts,
  - Mobility simplicity
- Frustration aversion (most interviewees)
- Time-saving (most interviewees)

Secondary rationales

- Wish for physical exercise (several interviewees)
- Long-term habits (few interviewees)
- Limiting travel expenses (few interviewees)
- Safety (very few interviewees and only indirectly)
- Social contact and caretaking (few interviewees)
- Esthetics (very few interviewees)
- Environmental concerns (very few interviewees)

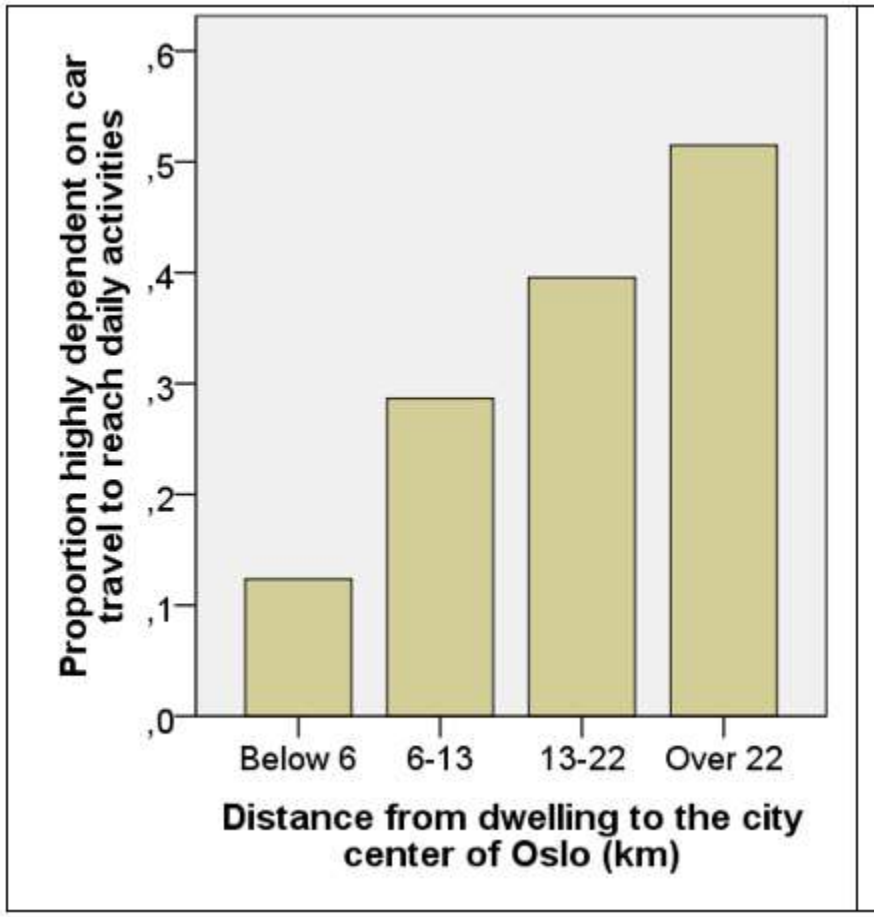
Distance overcoming is an important intermediate criterion for choice of travel mode. This purpose triggers the rationale of avoiding too great physical effort as well as the time-saving rationale to be activated

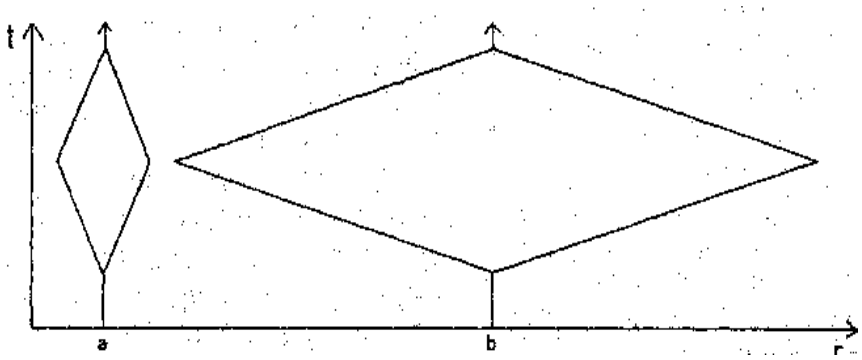
Convenience - an example for a resident of a second-order center:
"Yes, but, well, such short trips, well they are so short that, during the rush, it is almost faster to bike those two kilometers. And regarding the car, it is no advance for these short trips, when the motor does not even get warm, even polluting, and in addition on has to pass this beloved road toll line." (ID33352).

Frustration aversion – an example for a suburbanite:
"It is a long way uphill to the bus stop. … The first year I lived here, I tried to live without a car … so then I tried to take the bus. …. I reported [to the traffic planner of the transit company] each time the bus just passed without stopping, or did not show up, or was much delayed.. I was so angry, I was seriously mad with the transit company. Then, finally, I bought a car." (ID35894).

Time saving – an example for a suburbanite:
"In my view, the [local] transit provision is very good…buses go all the way. And the departures are relatively frequent. What is cumbersome is that it takes too long time. 35 minutes in total from leaving home [before arriving at the workplace] … [more than three times as long as by car] … On the way home … the bus that I needed to take never showed up. … So I had to take the next one. … which is indeed stuck in congestion! .. It took an hour, all included." (ID52803).

