European Journal of Geography Volume 8, Number 5:62 - 76, December 2017

CREATING PUBLIC OPINION AND DEVELOPING SPATIAL CITIZENSHIP THROUGH MAPS: THE CASE OF ZARAGOZA, SPAIN

María ZÚÑIGA-ANTÓN
University of Zaragoza, Department of Geography and Regional Planning, Zaragoza, Spain
mz@unizar.es

María SEBASTIÁN LÓPEZ
University of Zaragoza, Faculty of Education, Zaragoza , Spain
msebas@unizar.es

Rafael DE MIGUEL GONZÁLEZ
University of Zaragoza, Faculty of Education, Zaragoza, Spain
rafaelmg@unizar.es

Ángel PUEYO CAMPOS
University of Zaragoza, Department of Geography and Regional Planning, Zaragoza, Spain
apueyo@unizar.es

Abstract

The current context of social transformation and urban changes increases the need for updated knowledge of living spaces. Citizens demand to have monitoring tools available applied to public actions affecting their local environment and neighbourhoods. Aware of this situation, geographers are in a position to provide these tools - urban thematic maps - to ensure citizen-geographical information interaction. The purpose of the present study was to investigate the efficacy of the GIS project *Zaragoza map by map*, in order to train, raise awareness, and empower citizens by using digital maps for their everyday urban space. Communicating by social networks involves generating public opinion trends on specific issues of daily life, such as transportation or public facilities, and thus, suggesting grassroots proposals for improving the built-up environment.

***Keywords**: Neogeography, thematic map, urban space, social networking, spatial citizenship*

1. INTRODUCTION

The concept of neogeography involves the reinvention of geographical science, since it requires techniques and tools for non-expert users for personal and community use (Goodchild, 2008a). Geographical tools have given this type of user a window on the world they know and for which they can generate new spatial information. Proximity and familiarity with the subject of science is the most important factor determining its reach in society (Goodchild, 2008a). People can certainly control their personal environment; everyone is an expert in geography in as far as it is a familiar and social space in their stage of life. Everyone needs to know how spatial relationships work in order to function daily and commute in the urban environment. As neogeography blurs the boundaries between the traditional roles of producer, communicator and consumer of geographical information (Rana et al, 2009), it can

be understood that, in the context of socio-spatial changes in cities, there is an evident need for an even more comprehensive and updated perspective on living space provided through the knowledge of non-expert users.

Cohn (2008), Dickinson et al. (2010), Connors et al. (2012), Haklay (2013) have underlined the strong links between neogeography and citizen science: increasing diversity of participants in the production of geographical knowledge, reducing the gap between researchers/policy makers, and the public/volunteers participating in data collection, also dissemination of a scientific project. People with a high degree of social involvement can contribute valuable insights and information on their environment in what is called "Volunteer Geographic Information" (Elwood, 2008) (Goodchild, 2008a), which is extremely powerful when there is interaction and integration with geographical science. This has specific professional skills: the ability to reason beyond observation to develop new generalizations and theories; to test theories by comparing predictions to observations; and to possess the sophisticated analytical tools needed to reveal insights that are not immediately apparent (Goodchild, 2008b). Amateur geographers should develop their own skills. Spatial citizenship requires at least three (Gryl et al., 2010): handling techniques and spatial information methodology; assessment and reflection on spatial representations; communication and citizens' involvement in spatial representations.

Interaction between geography educators/scientists and citizens has been synthesised by Bednarz and Bednarz (2015) and divided into three categories, from less to more engaged and updating the responsabilities of citizenship: interactive map sites; volunteered geographical information initiatives; and citizen science projects. The project analysed in this article, *Zaragoza, map by map,* belongs to the third case. Individuals are engaged in collecting data and sharing it using web-based services. Such citizen science projects tend to focus more on urban and environmental issues and concerns, in addition to coordinating amateurs to work with professional geographers, not only to provide data for complex spatial scientific analysis, but also to become active social network users in order to create public opinion, advise civic organizations, and suggest policies to the city council. Thus, citizens will get to know better the kind of city they have in spatial terms, where the problems and challenges lie, and how these can be solved. Bridging the gap between citizen information and geographical information (Sebastian et al, 2014) is the first step in raising awareness of spatial citizenship and involvement.

Zaragoza, map by map was launched in October 2013 as a civic exhibition, sponsored by the Environmental Unit of the Zaragoza City Council (Centro Ambiental del Ebro, 2013), which gathered several cartographic materials on the city: green areas, public facilities, transportation, retail proximity, etc. by districts and blocks. Later, a second exhibition was set up in a larger venue in October 2015. During this period, civic activities were organised, as well as a dynamic feedback with visitors through social media, which convinced city councillors to place maps on the city homepage (Ayuntamiento de Zaragoza, 2013) tp provide general knowledge. This online geographical information has encouraged collaborative map making on the same city webpage, and also civic involvement.

2. OBJECTIVES AND METHODOLOGY

Following Haklay (2013), the main target of *Zaragoza, map by map* was to increase the use and creation of geographical information by non-experts, as a neogeography example to:

- Make geographical information available to citizens by promoting reading and efficient interpretation thereof;
- Bring citizens the results of the thematic research conducted by the University of Zaragoza in the field of district demographics and accessibility to services and public facilities, in order to empower civic organizations demanding similar living conditions across the different areas of the city;

- Collect spatial information through collaborative maps on line and social media, generated by

visitors and citizens in order to lobby local decision-making related to several issues, such as transit.

