TeMA

Journal of
Land Use, Mobility and Environment

This special issue collects a selection of peer-review papers presented at the 8th International Conference INPUT 2014 titled "Smart City: planning for energy, transportation and sustainability of urban systems", held on 4-6 June in Naples, Italy. The issue includes recent developments on the theme of relationship between innovation and city management and planning.

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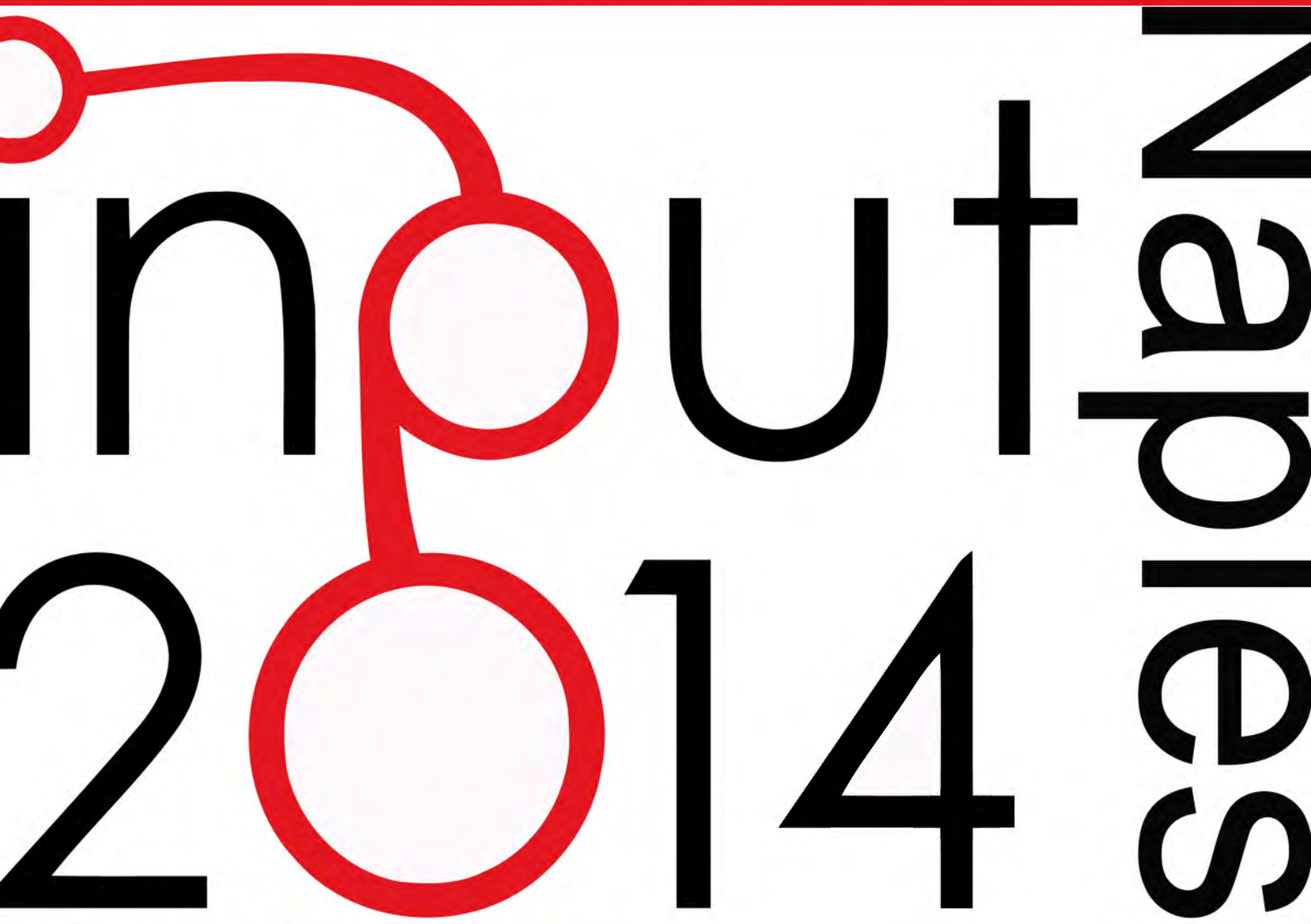

Smart City

planning for energy, transportation and sustainability of the urban system

Special issue, June 2014

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TeMA Journal of Land Use, Mobility and Environment

SMART CITY

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TeMA Journal of Land Use, Mobility and Environment

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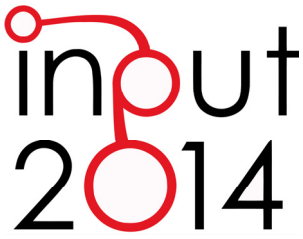
TeMA Journal of Land Use, Mobility and Environment

This special issue of TeMA collects the papers presented at the 8th International Conference INPUT 2014 which will take place in Naples from 4th to 6th June. The Conference focuses on one of the central topics within the urban studies debate and combines, in a new perspective, researches concerning the relationship between innovation and management of city changing.



TeMA Journal of Land Use, Mobility and Environment

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EIGHTH INTERNATIONAL CONFERENCE INPUT 2014

SMART CITY. PLANNING FOR ENERGY, TRANSPORTATION AND SUSTAINABILITY OF THE URBAN SYSTEM

This special issue of TeMA collects the papers presented at the Eighth International Conference INPUT, 2014, titled "Smart City. Planning for energy, transportation and sustainability of the urban system" that takes place in Naples from 4 to 6 of June 2014.

