

Spatial Mobility in ‘High-Speed-Societies’: Study of Generational Differences with Mobile Phone Data



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Introduction

- Spatial mobility is one of the most important constituents of everyday life.
- In the era of “high-speed societies” the **individual ability to be mobile or change the habitual mobility** has turned out to be an essential individual capital.
- Not all individuals are able to **keep up with these “social accelerations”**.
- Previous studies have analysed the patterns of activity spaces and mobility by gender, ethnicity, income, socio-economic status. There are only scarce studies concentrating on **age differences in patterns of activity spaces**.

Objective

... to focus on differences in activity spaces of various generational groups.

1. What kind of age differences can be observed in the **number and distance of visited locations** in Estonia and abroad?
2. What are the differences in activity spaces of **spatially active and less active individuals**?
3. What kind of age differences can be observed **in the geography of activity locations**?

Activity space approach

- Activity space as **physical locations** individuals have visited in certain time period.
- **Needs for mobility may change** during various time periods and across life course.
- Three types of factors when **explaining the variation in the activity places**:
 - **external factors** (e.g. existence of personal vehicle, number of working hours, location of residence, social network, uses of ICT),
 - **socio-economic factors** (gender, age, income, education, occupation),
 - **human internal factors** (habits, values, preferences, attitudes, prejudices).
- **Increased speed in contemporary societies** as one of the most essential social transformations (Rosa, 2010); ability to be mobile as an essential resource in “high-speed-societies”.

Generational differences in activity spaces

- Studies mainly concentrate on **social-chronological margins**, but rarely connect them directly.
- **Differences in activity spaces among generations** could mainly be explained through three dominant theories:
 - **individual lifetime** approach - age as a life span from birth to death (focusing foremost on external factors);
 - **life-course** approach - human development and life experiences during different stages of the life (e.g. activity in labour market, parenthood, retirement) (e.g. Elder, 1975);
 - **socio-historical theory** - individuals' birth year as their spatio-temporal starting point (Mannheim, 1997; Corsten, 1999).
- **Spatial mobility as social transformation process** (Castles, 2010) individuals' ability to be mobile acquired during socialization within a particular spatio-temporal social context.

Data: Passive mobile positioning

- **Call Detail Record (CDR) database**
- Biggest Estonian mobile operator Telia, market share 39% (2015).
- 96% of the population of Estonia use mobile phones.
- Telia's network covers 99.9% of the country.
- Data management by 



Data: Passive mobile positioning

Residents of Estonia when they were in Estonia

Outgoing call activities

- ID
- Time (accuracy by second)
- Location: network cell

ID

Residents of Estonia when they were abroad

Incoming and outgoing call activities made abroad via the roaming service.

- ID
- Time (accuracy by second)
- Location: country

- Language, gender, year of birth
- Calculated home anchor-points (Ahas et al. 2010)

Individuals of the study

- **Period:** one-year from January to December **2014**.
- The study involves all people who met the following **criteria**:
 - age 20 years and more, user language Estonian or Russian, gender and place of residence are known, call activities are in whole study period.
- There were **95 489 people** who met these criteria.
- The **profile of the people** differs a little compared to whole population of Estonia based on census 2011.
 - **Youngest and the oldest age groups** are somewhat under-represented and the middle age groups over-represented in the study.
 - The proportion of **women** is little bit higher.
 - **Estonian-speakers** are overrepresented .

Age groups

- **20-29-year-olds** (born 1985-1994), students or in the initial phase of their career, mostly born and grown up in the period after Estonia regained independence;
- **30-39-year-olds** (born 1975-1984), mainly engaged in working and raising children, born in the end of Soviet time and formative years in the period after Estonia regained independence;
- **40-49-year-olds** (born 1965-1974), mainly in the active phase of their career, experienced diverse social circumstances during their formative years;
- **50-59-year-olds** (born 1955-1964), mainly engaged in work, formative years in the Soviet period;
- **60-69-year-olds** (born 1945-1954), many of them being pensioners, formative years in the Soviet period.
- **70+-year-olds** (born 1944 or earlier), mostly being economically inactive pensioners, formative years in the Soviet period.