Methodology for the project was based on Alonso et al. (2010) taking exhibition and related activities as the main element, consisting of the following: (1) data, (2) exhibition character, (3) context, (4) exhibition design and materials, (5) circulation space and (6) audience.

(1) Data: The whole project hinged on demographic, social and urban data available from the 2012-2015 local census, including spatial statistics in the fields of population (structure by age/ethnicity/income, evolution and distribution), urban growth, open spaces, traffic and transit and public facilities. The data are mapped on several scales: city, district, census tract and block.

(2) Exhibition character: this was defined though several criteria described by Alonso et al. (2010). The exhibition had a documentary function because it was mainly linked to geoinformation and the scientific value of the maps; the exhibition was contextualized in the cultural and social environment of visitors; the exhibition was temporary and portable: it had a limited and extensible duration, but was also easy to install and carry to other venues; the nature of the exhibited material was mixed, as it included analog and digital resources and maps; the exhibition was versatile as it allowed different reading levels according to different mindsets, education level and age; finally, the exhibition encouraged interacting and participating with materials and activities for visitors designed around urban and civic affairs.

(3) Context: The initial project was designed to be exhibited at the Environmental Education Centre. In its original location, the exhibition could be visited for three months (October-December 2013). There was a second, longer period (October 2015-May 2016) at the Center for Art and Technology, eTOPIA. Apart from the general public, professional geographers were involved and supported the project at several events: 16th Conference of Geographical Information Technologies (June, 2014), ESRI Conference (October, 2014), National Conference of the Spanish Geographers Association (October, 2015).

(4) Exhibition design and materials: The project was based on the approach of spatial information for non-expert users by learning how analog and digital cartography can operate as a communication tool to improve their local environment. This required preparing material, taking into account the subject, the level of complexity, format and the map design. The topics selected for representation as maps on boards structured the story line of the exhibition, according to the dataset mentioned above: city evolution, population, open spaces, public facilities, transportation, and assessment of the city. The exhibition became more complex as visitors advanced through it. It started with a very simple remote sensing image of the whole metropolitan area, and gradually included more levels of thematic information and detail of geospatial information, i.e., demographic structure by blocks. Thus, the visitor was trained in map reading and interpreting, and later in spatial citizenship. The material used in the exhibitions consisted of: (1) the first exhibition: 21 boards; (2) the second exhibition: 39 boards. Panels in both exhibitions varied in size, ranging from 50 x 50 centimeters to over400 x 400 centimeters. In addition, there was an interactive board in which visitors could propose new spatial information to be incorporated, as well as all digital maps projected on a 42-inch screen and a web viewer. It was developed in collaboration with the Spatial Planning Research Group (GEOT) - part of the Environmental Sciences Research Institute at the University of Zaragoza - and the company, GeoSpatiumLab.

A second, totally digital format of maps and materials was available on the Internet and web platforms in order to promote interaction and user versatility from different devices: computers, pads and phones (Ayuntamiento de Zaragoza, 2015). This was done through spatial visualization technology based on OpenLayers open source framework, and supplemented with JQuery library (JavaScript), to simplify the way people interact with HTML documents, manipulate the DOM (Document Object Model), handle events, develop animations and add interaction with AJAX (Asynchronous JavaScript and XML) (Zuñiga et al, 2015). Moreover, a huge screen was set up in the building, to project a series of animated maps.

The map design differed depending on the degree of complexity of each map, according to the classification of cartographic trajectories (Zuñiga, 2009). For the simplest, geospatial information was supported by aerial images, delimitation of urban spaces and the use of bar or sector charts. A second level introduced information on surfaces, locations and proximity through analysis of areas of influence. Finally, the map most complex presented three spatial variables: a grey scale for choropleths, and a combination of color and volumetric proportional figures (Zuniga et al, 2012), as shown later.

(5) Circulation space: Spatial distribution of boards was the most decisive element in the exhibition. How visitors perceive the materials depends largely on the location of objects, their relationship to each other (Alonso et al, 2010), and the rhythm of circulation. Determining the exhibition rhythm is critical (Belcher, 1991), as visitors should familiarize themselves with the simplest mapping information (aerial image and thematic mapping) before analyzing and interpreting information specific to their quality of life through multivariable and complex mapping. Material (Fig. 1) in the first exhibition was organized as a circulation comb (Lehmbruk, 1974), and the second exhibition used a chain circulation pattern, although both clustered the material by topic and levels of complexity. Trazacultura, an expert company in cultural design, laid out the circulation space in the second exhibition.