INPUT (Innovation in Urban Planning and Territorial) consists of an informal group/network of academic researchers Italians and foreigners working in several areas related to urban and territorial planning. Starting from the first conference, held in Venice in 1999, INPUT has represented an opportunity to reflect on the use of Information and Communication Technologies (ICTs) as key planning support tools. The theme of the eighth conference focuses on one of the most topical debate of urban studies that combines , in a new perspective, researches concerning the relationship between innovation (technological, methodological, of process etc..) and the management of the changes of the city. The Smart City is also currently the most investigated subject by TeMA that with this number is intended to provide a broad overview of the research activities currently in place in Italy and a number of European countries. Naples, with its tradition of studies in this particular research field, represents the best place to review progress on what is being done and try to identify some structural elements of a planning approach.

Furthermore the conference has represented the ideal space of mind comparison and ideas exchanging about a number of topics like: planning support systems, models to geo-design, qualitative cognitive models and formal ontologies, smart mobility and urban transport, Visualization and spatial perception in urban planning innovative processes for urban regeneration, smart city and smart citizen, the Smart Energy Master project, urban entropy and evaluation in urban planning, etc..

The conference INPUT Naples 2014 were sent 84 papers, through a computerized procedure using the website www.input2014.it . The papers were subjected to a series of monitoring and control operations. The first fundamental phase saw the submission of the papers to reviewers. To enable a blind procedure the papers have been checked in advance, in order to eliminate any reference to the authors. The review was carried out on a form set up by the local scientific committee. The review forms received were sent to the authors who have adapted the papers, in a more or less extensive way, on the base of the received comments. At this point (third stage), the new version of the paper was subjected to control for to standardize the content to the layout required for the publication within TeMA. In parallel, the Local Scientific Committee, along with the Editorial Board of the magazine, has provided to the technical operation on the site TeMA (insertion of data for the indexing and insertion of pdf version of the papers). In the light of the time's shortness and of the high number of contributions the Local Scientific Committee decided to publish the papers by applying some simplifies compared with the normal procedures used by TeMA. Specifically:

- Each paper was equipped with cover, TeMA Editorial Advisory Board, INPUT Scientific Committee, introductory page of INPUT 2014 and summary;
- Summary and sorting of the papers are in alphabetical order, based on the surname of the first author;
- Each paper is indexed with own DOI codex which can be found in the electronic version on TeMA website (www.tema.unina.it). The codex is not present on the pdf version of the papers.

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SPECIAL ISSUE

Eighth International Conference INPUT
Smart City - Planning for Energy, Transportation and Sustainability of the Urban System

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GEOVISUALIZATION TOOL ON URBAN QUALITY

INTERACTIVE TOOL FOR URBAN PLANNING

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ABSTRACT

This paper describes the implementation of a tool that enables to gather and compare data from different sources for the benefit of urban planners. The tool is easy to access on different types of devices (personal computers, tablet, smartphones) thus being easily available in many various situations from urban planners and decision makers. It may also be used to find correlations between different phenomena in different time frames, so that solutions to possible problems can be rapidly suggested. The paper shows the process of implementation of the tool and some examples of application to the city of Torino in Northern Italy, a city who dealt with several urban transformation in the last two decades.

KEYWORDS

urban quality, geovisualization, planning tools, gis

1 INTRODUCTION: GEOVISUALIZATION

The term geovisualization indicates the ability of a GIS program to visualize geographical information according to various applications, including interactive maps, tridimensional models, maps and synthesis tables, representation of temporal events and schematic view of the internal relations of a network. It allows reproducing basic geographical representations as well as advanced representations (maps) of the data contained in geographical database. Maps are the main tool for presenting geographical information to users and allow the interaction.

Maps created through GIS are different from static printed maps because it is possible to interact with them. An interactive map can be explored or widened and the information layers which are represented may be switched on and off with appropriate visualization scales.

Even more interesting is Web GIS, a geographic information system published on the web that is the web extension of applications born and developed to manage digital cartography. A web GIS project differentiates itself from a GIS project for the specific aims of communication and information sharing with other users. Through GIS, GIS applications traditionally developed for standalone users or in LAN environments may be implemented on a web server (also called map server) allowing the interaction with cartography and associated data through internet.

The next step could be to have the same data always handy especially during a survey, travelling, etc. Web GIS used on a desktop pc does not provide this capability. A handy cartography that interfaces with the position of the consulting person is necessary; this is called web mobile GIS.

Being GIS one of the most performing tools among all technologies related to information, it is used more and more frequently as a decision support tool. Many are the fields of application based on geospatial information technology, in particular those who are related with territorial and urban planning, that is the discipline that studies and regulates territory management processes, evaluating the consequent evolutionary dynamics. It is the activity through which territory overall structures are assessed. In this field the need of a common information data base shared anytime by different operators is fundamental. By means of GIS systems it is possible to share, manage and represent several territorial data.

2 A NEW TOOL TO VISUALIZE URBAN QUALITY

Territorial planning requires more and more access availability to various types of georeferenced data; to answer this question, a specific research was carried out in order to identify the most adequate tools to gather and manage such significant data.

Data typologies gathered with this tool are essentially two: georeferenced data of urban transformation (perimeters and data describing transformations) and data on the quality of life in the city of Torino (georeferenced indicators on urban structures and services).

The development of the tool raises from the idea of gathering all available data on a unique platform as user friendly as possible. Many people do not know how to use or don't have Arc map and then they cannot interact with the data.

To overcome this limitation we found the answer in the Google beta application "Fusion Table" that exactly allows to load data previously processed by ArcMap on a web platform accessible to all with the possibility to be interactive and interrogated by using filters and selections.

