Measuring Citizens' Fear of Crime Using a Web Application: A Case Study

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Abstract

The authors evaluate the use of a Google API web application to test where people feel safe and unsafe with respect to crime in Nagykanizsa, a relatively small settlement in Hungary. The web application provided users with tools to show areas where they feel safe or feel fear, which they indicated with polygons. The authors introduce how the application was developed and how the participants used it.

Keywords:

mapping fear of crime; Google API, mental map

1   Indroduction

The change of political system in the Eastern European region opened up new prospects in Hungary. From being isolated from the rest of the continent, Central and Eastern European countries are now integral parts of Europe again. This also means that the borders, which used to serve as barriers to block the free movement of criminals (Sallai, 2003), are now open. Parallel to these changes, all statistics indicate that the crime rate has been increasing significantly and steadily since 1989. The crime wave shocked the country and the formerly solid structure of the police forces was undermined, which made the situation even worse (Sallai, 2003). Although the number of crimes has declined slightly in recent years, the fear of crime exists to a much greater extent within Hungarian society than police statistics show (KSH, 2014). However, recent research in this field in Hungary is still lacking.

The study of the fear of crime has an extremely rich literature. The term itself was defined by Ferraro & LaGrange (1987) as 'the negative emotional reactions generated by crime or symbols associated with crime'. Doran & Burgess (2012) outlined that several studies of the fear of crime showed that places evoking it are concentrated in certain areas with particular environmental characteristics. The research by Lederer & Leitner (2012) in Linz also revealed

that there are specific hotspots for the fear of burglary, mainly in the city centre, and statistically significant differences between districts in the pattern of the fear of burglary.

Since 1989, there has been a discrepancy between official crime statistics and the fear of crime as reported by citizens in Hungary. However, this discrepancy was not studied by scientific methods. A European survey found that just half of crimes are reported to the police. Crimes such as car (89% of cases?) and motorcycle theft (82%), burglary and housebreakings (81%), theft from a car (63%), robbery (59%), and theft of personal property (54%) are usually reported to the police (Nyíri, 2005).

The spatial distribution of the fear of crime in Hungary was investigated for the first time by Kó in 2005, with the support of an EU project. The researcher used a complex questionnaire which garnered approximately 10,000 responses from all over the country. The questionnaire focused only on non-urban areas, however, and therefore could not reveal city-level tendencies.

Sallai & Mátyás's paper (2015) investigated the objective and subjective aspects of safety in nine Hungarian cities. They used official police statistics as sources of objective safety data. The analysis concerned whole cities and it did not make any distinction between different neighbourhoods. Although the researchers made some statements concerning the subjective nature of a sense of safety, it is not clear which type of indicator they used. The study mentioned that their statements rely mainly on the results of an EU study made in 2005 (i.e. Nyíri, 2005).

Ordinary citizens presume a relationship between the Roma minority and crime. A study by Nézőpont (2008) revealed that 91% of the respondents thought that so-called "Roma Crime" is a real phenomenon in Hungary. Recently, it has become illegal to register the offender's ethnicity in crime statistics in Hungary. As shown in the literature, the fear of crime is strongly related to prejudice (Skogan, 1995), and preconceptions have an essential role in judging the crime situation. According to numerous studies, prejudice is present in Hungarian society too. After the political turn, a very rich literature emerged on the prejudiced attitude of the Hungarian adult population towards various minority groups (Pataki, 1997; Erős, 2007; Political Capital, 2008). Despite the different backgrounds and approaches of these studies, their main findings are identical: the Roma minority is the ethnic group most subjected to racism in Hungary. They are the largest minority living in Hungary, as well as the most common target of the far right. The majority of the adult population believes in negative stereotypes of the Roma people and prefers not to have social contact with them (Váradi, 2014). In 2013, a study on the town of Kalocsa, Bács-Kiskun County (Pődör & Dobos, 2014) revealed that there is a correlation between the fear of crime and the presence of Roma minorities, although official crime statistics did not confirm this result. The data for Pődör & Dobos's study (2014) were collected using paper-based questionnaires.

Evans & Waters (2007) presented various tools for capturing fear of crime. Notably, they developed a web application where respondent could highlight high crime areas with dots. The results were processed and aggregated to a density map.