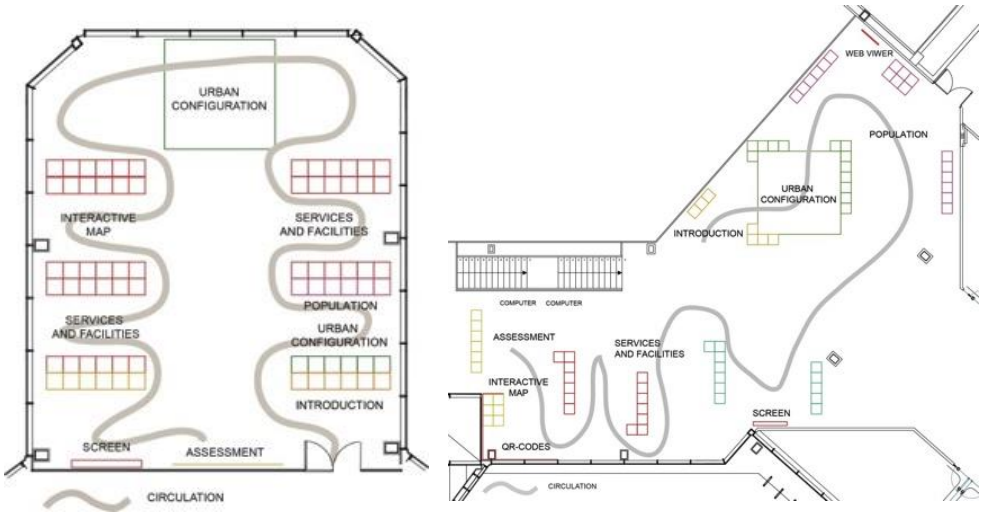


Figure 1. *Circulation space of the exhibitions. Left: First exhibition comb circulation space. Right: Second exhibition chain circulation space.* Source: *GEOT and Trazacultura; 2016.*

(6) Audience: Map design included a non-expert user in geospatial information. Grading the complexity of cartography and map training in order to assess living conditions are essentials to achieve active spatial citizenship and proposals for improving public spaces and local actions on urban issues. The project aimed to disseminate neogeography to democratize the use of geospatial technologies and generate collaborative geodata by non-experts for their personal and social activities (Goodchild, 2008a). It included several dimensions, such as Web 2.0, GPS, free software mapping, Volunteered Geographic Information, interactive and collaborative mapping, social media, etc. (Rana et al, 2009). One way or another, all are intrinsically linked to *Zaragoza map by map*.

3. MAPPING FOR CITIZENS

Exhibitions consisted of twenty one boards (first) and thirty nine (second). However, *Zaragoza map by map* has a total of forty one maps or remote sensing items designed and created specifically for this project, based on socio-demographic research previously conducted by the research group GEOT. Additionally, it should be noted that the project was enriched with complementary formats allowing visitors to keep in touch with it through a web viewer (http://cenarbe.cps.unizar.es/visor Demografico/) and the animated screen on the outside (Fig. 2). With this set of resources, mapping was made accessible

and understandable to the citizens participating in the project activities particularly the exhibitions. However, the gamble in bringing spatial information to the public was the idea of covering the facade of a building with digital, interactive maps, projected through LED lighting technology. Thus, maps and spatial information on the city invaded the public space and perception of pedestrians, who tended to be attracted by this visual device, and to participate in spatial citizenship activities.

Figure 2: *Left: Demographic map viewer. Right: Exterior showing of the exhibition maps.* Source: *GEOT and GeoSpatiumLab; 2016.*

Figures 3 and 4 show a sample of the complete map list from *Zaragoza map by map*. Each of the maps belongs to one of the categories in Tables 1 to 6, according to the different thematic objective for which it was designed: (1) urban development and metropolitan area, (2) demographic structure, (3) maps for kids, (4) proximity to public services and facilities (5) interactive maps and (6) assessment of the city by their citizens. Later, the description of the mapping was based on the following parameters: (1) target, (2) number of boards, (3) degree of grouping, (4) level of complexity, (5) format, and (6) cartographic design.

