

METHODS AND TECHNIQUES OF SPATIO-TEMPORAL DYNAMICS RESEARCH

Ondřej Muříček

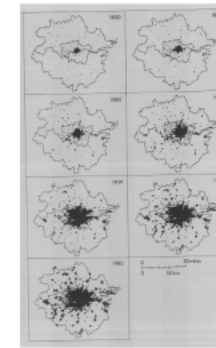
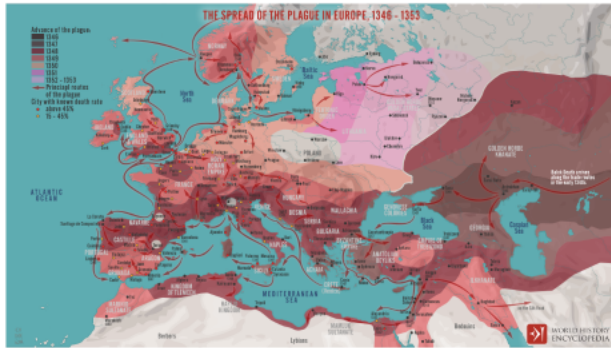


Global change research methods - Human Geography

SPATIO-TEMPORAL DYNAMICS ?

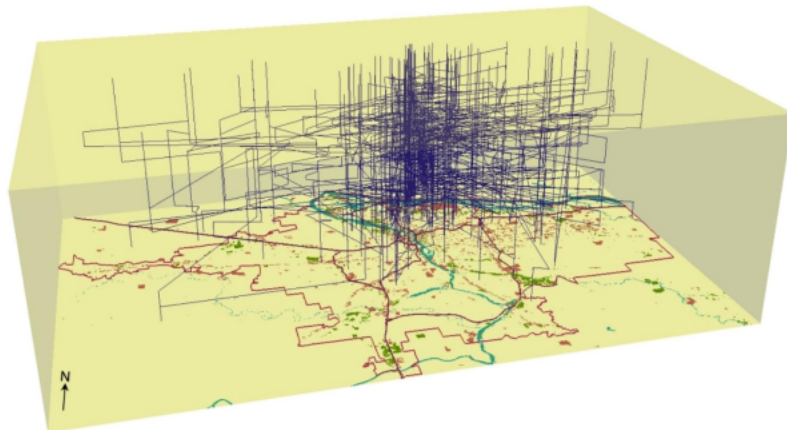
several perspectives on the subject in the context of human geography:

1 diffusion / expansion of a phenomenon in time and space

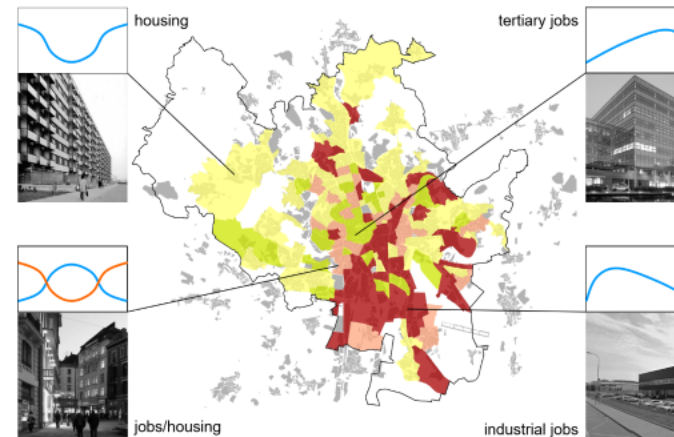


- development series / sequence of states of a given phenomenon

2 mobilities

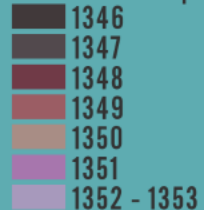


3 rhythms of places

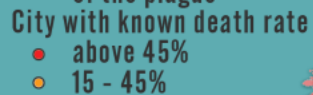


THE SPREAD OF THE PLAGUE IN EUROPE, 1346 - 1353

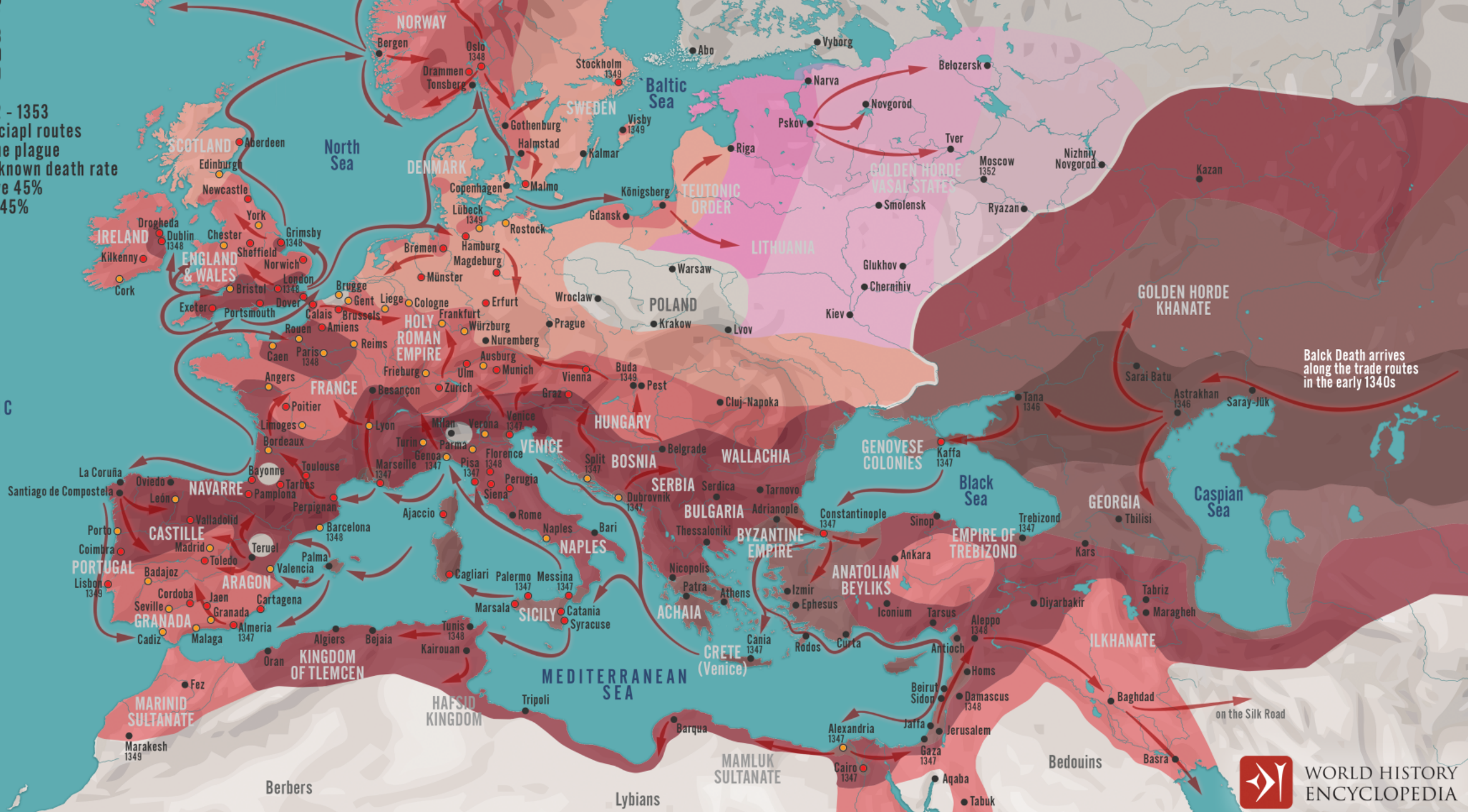
Advance of the plague:



Principi routes of the plague



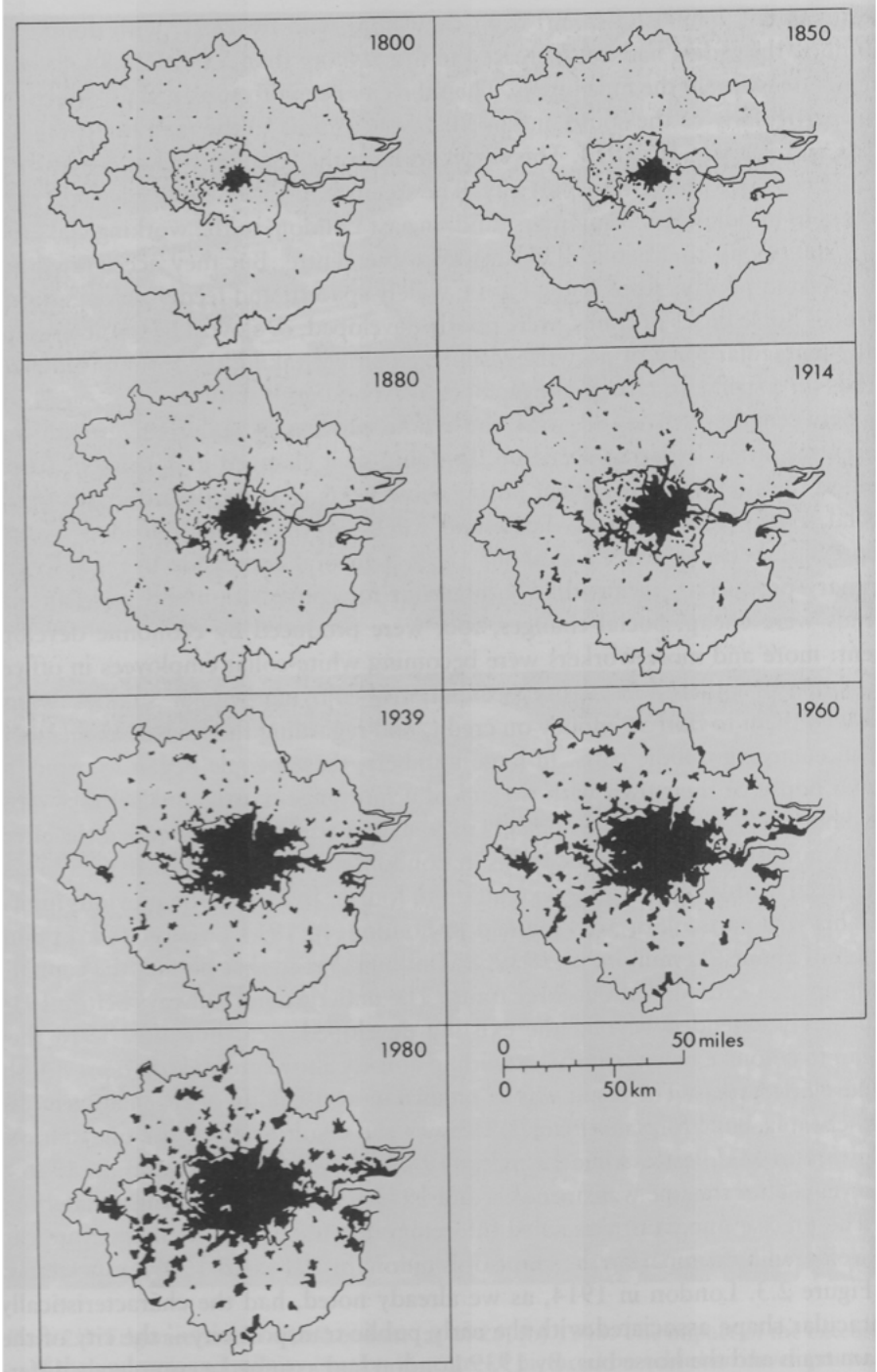
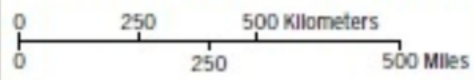
ATLANTIC OCEAN