Solymosi et al. (2015) have recently developed an application called FOCA, which aims to correctly identify crime in place and time. Their research focused on transportation with a view to identifying unsafe areas within the whole journey environment.

Many studies have used mental maps to interpret an environment qualitatively in terms of feelings such as fear, desire and stress. Matei (2005, in Pődör & Dobos, 2014) used mental maps to reveal the role of media in shaping urban space in Los Angeles. He used 215 mental maps taken from seven neighbourhoods across the city and processed them in GIS. The results proved that people's fear is associated with a concentration of certain ethnicities in a given area.

Mapping the fear of crime and so-called emotional mapping have much in common, as fear is clearly related to emotions. Several research papers deal with emotional mapping (e.g., Panek et al., 2016), in which web applications collect the emotional perception of urban space. A more complex research project (Resch et al., 2015) uses technical and human sensors and georeferenced social media posts, from which the researchers extract contextual emotional information.

Since the police have not carried out any systematic survey on the fear of crime in Hungary, the aim of the present study was to develop a simple web application allowing the compilation of a mental map which would measure, at least to some degree, the fear of crime. As the authors had not had particularly positive experiences in Hungary with the crowdsourcing of data (Pődör, 2014), they decided to use as simple an application as possible for this experiment. The results can be compared to the official crime data at local city level. The difference between official data and the results of the fear of crime surveys points to deeper sociological problems in the urban environment. In order to assess the applicability of this application, a feasibility study was also carried out. A pilot area was selected for this purpose, and the responses were analysed.

2   Study area

We selected a medium-sized settlement in Hungary for testing the feasibility of the application. Sociological studies on the spatial distribution of the Roma minority have been published since 1970 (Matolay & Vekerdi, 1970). Several studies (Pődör & Dobos, 2014) proposed the idea that ethnicity influences citizens' fear of crime. In view of this, for our case study to test the feasibility of the application, we selected Nagykanizsa (pop. approximately 48,000), near the Croatian and Slovenian border in SW Hungary, where the minority Roma community lives in a particular area and does not spread to other neighbourhoods.

Compared to the crime statistics of the whole country (a total of 329,575 recorded crimes in 2014), Nagykanizsa has an average crime rate (2,392 recorded crimes in 2014, decreasing to 2042 in 2015). The former Soviet military barracks are used to accommodate the deprived, mostly minority people in the settlement. According to the integrated urban development strategy, the number of elderly people is generally growing, except among the Roma minority, where the percentage of younger people is increasing. Spatial segregation is a characteristic of the town. It occurs in areas where the socially disadvantaged population can

be found concentrated, mainly areas of municipal social housing, where people are less likely to own property, and areas of properties without the full range of utilities. The town administration is aware of the problem and would like to resolve it with an anti-segregation programme. However, the necessary finances are still missing for its full implementation. The districts concerned, numbered 1 to 8, as defined by the town's integrated social development plan, are indicated in Figures 2 and 3, which display the results of our study.

These urban areas can be characterized as follows:

1: Centre. This is a mixed-function area. Typical phenomena here are: ageing buildings, especially in the central area of the city where old buildings are common, high unemployment and low numbers of active workers.

2: North and North-East. This is a mixed area of family houses and industries; the unemployment rate is the second highest of any area in the city. "Dózsa Street" action area, which has recently started to become a slum area, is in this district.

3: East. The eastern part of the city is a large urban residential neighbourhood, where we find mainly blocks of flats. The area functions like an individual town, with a population of around 20,000 and the highest proportion of active workers.

4. Ligetváros. This is the most disadvantaged area in the city, with mainly unemployed people with a low level of education.

5. Sánc-Szabadhegy. This is a suburban area with mainly family houses, inhabited by younger, relatively affluent people.

6. Kiskanizsa-Bajcsa. This covers predominantly agricultural areas.

7. Miklósfa-Bagola. This is a fairly rural, residential and recreational area of the city.

8. Palin. This is a newly developed residential area with family houses.

3   Methodology

Mental mapping is a research method on how we see and perceive a space in our mind (Downs & Stea, 1973). Individual perception of an area may depend on a large number of factors, such as mode of transport, age, education, etc. Mental mapping can be used for various purposes: urban planning, anti-segregation measures, research into equal opportunities and behavioural geography, etc. (Letenyei, 2005). An exaemplary study was carried out by Stanley Milgram (1992), who developed the free recall technique, where respondents had to draw on a blank sheet of paper. The problem with this method is that different people see the same places differently, so it is difficult to compare these maps to each other and to extract information. Recently, various data collection techniques have been developed in the context of mental mapping: purely quantitative data collection methods by survey; purely qualitative, non drawing-based methods by interviews; free recall data collection techniques based on freely drawn maps; oriented recall map drawing, where the respondent is given a base map to draw on supplemented with an interview.