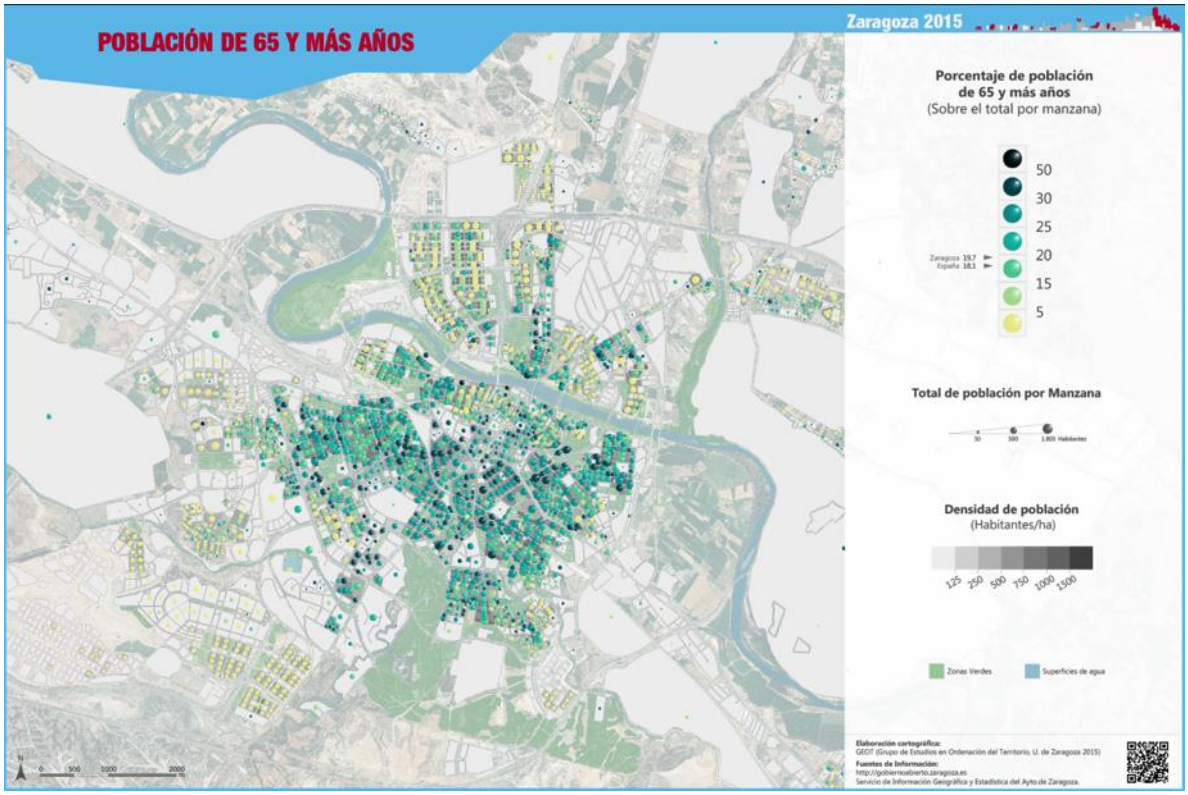


Figure 3: *Population over 65 years map.* Source: *GEOT, 2015.*

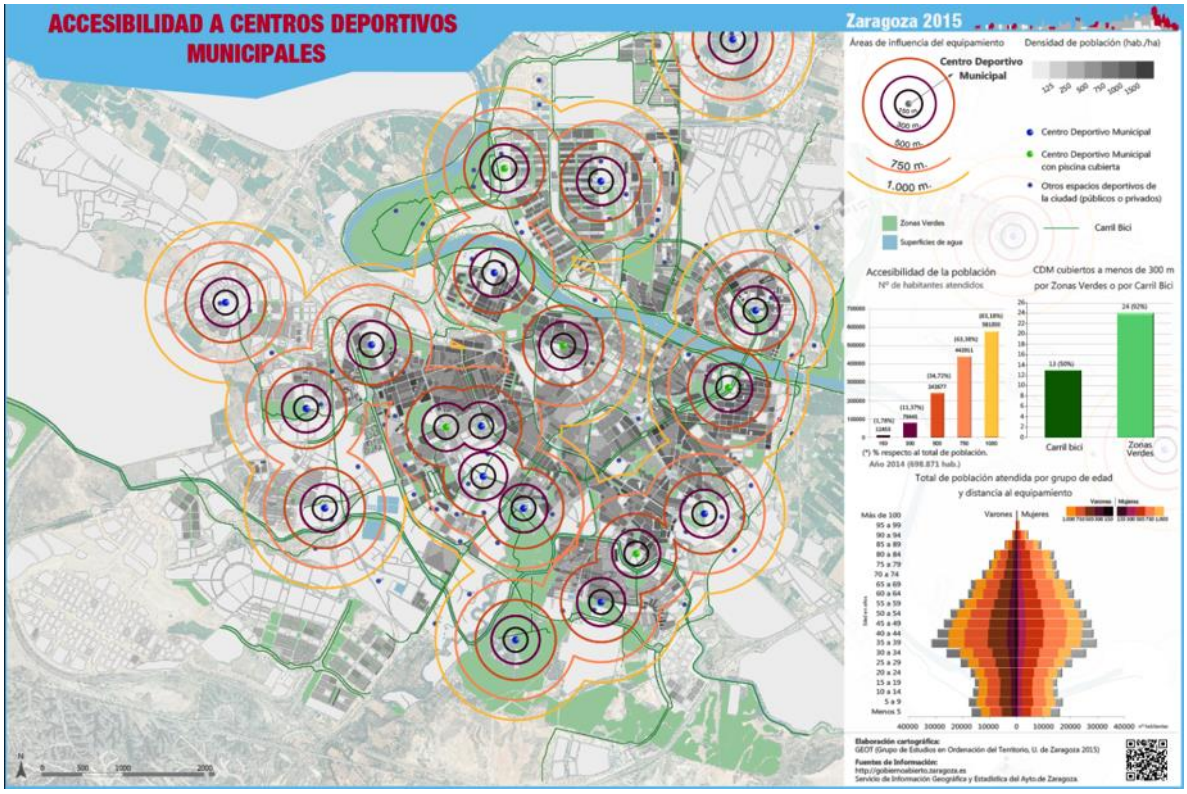


Figure 4: *Proximity to sports centers.* Source: *GEOT, 2015.*

Table 1: Urban development and metropolitan area.

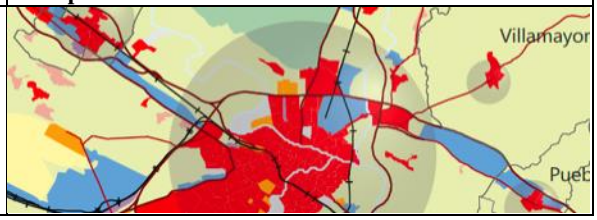
Target user	**Scale**	**User level**	**Format**	**Map design**
Non expert	District	Basic	Analog	Two boards show remote sensing images comparing spatial development between 1927 and now. The third shows the extent of the built-up urban area, qualitative information displayed through graduated colour. In addition, there is a map of land use represented by surfaces and varying colour and other visual delimitation of the metropolitan area.
Exhibition 1:				**Exhibition 2:**
Number of boards: 3				Number of boards: 3
Example: Urban change				**Example:** Land use
 				

Table 2: Demographic structure

Target user	**Scale**	**User level**	**Format**	**Map design**
Non expert	District	Intermediate	Analog Digital	These are panels containing quantitative demographic information, represented by point implementation, either linked to proportional size or pie charts. Additional variables are included by dots with different colour values.They are included in the demographic information web viewer.