Google Fusion Tables is a specialized program very interesting for database management. The service, always free and completely on line, has a very precise aim: it helps large database and multiple tables

distributed database managers to use their own data, filter them, implement graphical representations that can be distributed in the simplest possible way.

The georeferenced interactive map on life quality in the cities is, therefore, a tool that gathers various georefernced data (indicators) regarding a town (in this case Torino) giving the possibility to visualize them in different graphical shapes.

A very interesting feature of the tool is its interactivity that is the possibility to personalize the map through various filters available for each indicator. All this is accessible not only through a pc connected to the internet, but it is also possible to visualize and actively interact using a tablet or a smartphone, thus making this tool available in several different situations.

2.1 URBAN QUALITY DATABASE

In order to study the indicators related to urban life quality, the 92 statistical zones of the "Comune di Torino" are taken as cartographical basis to represented and gather data.

The choice was made in this way because statistical zones represent a good compromise both for number of areas and size, thus originating more clearly readable maps.

The indicators taken into account and processed were divided into two large categories:

- Structural data: they describe how the public town is organized at a structural layer: urban density, functional mix, green areas, pedestrian areas, public lighting;
- Services and facilities data: that measure public services that the town offers to its inhabitants: average accessibility in origin by public transport, cultural and leisure facilities, nurseries, sport facilities,.

2.2 URBAN TRANSFORMATION DATABASE

To produce the database related to urban transformation, the first operation has been to draw and georeferenced through ArcMap the various perimeters of urban transformation the map of the town of Torino.

To build this map only large transformations (>50.000 sqm) have been taken into account.

For each transformation a file describing the intervention was produced with all the info that it was possible to find, such as the planning instrument, period, start and end of the intervention, the surface related and the population involved.

Finally the transformations were gathered and grouped into four families: urban requalification (physical interventions), infrastructures (physical intervention for streets a d transport), urban regeneration (physical intervention with social contribution) and social contribution interventions (without direct material implications).

3 TOOL IMPLEMENTATION

The tool design was divided into practically three large steps, both for urban transformation and for urban life quality indicators.

For urban transformation:

- The first step was to draw the perimeters of transformation areas and subsequently fill the various descriptive files gathering the information.

- The second step consisted in integrating geographical information (perimeters) with the descriptive files to get a large database with both types of information. Four different maps were produced from the categories in which transformations were gathered.
- The third step, that determines the passage of the information from the GIS to the Web GIS form, required a reasonable organization of the database that was subsequently loaded on the web through the Fusion Tables application, previously described. Geographical information and the database containing the information of every single transformation were loaded separately and joined together through a table merge step. Subsequent steps were only aimed to the representation of data by applying filters and interactive maps.

For urban quality indicators:

- The first step was shared with some experts in order to select and gather the indicators in order to produce the status of urban quality in Torino. Following the research of the various data sources, we processed several analyses of the previously described indicators.
- The second step was mainly characterized by the preparation of the database on ArcMap and Excel by georeferencing all gathered data and organizing them to build the representation on the statistical zones of Torino.
- Also for urban quality the third step was the one that led the transition of geographical and informative data to the web, with the same previously described methods.

4 EXAMPLES OF POSSIBLE APPLICATIONS

In order to demonstrate the effectiveness of the tool in decision making processes, in following paragraphs some examples of maps, created through the correlation of indicators, are illustrated.

The first four applications just take into consideration one family of indicators (i.e. urban quality, urban transformation, demography, real estate market) while the last two examples simultaneously display indicators from different families (urban transformation/real estate market and accessibility/public services) thus providing an example of the potentiality of this tool in combining different kinds of data. Real estate market and demographic data, not described in the initial data bases, were added in a second time in order to increase the potentiality of the instrument.

4.1 URBAN QUALITY

Geovisualization on urban life quality gathers all the indicators listed before. In addition also resident population with foreign citizenship were included. Such elements allowed to perform some analysis related to urban transformations, dating between 1991 and 2012 were available. This allowed to monitor the behaviors of residents before, during and after urban transformations.

With the use of this single map, analysis per statistical zone may be performed on the main characteristics of the public town, through the interactive reading of data that allows to create, in few simple steps, maps that represent the behavior of an indicator.

As show in the following pictures, it is possible to “query” each single zone on one or more values (Fig. 1). By selecting the appropriate filters (Fig. 2) it is possible to visualize specific zones on the basis of the values of the single indicators. In the example, an urban quality indicator was selected with a rather high value range between 61 and 100 (aggregated index), that show on the map only the areas with the level of urban quality included in the selected range.

