



Can a Map Save City Shops? Applications of Data Visualization to Represent the Material and Immaterial Urban Survey

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Abstract. From the origins of civilization it is known that a picture is worth thousands words. However, the scientific study of visual communication applied to the data visualization represented on the territorial extension is a relatively recent field of research, dating back to the late 1800s, long after the first golden age of statistical graphics. The paper presents a case study in the city of Parma and it assumes that a thematic map can be more effective than a chart diagram in displaying the territorial distribution of the answers of a census of the commercial units of the city, realized with the collaboration of the shopkeepers. The translation of percentages and graphs in a thematic cartography, through the ultimate open-source tools of interactive mapping and live geolocation of the information, allows an immediate and intuitive visualization and a field control in real time. Even more, it underlines the spatial connections and the critical points and potentialities for those who must make decisions regarding the future of the commercial sector in a historical moment of serious crisis and rapid transformations.

Keywords: Urban survey · Immaterial survey · Infographic · Data visualization · Geolocation · Interactive mapping

1 Introduction

Bruno Munari wrote in 1968 the book *Design e Comunicazione visiva*, in which he stated that knowing visual communication is like learning a language made of images, that have the same meaning for people of any country and language. Perhaps the visual language is more limited than spoken one, but certainly more direct (Munari 2018, p. 75). Moreover, most communicants use the visual aid to express ideas or share information because is known that people tend to remember 10% of what they hear, 20% of what they read and 80% of what they see. This well defines the theme of this paper, which has been analysed here through a case study applied to the city of Parma.

To ensure that the message is received in the full meaning intended by the broadcaster, regardless of sensory filters, operational and cultural factors that characterize the receiver, the communication based on images must necessarily go through rules based on the objectivity of the images used, so that they are equally legible for everyone and cannot create “visual confusion” (Munari 2018, p. 13).

Such statements may seem obvious in the current historical period, more voices called “Visual civilization”. Paradoxically, however, the continuous visual bombing led to a weakening of the analytical capacity of the sight, which is limited to a superficial perception, rather than critically discern the information acquired. Who today deals with visual communication, whatever the field in which he operates, from advertising to design, from web design to the typical technical representation of architecture, from time to time he has to find the more coherent and effective key of communication in relation to the characteristics of the object and the purpose of the message. Visual thinking and conceptual maps can grow in the mind of the observer, through the designer’s wise guidance. In any case, the fundamental elements remain those typical of the “communication” in its broadest sense: the actual information to be transmitted and the (visual) support by which to do it, that is, the set of elements that make the message visible.

