Supporting movement patterns research with qualitative sociological methods – gps tracks and focus group interviews

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1. Introduction

Exploration of human movement patterns is a lively subject of various research directions. Knowledge about pedestrian mobility have been used to analyze tourist way-finding decision making (Xia et al. 2011, 2008), movement of tourist in recreational areas (Orellana et al. 2012, Shoval 2010, Shoval & Isaacson 2007), spatial behaviours in dangerous situations (Zheng 2009) and in location-based services (Li 2006, Millonig & Gartner 2007). Recent advances in Information and Communication Technologies (ICT), the advent of social media and pervasive nature of GPS and A-GPS tracking technology that is embedded in almost every new mobile devices – smart phones, net books, tablets or even specialized sport-oriented gadgets like pedometers and photometers, results in increasingly wide stream of data about human location in geographical space. However, in most cases this data comes in a raw form of geolocated points, accompanied with time of recording and sometimes with additional information about source or positional accuracy. This can be used further to infer more information like speed and movement vectors, trajectories or movement suspension patterns (Orellana & Wachowicz 2011). But in the end we may only have knowledge that a person, be it a tourist, city dweller or unidentified pedestrian, is or was in a given location for a certain amount of time. The person's motives remain unknown. This is especially true for cities, where accuracy of most common tracking solutions is not sufficient enough to discern between places, points of interests or counterstructures in dense urban space. GPS tracks are often used to study most visited areas in a given region by manual or semi-automatic identification of trajectory stops or analysis of density maps. Those methods can be reasonably applied to tourist movement in natural protection areas or in tourist districts (Orellana et al. 2012) with clearly established administrative boundaries (Shoval 2008) where pedestrian motives for visiting can be assumed with high dose of probability. In analysis of socio-spatial structures of a relatively large city this approach however, is not ideal.

Research presented here is part of the larger project that aims to analyze relationship between spatial behaviour of city visitors and socio-spatial structures of a city. The former is studied in the experiment where GPS tracks are analyzed not only using GIS methods but with the support of qualitative social techniques, namely Focus Group Interviews. This "soft" approach is difficult to combine with numerical methods used in movement patterns analysis but we hope that it will provide additional information, unattainable in any other way. Here we present some insight into the process and discussion about the approach.

2. Methods

To aim of the EBEH experiment was to study spatial behaviour of two groups of city users:

students and tourists. Automatic GPS loggers were used to constantly record location in 5 second intervals. Two groups of tourist were sent for a period of five days to two large polish urban areas: city of Poznan and Tricity (Gdansk, Gdynia, Sopot), during summer of 2013. Each group consisted of 10 volunteers that never before visited given city. The group was further divided into sub-groups of one, two, three and four persons. Students were first-year students from two faculties located in different parts of Poznan and from various faculties in Tricity. Forty volunteers agreed to carry GPS loggers for a period of one month, shortly after the beginning of the academic year.