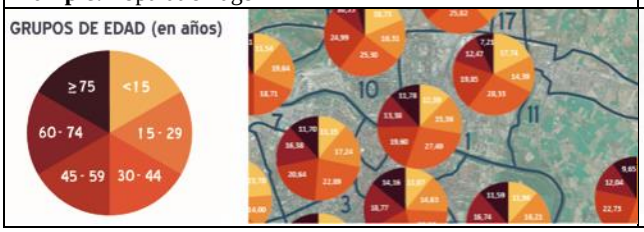
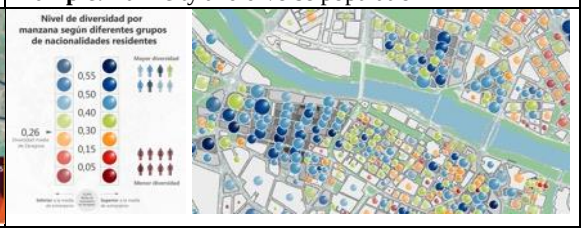
Exhibition 1:	**Exhibition 2:**
Number of boards: 3	Number of boards: 6
Example: Population age	**Example:** Ethnicity and diverse population
	

Table 3: Maps for kids

Target user	**Scale**	**User level**	**Format**	**Map design**
Child population	Aerial photography on the city (Non scaled)	Basic	Analog	This map is an impression of the aerial image of the city on a panel of 4x4 meters, including elements that allow kids to interact (landmarks of the city, car and transit, playing, etc. This remote sensing resource was used in the two exhibitions.

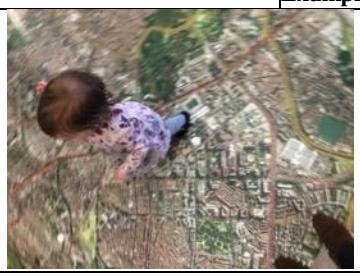
Exhibition 1:	**Exhibition 2:**
Number of boards: 1	Number of boards: 1
Example: Aerial photography	**Example:** Aerial photography
	 

Table 4: Proximity to public services and facilities

Target user	**Scale**	**User level**	**Format**	**Map design**
Non expert and expert	Blocks, from which a (service) buffer area is designed	Intermediate Advanced	Analog Digital	These are cartographical compositions to be understood through three reading levels: the first acts as background (population density by block; darker grey shows more dense areas). In the second, facilities, shops and services are shown by blue dots. Finally, linear buffer areas are displayed by distance implementation.

Exhibition 1:	**Exhibition 2:**
Number of boards: 6	Number of boards: 14
Example: Proximity to pharmacy	
	

Table 5: Interactive maps

Target user	**Scale**	**User level**	**Format**	**Map design**
Non expert	Blocks	Basic Intermediate	Analog	As below, background represents population density by block and the only tram line. It is expected that visitors and citizens will suggest new alternatives to the second line, or bus network, or locate their living spaces, or make any proposal to improve the urban space, built-up environment, traffic, local neighbourhood. For this, citizens are encouraged to submit their proposal via Twitter, hash tag #zgzmapamapa

Exhibition 1:	**Exhibition 2:**
Number of boards: 1	Number of boards: 1
Example:Transport proposal: new tram lines	**Example:** Your daily life space
	

Table 6: Assessment of the city

Target user	**Scale**	**User level**	**Format**	**Map design**
Expert	Blocks	Advanced	Analog	This is a cartographic composition with two layers. First, block density as in previous examples. Second, two quantitative variables in a dot. Thus, size means total population by block; colour reflects the number of public facilities that are in a radius of 300 metersrom the block.

Exhibition 1:	**Exhibition 2:**
Number of boards: 1	Number of boards: 1
Example: Assessment of the proximity to public services and facilities	
	

4. RESULTS: CIVIC INVOLVEMENT AND SPATIAL CITIZENSHIP

Validation of the usability and outcomes of the exhibition will be based on the active involvement of visitors. More specifically, the analysis gave citizens enough knowledge to empower a demand for collective reflection and proposals for their own community. To address this, the quantitative and qualitative information obtained was analyzed, using information from various sources: (1) simple questionnaire or personal communication from visitors; (2) surveys and semi-structured debate with a specialized public; (3) participation on-line and analysis on social networks.

In total, more than 5,000 people visited the two exhibitions. They were divided into 3 groups: (1) non expert public (citizen, neighborhood associations, senior centers, secondary schools); (2) special visitors (children, people with physical or mental disabilities); (3) expert participants (agents of public administrations, geography students and participants in the AGE meeting) (Fig. 5). In addition, information was available on the number of web viewer visitors (Fig. 6). Related to this, the trend of visits had two main spikes – one in October, when the exhibition was opened, and the other in April and May, when there were activities with the audience more often.