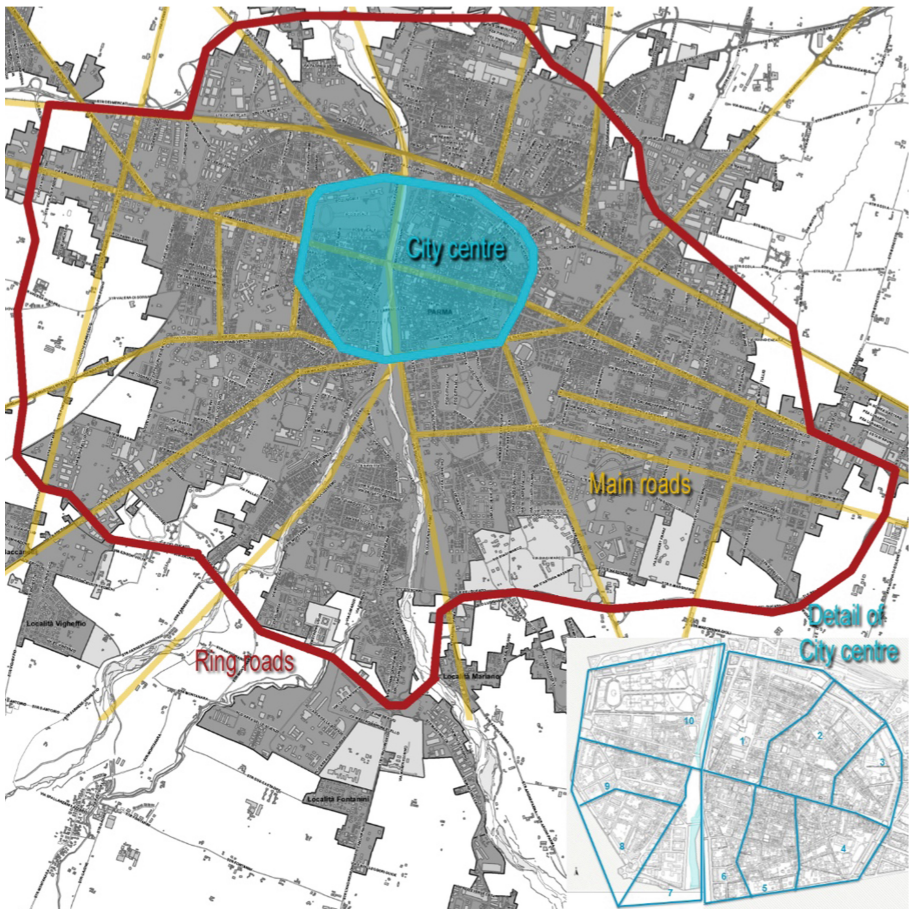


Fig. 1. Study area: Parma city, historical centre and periphery inside the ring roads (by D. Bontempi).

The theme is very sensitive when, at urban scale, you must transmit information of various nature, be they outcomes of scientific studies, or practical information that can be useful to the user. To draw the map of a city means organizing a spatial experience through selective representation operations, trying to be objective. Certainly, the base is material: therefore geometry, structure and urban morphology. The identifying elements of a certain urban area are localized through more or less iconic symbols (pictograms). But the situation is complicated in the transmission of intangible information, which can be the result of thematic surveys and must be communicated legibly, both in relation to the general field of study, and with in-depth analysis of the multiplicity of information, often inhomogeneous, which have been collected.

Signs and drawings used to communicate don't always represent the object in a veristic and recognizable way, but they take a precise meaning related to the signifier that they represent. If iconic, they can be read intuitively, if symbolic, they need a legend (key code). Object of the research is the significant/meaning relationship, in order to find signs that bring more or less detailed information and guide in understanding complex phenomena.

The so-called *Data journalism* is a form of hybrid journalism born around the mid-nineteenth Century, based on the study of the best visual representation of statistical data as a support for analysis and communication. Initially aimed at supporting the readings of experts in the field, in more recent times it progressively extended towards more complex graphic narrative forms, the *Visual journalism*, intended for more general users. The most innovative applications of this branch of studies are visible in the proliferation of online infographics, with high peaks in the website *Information is beautiful* (Mc Candles 2009) that collects a huge amount of highly effective communicative material.

In the specific field of our disciplinary sector (Cundari 2005; Marotta and Novello 2015; Cennamo 2016), graphic tools are used for the visual and narrative representation of the results of interdisciplinary urban studies since the first experimental applications in the late 1800s, mastered by Minard and Snow (Moretti and Burgio 2017). Today, the possibility of using digital maps on which to draw the information, finding signs and symbols that, although referring to more or less articulated legends or databases, is a concrete *modus operandi* that sees a huge dissemination: if the visual language is clear, maps are easy to read even for general users. The last frontier is the automatic acquisition of geolocated information through digital devices of everyday use (MIT Senseable City Lab).

Graphic communication and spatial representation through digital tools are the preferential system of knowledge and communication of the complexity of the contemporary city (Luigini and Moretti 2018), not only in architectural or urban key, but also from an anthropological, economic, cultural, social, etc. point of view (Cirafici 2014; De Carlo 2015). Thanks to the use of digital systems always more flexible and effective, the representation of information allows its transmission in a faster and thorough way, spreading it more effectively than other methods of communication.