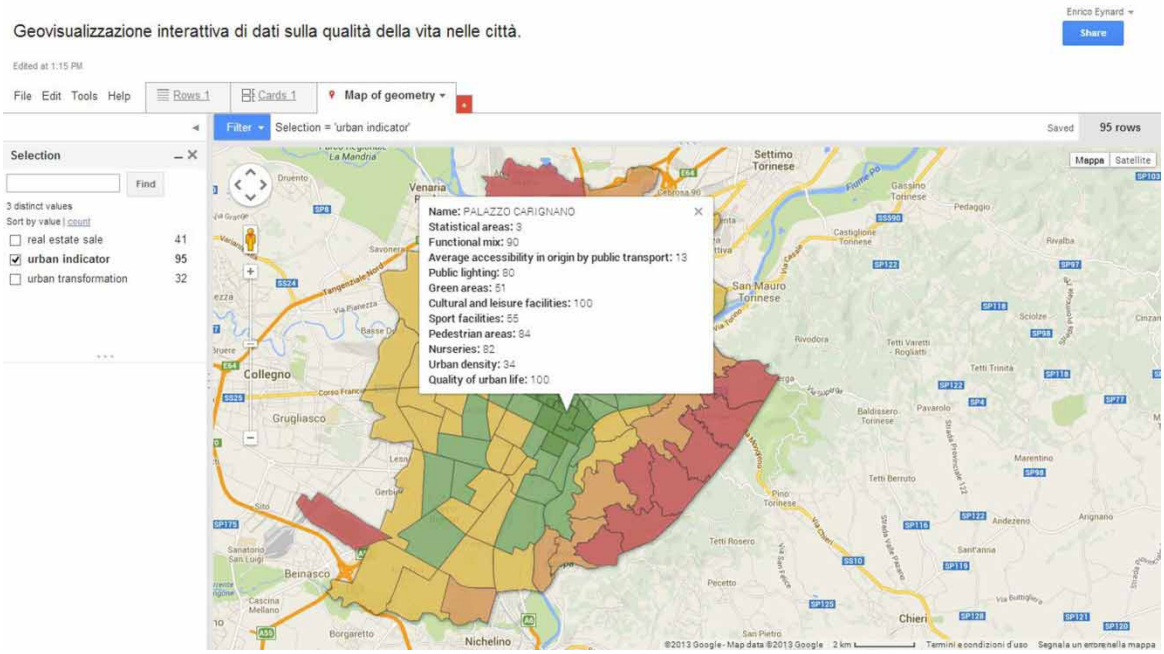

Fig. 1 Querying data of each statistical area

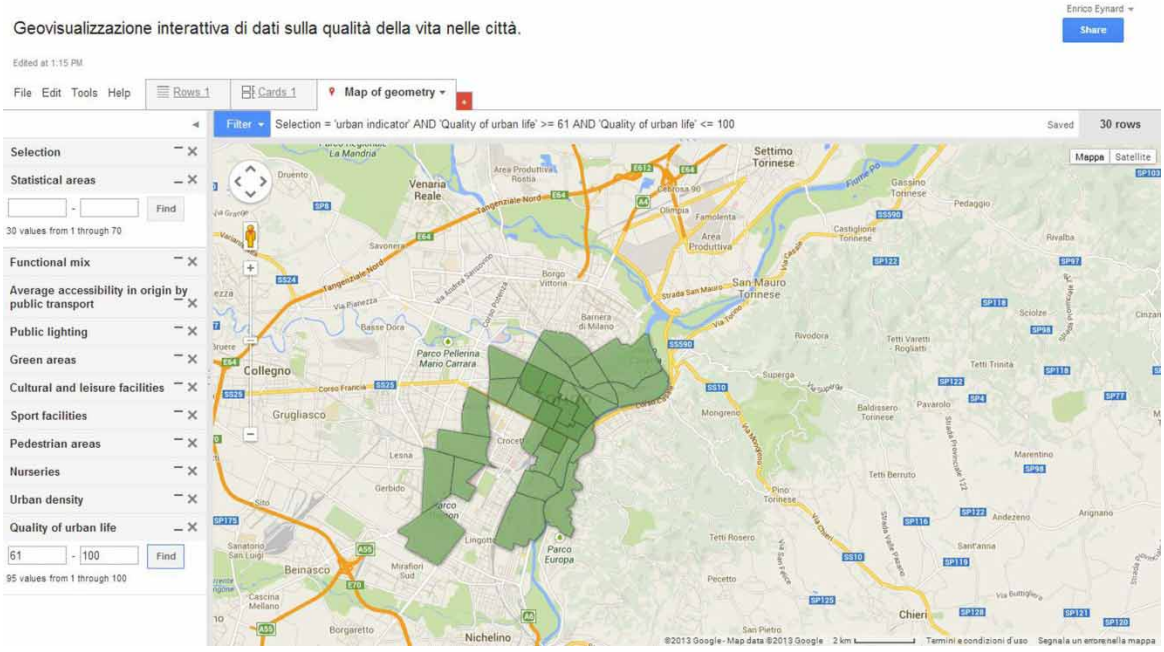

Fig. 2 Available filters

4.2 URBAN TRANSFORMATIONS

The map of urban transformations contains all the perimeters and the information previously illustrated. Mainly it consists of a georeferenced database of transformations that may be consulted to produce the representations related to the interventions that the user wants to visualize. The most interesting aspect consists in the possibility to overlay these layers with others in order to compare the transformations with the indicators of the various loaded maps. This allows to deeply analyse urban dynamics in order to evaluate whether the transformations had positive or negative effects on the town and its population.

As shown in the following pictures, differently from previous examples, colors are related to different families

of interventions, rather than to the value of indicators.

In this case (Fig. 3) filters can be configured to select some typologies of intervention through the characteristics such as typology, work start and end year, time period, planning instrument, surface. In the chosen example, only regeneration and urban requalification interventions were selected.