Our web application is based on an oriented recall technique and is intended for online use and mobile phone applications. For the base map, we chose Google Map. For the online survey, we used mainly social media (Facebook, Viber) to reach the participants. In order to calculate the results, we covered the area with a fishnet (200*200 m) and used basic GIS calculating methods.

4 Web application

We used an Apache server, which contained the MySQL DataBase Management System; phpMyAdmin provided an interface for connection to our database. ReCaptcha, offered by Google, helped us to avoid answers from robots.

The database can be divided logically into two parts: one stores the answers to the questionnaire and spatial data produced by the participants; the other relates to configuration and administration.

On the website, the respondents provide their postcode, age, gender and usual mode of transport. The questionnaires table stores the answers. The primary key of the table is UserID. This UserID is very important, because it maintains the connection with other tables and the map drawing as well.

After giving responses to the questions, the user finds a short explanation of how to use the map. Following the instructions, they can indicate places where they feel safe with a polygon tool; with another tool, they can indicate those places where they feel fear of crime. The respondents are asked to draw their daily routine polylines too. The database stores the polygons and polylines with their coordinates. In the polygon table, the FearRoutes attribute is a Boolean value which indicates whether a place is safe or unsafe. In addition, we have the attribute UnitedPoint to identify the points that form a polygon made by the same respondent.

The webpage utilizes the Google native web API, and the drawing function is available through Drawing Manager. The webpage is available at http://bunmegelozes.amk.uni-obuda.hu/. Respondents can use the webpage without registering; they only have to answer the questions listed above and to indicate that they are not Robots. Administrators should identify themselves; they can configure the page, create basic statistics, and download the results of data acquisition. The webpage was also optimized for mobile devices.

5 Results

Our hypothesis was that the results would be similar to those of our previous study (Pődör & Dobos, 2014), where we used paper-based questionnaires with a map and some interviews. The conclusion showed that the places that generated fear of crime among citizens were mainly related to Roma minority groups, although these results were not confirmed by official police statistics.

In the present study, we investigated another town that has a similar sociological background, with Roma minorities and socially disadvantaged people living in a closed community in a particular area. We surmised that if this case study gave us similar results, then the method could be used to analyse citizens' fear of crime in later studies as well.

We had 102 anonymous respondents in the test. The majority of the survey participants were female (54%), most of the participants were in the age group of 30–45 years (47%) and 46–60 years (23%), only 20% of them were between 18 and 29, and only 9 participants were over 60.

Most of the respondents typically walk during their daily routine route (34%). Of the remainder, 27% use public transport, 22% use a car, and 16% cycle. All the participants were local, as the postcodes confirmed.

The 102 participants created 657 polygons, of which 40% depicted safe and 60% unsafe places. Approximately 1% of polygons were faulty, consisting of a single point only. The maximum number of polygons produced by a single respondent was 15, while another presented only one unsafe place. The largest group drawing the same number of polygons (2), usually one for a safe and one for an unsafe place, represented 16% of the participants. 15% of the participants created eight polygons; 28% produced 9–15 polygons, and 37% of them drew 3–7 polygons (Fig. 1).
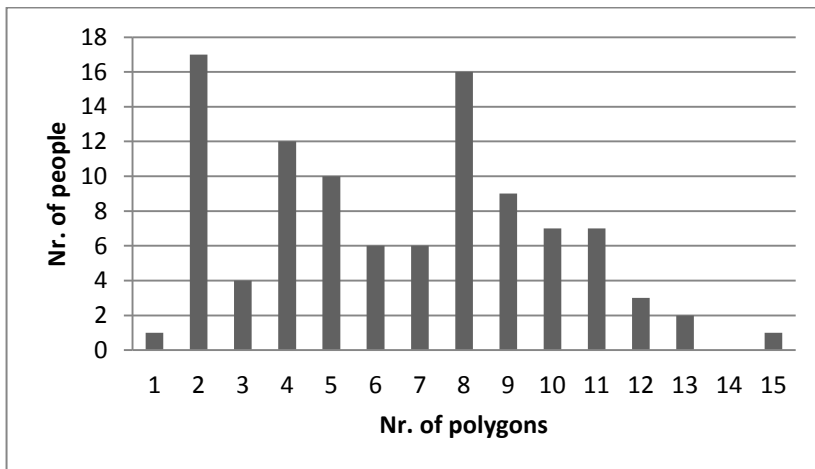