2 Case Study: Survey of Commercial Buildings and Units

With these assumptions, the topic was addressed of restitution of the multiplicity of very heterogeneous information that was the result of the research work carried out on the basis of the collaboration agreement between ASCOM Parma and the Department

of Engineering and Architecture of the University of Parma. This marked the launch of a Commerce Observatory for the collection of data and information to be included in an informative database that can be constantly implemented and updated, for the purposes of an exhaustive analysis of the commercial urban context spread along all the streets of the historic centre and the first suburbs.

The study had a precedent in the years 2009/10: the Agreement between University of Parma, Dep. DICATeA (now DIA) and the Municipality of Parma for preliminary analysis and identification of guidelines for the implementation of a development plan for the “Natural Shopping Centres” (CCN) in the historic city. The survey, conducted with data sheets and photos, was focused on nine main streets in which there is a greater concentration of buildings with commercial ground floor, with the intention of classifying the characteristics and identifying shared strategies of valorisation of their specificity, as they were spontaneous open sky commercial centres (Giandebiaggi and Vernizzi 2011; Vernizzi and Bontempi 2015). The peculiarity of the new project lies in the census carried out for the whole of units located inside the ring roads.

For the definition of the planning of the areas to be surveyed, several parameters were taken into consideration: boundaries of the circumscriptions, main roads, identification of dense inhabited areas. Considering this area, compared to the municipal boundaries, a large part of the territory occupied by scattered houses and not built-up areas has been left out, but it contains only small peripheral nuclei in which there could be commercial businesses (Fig. 1).

To provide a comprehensive picture on the consistency, location and type of the commercial units located in the municipal area, not only the position of bar/restaurants and shops with their product category were identified, but also some architectural, urban, functional and management elements.

From the point of view of scientific analysis, it is necessary to obtain and process targeted and detailed data in order to develop tailored solutions, to confirm some trends with numbers and also, sometimes, to deny some feelings based on common perception that are not numerically relevant.

The theme is very hot and difficult to define, even for the complexity of the variables involved: vendors, suppliers, franchising, logistics, property owners, neighbours, urban hygiene, urban furniture, accessibility, car mobility and parking, public transport, bicycle and pedestrian mobility, tourism and cultural promotion, etc. The data will support the programmatic preparation of a series of interventions for the enhancement and protection of the trade in the city of Parma, starting from the potentialities and vocations that emerged during the analysis phase. All this, in the belief that the coverage and health of the commercial presence in the city has a major impact on the quality of life (Fig. 2).

Beyond the more usual issues related to the preparation of survey sheets agreed with ASCOM, concerning both the characteristics of the buildings and the individual business units, the theme of major disciplinary stimulus lies undoubtedly in the attempt to find a synthetic communication key that, between an information system and a thematic map, it can graphically return the meaning of the analysis and especially its outcomes in terms of punctual content that can be readable by categories of non-technical users and with very different functional interpretations.



Fig. 2. Preliminary study to define the survey sheets: types of commercial buildings and accessory elements. (by D. Bontempi).

Tools now essential as open source databases, through which to condense the transmission of information, are added to the research in terms of signs/symbols/icons of immediate visual effectiveness, able to make immediately readable the salient aspects emerging from the thematic reading at urban scale. The study try to graphically translate the problems, to lighten their analysis in order to identify possible solutions.

3 Planning and Execution of the Survey

The preliminary study of the typologies present in the area allowed to draw up a list of data classes that we wanted to collect, both relating to the urbanistic/architectural features and the detail of management information requested according to the client's needs.

Considering the territorial extension to be analysed, the census was divided into two phases during two successive academic years: A.A. 2016/17 the historic city centre, inside the old walled city, A.A. 2017/18 the first suburbs inside the ring of bypass road.

The students, adequately formed, carried out a census of the buildings containing commercial activities and of the single units (shops), compiling, with the collaboration of the individual shopkeeper, information sheets in Excel format. Subsequently, they transcribed the data in an online questionnaire created with *Google Forms* (Fig. 3).