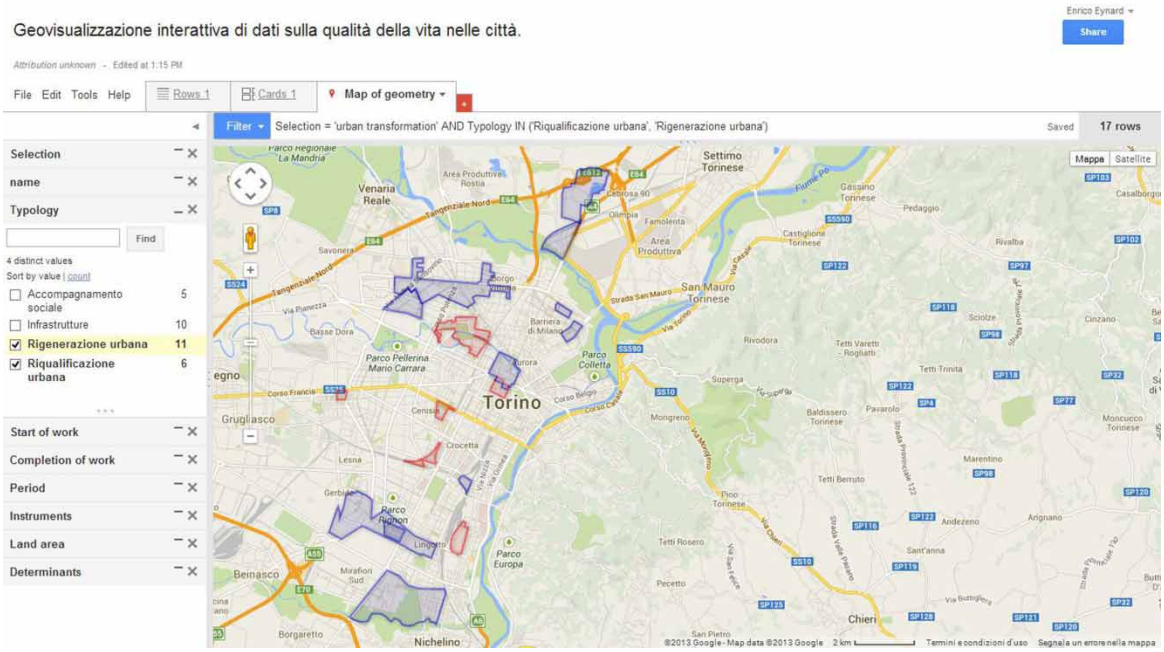

Fig. 3 Application of filters

4.3 DEMOGRAPHIC DATA

In the map on statistical zones, demographic data were also included; in particular the total resident population between 1991 and 2012 and residents with foreign citizenship.

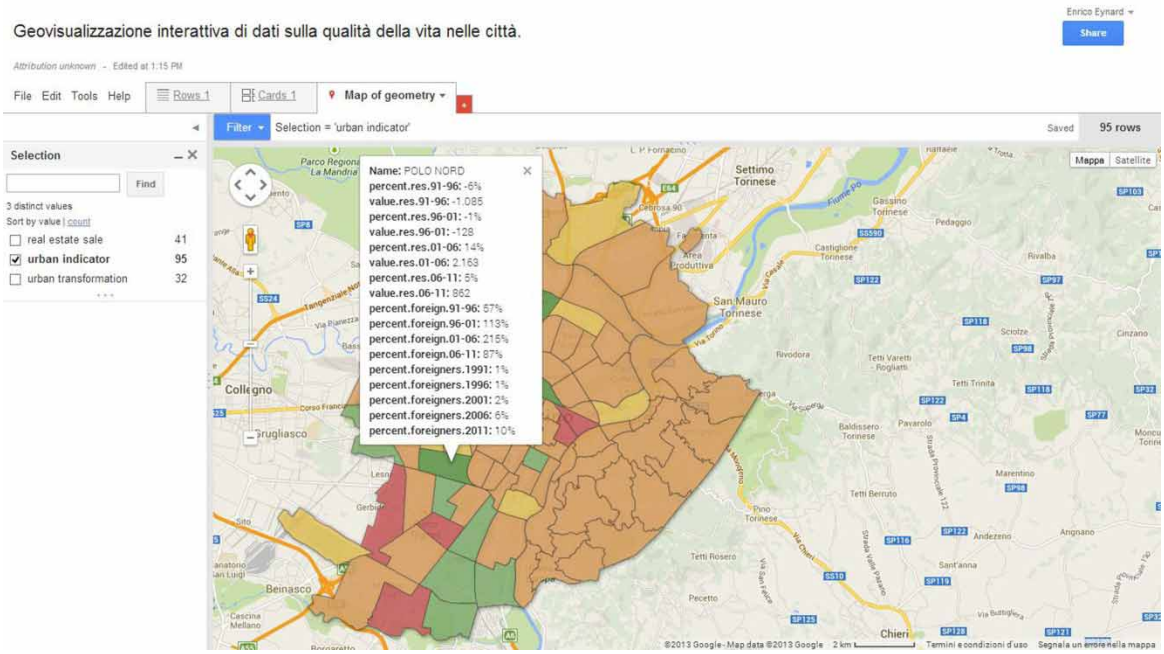

Fig. 4 Querying data of each statistical area

Having a significant historic series, it is also possible to connect these data with urban interventions, in order to show possible correlations with urban quality indicators.

As for demography, some pictures are reported in the text: figure 4 shows the statistical areas in a semaphore scale, that represents with the red color the areas where population decreased and with green color the areas where the resident number increased.

In the following figure (Fig. 4) an example of interrogation on a statistical area of demographic data is reported. Finally the various available filters were included and the filter related to the percentage of residents with foreign citizenship was activated on a statistical area. The value included >20% allows to visualize only the zones with more than 20% of foreign residents (Fig. 5).