EUROPE: SPREAD OF THE INDUSTRIAL REVOLUTION
0 250 500 Kilometers
0 250 500 Miles



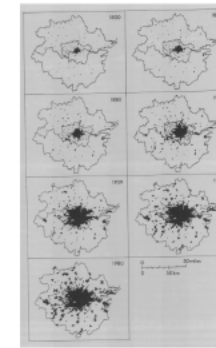
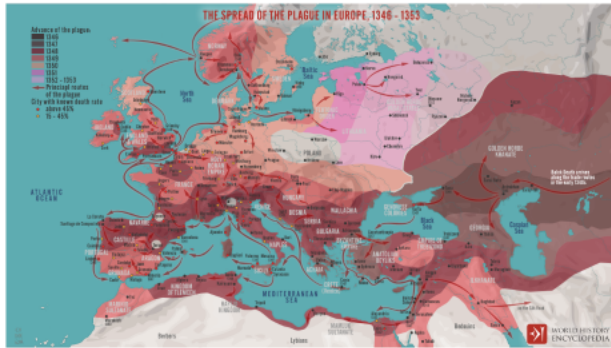
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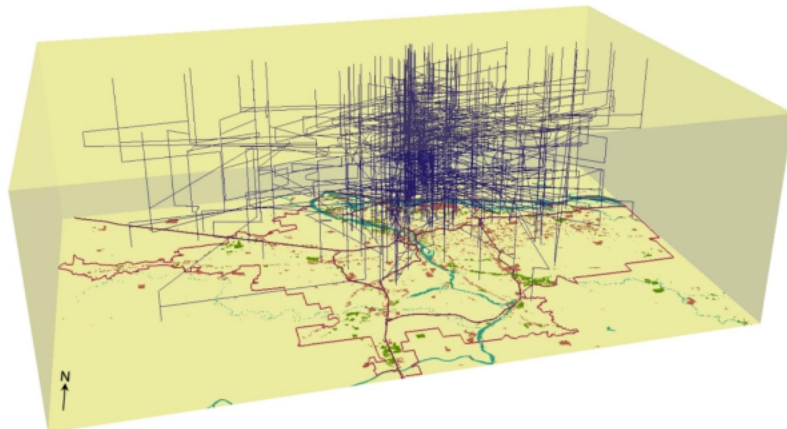
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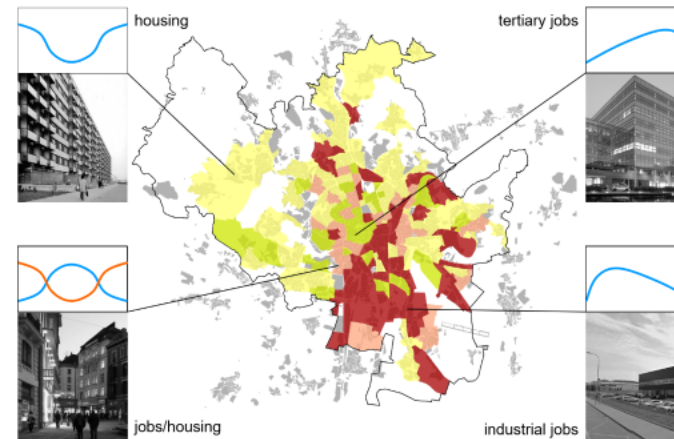


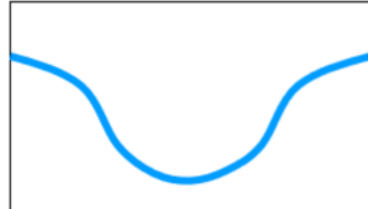
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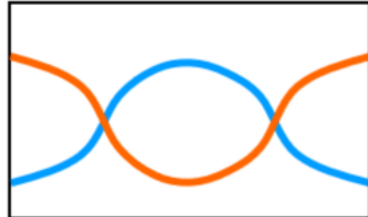
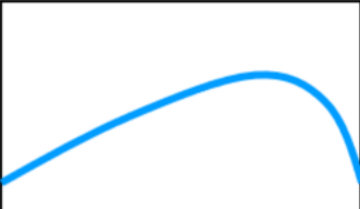