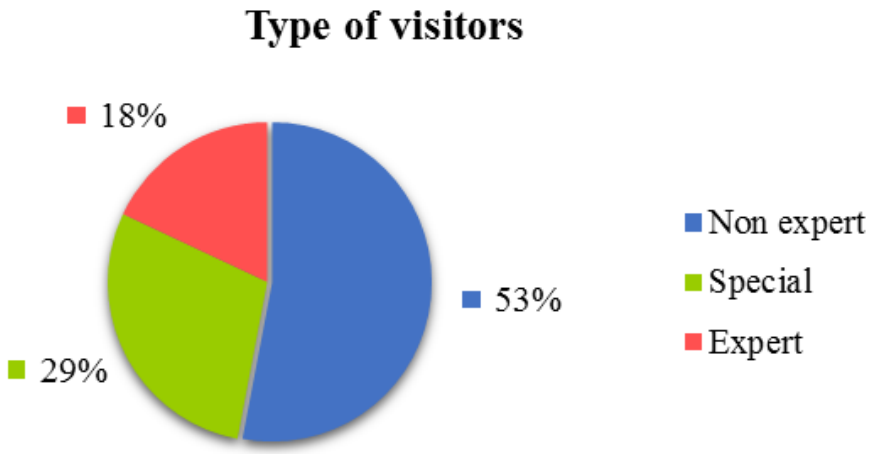


***Figure 5**: Percent of visitors by category.*

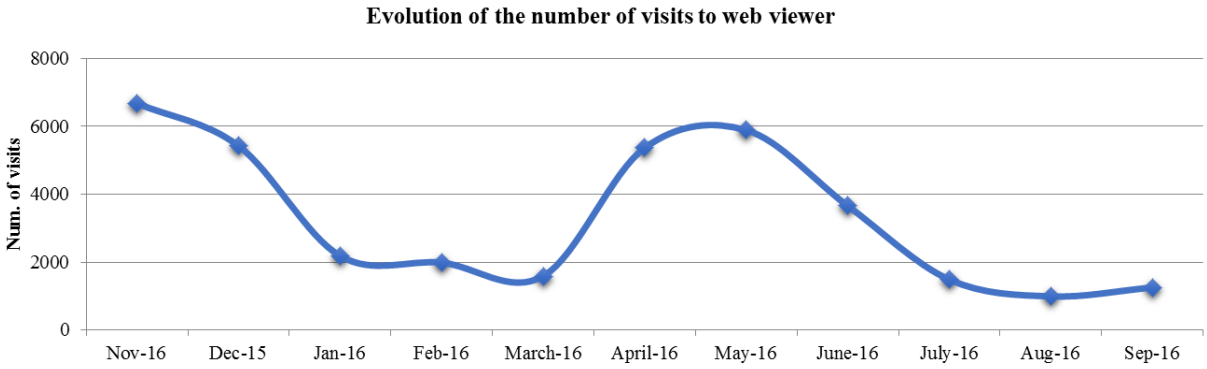


***Figure 6:** Number of visits to web viewer.*

4.1. Results according to the spatial and thematic perception of visitors

Researchers asked visitors to respond to a set of generic questions related to the exhibition, as well as their perceptions and subsequent perception of visiting the city of Zaragoza. Specifically, the following eight general questions were formulated:

(1) General perception: What image does Zaragoza present? Do you think that Zaragoza is a stagnant or growing city? Could you draw your living space?

(2) Assessment: How do you assess the facilities in the city? Would you be able to identify the areas requiring the most urgent urban intervention?

(3) Citizen participation: What are the main strengths and weaknesses that you have perceived? Could you draw a new tram line and outline the route and proposed tram stops?

(4) Final remarks: What is your general perception of the effectiveness of mapping?

The participants' views showed different results on proficiency in assessment and use of basic geospatial and thematic information.. These are the estimated values (Fig. 7):