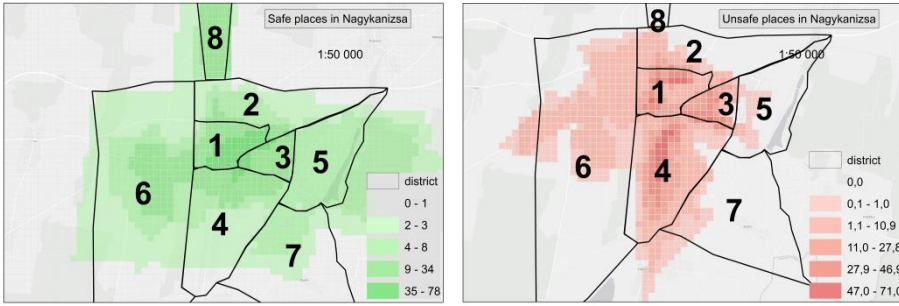**Figure1:** Number of polygons created during the survey by the participants

Figure 2: The safe and unsafe places in Nagykanizsa

Figure 2 shows the results. There are three distinct types of area in the town: (1) areas where all respondents indicated fear; (2) areas marked by all respondents as safe; (3) mixed places, interpreted differently by the respondents.
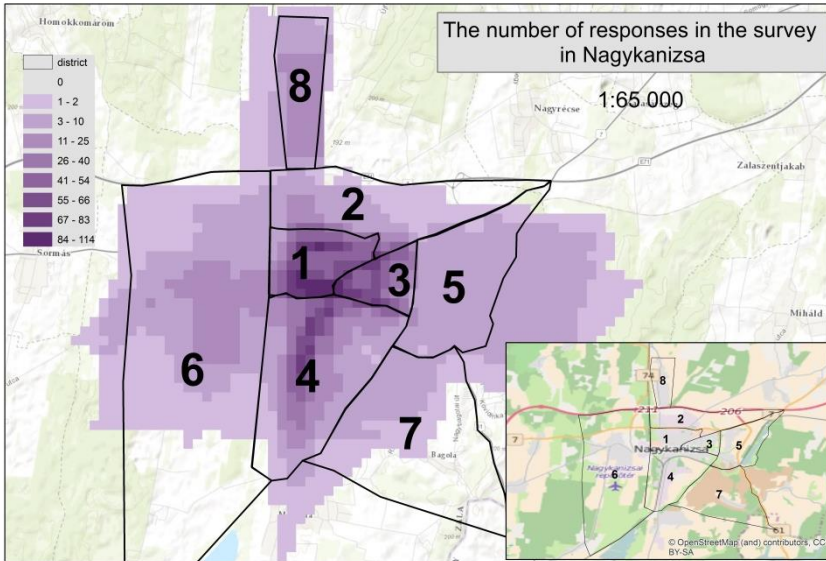

Figure 3: Number of responses referring to overlapping polygons in various areas of the town?].