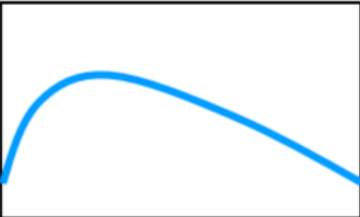
housing



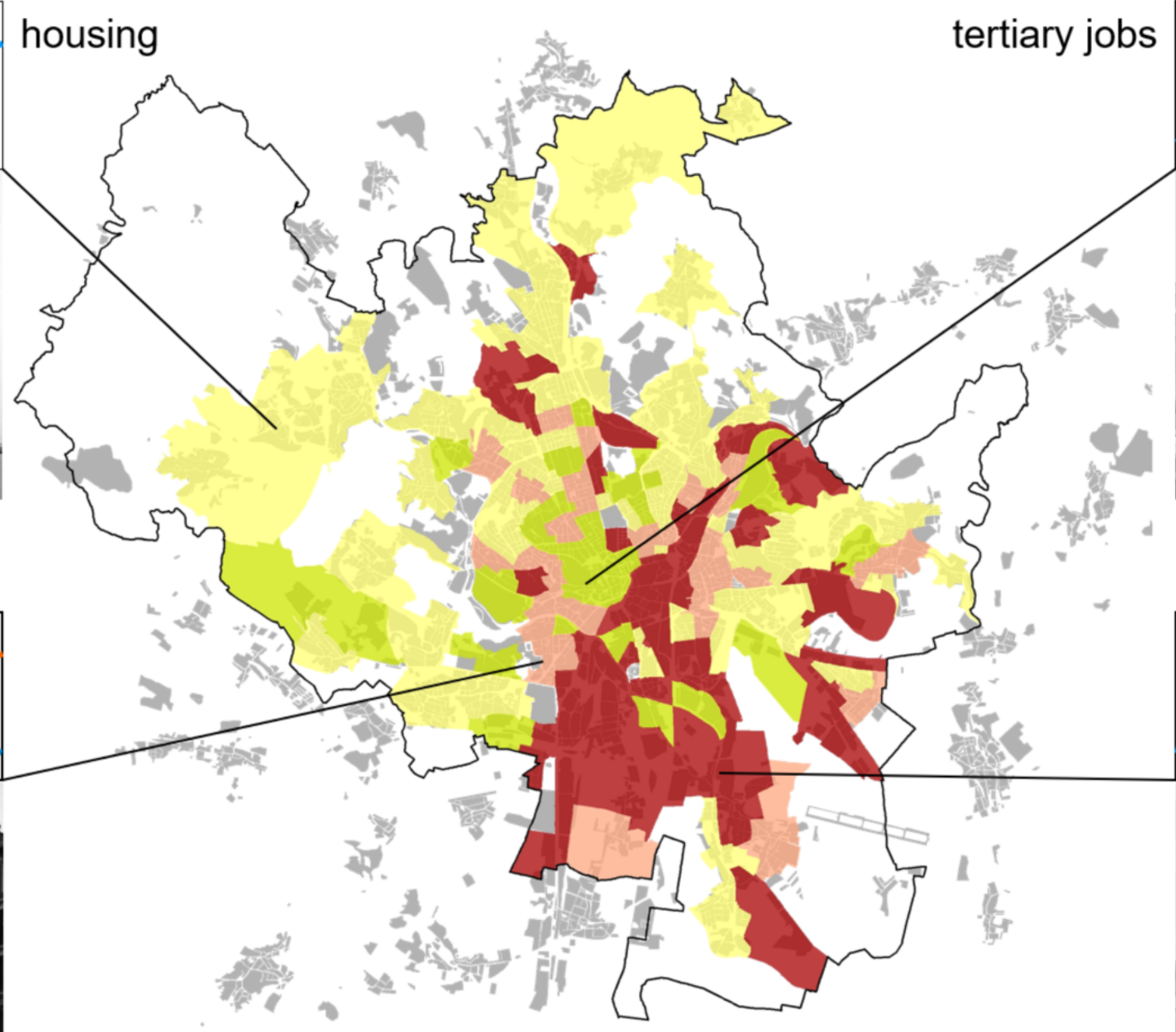
tertiary jobs



jobs/housing



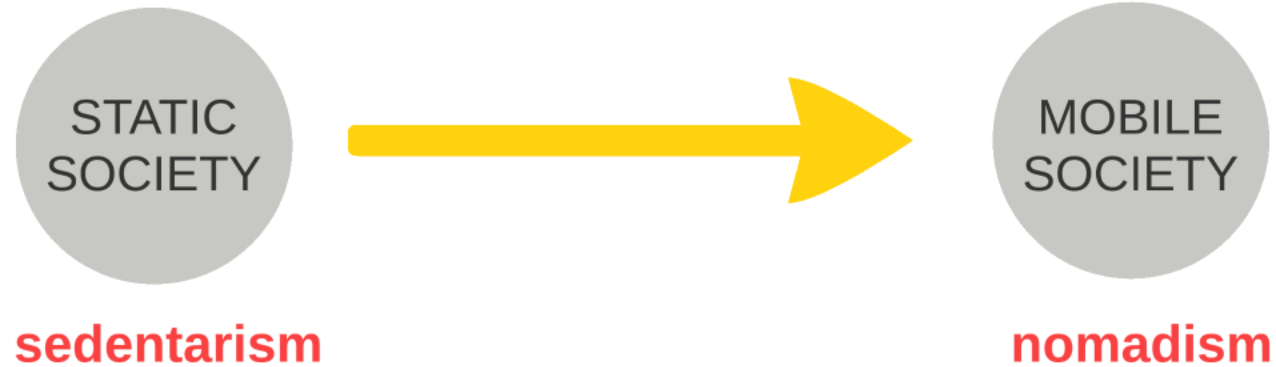
industrial jobs



UNDERSTANDING MOBILE SOCIETY

functioning of contemporary society is based on flows and movements of people, artefacts, capital, information and signs on different social and geographical scales

physical movements | digital relations | communication



the new mobility paradigm (Urry & Sheller)

including social and cultural practice in the study of mobilities / movements

adding new dimensions, approaches and methodologies to **doing "mobility" research**

from where to where? how long? what distance for how much? at what speed?

+

motivation? feelings? contexts? risks?

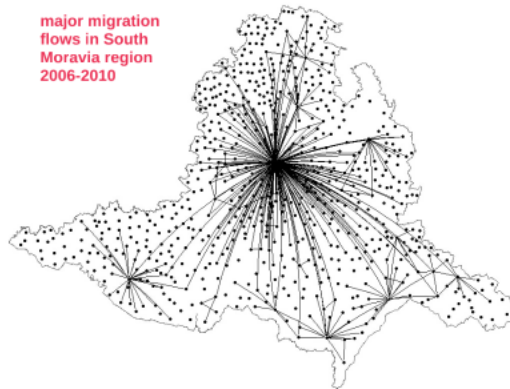
TYPES of MOBILITIES

"irreversible" flows

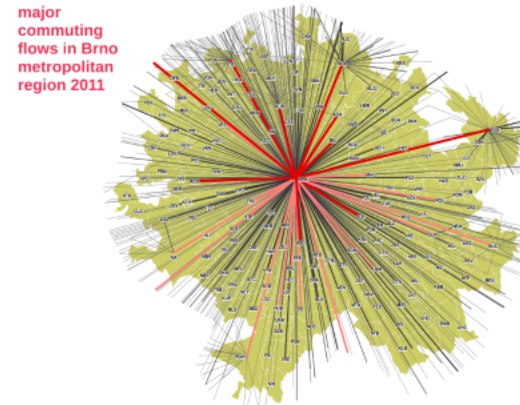
reversible flows / circulation

other movements / rhythms

MIGRATION



COMMUTING



OTHER EVERYDAY MOBILITIES



number of shoppers on a typical Monday in Vankovka shopping center

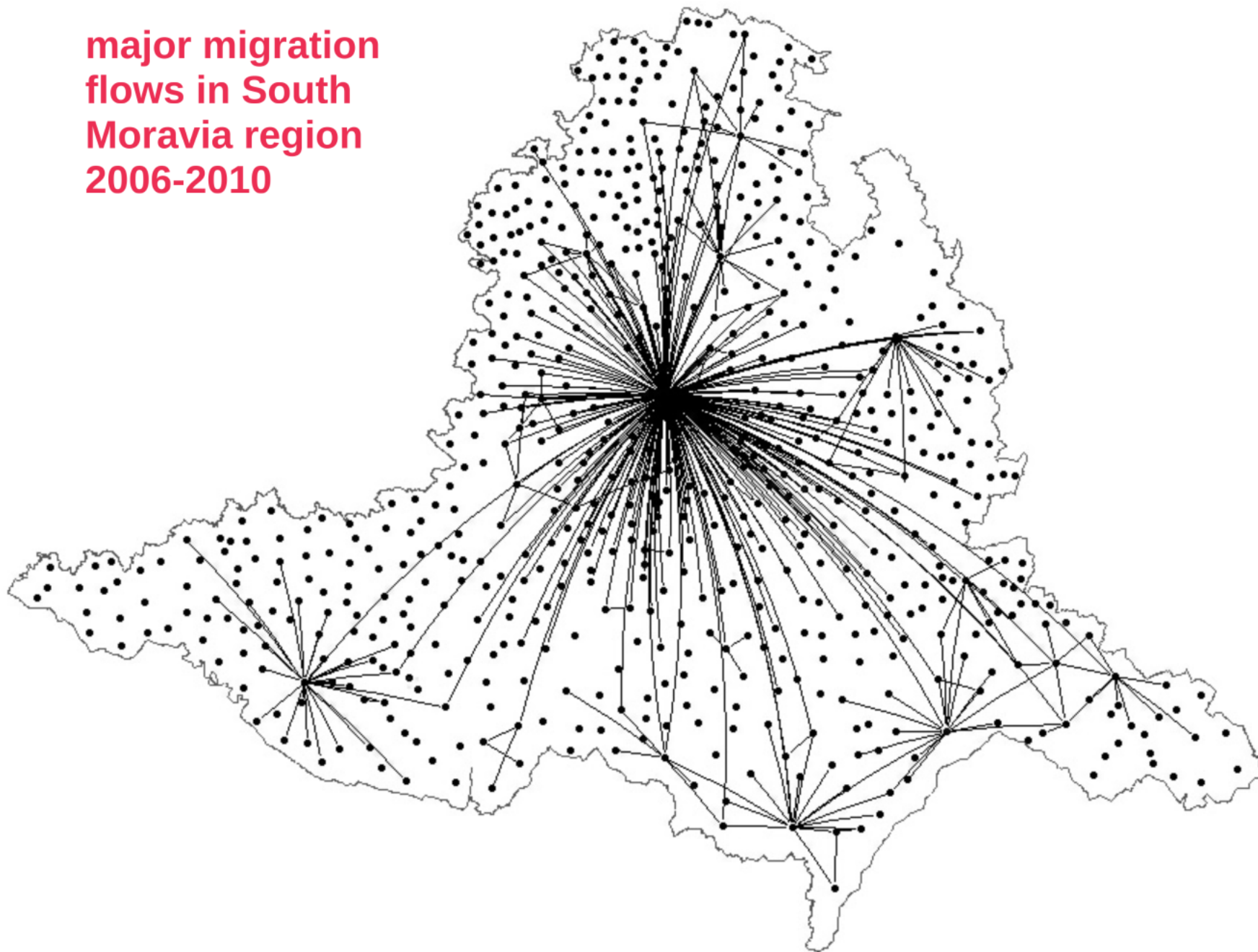
large differences in data availability and validity

relatively available migration data - the problem is often capturing migration between smaller spatial units (intra-urban migration)

limited access to commuting data - often only through censuses; emphasis on work commuting

lack of data describing small, irregular or semi-regular movements for services, leisure activities, family, etc.