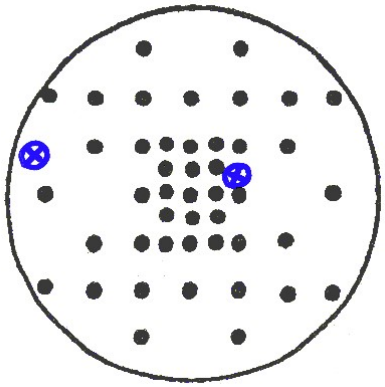
Those who need to overcome long distances to reach daily destinations need fast means of transportation – and they therefore consider themselves as more car-dependent

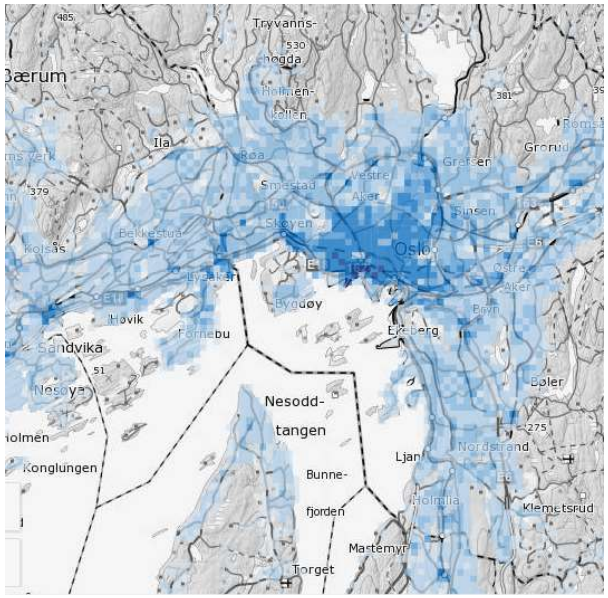




Combined built environment characteristics, time-geographical restrictions and transport rationales – an example

Built environment characteristics, e.g.





Time-geographical restrictions, e.g.

- Coupling constraints
  - Need to present at the workplace
  - Need to pick up child in kindergarten
- Capacity constraints
  - Need to be at home in the evening and night for family obligations and sleep
  - Do not have physical fitness for bike commuting at distances exceeding 5 km