Methods

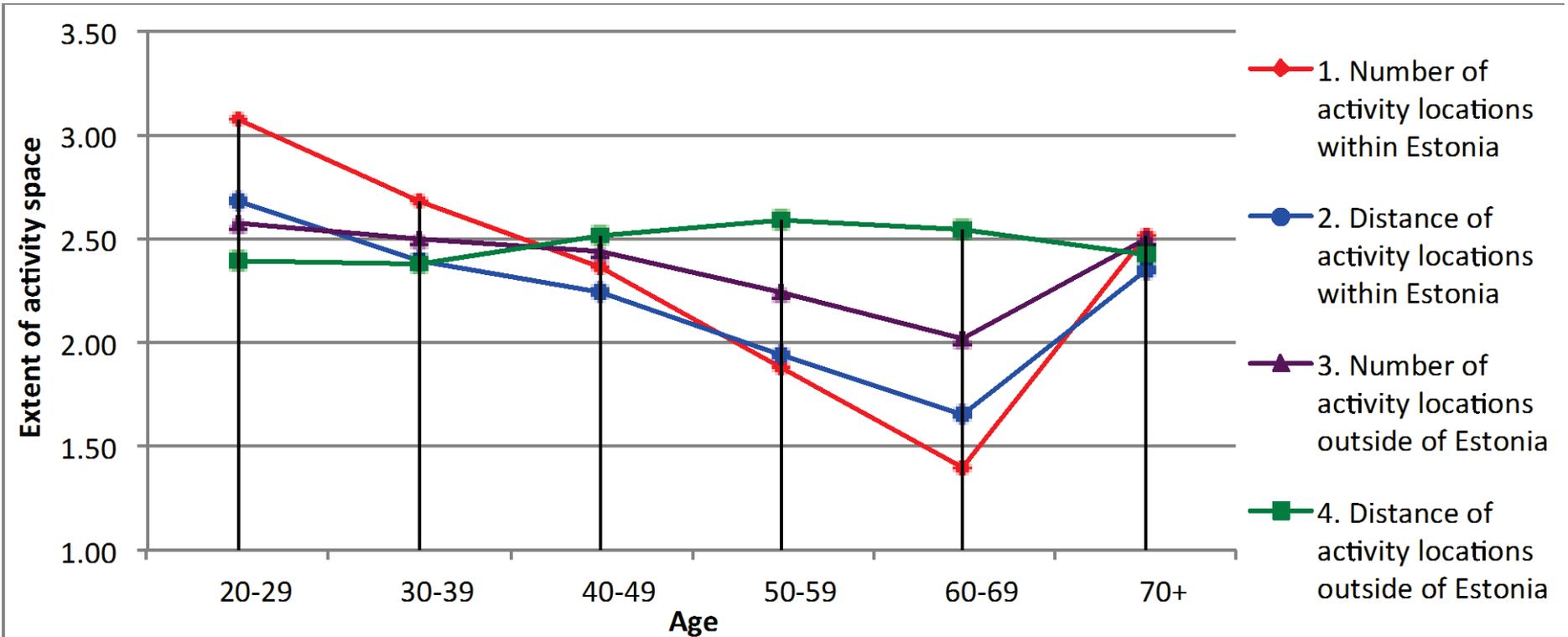
- **Two main indicators:** number and distance of activity locations.
- These two dimensions are measured both **within and outside of Estonia.**

Indicators	Variables
1. Number of visited locations within Estonia	1.1. Number of unique activity districts
	1.2. Number of anchor points districts on three months and more
2. Distance of visited locations within Estonia	2.1. Average distance of unique activity districts from place to residence
	2.2. Monthly average distance between work and place of residence
3. Number of visited locations outside of Estonia	3.1. Number of trips abroad
	3.2. Number of countries visited
4. Distance of visited locations outside of Estonia	4. Distance between capital cities of the countries one has visited abroad

