Using mobile positioning data for mapping space-time behavior and developing LBS:

Experiences from Estonia



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Objectives:

 Introduction - Mobile positioning in geographical studies

Examples from Estonia

 Discussion: strengths and weaknesses of mobile positioning based methods



Mobile positioning is recording digital track of the people



Geographical database with location coordinates:



🚰 MyTable : Select Query										
	id	pos_usr_id	date_stamp	X	У	sek	kell_aeg	aeg_piv		
►	17236	6748321	4.04.2006 21:31:17	546259	6585054	17	21,07138888889	04 21:31		
	17237	6442077	4.04.2006 21:31:23	552184	6569618	23	21,07305555556	04 21:31		
	17238	4468383	4.04.2006 21:31:32	521182	6591719	32	21,07555555556	04 21:31		
	17239	7324279	4.04.2006 21:31:46	548568	6595529	46	21,0794444444	04 21:31		
	17240	4955902	4.04.2006 21:31:53	548879	6595505	53	21,08138888889	04 21:31		
	17241	2037109	4.04.2006 21:31:59	523666	6574430	59	21,08305555556	04 21:31		
	17242	3477966	4.04.2006 21:32:13	659610	6473719	13	21,07027777778	04 21:32		
	17243	2877838	4.04.2006 21:32:33	531464	6587794	33	21,07583333333	04 21:32		
	17244	4746887	4.04.2006 21:32:40	540462	6588749	40	21,0777777778	04 21:32		
	17245	8645111	4.04.2006 21:32:48	541829	6597702	48	21,08	04 21:32		
	17246	9285888	4.04.2006 21:32:54	525401	6591443	54	21,08166666667	04 21:32		
	17247	4177520	4.04.2006 21:33:02	525401	6591443	02	21,06722222222	04 21:33		
	17248	2799285	4.04.2006 21:33:16	545738	6598697	16	21,07111111111	04 21:33		
	17249	2653442	4.04.2006 21:33:27	529517	6471793	27	21,07416666667	04 21:33		
	17331	6748321	5.04.2006 9:45:30	546105	6581920	30	9,075	05 09:45		
	17332	6442077	5.04.2006 9:45:37	537506	6583274	37	9,07694444444	05 09:45		
	17333	4468383	5.04.2006 9:45:40	532388	6588742	40	9,07777777778	05 09:45		
	17334	6131988	5.04.2006 9:45:48	546141	6598513	48	9,08	05 09:45		
	17335	4955902	5.04.2006 9:46:03	543079	6589033	03	9,0675	05 09:46		
	17336	2037109	5.04.2006 9:46:10	523574	6574245	10	9,06944444444	05 09:46		
	17337	9435577	5.04.2006 9:46:17	543623	6588384	17	9,071388888889	05 09:46		
	17338	3477966	5.04.2006 9:46:25	657606	6472836	25	9,073611111111	05 09:46		
	17339	2520233	5.04.2006 9:46:32	551749	6581222	32	9,075555555556	05 09:46		
Record: 14 4 1 1 1 14 14 140754										

Active positioning – tracking, asking locations with special queries



"Trace phone 50xxxxxx with 15 min interval 10.03.08-14.03.08"

Network based methods

CGI+TA

Handset based methods

www.positium.ee

Real-time positioning environment



Passive positioning – location information from memory files of mobile operator





Passive positioning data

CELL global identity (CGI)

Research team in Estonia

- Chair of Human Geography University of Tartu – analyses methods
- Positium LBS data, modelling, web solutions
- Nutiteq Handset based positioning

Data exchange

- Contracts and online connection to 2 biggest Estonian mobile operators EMT and Elisa
- Active positioning data since 2003
- Passive positioning data since 2004

Experiments with active mobile positioning



Studying suburban commuters space-time behaviour in Tallinn:

- Sampling 600 families from new settlement areas
- Questionnaire 60 min questions by polling firm EMOR TNS
- Tracking mobile phones of 277 persons
 8 days with 15 min intervals

Location of home and work locations, movement



Passive mobile positioning



900 million locations of 600 000 Estonians (45% of total pop.) during 2 years



Model for determing anchor points:

- home

- work





Mobile positioning versus traffic counter: 1 week





Activity spaces: Daily connections between work and home anchor points



Local community level

Regional level

Traffic analysis: geographical distribution



Tourism studies



Positium Barometer

Web based tourism monitoring tool

www.positium.com/barometer/tourism

O http://positium.ee/barometer/tourism/	•						
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• • •	2						
POSITIUM Barometer PO	SITIUM						
Welcome to Tourism Barometer!							
Tourism Barometer lets You make statistical reports about							
foreign visitors in Estonian municipalities.							
Data in our database: 01.04.2004 - 31.08.2007							
Please log in!							
Order reports							
Data and method							
Demo Report							
Order an extensive tourism study							
Example of tourists movement:							
Latvians visiting Metallica concert							
2006.6.12 22:00:00							

Demo password

USER: enter2008

PASSWORD: Wicpyg39

Basic statistics



Nr	Nation	Visitors	%	* Change	
1	Finland	2 060 000	41%	▼ (-7%)	
2	Latvia	653 000	13%	▲ (+13%)	
3	Russia	383 000	8%	▼ (-16%)	
4	Norway	319 000	6%	▲ (+17%)	
5	Lithuania	273 000	5%	▼ (-7%)	
6	Sweden	248 000	5%	▼ (-13%)	
7	United Kingdom	171 000	3%	▲ (+15%)	
8	Germany	166 000	3%	▼ (-7%)	
9	Poland	113 000	2%	▼ (-14%)	
10	Denmark	67 900	1%	▼ (-5%)	
11	Other Countries	515 000	10%	▼ (-1%)	
	Total	4 970 000	100%	▽ (-4%)	



Modelling weather dependence of tourism





Whether dependence of international tourists movement in Estonia

Correlation between air temperature and mobile positioning

99% of cells had statistically significant correlation

67% of cell had medium correlation

12% of cells had strong correlation



Possible to model and forecast places where tourists react to weather

(change plans...)



Mapping destination choices in Estonia



Movement of tourists sleeping more than 3 following nights in Pärnu



Modelling impacts of tourism events



International tourists movement to concert of Metallica

2006.6.14 13:00:00



www.positium.ee/map3d

Homes of domestic tourists visited Ecological Festival in Põlva



Strenghts of mobile positioning



Strengths of mobile positioning:

- Recording actual locations of phones (people)
- Phones are widespread
- Spatial resolution is better than in questionnaires

Mobile phones are everywhere and people like to carry them on

Digital data

Real-time applicability!



Problems with mobile positioning



Criticism about using mobile positioning in human geography

 "quantitative geography" is not mainstream

developed by GIS-people – no enduser oriented solutions

- Human geographers lack often quantitative methods and GIS
- GIS specialists lack theories and methods of human geography
- Tracking projects end as "games with moving dots"

Geographers lack knowledge and skills in cartography

■ *Google* – solution?

Troubles to get data

How to reach operators?

High cost of data?

How to manage huge GIS databases?

Long chain of value of LBS

OPERATOR



Sampling issues

Penetration of phones

Different operators, prices ...

How and where "they" use phone...

Privacy and surveillance



What is surveillance fear about?

Mobile positioning fear is connected with transparency and awareness issue!!!

- Who is watching me?
- What do they know about me?
- How do they use it?



Because of surveillance fear:

There is not personal data linked

Positioning experiments end-up with "moving dots"

Need to link movement data with personal profile

Linking movement data and social data:

Social Positioning Method (Ahas and Mark 2005)



Learning about privacy from social positioning experiments as **Joint Space** <u>www.positium.ee</u>

Conclusions



- Different research perspectives for human geography and GIS?
- Real-time geography, "socialization" of maps
- Need to avoid similar situation when "conservative" cartography was excluded by end-user oriented "Google maps"

- Is there place for traditional quantitative models?
- Is there need for new approaches using new electronic data?
- Sampling? Qualitative GIS?

Paradigm of mobilities (Sheller & Urry, 2006)

The displacement paradigm: moving to go somewhere to do something

The mobility paradigm: turning mobility, communication and ongoing activities into a creative performance...

Thank you!!!





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