The questions concerned both data relating to the building as a whole (location, other functions, additional rooms, state of preservation, accessibility and mobility) and questions relating to the single unit with its appurtenances (size, product category, management).

For the first time, an online digital delivery was experimented in this type of work. The material collected through *G.Forms* has the unquestionable advantage of building



Fig. 3. Excel datasheet and Google Form datasheet (example, by D. Bontempi).

in real time the results report with an intuitive and immediate visualization, and at the same time it generates the corresponding database in a structured spreadsheet for further studies and statistical elaborations. Unfortunately, it doesn't allow to upload images and for this reason, during this transitional phase, the excel version of the cards was also collected for a double check review.

About 140 students were involved, for a total of 1711 building datasheets and 3020 unit datasheets on 355 streets. Excel files can be read individually, to check the information collected for each unit and building they belong to. *G.Forms* automatically provide the statistical report of aggregated responses, comparing the center and the first periphery.

The large amount of data collected was generally consistent. We estimated that the survey covered about 70% of the total businesses in the city, with good validity for statistical analysis, although the response rate on some sensitive questions drops dramatically to 15%.

4 From the Database of the Answers to the Interactive Mapping

In view of the considerable potential of the instrument used, some issues have been found on which it is necessary to work to optimize especially the storage and analysis phase. On the one hand, XLS files allow a vertical reading of the episodes in detail, but they do not render a statistical response, unless you manually transcribe the data. On the other hand, *G.Forms* provide an overall (horizontal) response, but it don't allow to immediately verify which schedule corresponds to a given answer (an incorrect compilation, critical issues or curious data ...) (Fig. 4). The app does not contemplate second thoughts or subsequent corrections, because it has been formulated to answer questionnaires.

Once the survey and the loading of the data on *G.Forms* have been completed, the overall database of the commercial units in excel format has been exported. Cross checks have been made to control congruency, internal, whit the Excel sheets, compared to the territory and compared to other databases (trade censuses, vacancies, franchising, etc.). A considerable work has been carried out on the commercial categories to reduce their variability, to homogenize them under a shared nomenclature, and also to group them in significant macro-sectors for a better reading of the map legend (restoration, food store, non-food stores and services). Particular attention was paid to the accuracy and completeness of the address tab, through which each store will be subsequently geolocated (Yeeply 2017).

To view the map, *Google My Maps* app has been used. There the Excel database was loaded and automatically converted into geographical data. This software is open source, it requires low technical IT competence both of survey operator and user and it has friendly interface via desktop and smartphone. It is fully supported by *Google Maps* and *Google Earth*, which are very used and compatible with all devices, as well as the leading cartographic data interchange formats (Fig. 5).

Previously, this app had been successfully tested to disseminate the results of a scientific research concerning the historical evolution of the conventual complexes in the walled city (Bontempi 2019).

A similar census developed on behalf of the Municipality of Parma by the Urb&Com Lab of the Politecnico di Milano has instead adopted *OpenStreetMap*, but we felt that it had less interactivity potential for non-specialized users (Paris and Limonta 2017; Wikimedia 2017).