major migration
flows in South
Moravia region
2006-2010



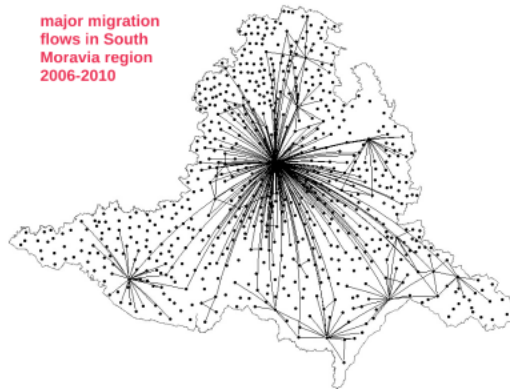
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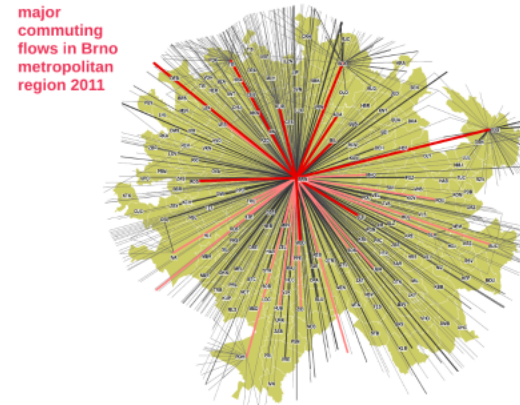
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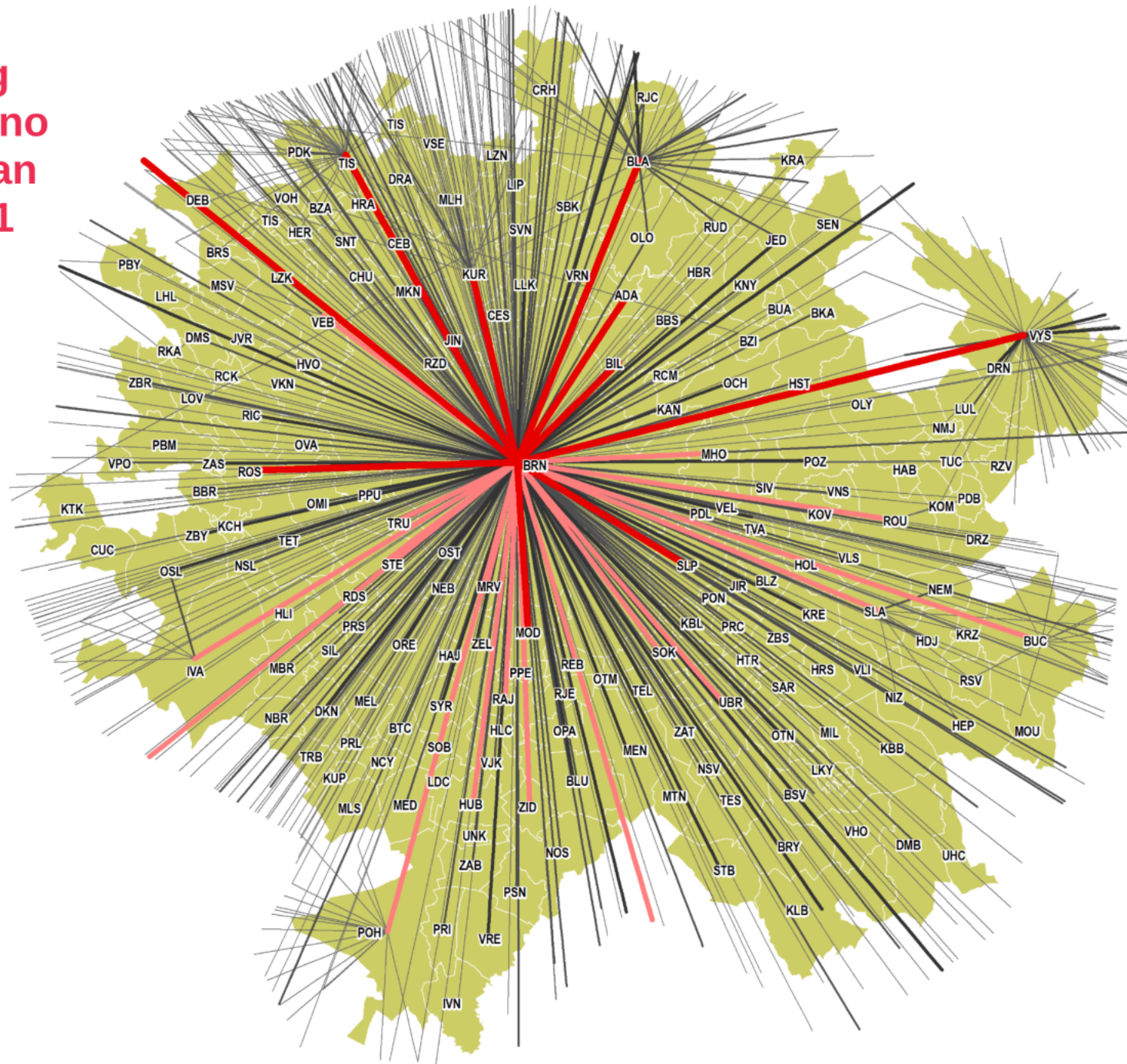
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major commuting flows in Brno metropolitan region 2011



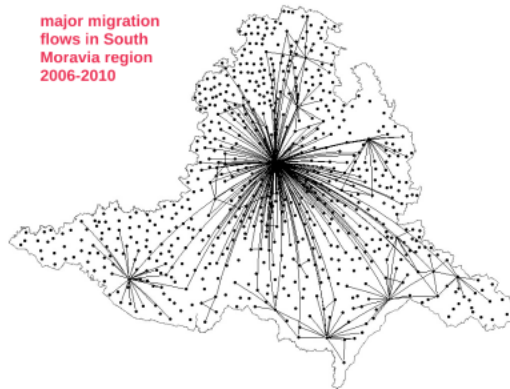
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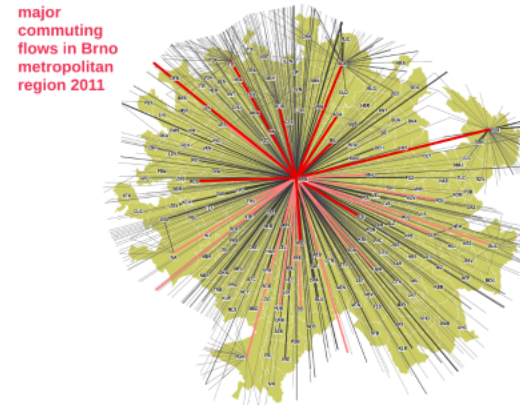
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EVERYDAY MOBILITIES

in SPACE where?

geography | town planning

spatial extent of **activity spaces & daily (urban) systems**

anchor points

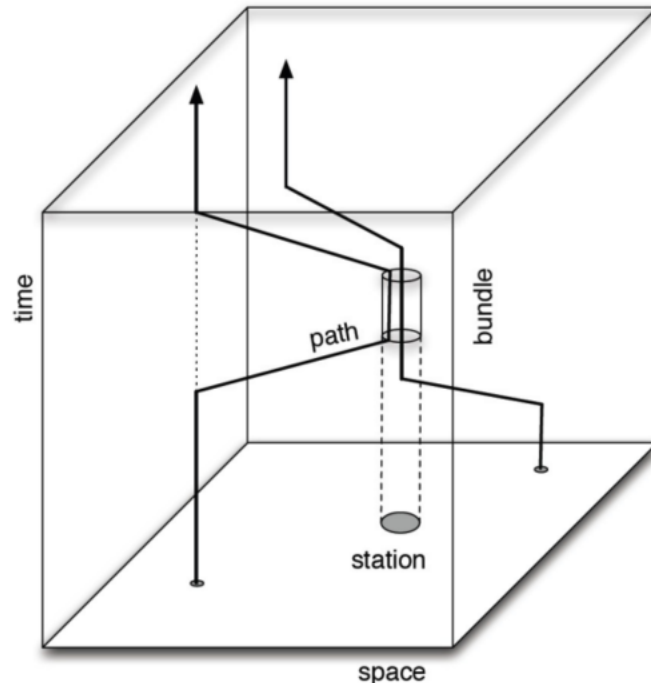
in TIME when?

time geography | temporal planning?
chronourbanism?

timing and rhythms of daily practices

pacemakers

very often, **WHERE** is defined by **WHEN** and vice versa



Hägerstrand's time-space aquarium

authority constraints

rules, timetables, conventions

coupling constraints

coordination - synchronization / synchorization

capability constraints

biological / cognitive / technological limits

MOBILITY DATA

generated by researcher through surveys, interviews and experiments

travel diaries **place observation**
go-along research **questionnaire survey**

generated by subjects outside the research - external resources
(statistical offices, government authorities,...)

commuting statistics **timetables**
transportation records

data with only an indirect link to mobility - must be interpreted appropriately

mobile phones locational data **social networks data**
operational data of branch companies
(occupancies, activities)

TRAVEL DIARIES

individual mobility records in the form of a structured diary (sequential order)
generating "micro-data"

travel diary

start time/point

end time/point

distance

travel mode

purpose of the trip

other comments?

time-use diary

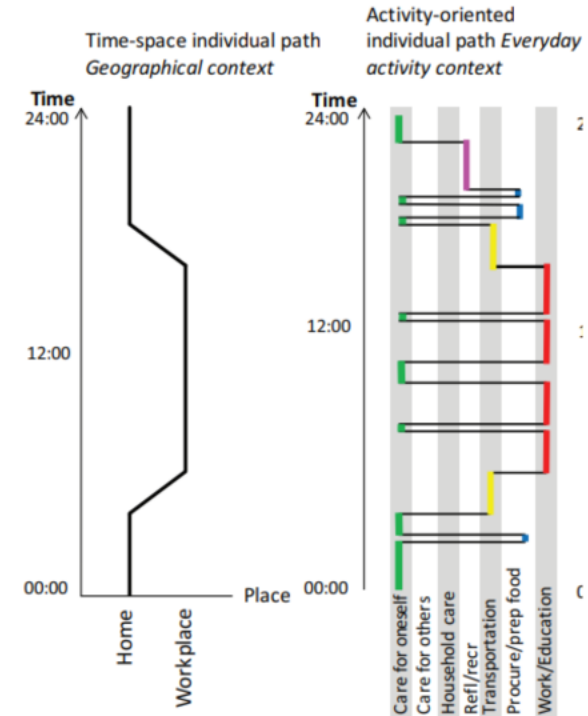
time

place / locale

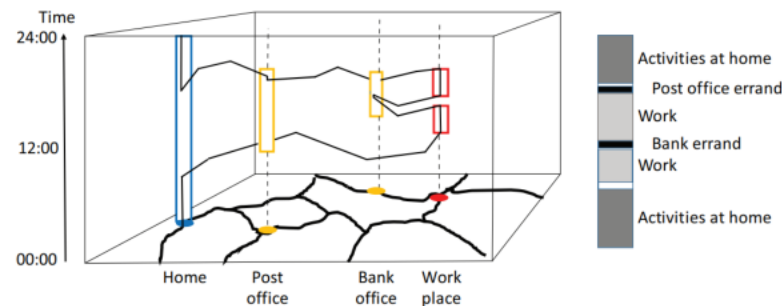
activity

with whom?