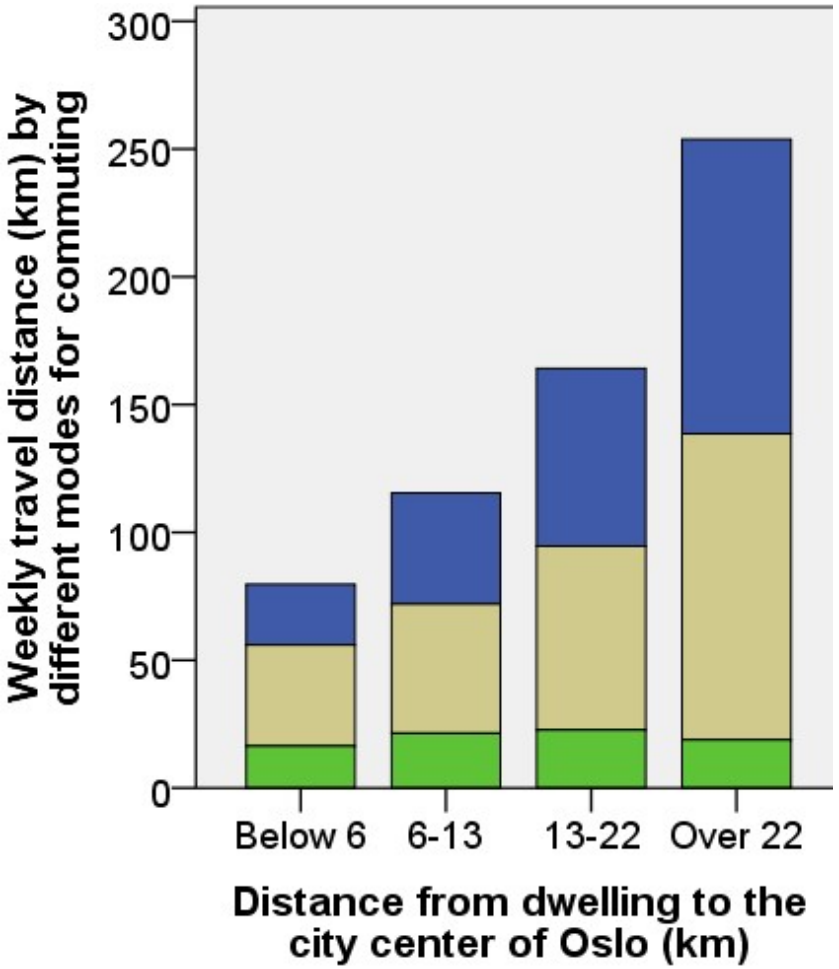
Steering constraints

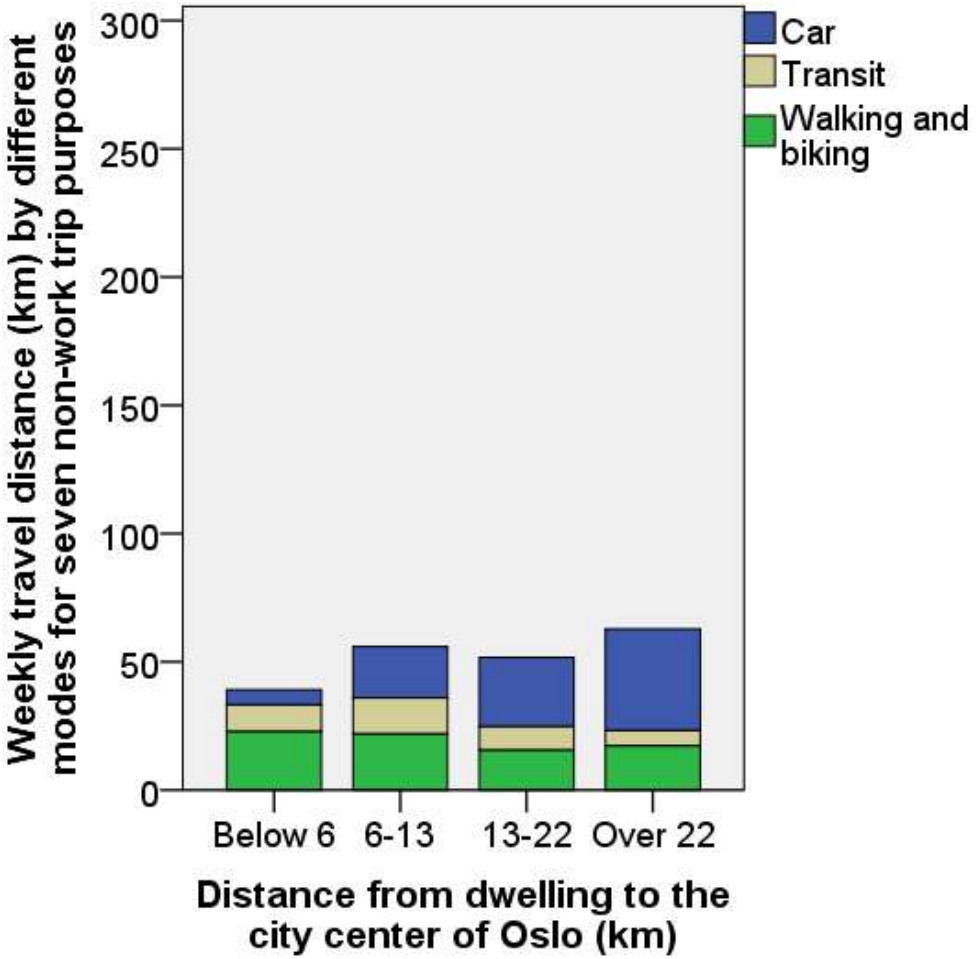
- Working hours, kindergarten opening hours
- Transit lines and timetables

Rationales for location of activities, e.g. employment

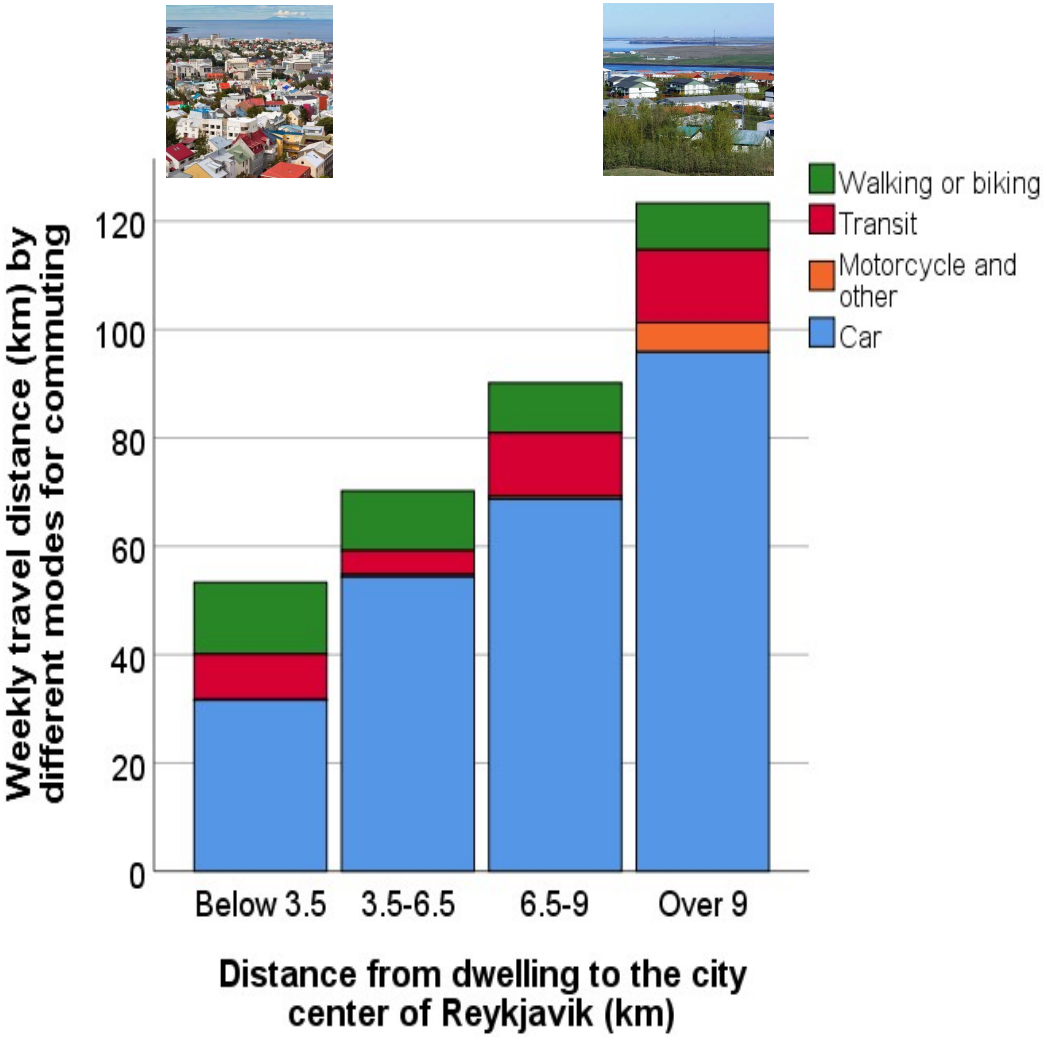
- Limitation of the friction of distance, in terms of
  - Time consumption
  - Monetary expenses
  - Physical effort
- Choosing the best facility, in terms of
  - Job content
  - Salary
  - Work conditions
  - Colleagues