Methods

- The values of each of these single variables were **divided into quartiles** (values 1-4).
- **General linear model**
 - Model I - model with only age as a variable.
 - Model II - full model.
- Differentiated **spatially active and less active individuals** (the highest and lowest quartiles).
- **Binary logistic regression**
 - Spatially active and less active individuals are compared to those having average spatial activity (2nd and 3rd quartiles).

Extent of activity space by age



- The **extent of activity space declines linearly** with age. Spatial activity is steeply increasing among the oldest group (70+).
- Extent of **activity space outside of national territory has remained more stable** along the life course.

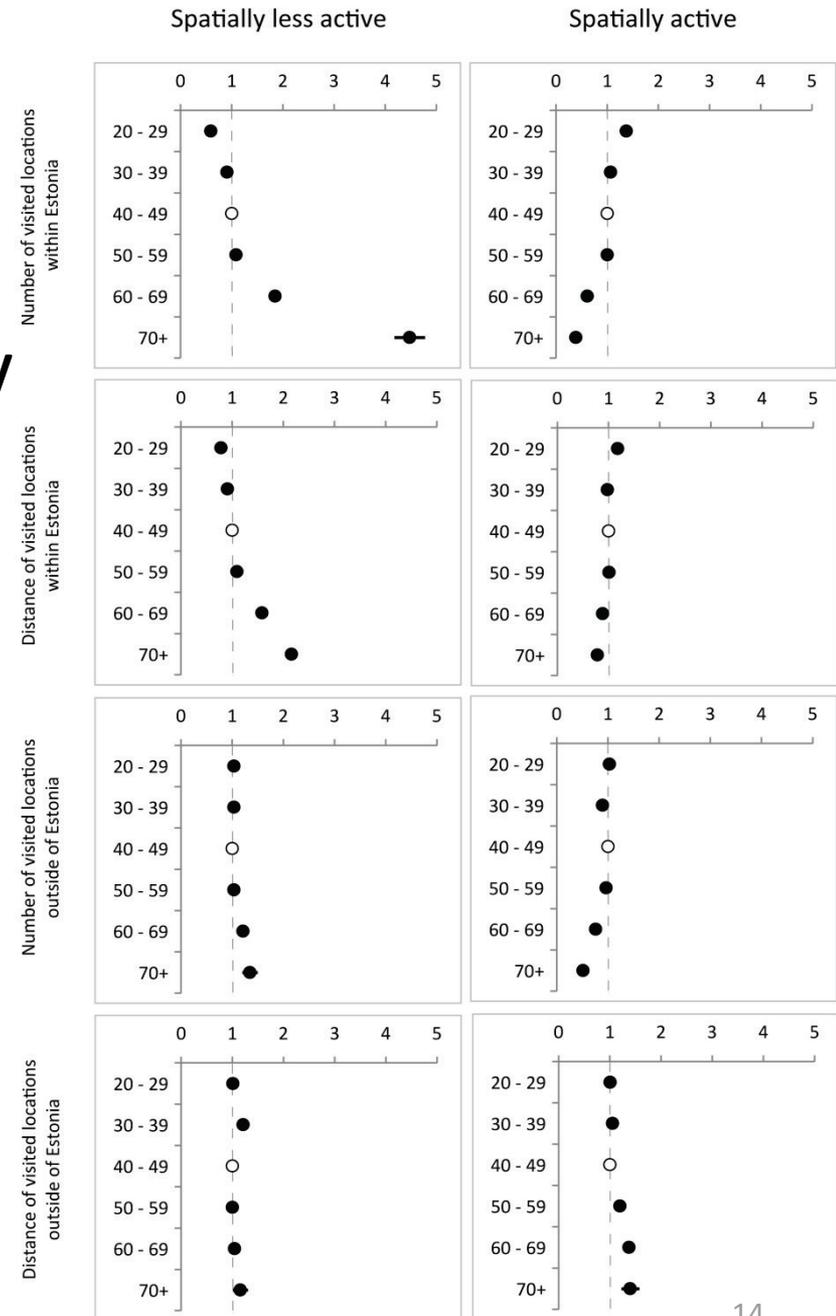
Extent of activity space by age, controlled by background variables (B, sig.)