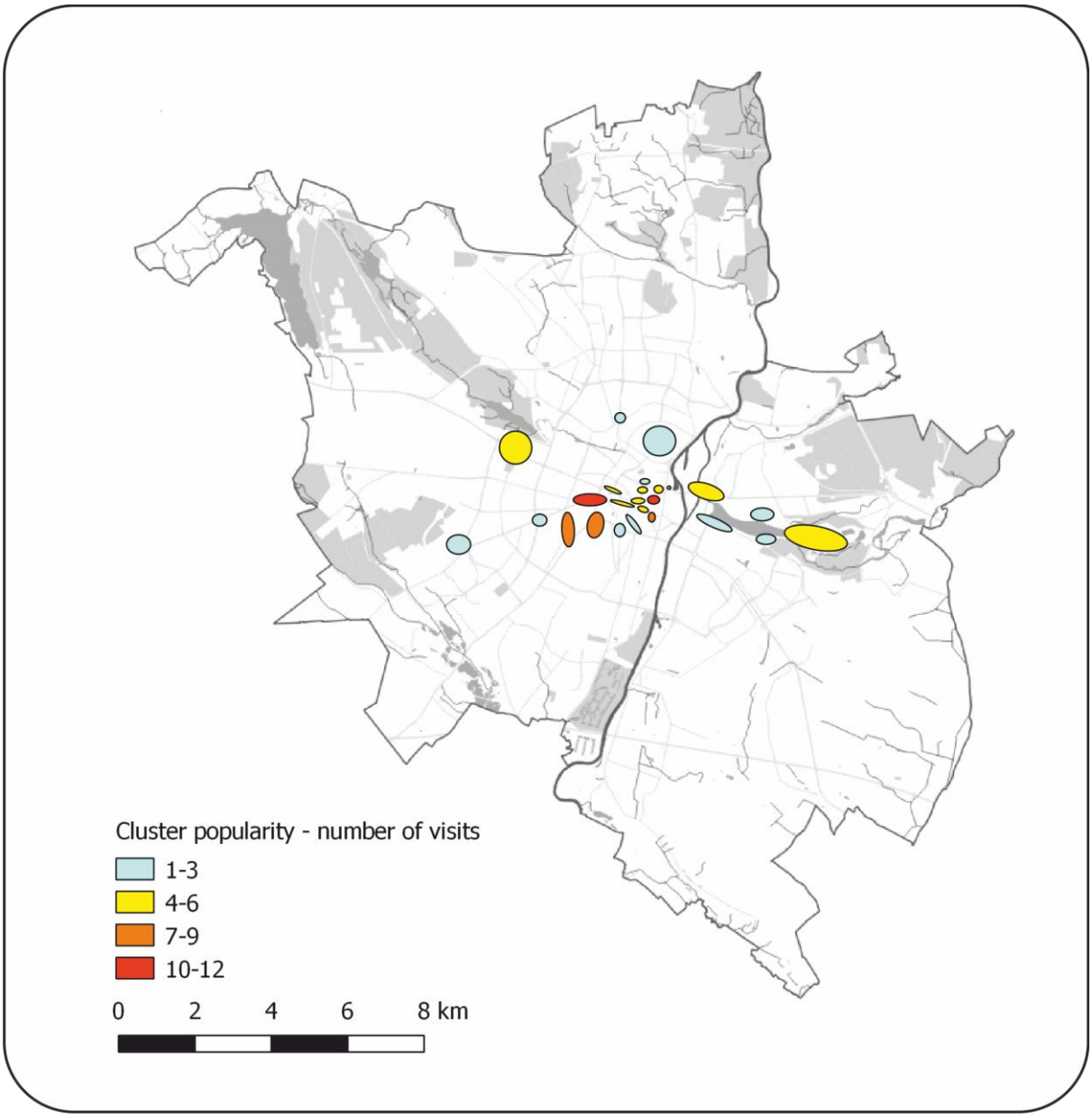

Figure 1.Aggregate ellipses representing most frequently visited areas of Poznan as derived from GPS tracks. Popularity associated with ellipses represents number of days in which participants have spent significant time in this area – with significant time being determined by PVC.

GPS track points were collected, supplemented with short questionnaire and finally anonymized. As points corresponded to 5 seconds intervals it was possible to generate density maps that showed in which part of the cities participants were spending most of their time. Clusters were constructed using Percent Volume Contours (PVC) (Gibin et al. 2007) for each sub-group and for each day. In each case clusters representing 75 percent contours were selected for further analasis. From them an aggregate cluster map was developed, with approximate ellipses representing most frequently visited areas of the city. On Figure 1 there is an example of such a map constructed for Poznan. Popularity associated with ellipses represents number of days in which participants have spent significant time in this area – with significant time being determined by PVC. Also, movement trajectories and sequences were derived from aggregate ellipses. To connect them to places existing in urban space overlays were constructed and interpreted by two different researchers with expert knowledge about given city. This approach was planned to study the bias introduced by person responsible for interpreting the data.

After each part of the experiment we organised a Focus Group Interview (FGI) with its participants. Tourist were encouraged to talk about the visited cities – places both worth visiting and unattractive, lodging choices, activities during the stay, experiences and impressions. They were also asked to collaboratively draw a mental map. Students were additionally asked about their daily movements, night life and how they made their choices of place to stay. Both groups described motivations of their spatial behaviour, decision making process and a set of conclusions, observations, feelings when they were "using" the city.