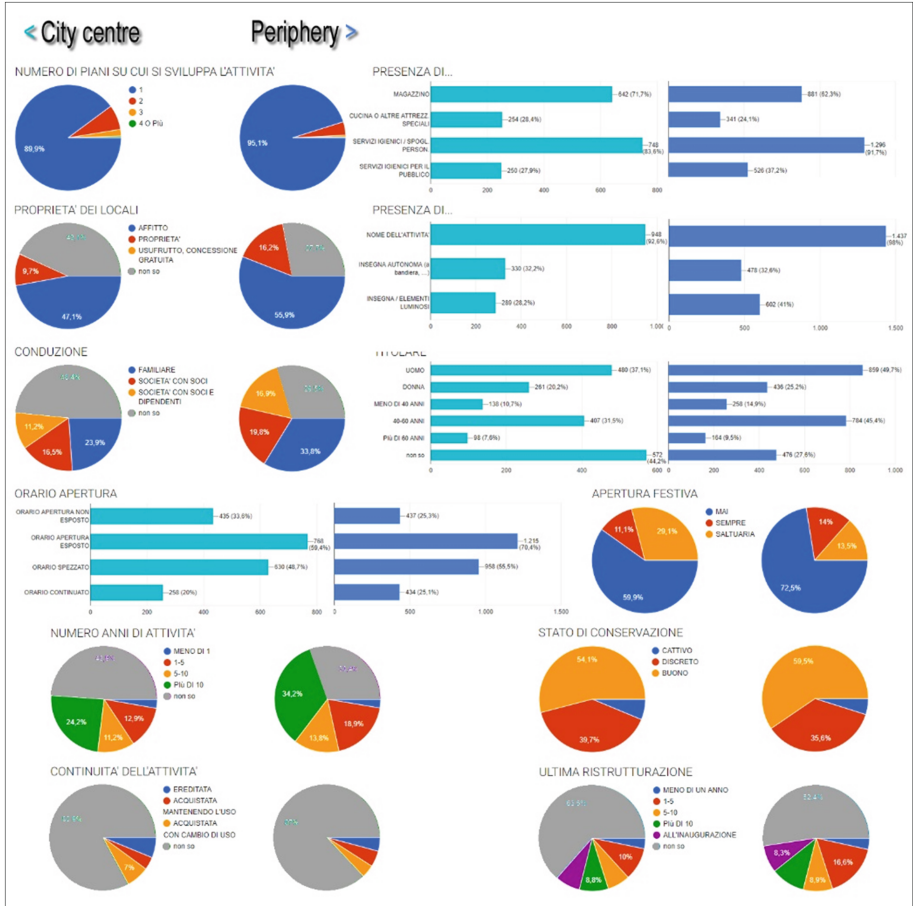


Fig. 4. Collection of answers: diagram graphs are intuitive to detect percentages, but they fail to represent the distribution of responses in space: the problem is only partially described. (by D. Bontempi).

5 Same Data, Different Images: How to Choose the Most Effective Output

The final step of the research, which is still undergoing, is the realization of the report of all the statistical results, both through graphs and thematic maps. This involved comparing various simulations and hypotheses, in order to optimize the quality of the graphic communication of the data.

The versatility of *Google My Maps* app allowed to experience a large number of combinations with a mix of graphics and text, both in the basic cartographic level and in the pointers symbolizing the units surveyed. The map can be viewed in different predefined layouts (simple navigator, aerofoto, chorography, buildings, etc.) and as usual, the level of detail of the representation is automatically set according to the map scale. *G.Search* is available for all geo-referenced entities in the classic *G.Maps*, and consequently the related web interconnection (reviews of activities, general information from public databases, links to websites and more) (Fig. 6).

It is possible to enter up to a maximum of 10 layers on/off, each of which can contain up to 2000 entities, for a total of 10,000 entities overall. Entities are areas, lines or points that can be drawn directly on the map, added by *G.Search* or uploaded via .csv, .xlsx, .kml, .gpx files. By clicking on each entity, you access the editable table of information which can contain images or photographs, textual or numeric data, web links, and it can be individually edited. For each level, a general data table is generated that can be edited in order to create categories for displaying entities. The data contained in each level can be visualized according to a uniform style (all the same), individual (personalized), or defined by categories from the data table (for example small-medium-large). The app allows different ways modes of displaying data by colour, shape of the punctual icon (pictogram) or transparency and border of the area. The label with the name of the entity (such as the name of the store) can be activated. Finally, it is possible to export data in .kml or .kmz format, compatible with CAD and most GIS software.

Some answers that triggered the reasoning on how to display the data were relating to vacant premises, that have been separated because the lack of information on the rest of the questions would have polluted the results; the bar and restaurants, that have opening hours different than shops. On the retail trade, the most interesting views were agreed with the client of the survey: Sunday openings, state of conservation and last renovation, product categories, business continuity, etc. For each of these aspects, the best combination color/icon/label has been tested.