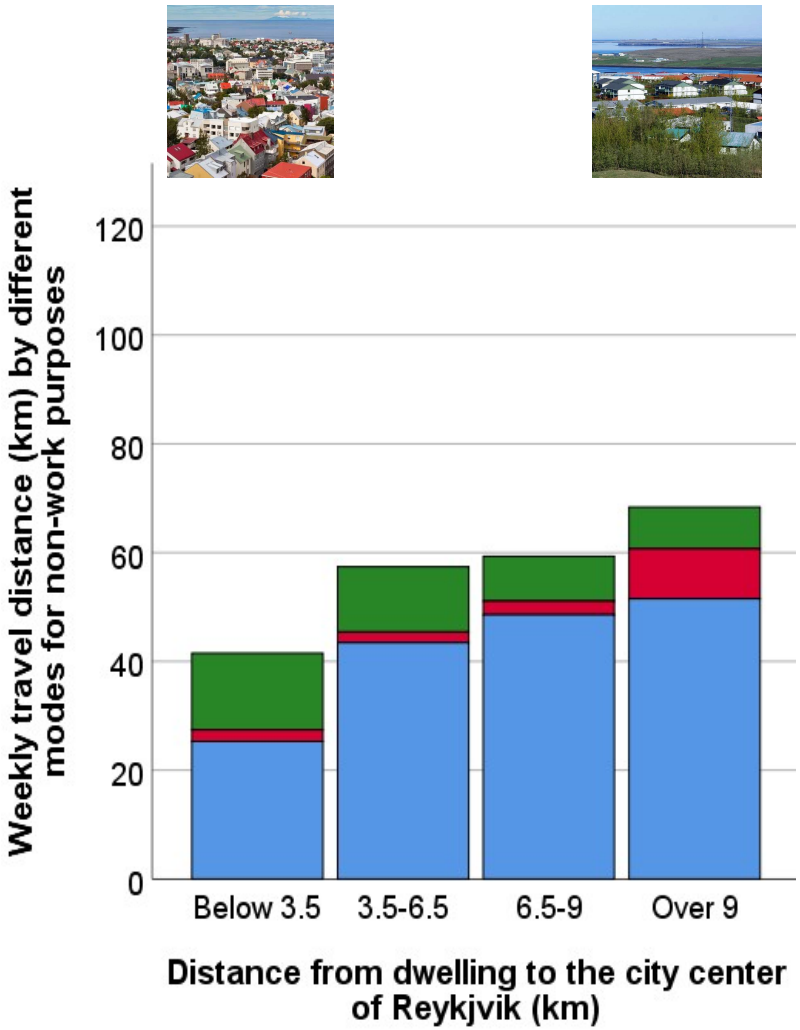
Intra-metropolitan travel for **commuting** and seven **non-work** purposes, Oslo