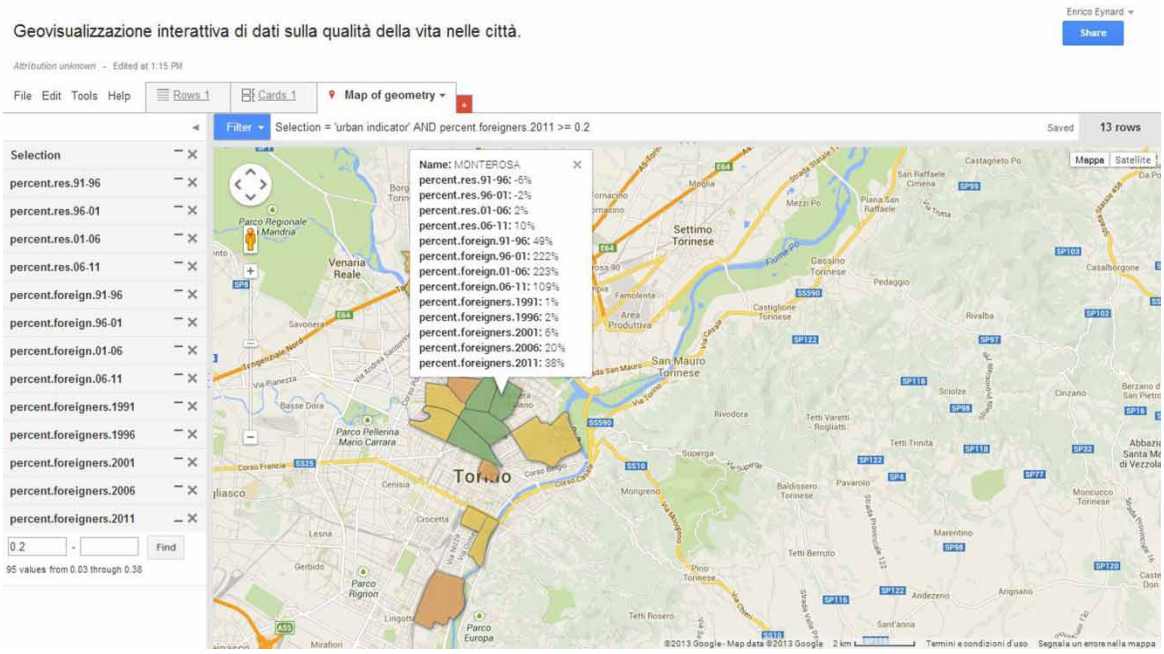

Fig. 5 The available filters

4.4 REAL ESTATE MARKET

In order to make this research more complete, we decided to include also data on real estate market. The data source is the real estate observatory of the town of Torino. Data area are related to real estate values for the 40 censuary microzones of the town: such values are expressed in euro/sqm and represent the average unit prices of the offer.

The micro zone is a portion of the municipal area, that presents homogeneity in the characteristics of location, urban, historical and environmental values and is representative of a segment of the real estate market.

The subdivision in micro zones, in this case, has been classified with respect to the real estate value (2013). The darker red color represents the areas with higher average selling price.

As in the case of the other maps, it is possible to interrogate the single zone on the various real estate values, percentages of variation and variation values.

Finally different filters may be selected: in figure 6 for example a filter has been activated on the basis of the variation between 2008 and 2013. A range of values between -900 €/sqm and 1 €/sqm was inserted, so as to visualize only the zones that showed a decrease in average selling prices in that period.

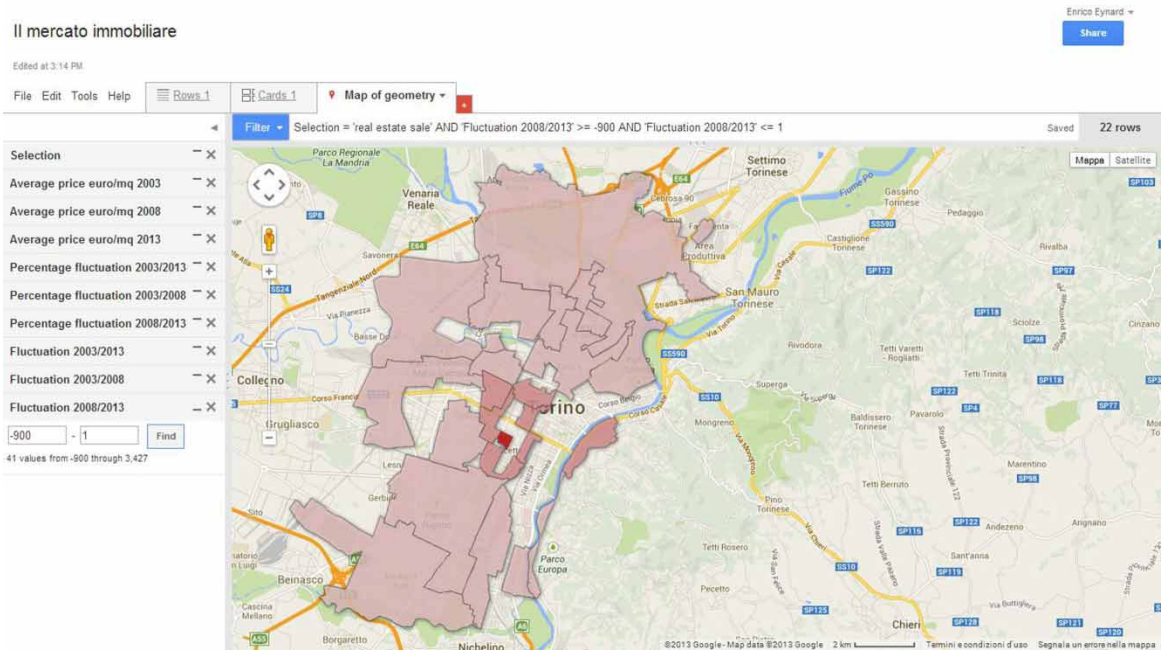

Fig. 6 The available filters

4.5 URBAN TRANSFORMATIONS AND REAL ESTATE MARKET

This example and the following one are related to specific applications of the tool on items that are interesting for urban planners, in order to show some of the capabilities of the proposed interactive geovisualization tool.