The combined reading between the percentage graphs (statistic horizontal reading) generated with *G.Forms* and the mapping generated with *G.My Maps* (cartographic view plus individual vertical data sheet) shows the complementarity of the visualization: on the one hand the number, but on the other the spatial distribution of the answers.

6 Conclusions

The visualization of the replies to the questionnaire represented on the map has brought some benefits? We think so. If the use of infographics in data visualization is consolidated (numbers are more intuitively comparable and memorized through graphs, diagrams, tables, or through their organization as forms), often in economic and management planning we tend to forget that we are speaking of reality distributed on the space, along the streets.

A first important result of this method was to recognize the concentrations of shops along some streets, mainly the penetration radials in the city, also in recent extensions

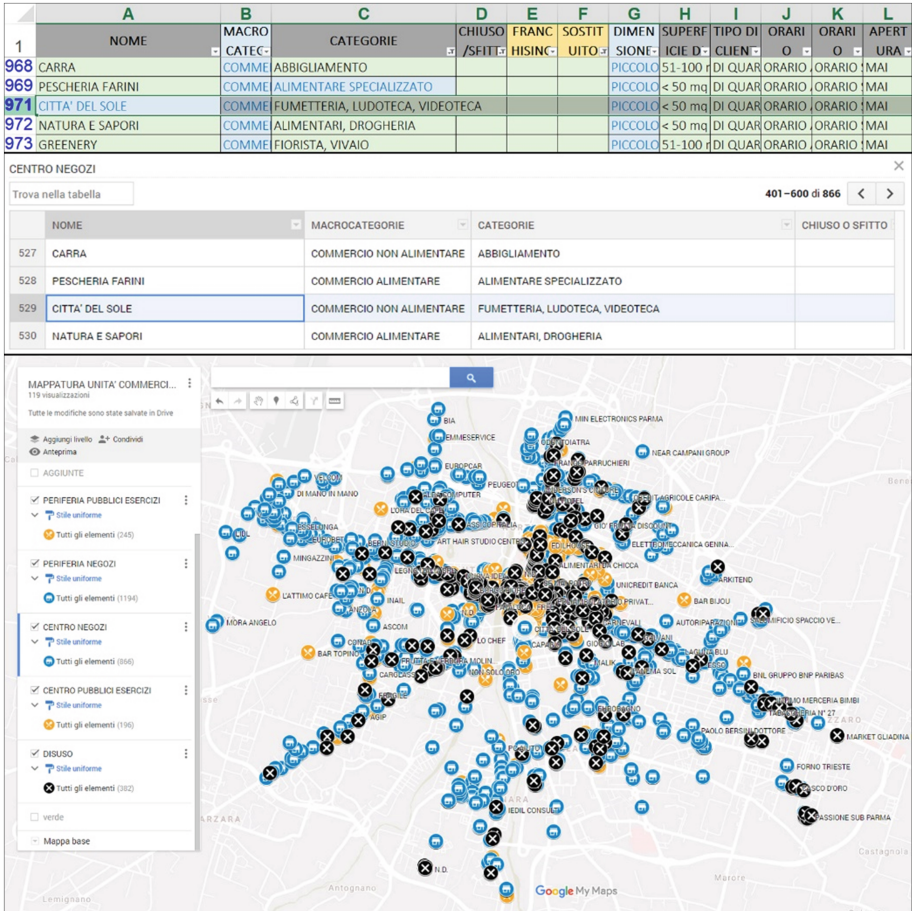


Fig. 5. From survey, to the excel database, to the map, in Google My Maps App. (by D. Bontempi).

in a symmetrical way and in continuity with what had happened historically in the old centre. This may seem obvious, but administrative policies had thus far tended to differentiate the strategies between historical centre and the periphery, as is there was an invisible “fence” around the walled city, less on commercial streets than the residential ones. With a view of limited resources, this is fundamental: interventions located where there is greater necessity, and together more visibility, means results optimized and lower costs. The idea to group the streets as already tried for the “Natural Commercial Centres” can give a unitary image and coherent signposting.