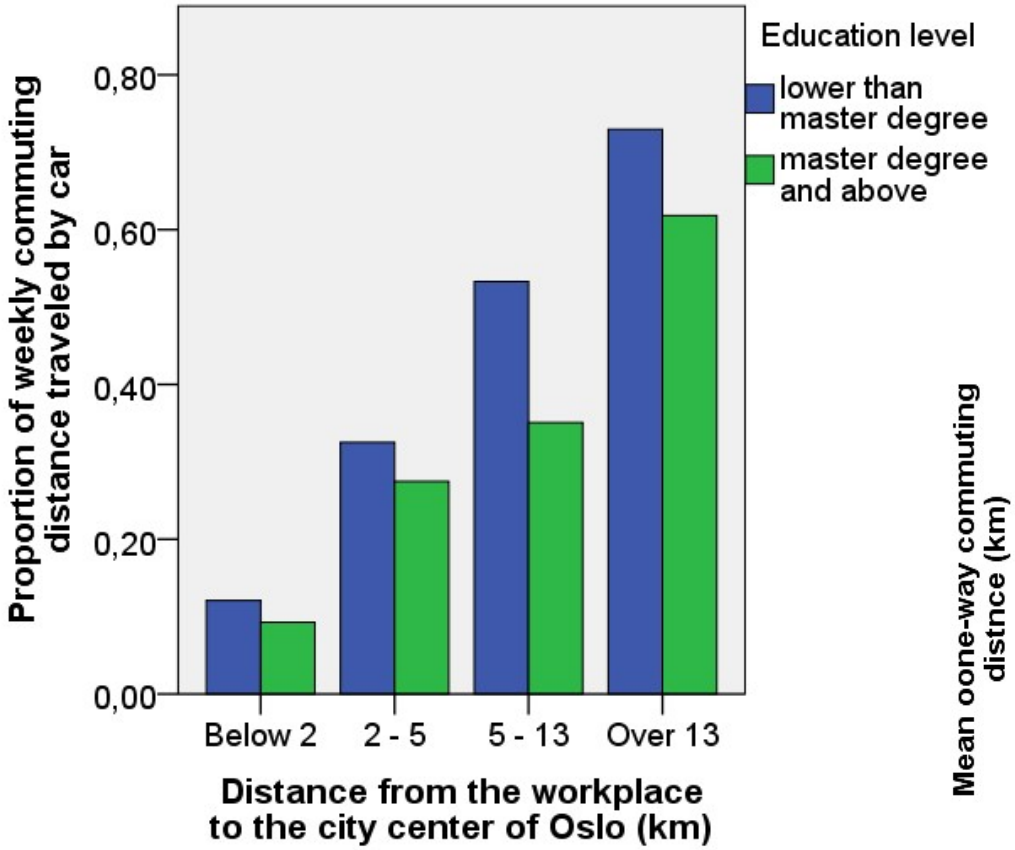


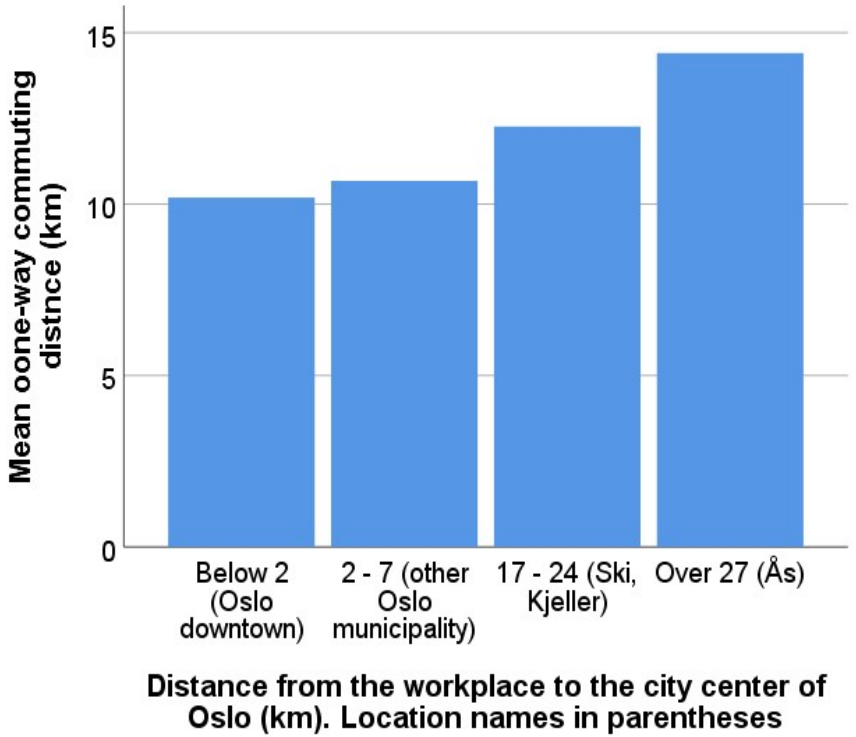
Intra-metropolitan travel for **commuting** and seven **non-work** purposes, Reykjavik