Most of the responses are connected to the town centre, Ligetváros and the Eastern part of the town (Fig. 3); some areas elicited a response from 100% of participants. This is also an important point for the analyses, because the results can be considered more reliable.
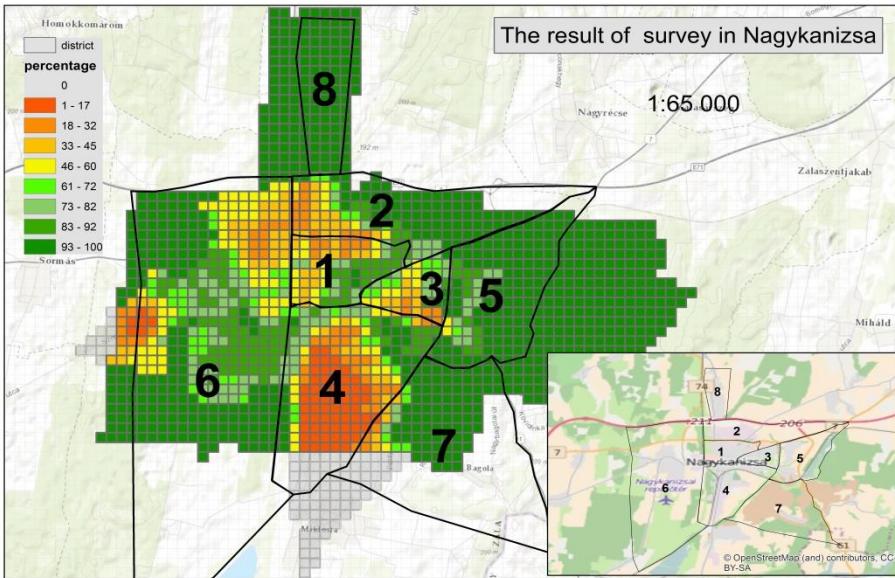
Figure 4: Overall results in Nagykanizsa showing the number of squares perceived as safe (green) and unsafe (red)

We compared the percentage of votes indicating safe places to those for places marked as unsafe. The results can be seen in Fig. 4., where green indicates places where that the majority of participants perceived as being safe, and red shows places which only 1–17% percent marked as safe. The centre of the inner part of the town, numbered 1 on the map (Fig. 4), proved to be the one perceived as the safest by most of the respondents: there are 71 polygons here (Fig. 3). This is a multifunctional area, which has residential, administrative, commercial, religious, educational and medical functions; it is also a social centre with services, restaurants and accommodation. Palin (8) also seems to be safe. It is an elite residential area with an upper middle-class population. Altogether, 25 polygons indicate this area as a safe place (Fig. 3). In the outskirts, there are areas marked as safe but with a low number (1-10) of polygons only (Fig. 3).

Ligetváros (4), including Csengery Street, includes homes for socially disadvantaged and Roma minority people. The respondents drew 71 polygons altogether around this area, classifying it as an area where they have a fear of crime. Similarly, Dózsa György Street (2 and 1), in the North-Eastern part of the town, was flagged as being unsafe, with 62 polygons (Fig. 2). In the middle section of the street stands the former Soviet army base, which was occupied by squatters (Roma or homeless people). These outcomes are also supported by the ratio of places marked safe to those marked unsafe in Figure 4. Other areas, like Szabadhegy (5), produced interesting results which are problematic to explain. One respondent found that the fear of crime can be experienced there, which is quite unexpected because this is also a peaceful residential area. Similarly interesting is the case of Kiskanizsa (6), a mainly agricultural area that includes the local airport: some of the participants indicated with 4–6 polygons that this area is unsafe.
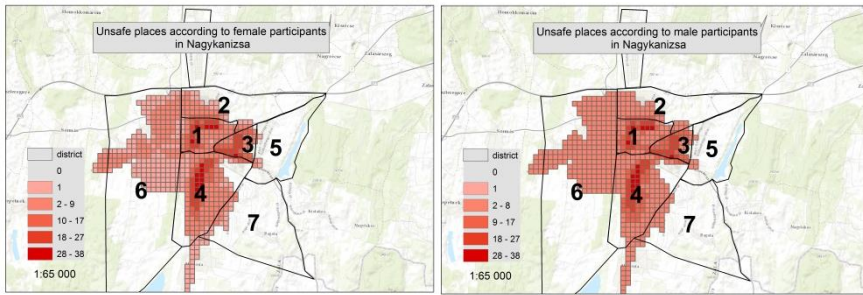
Figure 5: Unsafe places according to female and male participants