	1. Number of visited locations within Estonia (B, sig)	2. Distance of visited locations within Estonia (B, sig)	3. Number of visited locations outside of Estonia (B, sig)	4. Distance of visited locations outside of Estonia (B, sig)	5. Visits outside of Estonia (Exp B, sig)
Age 20-29 (ref. 40-49)	0.225***	0.154***	0.009	-0.005	1.238***
30-39	0.049***	0.021**	-0.048***	-.065***	1.017
50-59	-0.022***	-0.039***	-0.018	.076***	0.937***
60-69	-0.286***	-0.233***	-0.159***	.142***	0.613***
70+	-0.532***	-0.400***	-0.322***	.102***	0.266***

- Regression analysis confirms that there **are significant differences in the extent of the activity space among various age groups**, even when other available background variables are included in the model.

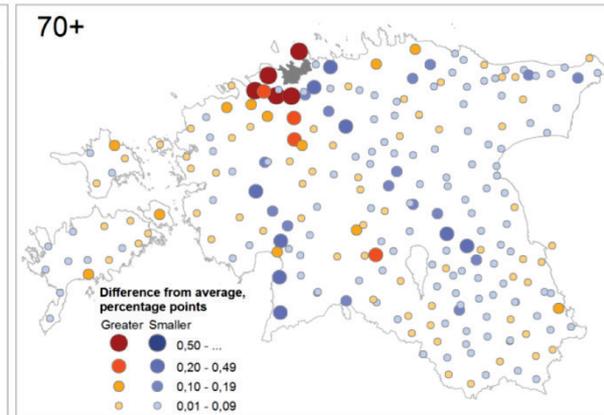
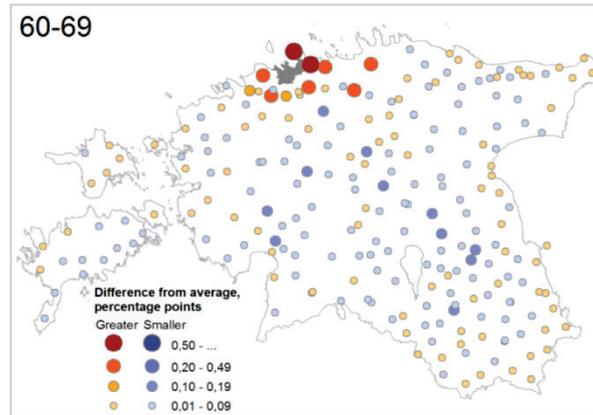
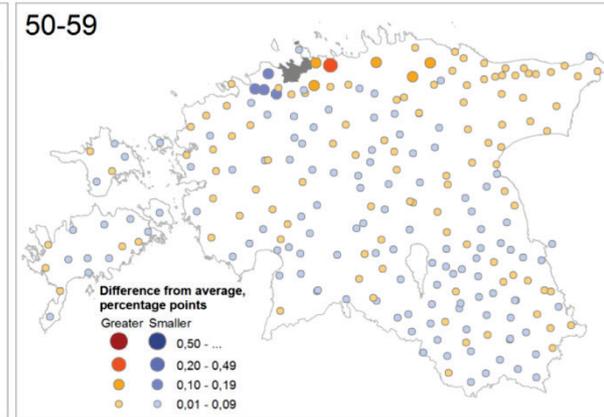
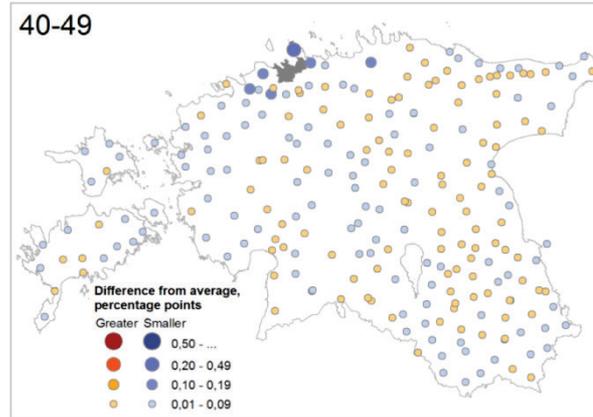
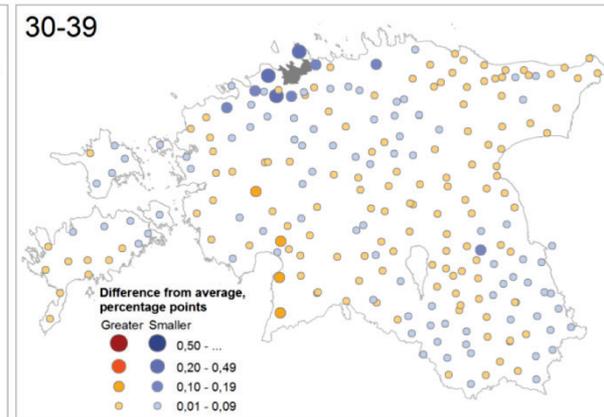
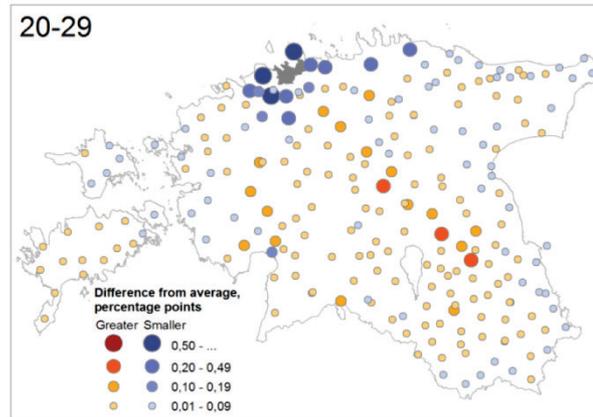
Differences of spatially active and less active individuals