Workplace location and commuting, Oslo

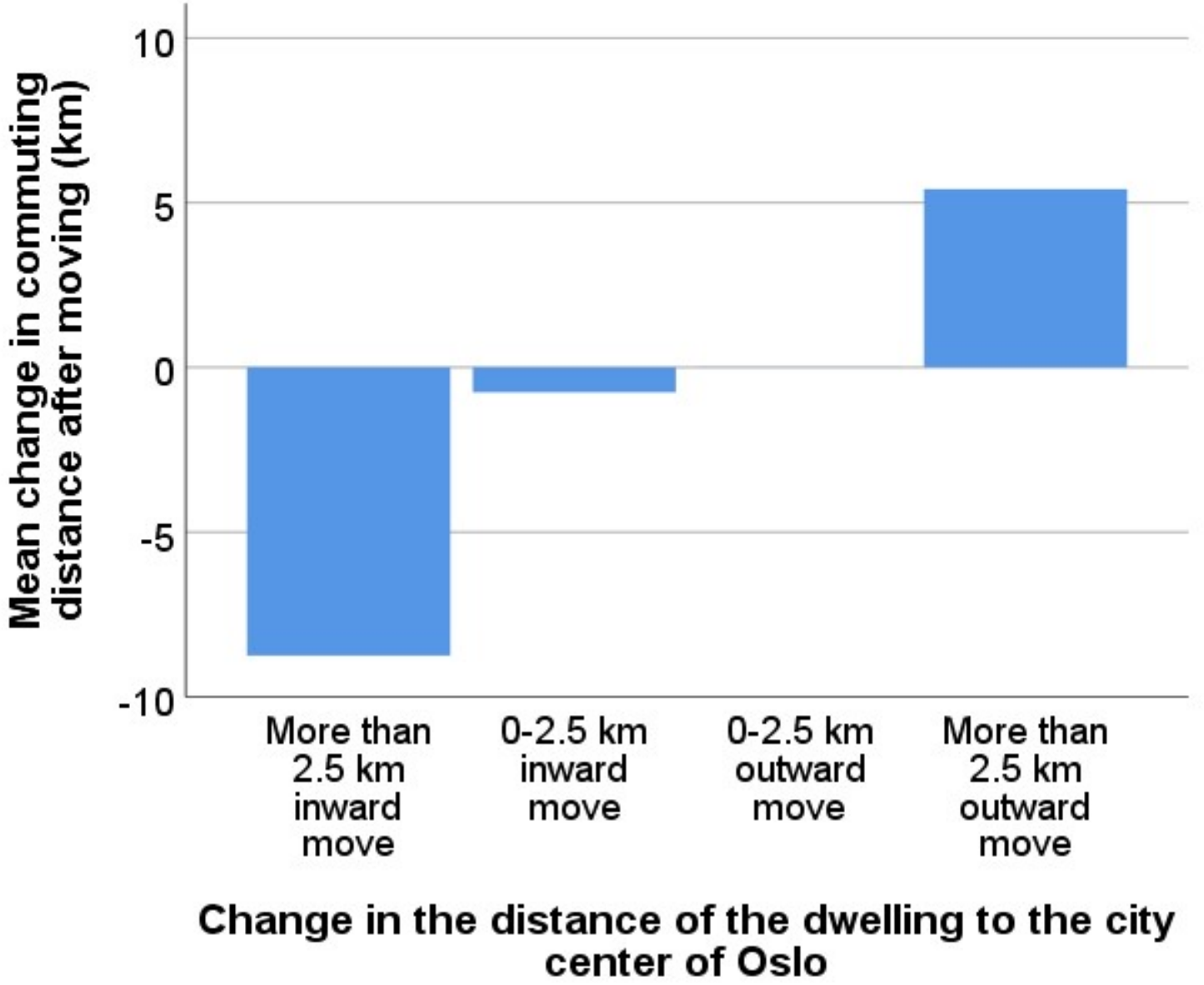




Association of built environment variables with **commuting** variables (controlled for demographic and socioeconomic characteristics of the respondents and for residential preferences) - **Oslo**

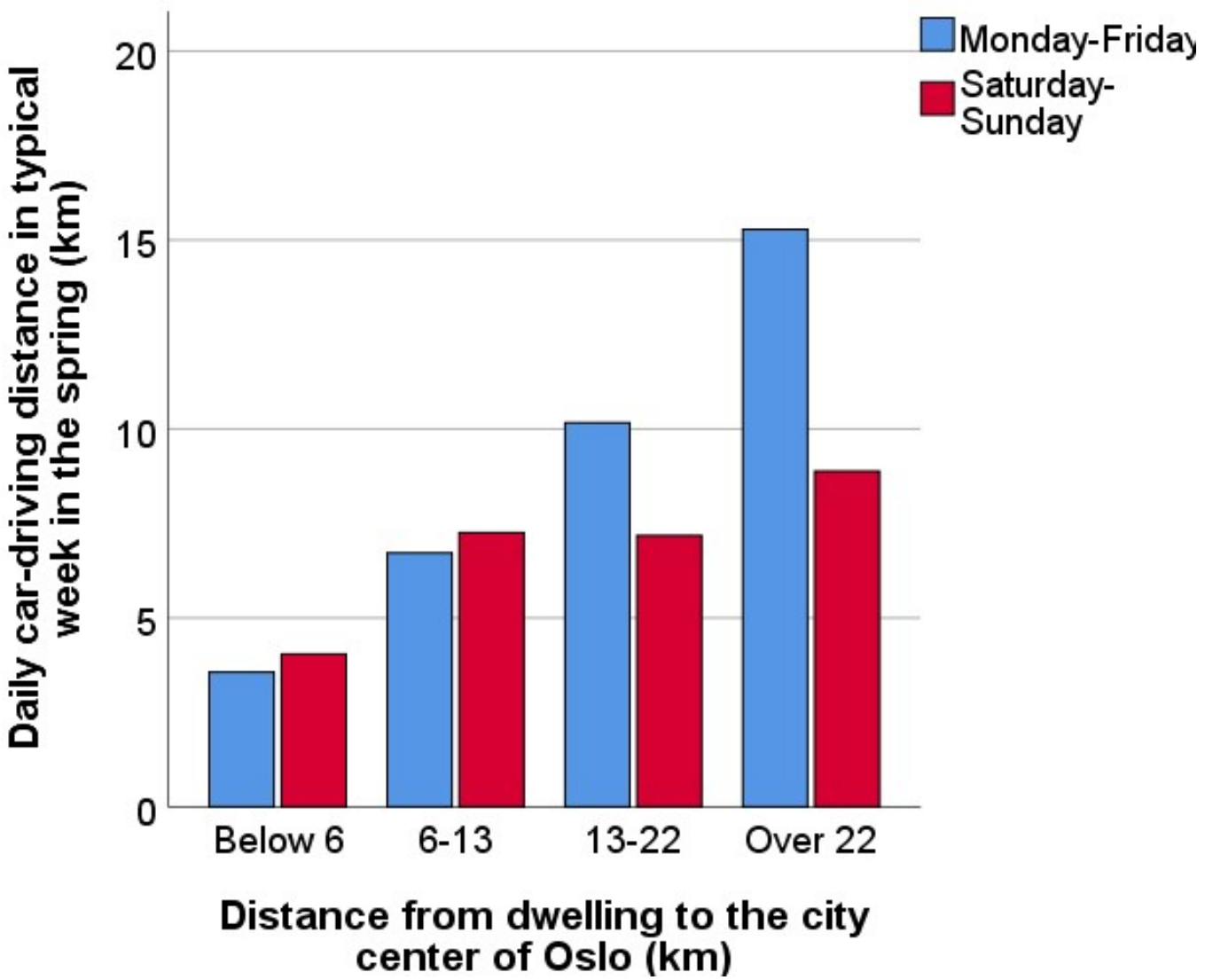
	Commuting **distance**	Regular commuting **mode**		
		Car	Transit	Non-motorized
Distance from dwelling to **Oslo city center**	**Very strong** (Beta=0.461, p=0.000)	**Moderate** (Wald=7.9, p=0.000)	**None**	**Strong** (Wald=36.4, p=0.000)
Distance from dwelling to closest second-order center	**None**	**None**	**None**	**None**
Distance from dwelling to closest **local center**	**None**	**None**	**None**	**None**
Population density in the local area of the dwelling	**None**	**Medium** (Wald=12.3, p=0.000)	**None**	**None**
Distance from **workplace** to **Oslo city center**	**Rather strong** (Beta=0.191, p=0.000)	**Very strong** (Wald=48.7, p=0.000)	**None**	**None**