We cannot detect significant differences between the opinions of female and male respondents in judging places unsafe. Both women and men found Dózsa György Street (1 and 2) and Csengery Street (4) the most dangerous areas (Fig. 5).
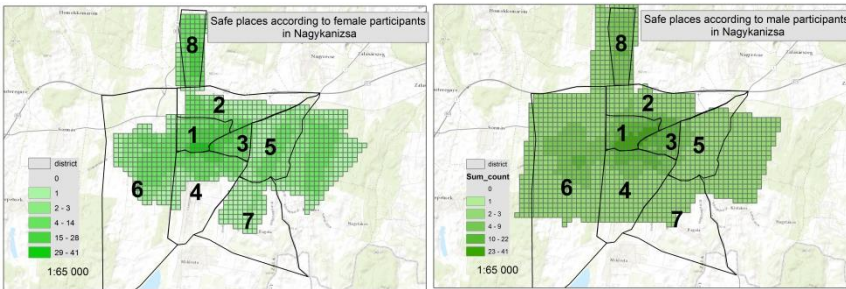

Figure 6: Safe places according to female and male participants

On the other hand, we notice a slight difference where marking places as safe is concerned: males mark more places as safe than females (Fig. 6). However, both men and women agree that Palin (8) is safe, and that the centre of the inner city seems to be the safest part of the city. Men found the outskirts safe, although woman disagreed with this, mainly due to the lack of public lighting.

6 Conclusion and Outlook

For consistency across results, it would be beneficial to develop a customized application to measure the fear of crime. There are several options to do this. The authors in this survey tested their application based on Google API, which is quite straightforward, allowing users to identify by drawing those places where they feel safe or feel fear of crime. The result supports the preconception that this tool can be useful to identify safe and unsafe areas in the town simply. This study confirmed the results of former experiments, which stated that the feeling of fear is connected mainly to ethnicity.

The results produced unexpected outcomes too: for example, peaceful residential areas were connected to the fear of crime. Even local police officers could not find an explanation for this; therefore, we should qualify the reliability of the data. This result may have occurred because the respondents were not familiar with drawing on a map, or they were using a false polygon (red, which indicates fear of crime, instead of green for safe places). It was also evident that some of the respondents created false polygons (only one point), which should be considered a factor of imprecision. We assume that with the increase of the sample size the inaccuracy can be filtered out. In a crowdsourced experiment, members of the public would be volunteering to do an online survey with the application. This would mean, however, that we could not control how precisely they would use the application.

Parallel to enhancing the accuracy in samples, we should also investigate the possible relationship between the daily routine routes and the locations of safe and unsafe areas. When our results are compared to official crime statistics, it turns out that our approach offers further knowledge on safe and unsafe places. This study suggests that standardizing the protocol of the survey with the web application described above will lead to more reliable measurements, though in addition we should implement other research methods such as in-depth interviews, paper-based surveys and analysis of crime statistics.

Acknowledgements

References

Doran D. J. & Burgess M. B. (2012). Putting Fear of Crime on the Map: Investigating Perceptions of Crime Using Geographic Information Systems. New York, NY: Springer.

Downs, R. M. & Stea, D. (1973). Cognitive maps and spatial behaviour: process and products. In: R. M. Downs & D. Stea (Eds.), Image and Environments. Chicago: Aldine.

Erős, F. (2007). Directions and tendencies in the research of prejudice. Educatio, 16(1), 3–9.

Evans, A. J. & Waters, T. (2007). Mapping vernacular geography: web-based GIS tools for capturing "fuzzy" or "vague" entities. International Journal of Technology, Policy and Management 7(2), 134-150.

Ferraro, K. F. & LaGrange, R. L. (1987). The measurement of fear of crime. Sociological Inquiry, 57, 70-101.

Integrated urban development strategy and social development plan of Nagykanizsa. 2008. http://www.terport.hu/webfm_send/3746 [accessed 2016–05–05]

Hungarian Police Department, Official statistics about the numbers of crime: http://www.police.hu/a-rendorsegrol/statisztikak/bunugyi-statisztikak [accessed 2016–05–05]

Kó, J. (2005). Fear from the East to the West: the territorial characteristics of the fear of crime in Hungary. Kriminológiai Tanulmányok, 42, 41-67. OKRI (National Institute of Criminology), Budapest.

KSH (2014). Hungarian Statistical Office official website: crime statistics https://www.ksh.hu/docs/hun/xstadat/xstadat_hosszu/h_zjj001.html [accessed 2016–05–05]

Lederer, D. & Leitner, M. (2012). Erfassung der stadtteilspezifischen Kriminal-itätsfurcht und Verortung von Kriminalitätsfurchträumen in Linz. In: J. Strobl, T. Blaschke & G. Griesebner (Eds.), Applied Geographic Information Technology. Berlin/Offenbach: Wichmann.