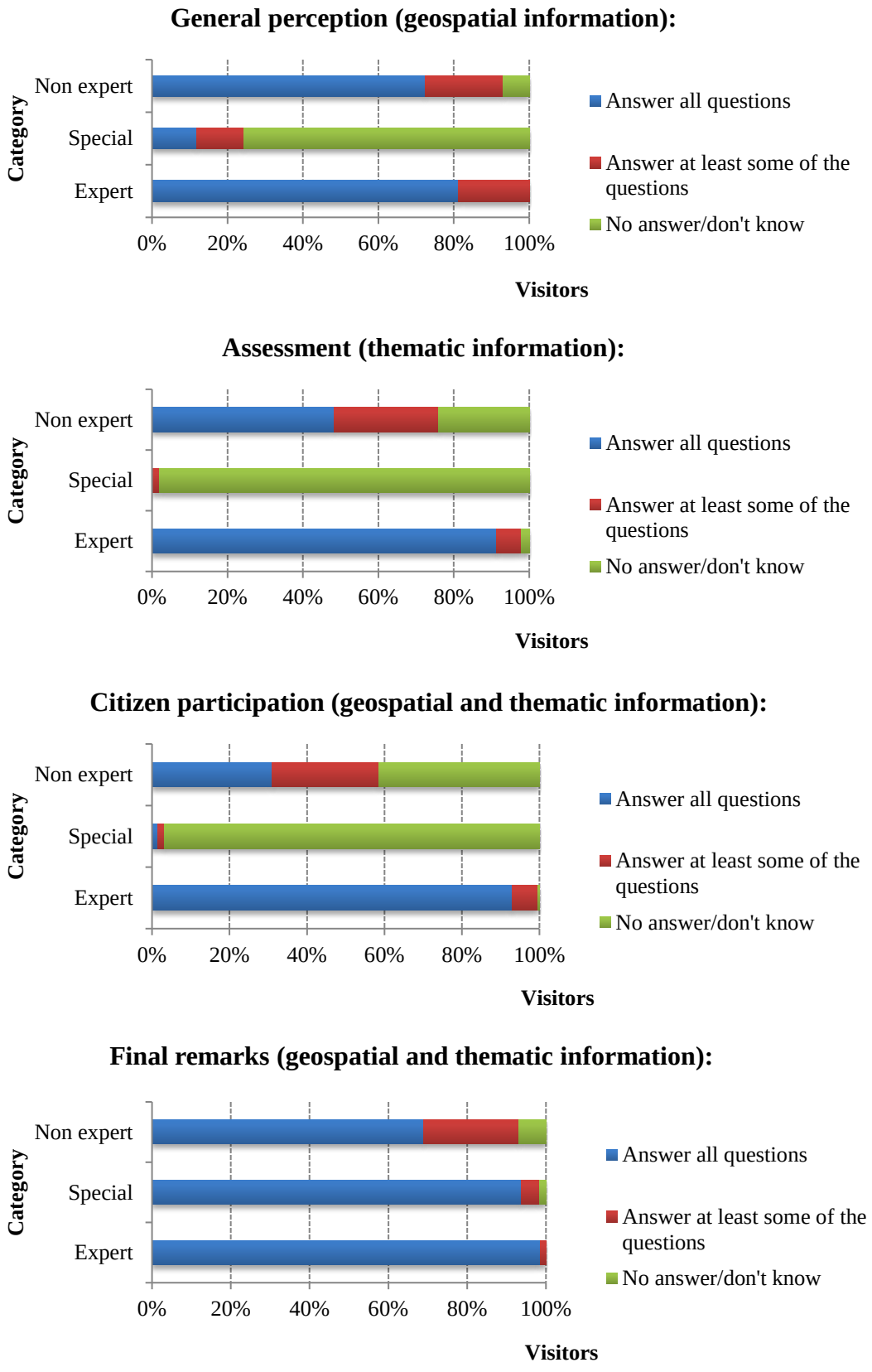


Figure 7. *Visitors' perceptions of the Zaragoza map by map*

4.2 Qualitative information generated in the context of the GIS Project Zaragoza map by map:

During the first seventh months of the exhibition in eTOPIA, a series of activities was run with undergraduate and graduate students of geography and history from the University of Zaragoza and University of Alicante (Fig. 8). In short, 144 students and 7 researchers were involved in these activities, all of which included a final discussion on the conclusions that users might draw from maps. This section presents the results of these activities (Table 7). These are the main issues that the GIS project can solve, and that the students considered useful for daily life and monitoring government actions. In conclusion, by asking questions to make a map, a citizen opinion has been created.

Table 7. *A question that a user can answer thanks to maps according to students' opinion and divided by thematic context.*

Thematic context	**Topic suggested by the public**
Urban development and metropolitan area	What was here during my grandfather's time? Where is the limit of my city? Does any part of the city have the same function?
Demographic structure	What kind of people live in my neighborhood? How many people live in there?
Maps for kids	Where is my house? Where is my school? Where am I, now? How can I go from here to the river?
Proximity to public services and facilities	Which is the closest park to my home? How many people use my tram stop? Where did the city government invest the budget last decade?
Interactive maps	If I could choose the new tram route… what would it be…? How do I use the city? Where do I go most often?
Assessment of the city	If I moved into a new house… Which area would I choose…? Are the locations of public and private services and facilities important in this decision? Where did the city government invest the budget last decade?

Figure 8. *Tweets related to one of the activities, on the 7th of April in eTOPIA*

4.3 Social media interaction with the GIS Project Zaragoza map by map

As said previously, this project used Twitter® to interact with non-expert users. Although we did not reach the ideal level of answers, two secondary objectives became possible: (1) a minimum of feedback and advertising, and (2) to generate new spatial information related to the future tram line (Fig. 9) and configuration of living spaces (Fig. 10 and 11).

Figure 9. *Tweets related to external assessment and advertising.*

Figure 10. *Tweets related to future tram line.*

Figure 11. *Tweets related to living space.*

5. DISCUSSION

The essence of neogeography lies in the assumption that democratization has grown up around geographical information, placing geospatial technologies within the reach of non-expert users for personal or professional use (Butler, 2006). However, some authors argue that this democratization has several limitations (Haklay, 2013). From the perspective of this project, it seems that users and citizens participating in activities have an elementary proficiency in assessing and handling basic geospatial information. However most users have limits when using spatial information enriched with thematic information, in particular socio-demographic or proximity weighted index. In this case, non-expert users do not find it easy to use and interpret complex geospatial information, but are better at observing the spatial environment in which they live. In order to analyse and make proposals to improve their community urban space, a training program led by a geo-mentor, such as a GIS expert and educator, would be useful (Favier and Van der Schee, 2014).

That is why initiatives such as *Zaragoza map by map* gives citizens enough knowledge to empower demand for collective reflection and proposals on their own community. In this case, maps and activities from the project wished for a new tram line for transit, including outlines for the route and proposed stops. Usually, citizens with no additional information about their city (population by neighbourhood, proximity index to public services, etc.) are less involved in civic participation or raising *not in my back yard* arguments. However, after urban learning processes and basic geospatial training to read and understand complex maps, citizens participating in *Zaragoza map by map* endorsed more equitable strategies covering the needs of the larger population, not just their own immediate area or block (Sebastian et al, 2014), thus reinforcing the sense of community. Spatial intuition has been replaced by spatial analysis: maps, data and empirical evidence confirmed what citizens suspected about urban issues and processes (ethnic concentration, lack of a specific facility, block aging, etc.), and this confirmed the conviction that their civic demands were appropriate.

As expressed previously (Bednarz and Bednarz, 2015), citizen science projects can encompass much more than simple data collection because they have the potential to enable people to participate in their city or community where they live. Such projects cover the requirements of citizenship, combining citizen management practices (increasing interaction between experts and citizens) to empower civic initiatives in urban decision-making processes. To this end, it is essential to encourage not only geospatial information visualization and data collection – as done in the case of Zaragoza, by making the maps and resources available to everyone on a website -, but also collaborative working tools (Goodchild, 2008a) for raising awareness, creating public opinion, and even lobbying city council policy makers from grassroots initiatives to promote efficient and more equitable urban management.