Changes in commuting distances after moving, Oslo



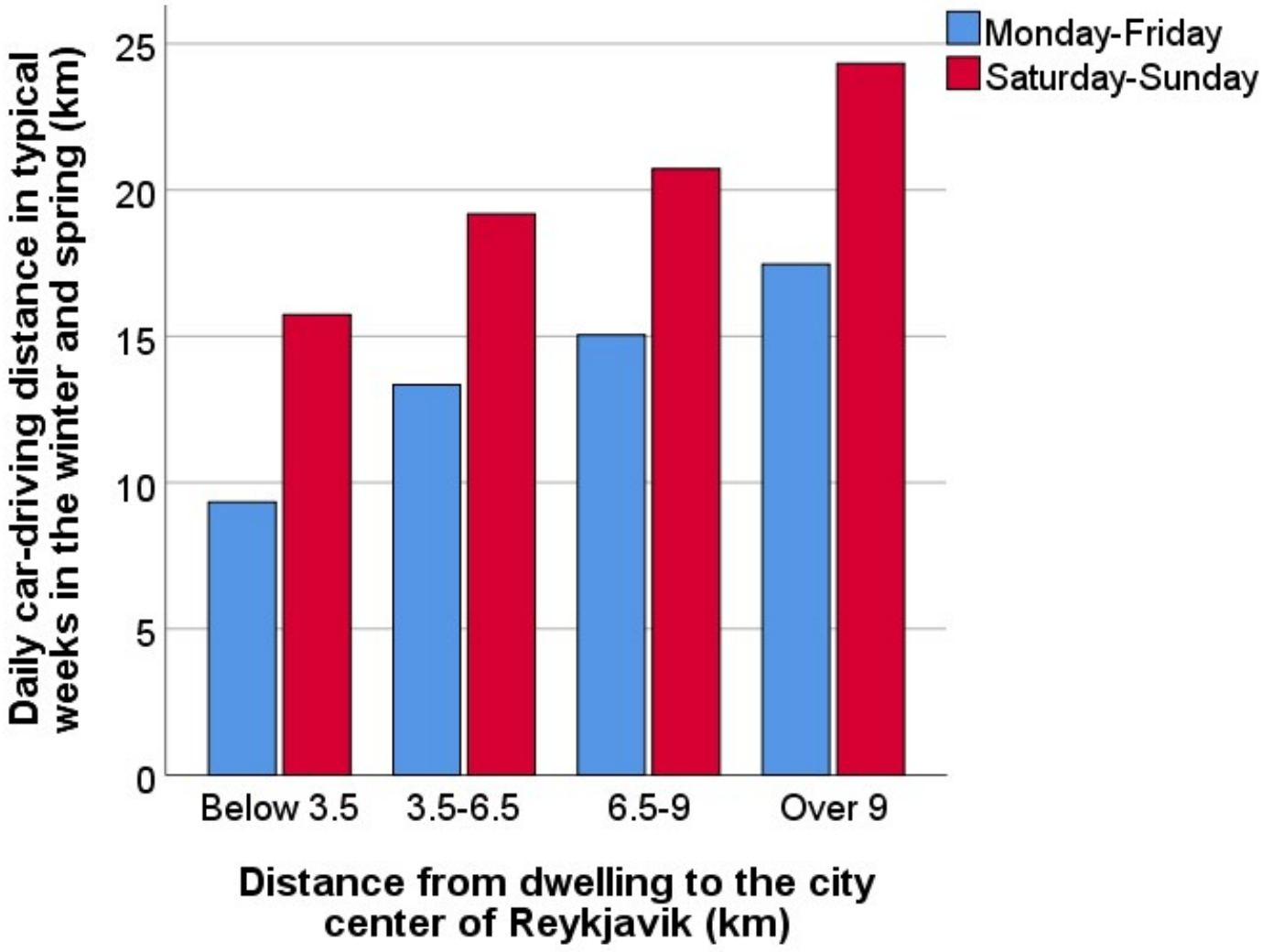
Self-reported car-driving distances, Oslo

(including travel outside the metropolitan area)



Self-reported car-driving distances, Reykjavik

(including travel outside the metropolitan area)

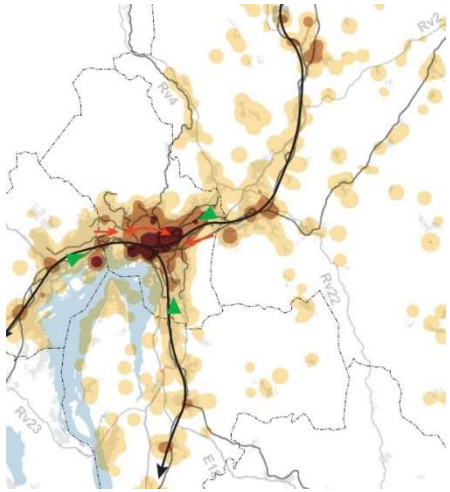


Oslo: Associations of built environment variables with self-reported **car-driving distances** (controlled for demographic and socioeconomic characteristics of the respondents and for residential preferences)

	Monday-Friday	Saturday-Sunday
Distance from dwelling to **Oslo city center**	**Strong** (Elasticity=0.442, p=0.000)	**Rather weak** (Elasticity = 0.130, p=0.054)
Distance from dwelling to closest second-order center	**None**	**None**
Distance from dwelling to closest **local** center	**None**	**None**
Population density in the local area of the dwelling	**Rather weak** (Elasticity = -0.119, p=0.086)	**Rather weak** (Elasticity = -0.116, p=0.031)
Job density in the local area of the dwelling	**Weak** (Elasticity = -0.076, p=0.036)	**None**

Why does the amount of car travel depend more on the distance from the dwelling to the **main city center** than to **local centers**?