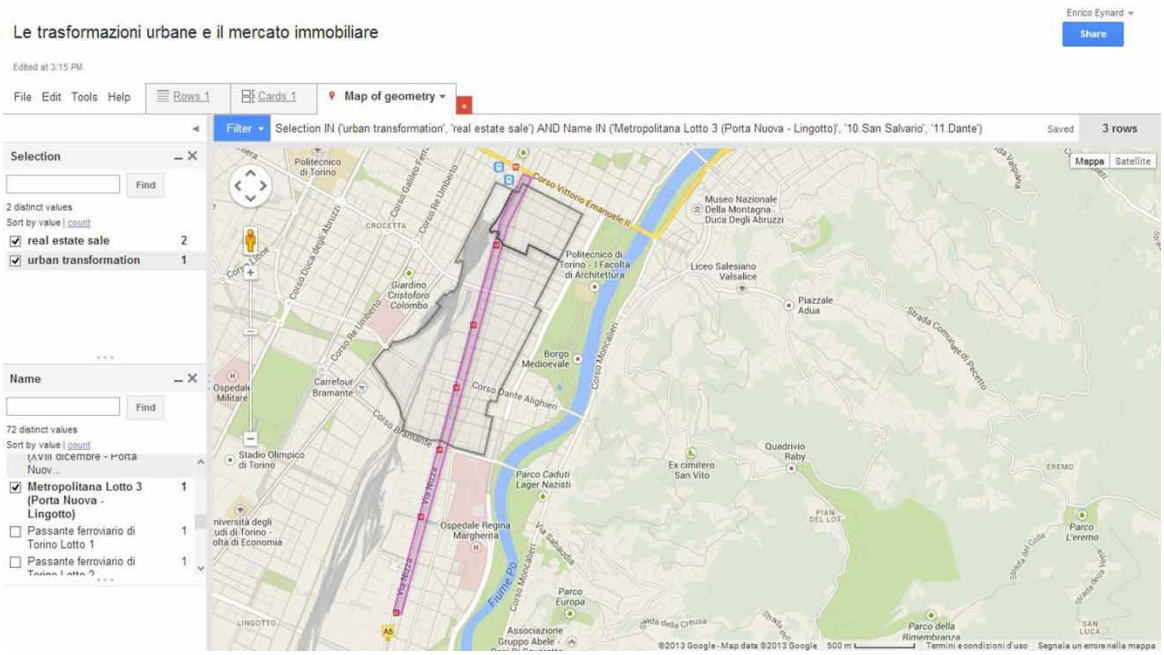

Fig. 7 View of Lot 3 of the metro highlighting the microzones investigation

The first test was performed using the data of the urban transformations and of the real estate market. Data are referred to the city of Torino. For each intervention there are various descriptive information. The period taken into consideration ranges between 1991 and 2001 and only the transformations related to areas larger

than 30.000 square meters were selected. The data of real estate market are related to values of the 40 census micro zones of the city of Torino. The values are expressed in euro per square meter and represent the average offer unitary prices.
A real demonstration is related to the three lots of the underground that generated an expected rise in the prices of the areas along the line. For the third lot of the underground the price increased been 10 to 20 % compared to the values of the zone.
In particular lot 3 of the underground, implemented between 2007 and 2011, may be compared with the indicator of real estate values (2003-2013). From the analyses carried out on the 2 main micro zones crossed by the line, namely San Salvario and Dante, the result appears to be an average increase in the prices of 56% from 2003 till 2013 and of 31% in the years of the construction of line 3 from 2007 until 2011. This value is slightly different from the average increase given by real estate companies, because also other factors contribute to the 31% increase.
Only two of the four micro zones crossed by the line of the underground have been selected, because the other two, Carducci and Lingotto, are too large to be influenced in a significant manner by a price variation uniquely due to this transformation.

4.6 ACCESSIBILITY AND PUBLIC SERVICES

The second application that combines two different types of indicators consists in the use of accessibility data (in origin) in 2008, namely the average measured in minutes of travelling time by public transport between the area considered and all the remaining zones of Torino.
As a first operation it was decided to map the data of the average accessibility per statistical areas, so as to visualize the average level of accessibility of each area and, in particular, to identify the most disadvantaged areas. Once this operation was performed it's possible, for decision makers, to evaluate different mobility scenarios on the base of present accessibility and of the attractors of the different areas.
Comparing the areas through these data, the zone it's possible to identify the areas offering the stronger availability of services and, as a consequence, with a higher accessibility potential demand.
In the first figure (Fig. 8) the map has been referred on the basis of the accessibility time in semaphore scale, where green represents the areas with the lower travelling time towards all other areas and the red color shows the less accessible areas. Those are the areas needing interventions in order to increase the transportation services.

5 CONCLUSIONS

The interactive data geovisualization presented, provides a mapping of the different indicators, related to some aspects of urban quality and urban transformations.
The possibilities of interactions with maps and data are several and can be use to analyze the town of Torino and compare urban transformations with resident population and the other indicators.
The tool presented is first example and can be further developed. New indicators may be implemented and a personalization may be introduced by the inclusion of Application Programming Interface (API fusion tables) in order to improve table formatting and of a programming language to improve the graphical man machine interface, making the use of the tool easier for all. Through the implementation of new indicators, new analyses will be possible. As an example crossing data on urban transformation with data related to health or air pollution it will be possible to investigate whether and how urban transformations may have influenced the rise of problems related the health of citizens.