ACKNOWLEDGEMENTS

This contribution has been prepared with the support of the Environmental Unit (Zaragoza City Council) and Ebropolis (Strategic Plan office for Zaragoza and metropolitan area), and under the project GEOT “Mapping tools for smart governance in digital cities: spatial analysis and life” (CSO2013- 46863- C3-3-R), National Program of R&D Oriented to Society Challenges. GEOT is the research group on studies in spatial planning at IUCA-University of Zaragoza.

REFERENCES

Alonso, L. & García, I. 2010. *Diseño de exposiciones. Concepto, instalación y montaje.* Madrid: Alianza Forma.

Ayuntamiento de Zaragoza. 2013. *Valoración de la proximidad de las zonas verdes, equipamientos y servicios en la ciudad de Zaragoza*.

https://www.zaragoza.es/ciudad/medioambiente/agenda21/observatorio/estudios-indicadores.htm

Ayuntamiento de Zaragoza. 2015. *Visor demográfico*.

http://cenarbe.cps.unizar.es/visorDemografico/

Bednarz, S. & Bednarz, R. 2015. Brave New World: Citizenship in Geospatially Enriched Environments. *GI Forum 2015:* 230-240.

Belcher, M. 1991. *Exhibitions in museums.* Leicester: Leicester University Press.

Butler, D. (2006): The Web-Wide World. *Nature*: 439. 776-778.

Centro Ambiental del Ebro. 2015. *Presentación y objetivos*. Available http://www.zaragoza.es/ciudad/centroambientalebro/presentacion.htm [08/02/2015].

Cohn, J. 2008. Citizen Science: Can Volunteers Do Real Research? *BioScience*: 58 (3) 192-197.

Connors, J., Lei, S. & Kelly, M. 2012. Citizen Science in the Age of Neogeography: Utilizing Volunteered Geographic Information for Environmental Monitoring, *Annals of the Association of American Geographers*:102(6), 1267–1289.

De Miguel, R. 2012. Geomedia for education in sustainable development in Spain. An experience in the framework of the aims of digital- earth.eu. *European Journal of Geography*, 3 (3), pp. 44-56.

Dickinson, J., Zuckerberg, B. & Bonter, D. 2010: Citizen Science as an Ecological Research Tool: Challenges and Benefits. *Annual Review of Ecology, Evolution, and Systematics*: 41, 149-172.

Elwood, S. 2008. Volunteered geographic information: key questions, concepts and methods to guide emerging research and practice. *GeoJournal:* 72, 133-135.

Favier, T. & Van der Schee, J. 2014 Digital Earth and Geography Teacher Training for the 21st Century: Teacher Competencies for Inquiry-based Geography Teaching in De Miguel, R. & Donert, K. (ed.) *Innovative Learning Geography in Europe: New Challenges for the 21st Century*. Newcastle, Cambridge Scholars Publishing: 65-76.

Goodchild, M, 2008a. Citizens as sensors: web 2.0 and the volunteering of geographic information. *Geofocus*: 7, 8-10.

Goodchild, M. 2008b: *Assertion and authority: the science of user-generated geographic content.* Berkeley: University of California Press.

Gryl, I., Jekel, T. & Donert, K. 2010. GI & Spatial Citizenship in Jekel, T., Koller, A., Donert, K. & Vogler, R. ed. *Learning with G*I V, Berlin: Wichmann, 2-11.

Haklay, M. 2013. Neogeography and the delusion of democratisation. *Environment and Planning A:* 45(1), 55-69.

Haklay, M. 2013. Citizen Science and Volunteered Geographic Information – overview and typology of participation in Sui, D.Z., Elwood, S. & M.F. Goodchild (eds.). *Crowdsourcing Geographic Knowledge: Volunteered Geographic Information (VGI) in Theory and Practice* . Berlin: Springer. 105-122.

Lehmbruck, M. 1974: Functions. Space and circulation. *MUSEUM magazine:* 3/4, 221-236.

Rana, S. & Joliveau, T. 2009. Neogeography: an extension of mainstream geography for everyone made by everyone? . *Journal of Location Based Services:* 3(2), 75-81.

Sebastián, M.; Zúñiga, M.; Pueyo, A.; Postigo, R.; Salinas, C.; Arranz, A. & López, C. 2014. Zaragoza Mapa a Mapa: una herramienta para el ciudadano in *XVI Congreso Nacional de Tecnologías de la Información Geográfica*, (Alicante, 25-27 de junio de 2014). Alicante: Universidad de Alicante. 856-864.

Zúñiga, M. 2009. *Propuesta cartográfica para la representación y análisis de las variables de población mediante sistemas de información geográfica e infografía: el caso español*. Zaragoza: Prensas Universitarias de Zaragoza.

Zúñiga, M.; Pueyo, A., & Calvo, J. 2012: The Spanish population during the twentieth century and beyond. *Journal of Maps*:8, 386-391.

Zúñiga, M.; Sebastian, M.; Perez, MJ.; Fernandez, MJ; Alonso, MP. & Pueyo, A. 2015. Visualización y análisis de información sociodemográfica a través de los servicios IDEZar del Ayuntamiento de Zaragoza in *XXIV Congreso de la Asociación de Geógrafos Españoles*. Zaragoza.