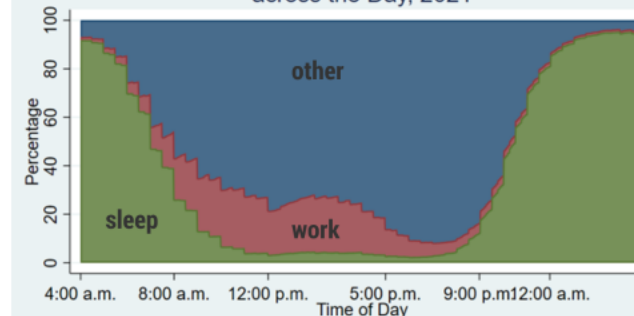
other comments?



various possibilities of visualisation



tempogram Work, Sleep, and Other Activities across the Day, 2021

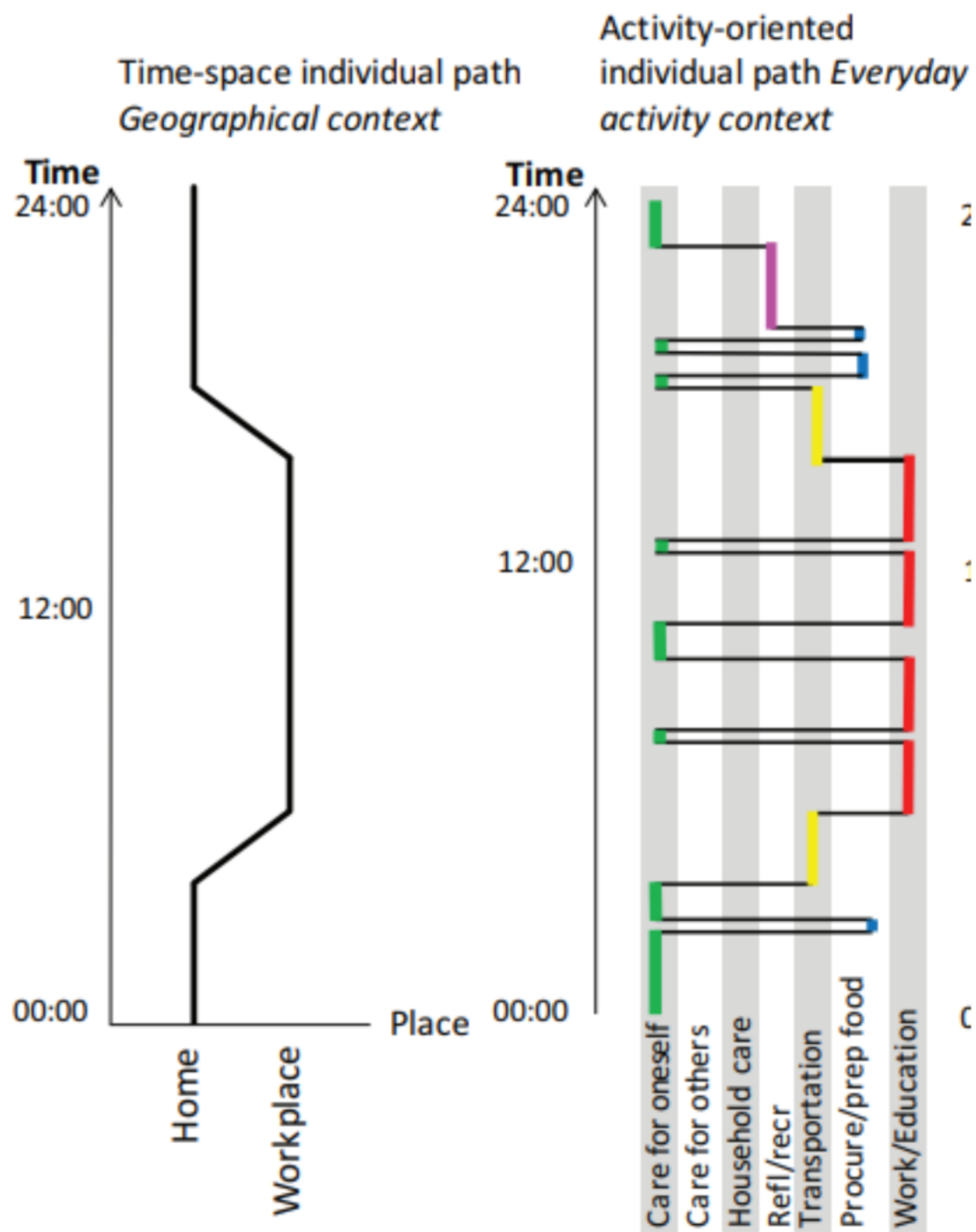


se diary

cale

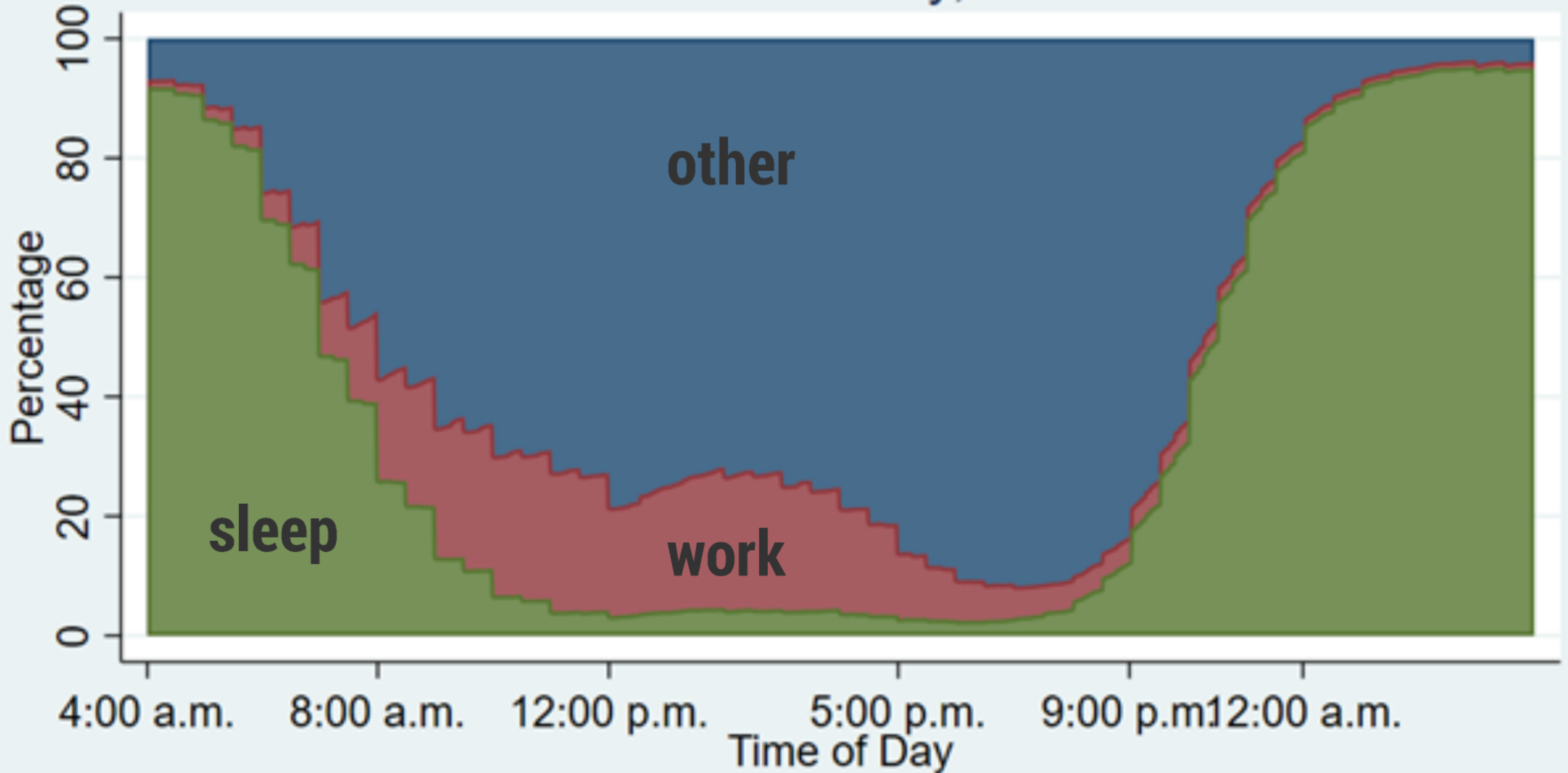
m?

nments?

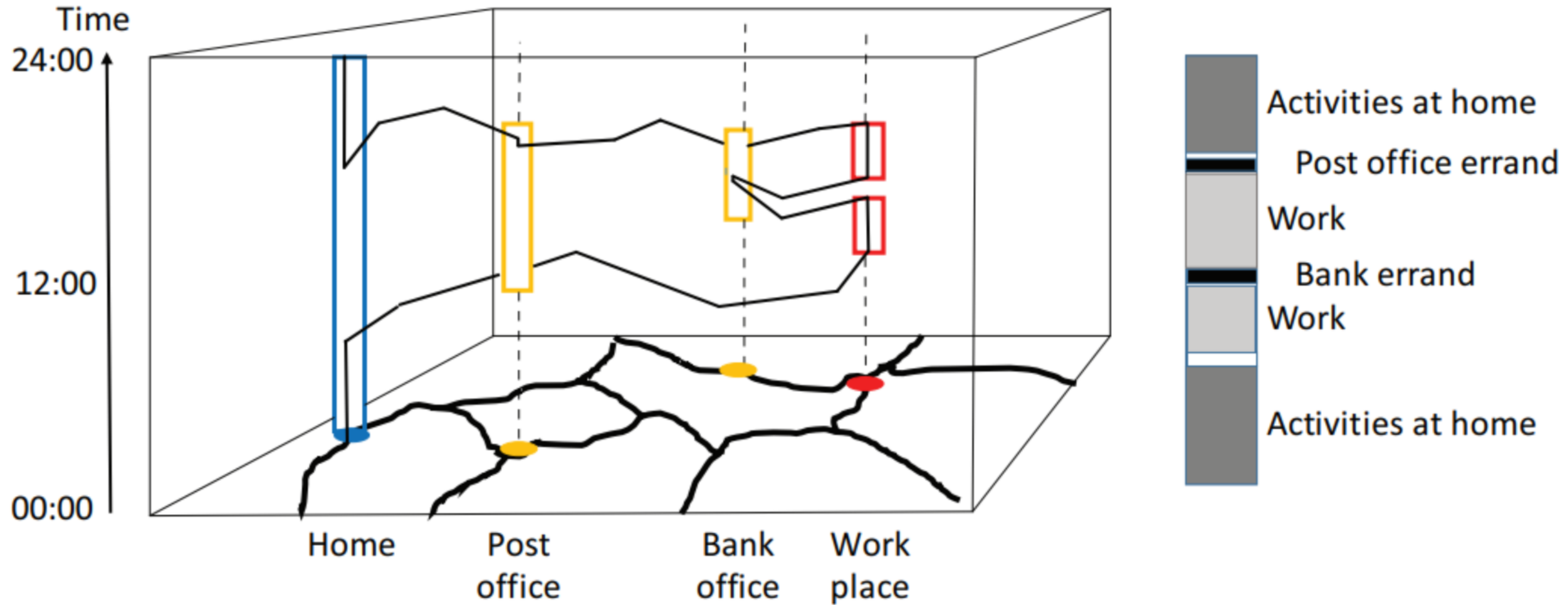


tempogram

Work, Sleep, and Other Activities across the Day, 2021



possibilities of visualisation



QUESTIONNAIRE | example

1

How would you rate the days of the week according to time commitment (from 1 to 5)?