- **Estonian-centred spatially active youth and outside of Estonia-centred spatially active older age groups.**
 - **The youngest age group** → high level of activity within Estonia (number and distance of activity locations).
 - **The older age groups** → spatial activity outside of Estonia (distance of activity space).
- **The oldest age group is more often in the spatially less active group** (8x more than in the youngest group), regarding both the number and distance of activity locations.

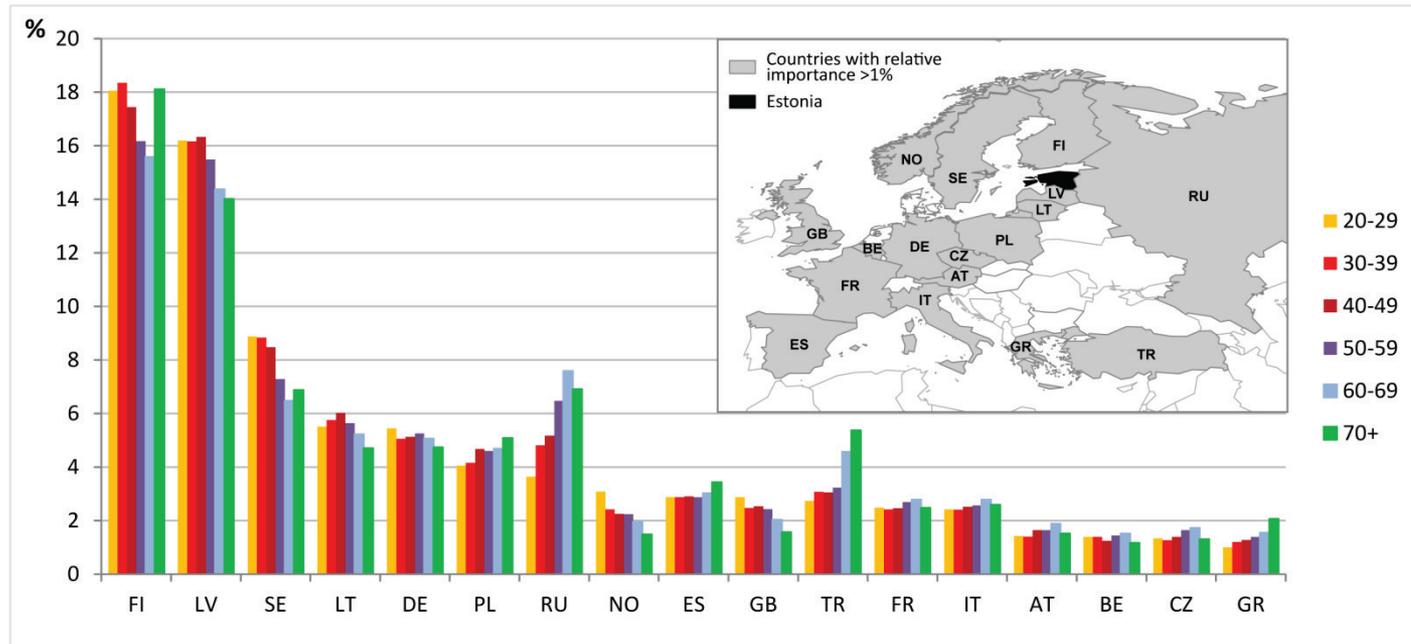


Geographical differences of visited districts

- Younger age groups' spatial activity more widespread (higher number of places).
- Middle age groups (30-49) → similar to the age groups' average.
- The people aged 50-59-years → more districts in the east of the Tallinn and in north-eastern Estonia.
- Older age groups → more districts around the capital city.



Relative importance of countries



- **Linearly decreasing** by age - Latvia, Great Britain, Norway.
- **Linearly increasing** by age - former post-soviet countries (Russia, Poland), Southern-European countries (Spain, Turkey, Greece).
- Similarly often **visited both by younger and older age groups** - Finland and Sweden.
- **Differences** across age groups **very small** - Germany, Belgium.

Conclusions

- The **decline in activity spaces with age**, that could be explained by the life course effect.
- Unlike to previous studies (Frändberg & Vilhelmson, 2011) **decline in activity space foremost within national territory.**
 - Cross-border activities are mostly leisure-related, therefore less dependent on the life course events, but more dependent on the individual lifestyle, or on available economic, social, cultural etc. resources.
- Decrease in activity space and **new mobility practices after retirement** (Westin & Vilhelmson, 2011; Kraft, 2014), but with heterogeneity and international focus.
- Certain generational patterns of **‘delayed mobility’** among older generations (Popov, 2012) and new **‘immobility culture’** among younger generations (see also Berg et al. 2014) in the transition society.

Limitations

- This study is not free of limitations - spatial behaviour based on mobile positioning data depends on the **mobile phone usage**.
- The **accuracy of the activity space measurements** across age groups may differ across the indicators (activity spaces within or outside of national territory, the number of and distance between visited locations).
 - Similarly to previous studies (Yuan, Raubal, & Liu, 2012) the movements recorded are in some degree more random and less predictable among **youngest age groups** (i.e. the correlation between call activity and distance of visited locations being weaker).
 - Spatial movements recorded with mobile phones are in some degree more random and less predictable **regarding distance of visited international locations**.

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