The integrated interpretation of the answers allowed to dispel some stereotypes, for example the quantity of ethnic shops, but at the same time it justifies that their concentration in some points of the city, on passing roads, generates an exaggerated perception. It also highlighted that some planning choices were not optimal, i.e. the

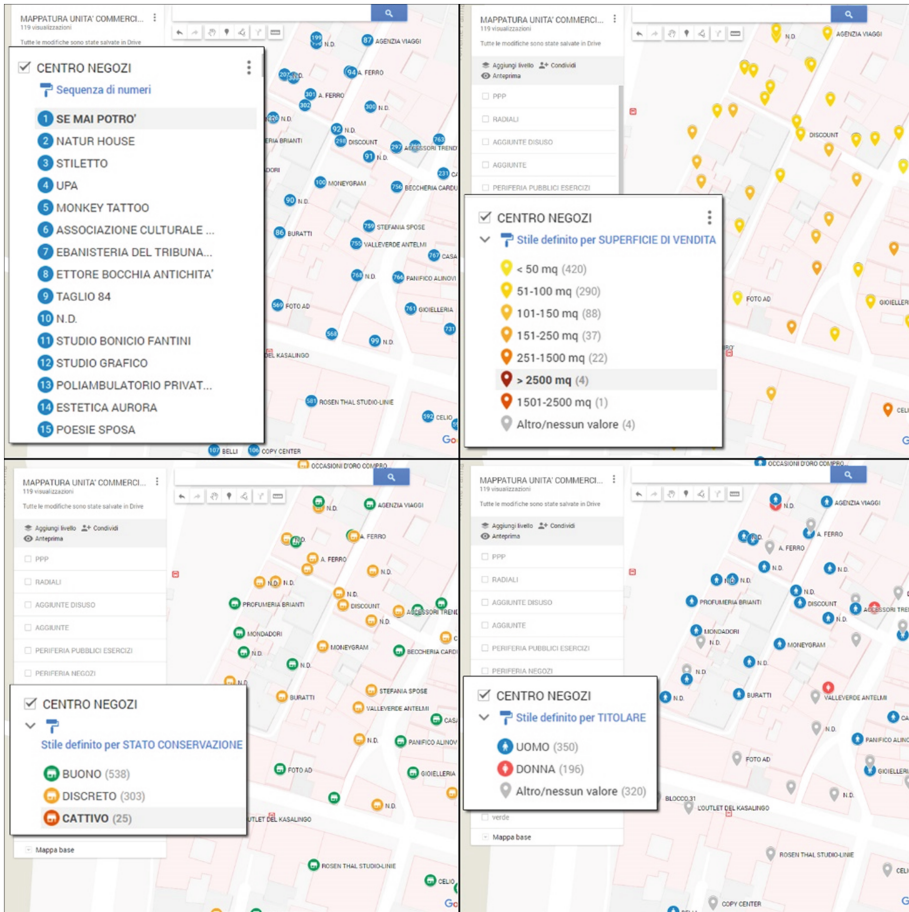


Fig. 6. Examples of custom graphic styles in *Google My Maps*, suitable for different kind of data. The chart and the map complement each other in the communication of the data (by D. Bontempi).

possibility of expanding the shops in the centre up to 400 m²: many of them are much smaller and these sizes are not feasible. On the other hand, it emerged that in many cases effective improvements can be achieved through small but significant interventions: architectural barriers, signs, clearly exposed timetables.