1 - calm day with a slow pace, 5 - hectic day with a very fast pace

2

Which activity/activities most influence/drive your daily schedule?

3

Select important time points during the working day to which your other activities must be aligned:

1. children's departure for school
2. the start of the working/school
3. start of shop/office opening hours
4. arrival of children from school or from leisure activities
5. arrival of a partner
6. lunch together
7. dropping off children at leisure activities
8. end of working hours
9. start of own leisure activities
10. regular care of a loved one or animal
11. having dinner together
12. the start of a favourite TV or radio programme
13. other.....

4

**Who are the people with whom you most often have to synchronize your daily non-work activities?
Who needs to be flexible?**

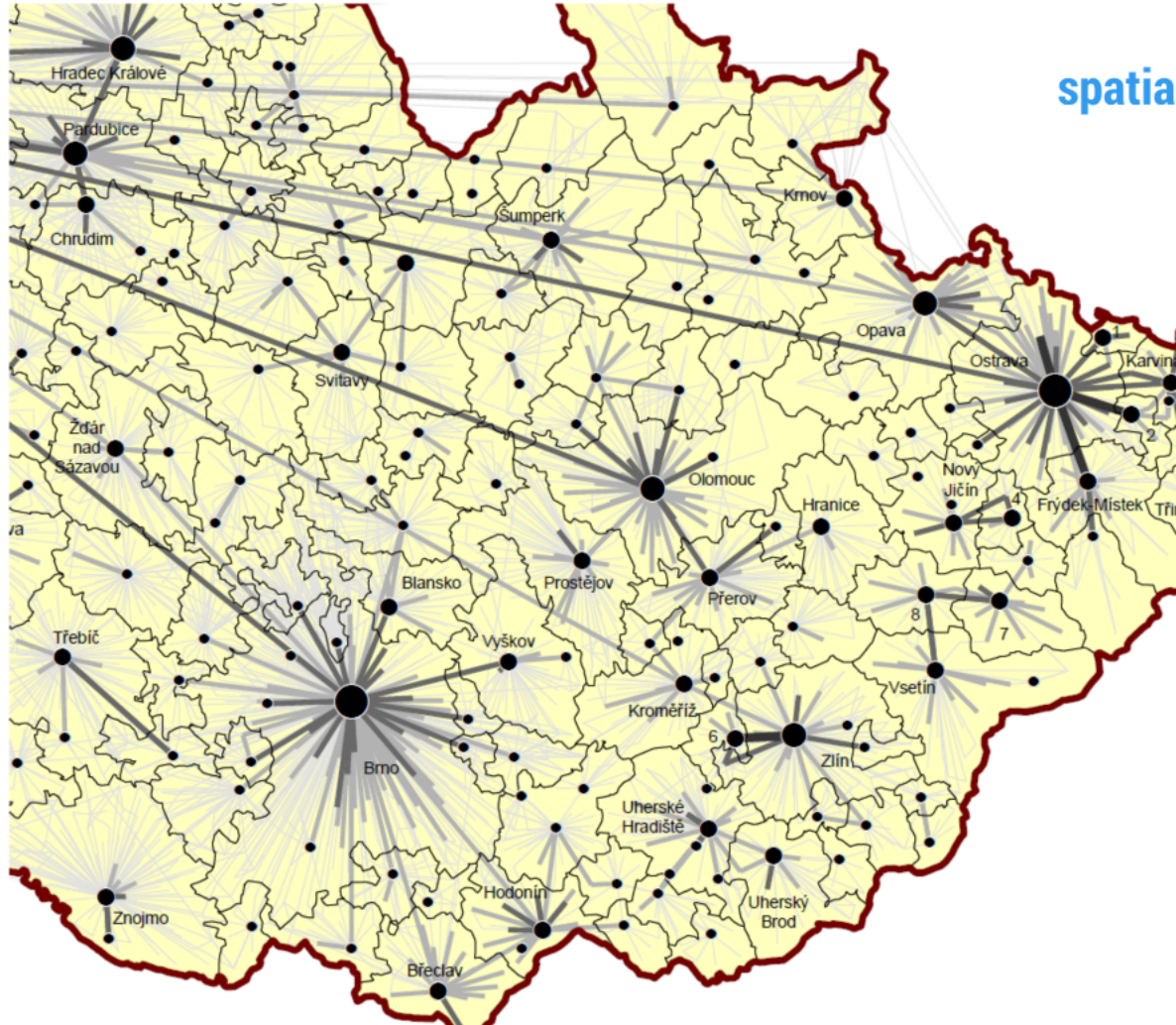
Task 1:

try to design 5 - 6 questions for a questionnaire to describe the respondent's transport to and from work

ANALYZING COMMUTING STATISTICS DATA | example

analysis of a relatively simple origin-destination matrix

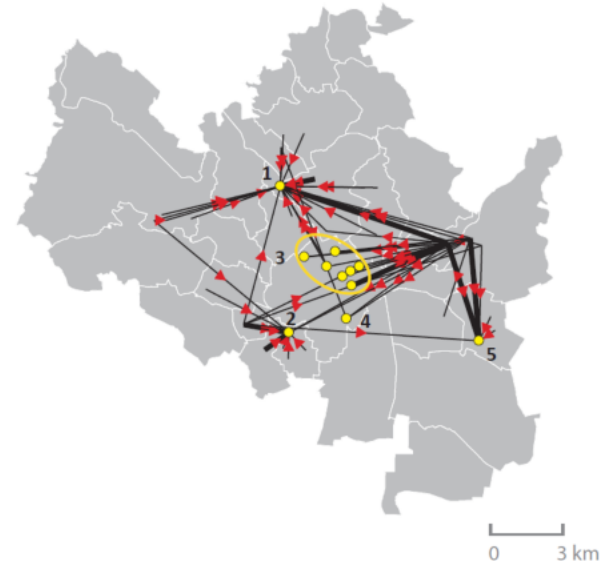
delimitation of "local labour systems" based on daily work commuting flows between municipalities

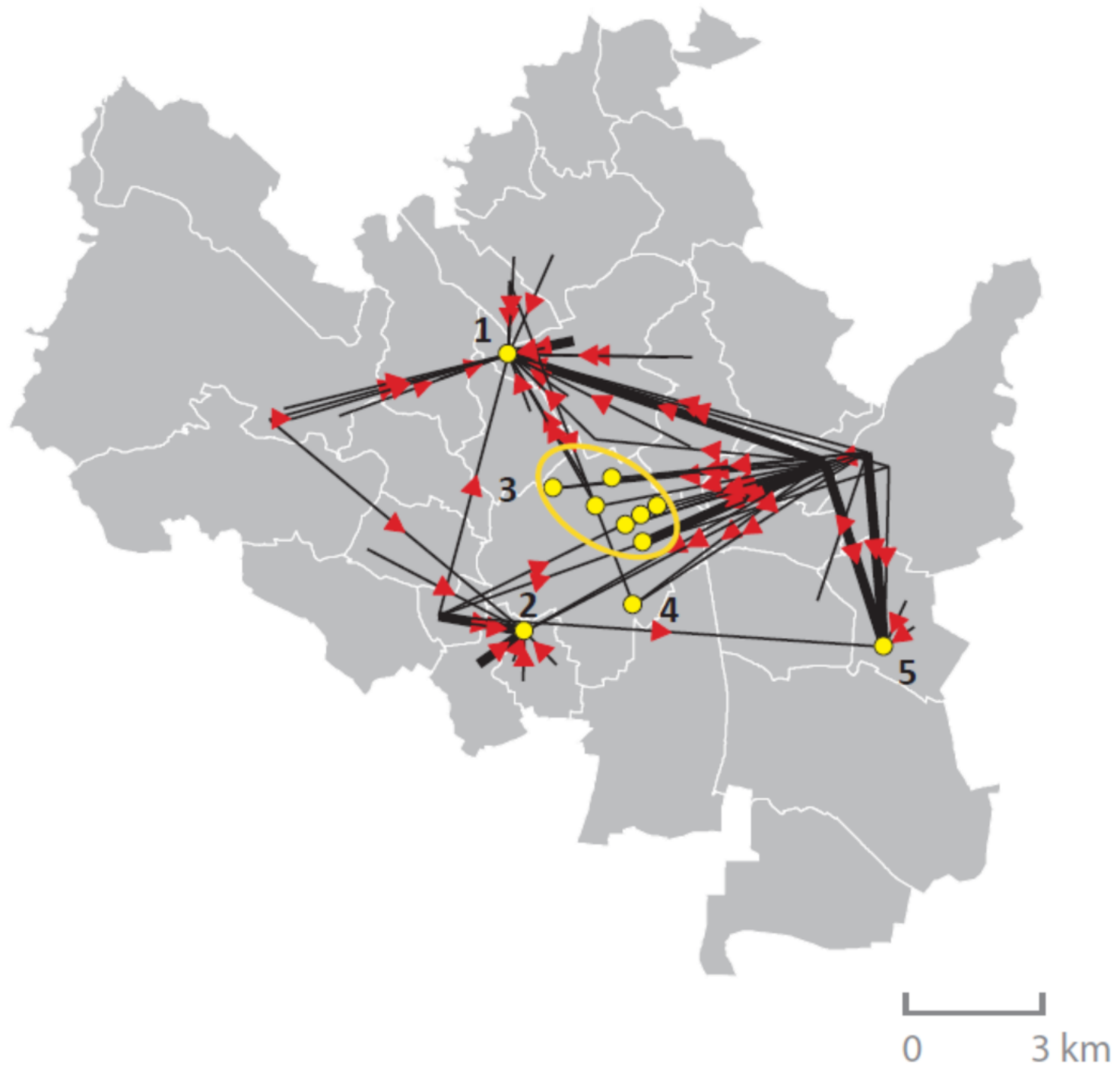


spatial extent of daily urban systems?