- For most travel purposes, most people do not necessarily choose the **closest** facility, but rather they travel a bit further if they can then find a **better** facility. This is especially true as regards **workplaces**.
- Travel distances therefore depend more on the location of the dwelling relative to **large concentrations** of facilities than on the distance to the closest facilities
- People who live **close to the city center** have a large number of facilities within a short distance from the dwelling and therefore do not have to travel long, even if they are very selective as to the quality of the facility
- Since **travel distance**s are often **short**, inner-city residents carry out a higher proportion of trips by **bike** or on **foot**

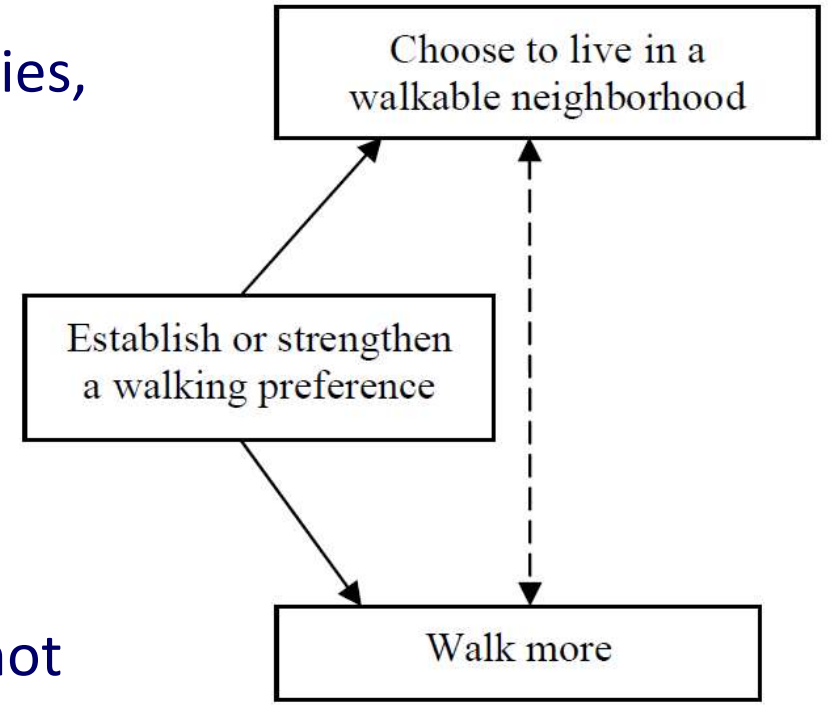


Travel mode choice **rationales** and their implications for inner-city and suburban residents

Rationales for **travel mode choice**	Travel modes encouraged for inner-city residents	Travel modes encouraged for suburban residents
Time-saving	Transit and non-motorized	Car
Convenience	Transit and non-motorized	Car
Limiting travel expenses	Transit and non-motorized	Car
Flexibility	Transit and non-motorized	Car
Avoidance of stress and frustration	Transit and non-motorized	Car
Predictability and control	Transit and non-motorized	Car
Physical exercise	Non-motorized	Non-motorized
Environmental concerns	Transit and non-motorized	Transit and non-motorized
Affective dislike	Varying	Varying
Social contact/communication	Car	Car
Safety	Motorized	Motorized
Caretaking	Car	Car
Obligation	Car	Car

…. but what about attitude-based **residential self-selection?**

- Self-selection in this context refers to "the tendency of people to choose locations based on their travel abilities, needs and preferences" (Cao et al., 2008, referring to Litman, 2005)
- Do suburbanites drive more than inner-city residents simply because they like to drive?
- No - why would people 'self-select' into areas matching their transport attitudes if residential location did not in itself influence travel behavior?
- Moreover, in all our analyses, we controlled for residential preferences



Conclusions

- Residential location **close to the main city center** contributes to **shorter** travel **distances**, **lower** shares of **car** travel and somewhat higher shares of non-motorized travel
- This effect is **particularly strong for commuting**, but exists for **non-work** travel and **overall car-driving** distances as well
- There are also some effects of proximity to **Smaralind** and **local centers** and local-area population **density**, but these effects are **weaker** and apply to **fewer aspects** of travel
- The main patterns found in the Oslo metropolitan area are **very similar to those found in other Nordic city regions** (including Reykjavik) – and also in other corners of the world.

Policy-implications for urban planning aiming to reduce car traffic

- Avoid urban sprawl – locate new residential development within already urbanized areas
- Densification through redevelopment and transformation of inner-city areas (e.g. derelict industrial land and superfluous traffic areas) is particularly favorable
- Polycentric development around suburban transit nodes is better than suburban sprawl, but has clear limits compared to inner-city development – unless people are denied the opportunity of free choice within the metropolitan labor and service market