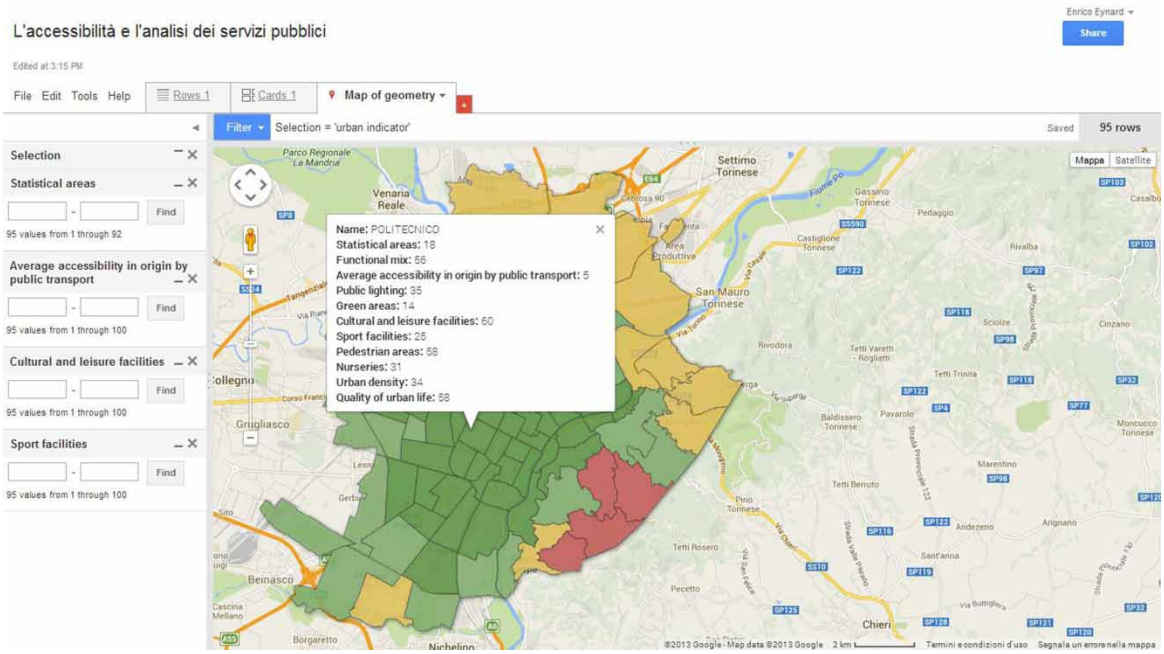

Fig. 8 Viewing the map themed to the level of accessibility

For example a possible relationship could be verified between asthma or breathing problems and period of transformations that may have produced dusts dangerous to breathing.

Another example referred to sociologic indicators could be related to criminal acts in streets and vandal acts. Such data could be compared with data related to public lighting to check whether less lightened areas may have a higher number of criminal events and soon. The use of this tool may be useful for urban planners or decision makers can provide them further information to evaluate new interventions or to identify possible problems to be solved. One of the most interesting possibilities, that also represents the aim of the project from where we started, consists in following the effects of urban transformation along their development (pre-intervention, during the intervention, post-intervention) in the town and the health of the inhabitants involved. It is possible to create a further function, similar to an "alarm bell" that can automatically detect critical areas for one or two indicators, in order to identify zones that require some intervention. Having the possibility to verify the results of previous interventions, it could also be possible to suggest the implementation of strategies that showed to be successful in other areas with similar starting conditions so to improve the quality of life in such areas.

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IMAGES SOURCES

Figg. 1 to 8: own production.

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Has obtained a second level degree in territorial, urban and environmental planning. He has studied at Politecnico di Torino and he is now working on several projects as a researcher at SiTi - Higher Institute on territorial systems for Innovation. In particular Enrico has worked on SOPHIE project (Evaluating the Impact of Structural Policies on Health Inequalities) and also on the competitiveness report of the Italian urban areas 2013 (analysis support and spatial assessment at Jessica system). Research projects and his interests are focussed on geovisualization, urbanistic, territory and environmental topics. He has experience in the use of specialised software for territory studies such as ArcGIS (Geographic Information System).

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Researcher in Geography at the Politecnico di Torino, Marco teaches "Geography, Environment, Landscape" and "Geographic and Economic Factors in Territorial Development" in the course of Territorial, Urban, Environmental and Landscape Planning. He has been member of EU-POLIS since its foundation and became its director in 2012. He has worked on ESPON research projects (2.3.2, INSTED, TANGO) and is part of the Milesecure-2050 team, a 7FP project. Marco has worked in the URBACT I Community Initiative project as expert and, as lead expert on wellbeing and quality of life, in the BHC project in URBACT II. He took part, in 2011, to the working group "Les systèmes métropolitains intégrés, leviers de développement territorial" for the French DATAR, in the framework of the "Territoire 2040. Aménager le changement" initiative. He has coordinated, with Egidio Dansero, the research "Smart Torino: opportunities and risks of the intelligent city paradigm" (a research project co-funded by the Compagnia di San Paolo).

Matteo Tabasso

Master of Science degree in Architecture and Urban Planning of Politecnico di Torino (Italy). Since 1999 he developed an extended experience in transport and urban planning both working for public authorities and for research institutions. Since July 2006 he has been working at SiTI as project manager, coordinating researches and projects on urban planning issues. Furthermore, he gained relevant international experience thanks to the involvement in several European funded projects and networks aiming at implementing innovative solutions for reclaiming degraded urban and industrial areas, analyzing the relationship between planning and transport in order to develop accessibility instruments to be used in planning processes.