employing mobility flows to delimit regions

employing mobility flows to analyze functional structure





RHYTHMS / RHYTHMANALYSIS

rhythms of individual everyday life | rhythms of specific place

CHRONOTOPE concept | presence of people in specific places at specific times

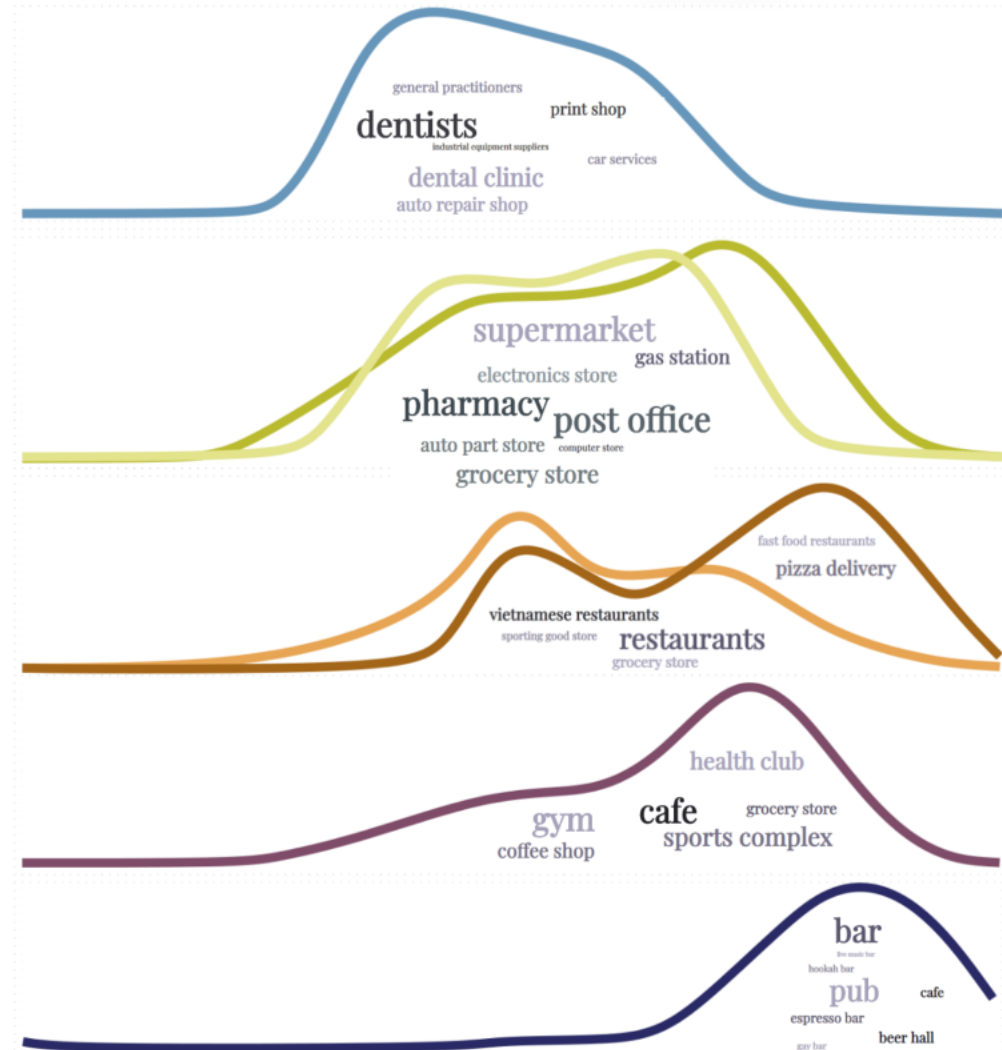
chronotope = inhabited place, where urban space meets the temporality of social interaction, which is regulated by public action for economical purposes (working hours), for social purposes (enabling the meeting among people and things) and for cultural purposes (local life traditions, marked in the historical and geographical features of the place).

chronotope of square

chronotope of bus stop

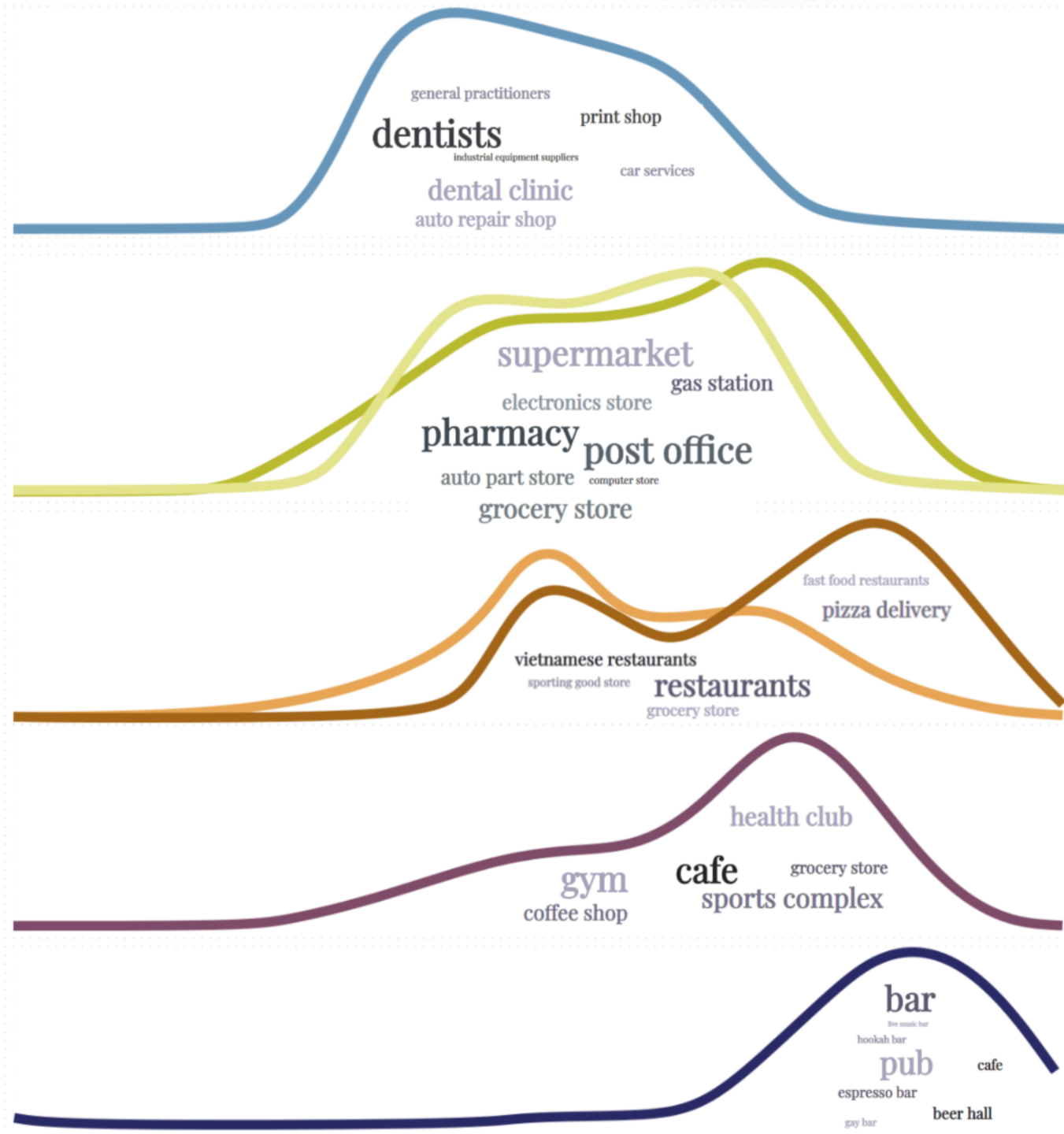
chronotope of university building

.....



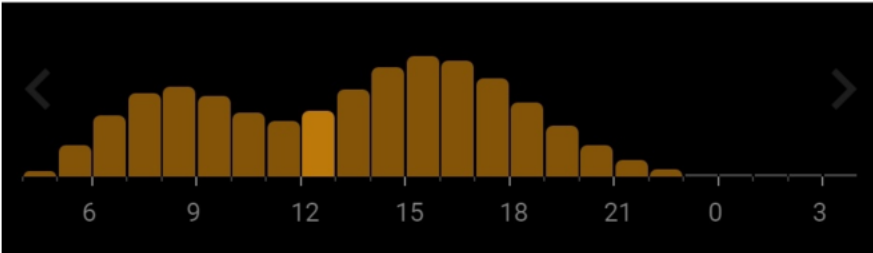
place, where
temporality of
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(s), for social
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(s) and for
life traditions,
and
(the place).