3. Results and discussion

The experiment produced three lists of places for each of the studied cities. Two experts' lists were the result of visual identification of places with aggregate ellipses and the third list were compiled from transcripts of FGI with volunteers. Comparing those list showed clear differences as shown in Table 1. Most importantly, place-names that were on the FGI list were often missing from experts' lists and 14 place-names from FGI list were missing entirely from map of most frequently vistited places. Further investigation and confrontation with map overlays allowed to correct the mistakes made by experts. Without the prior knowledge about the human motivations it is difficult to guess the particular place that attracted the visitor. In some cases it was clear that certain toponyms are only mentioned by FGI participants because they heard or read about it and not from a first-hand experience.

This places can be identified by comparing with tracking data. Conclusions can be summarised as follows:

- Simple identification of visited place by the use of density estimates or similar clustering methods can be misleading. Clusters of points can be an outcome of many different factors other than an attractive counterstructure in urban space. It can a be a public transport hub, a place of lodging that was chosen either on a basis of accessible parking lot or a brand loyalty, or even conveniently placed McDonald restaurant. Therefore, it seems necessary to supplement raw GPS data with qualitative methods.
- Complementing tracking data with FGI can be seen as a method of ground-truthing. The nature of group interview means that the conclusions are more general than what can be deduced from questionnaires. The set of human motivations, choices and behaviour can be related to wide range of data sets.

- FGI or similar methods can be used in a preliminary stage of research, especially when urban space that is being studied is not familiar for the researchers. It can provide a list of toponyms useful in description of stops in trajectories created from GPS data. This can reduce the bias that is introduced by person that is analysing the data as comparison of experts' lists clearly showed, by limiting available choices and resolving conflicting interpretations.

Table 1. Comparison between place-names associated with each cluster (ID's were selected randomly). Clusters highlighted with yellow color were associated differently by experts. "FGI participants" column shows whether a given place-name was present on a list constructed by analysis of FGI transcript.

Cluster ID	Expert 1	Expert 2	FGI participants
1	City Stadium	City Stadium	Y
2	New Zoo	Zoo	Y
3	PKP main station	"Poznan Glowny" trains station	Y
4	**„Cathedral – Maltanka train" area**	**Cathedral island**	Y
5	**Malta Ski**	**Malta**	Y
6	Malta water park	Malta water park	Y
7	Malta shopping mall	Malta shopping mall	N
8	**„Old Zoo – Kaponiera roundabout" area**	**Vicinity of Kaponiera roundabout**	N
9	Old Market	Old Market	Y
10	Cytadela Park	Park Cytadela	Y
11	**„Arena music hall – Przybyszewskiego roundabout" area**	**Jan Nowak-Jezioranski roundabout**	N
12	Botanical Garden	Botanical Garden	N
13	**Plaza shopping mall**	**PST „Słowiańska" tram station**	N
14	**Wechta office builidng – Garbary junction**	**„Biedronka" discount shop**	N
15	„Old Brewery" shopping mall	„Old Brewery" shopping mall	Y
16	Old PKS bus station	PKS bus station	N
17	**„UAM – Theatrical bridge" precinct**	**Opera house**	N
18	**Poznań Greenhouse**	**Wilson Park**	Y
19	St. Martin precinct	St. Martin street	N
20	Church-Synagogue/swiming pool	Synagogue	N
21	Green Gardens	Zielona street Park	N
22	Freedom Square	Freedom Square	N
23	tram junction on Wielkopolski Square	Wielkopolski Square	N
24	**MM gallery – Kupiec poznanski shopping precinct**	**Kupiec poznanski mall area**	N
25	St. Wojciech Hill	St. Wojciech Hill	Y

It is clear that in analysis of human spatial behavior GIScience researchers must acknowledge and deal with the 'human' part of the equation. The most popular method is questionnaire survey but social sciences have much more to offer in interdisciplinary studies as in the FGI example presented here. Therefore, utilisation of similar advanced qualitative methods should be encouraged in GIS.

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Biography

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