Letenyei, L. (2005). Preparing mental maps. In: Letenyei László, Településkutatás I, 147-185. Budapest: Ráció. [in Hungarian]

Matei, S., Ball-Rokeach, S. & Qiu Linchuan, J. (2001). Fear and misperception of Los Angeles urban space: a spatial-statistical study of communication-shaped mental maps. Communication Research 28 (4), 429–463.

Matolay, M. &Vekerdi J. (1970). Roma districts. Valóság, 1, 38-39)

Milgram, S. (1992): Psychological maps of Paris. In: J. Sabini & M. Silver (Eds.), The Individual in a Social World: Essays and Experiments. New York: McGraw-Hill. [in Hungarian]

Nézőpont Intézet (2008). Is the keyword is public safety? http://valasz.hu/itthon/a-kulcsszo-kozbiztonsag-19733/?cikk_ertekel=1&ertekeles=3 [in Hungarian] [accessed 2015–09–09]

Nyíri, Z. (2005). Crime and security in European capitals. EU ICS Consortium working paper.

Pánek, J., Pászto, V. & Marek, L. (2017). Mapping emotions: spatial distribution of safety perception in the city of Olomouc. In: GIS Ostrava 2016 – The Rise of Big Spatial Data. Springer Lecture Notes in Geoinformation and Cartography, 211-224.

Pataki, F. (1997). Prejudice, xenophobia, tolerance: from a social-psychological perspective. In Gy. Csepeli, A. Örkény & M. Székelyi (Eds.), Kisebbségszociológia (pp. 21–30). Budapest: Minoritás Alapítvány. [in Hungarian]

Pődör A. (2007). The possible application of GIS in the crime prevention strategies of municiplaities. In: Márkus et al. (Eds.), Földméréstől a geoinformatikáig: 45 éves a GEO. Székesfehérvár: NymE GEO. 275-286. [in Hungarian]

Pődör, A. (2014). Detection of ill trees / Testing the citizens fear of crime / Noise maps. COST WG Meeting. http://www.citizensensor-cost.eu/meetings/wg-meetings/vienna-sep-2014/

Pődör A. (2015). Usability study on different visualisation methods of crime maps. International Journal of Geoinformatics, 11(4), pp. 15-22.

Pődör A. & Dobos, M. (2014). Official crime statistics versus fear of crime of the citizens in a hungarian small town. In: R. Vogler, A. Car, J. Strobl & G. Griesebner (Eds.), GI_Forum 2014 – Geospatial Innovation for Society. Berlin: Herbert Wichmann. pp. 272-275.

Political Capital (2008). Diagnosis. Research summary on the state of prejudice and intolerance in Hungary. http://www.maraalapitvany.hu/upload- eloiteletesseg_tanulmany_081016.pdf [in Hungarian] [accessed 2015–09–05]

Resch, B., Summa, A., Sagl, G., Zeile, P. & Exner, J.-P. (2015). Urban emotions – geo-semantic emotion extraction from technical sensors, human sensors and crowdsourced data. In: G. Gartner & H. Haosheng (Eds.), Progress in Location-Based Services 2014, Cham, Switzerland: Springer. pp. 199-212.

Sallai, J. (2003). Before the EU accession, waiting for Schengen. Academic and Applied Research in Military Science, 2(1), pp. 107-138. [in Hungarian]

Sallai J. & Mátyás, Sz. (2015). Objective and subjective safety of certain Hungarian cities. In: Hervainé Szabó Gyöngyvér (Eds.), A 21. század eleji államiság kérdőjelei. Székesfehérvár: Kodolányi János Főiskola, pp. 335-407. [in Hungarian]

Skogan, W. G. (1995). Crime and the racial fears of white Americans. The Annals of the American Academy of Political and Social Science, 539(1) 59-71.

Solymosi, R. Fujiyama, T. & Bowers, K. J. (2015). Mapping fear of crime as a context-dependent everyday experience that varies in space and time, in Legal and Criminological Psychology Advance (online publication). Give website not doi

Váradi, L. (2014). Youths Trapped in Prejudice, Politische Psychologie. Wiesbaden: Springer Fachmedien .