re
stop
iversity building

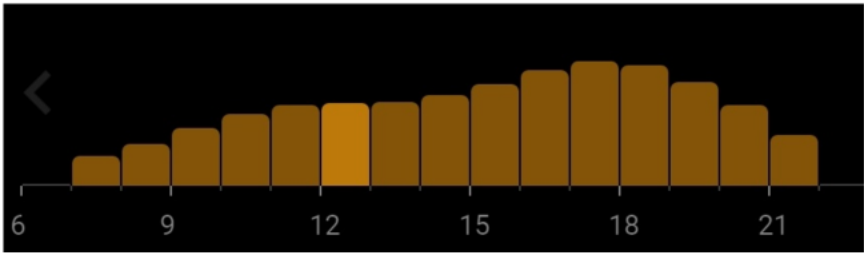


PLACE-BASED RHYTHMS

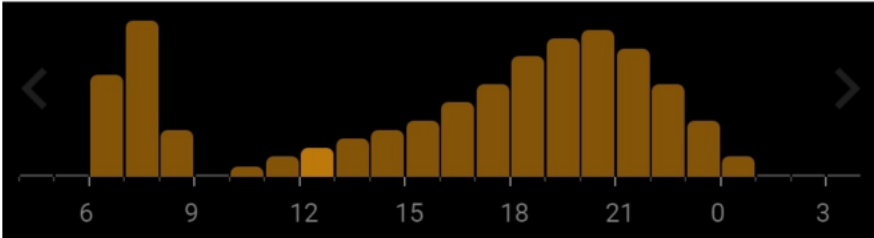
temporal identity of place



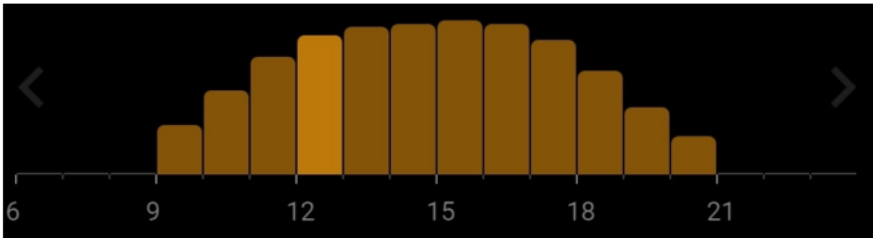
MAIN RAILWAY STATION | Wed



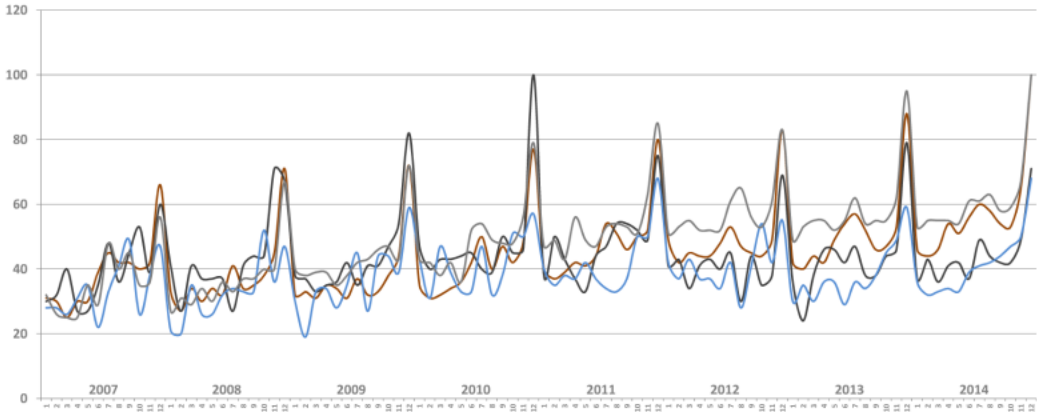
SUPERMARKET | Thu



PUBLIC TRANSPORT HUB | Thu



SHOPPING PARK | Sun



frequency of Google searches for the four largest shopping centres in Brno

Task 2:

try to outline the typical rhythm of the following types of places:

- big housing estate**
- industrial factory**
- suburban public transport hub**
- elementary school**
- parking lot in the city centre**

Why it is important to know not only the spatial structure but also the temporal structure of the city?

Can knowledge of rhythms be used for city planning?

MOBILE POSITIONING DATA

mobile phones as a means of studying human mobility and rhythms of places

various methods of SIM card detection in mobile networks | data provided in aggregated and anonymised form

ethical and commercial issues !!!

Solution for the Statutory City of Brno

You can only take care of a city if you know it well



Development and optimization of public transport



Effective planning of infrastructure development and maintenance



Crisis management planning

According to the statistical office, Brno has approximately 380,000 inhabitants. By **measuring population mobility based on mobile operator signaling data**, they found out how many people actually move around the city. The information obtained helps in effective planning of infrastructure construction, optimization of urban public transport, tourism, distribution of services and preparation of crisis management.



Jan Zvara,

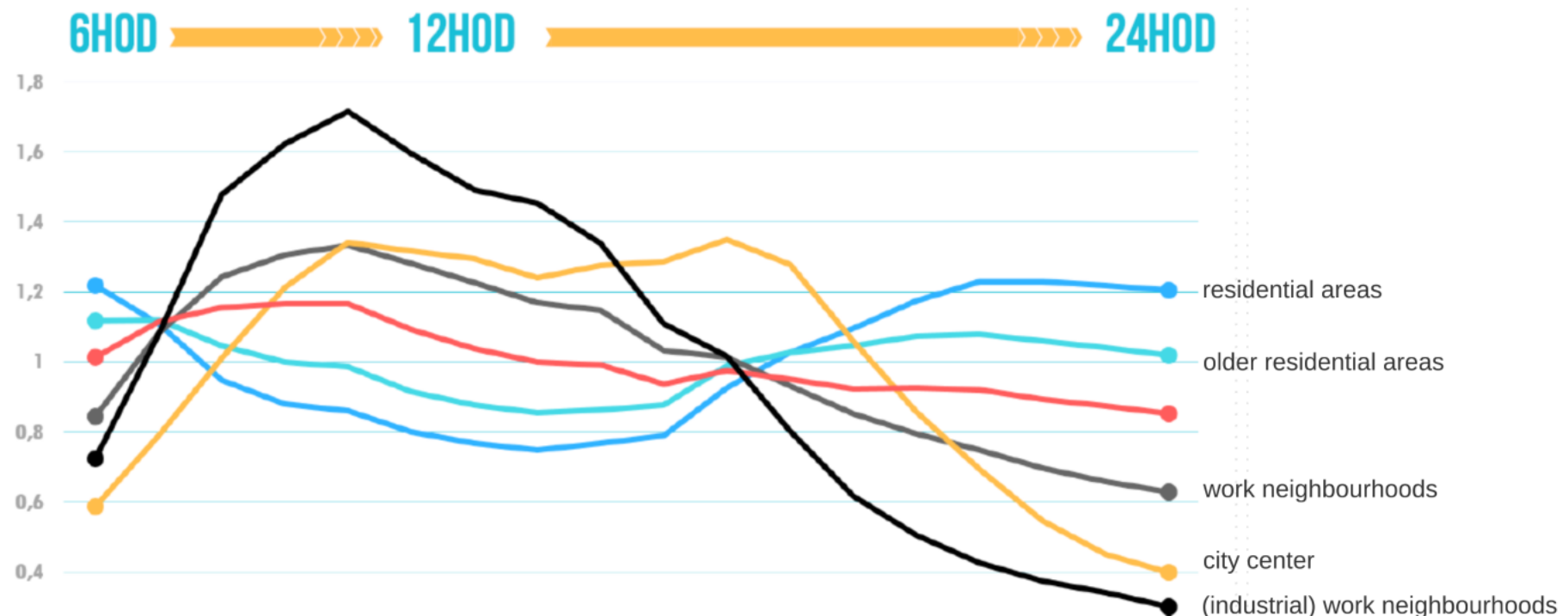
STATUTORY CITY OF BRNO

"The data obtained from the measurements added an important piece to the mosaic of information, and thanks to this we found out exactly how many residents move in the city."

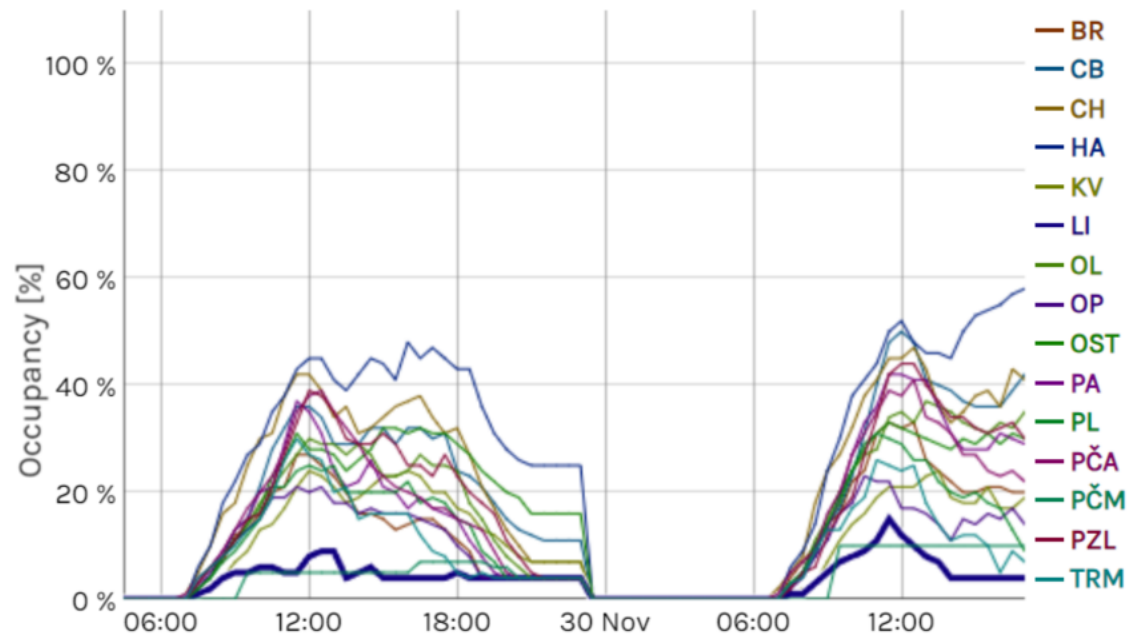
MOBILE POSITIONING DATA

1. identification of **rhythms** based on the variable presence of persons in time
2. measuring **event attendance**
3. identification of **anchor points**
4. identification of **mobility flows**

<https://ippraha.cz/stranka/4307/casoprostorove-chovani-uzivatelu-data-od-mobilnich-operatoru>



MOBILITY PROXY DATA | examples



real-time occupancy of Globus hypermarkets in the Czech Republic



financial transactions by credit card in Brno, February 2017

THANK YOU FOR YOUR ATTENTION