A second result is the possibility of future data integration, fully compatible with web GIS platforms, with other administrative databases. Direct access to the data source would bypass the problem of difficulty of direct survey, because sometimes traders are reluctant to answer or salespeople do not know the information. For example, this would be useful for evaluating the rhythm of openings/closings and therefore the rapidity of replacement, moreover valuing the long-standing historical shops. An evaluation of primary importance and considerable practical utility would be

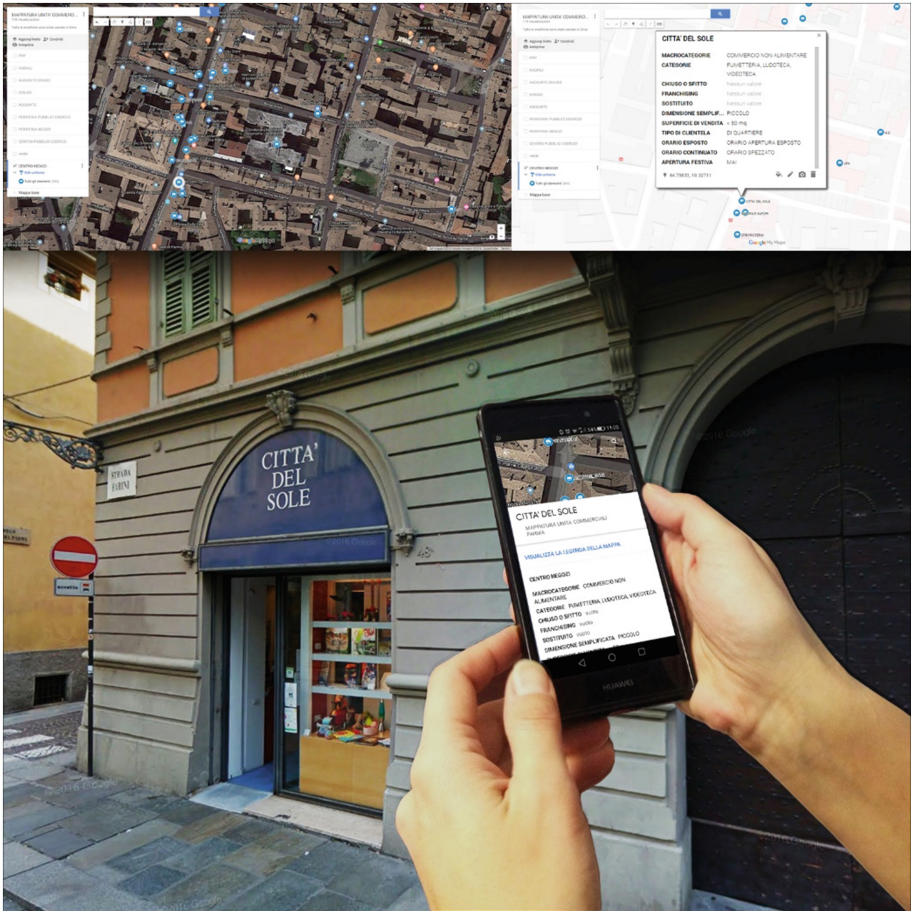


Fig. 7. Real time navigation of the interactive map, possibility of data control and updating *in situ*, suggestion for proximity advertising. (by D. Bontempi).

the mapping of the spaces available for temporary activities, both of private owners involved in the project, and underutilized spaces belonging to the public administration.

Since the map overlaps *G.Maps* and can be browsed in real time, it is already possible to view it in relations with the other informative layers of the urban digital cartography, such as road network elements (car parks, bus stops) or poles of attraction (museums, churches, public gardens), as well the more advanced features offered by related information). All these additional elements can clarify the overall picture of the situation and ensure better decisions (Fig. 7).

The real time display of the location of the entities is an incentive to improve the survey and keep the information updated, also on the initiative of the traders, to improve their visibility to the public and for proximity advertising. As known, the

monitoring over time is a crucial issue for any project of this type and the challenge of simplifying the management by non-specialists is a prerequisite.

A work of this type is useful on several levels: for the insiders, the analysts, the shopkeepers and also for the fruition by both residents and tourists. These tools are flexible, attention-grabbing and engaging: they definitively makes an impact in a superficial and hasty society. In a historical moment in which we are drown in information, the real challenge is giving users the information they need timely and in an effective way.

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