

# Data Integration In A Visual Mode

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*The principal aim of this paper is to discuss data integration issues in the context of urban scale studies. A special attention is dedicated to built environment, visual thinking and synthesis of knowledge. The paper is based on literature studies, professional experience and the outcomes of an experimental students' project conducted by the author last year. First, the theoretical background and the current state of research in the area is revealed. Then, the project theme, goals and organisation are described. So, the main idea of the experiment was to explore data collection methods at the urban scale without a design goal since the prime approach was to take into consideration students' perceptions of space and its multifaceted aspects. Thus, to maintain an open mind about gathering such information and not to bias participants towards one approach or another were crucial. Finally, the outcomes of the project are discussed. Students' presentations showed that they used different approaches not only in terms of digital tools but also in terms of their understanding of data integration.*

**Keywords:** *Built environment, visual thinking, data integration*

## BACKGROUND

Nowadays computer techniques are commonly used to support design process from early sketching to building information modelling and management. What is more, they play a significant role in the phase of preparing analysis, which precedes planning or design. A systematic survey and a comprehensive evaluation of computer software for urban design process was done by Charlton, Giddings and Horne (2008). The review concentrated on identifying and selecting software from six categories: 3D geometric modelling, pedestrian modelling, environmental noise mapping, thermal comfort software, wind analysis software and platforms (VR engines). The interesting work on finding low cost solution for visual-

ising city changes was described by Kaga and Sugawara (2008). Another development worth mentioning is a GIS tool kit for the socio-economic valuation of urban areas dedicated to designers and decision makers (Chiaradia, Schwander, Gil and Friedrich, 2008). There is no doubt that the idea of Space Syntax influenced methods of acquiring and performing specific data crucial to problem solving. Since it is a support tool for urban analysis, enabling informed decisions, a lot of successful examples of applications can be found in literature. For example, in the "Strategic Planning and Design with Space Syntax" (Czerkauer-Yamu and Voigt 2011) the authors discuss the constraints and opportunities of Space Syntax and show how it can add value to strategic

planning and design for a sustainable and sustaining built environment.

This brief overview only highlights main research topics in the field of urban studies and analyses in the context of searching for the best tools for the fusion of data. However, it is still difficult to find a comprehensive and ready to use methodology for multifaceted data integration.

Another issue which should be taken into account as a background study is connected with perception. The perception of space may be considered through the relationship between a human being and a built environment. As Bishop and Lange (2005) stressed, it was estimated that 80 percent of our impression of our surroundings comes from sight (Bishop and Lange 2005). A further concern is that, according to Sigmund Freud, a city is a metaphor of human psyche. To continue, the perception process is extremely individual, and actually depends on human psyche. What is more, it is necessary to quote here that a city is not only images of the forms given us in the process of visual perception but it also means all invisible and nowadays not existing forms. As a static picture of a city is not equal to reality, the perception of a city needs to consider time factor (Asanowicz and Asanowicz 2008). According to Ching "since we move in time through a sequence of spaces we experience a space in relation to where we've been and where we anticipate going" (Ching 2007). In other words, we receive lots of raw sensory information and our brains use this information in order to build a model of the world that we may use to predict and exploit the environment (Asanowicz 2011). The sequence of elements making up the spatial configuration of an urban assumption is a sequence of spatial pictures which we perceive as we get to know a part of the entire configuration. As Cullen (1961) stated "serial visions are a drama of juxtapositions that come alive when we walk down the street and experience the contrasts between, for instance, the street and the courtyard, light and darkness etc".

It is necessary to stress at this point that the ques-

tion posed in the paper is not how to read the city but, moreover, how to present such perceptual experience in a coherent manner. There is no doubt, such representation would involve not only visual thinking but also the capability of abstraction.

## **TASK, METHODOLOGY AND OBSERVATIONS**

The task of the project was to search and test different tools and methods in order to explore possibilities of data representation in a unified view. The subject was investigated on the basis of an experimental project conducted within a Computer Aided Architectural Design course for undergraduate students at the Institute of Architecture and Urban Planning of the Lodz University of Technology. The location chosen was of a municipal character - a part of Narutowicza Street in Lodz, between Kosciuszki Street and Dabrowskiego Square. Narutowicza Street is one of the most important streets in Lodz city centre, going West-East direction. It is perpendicular to the main urban axis, which is Piotrkowska Street. Its history, transformations and not realised projects of its future appearance place this street high on the list of urban problems in Lodz.

So, twenty four students formed four teams to elaborate on the task. They were expected to work in a little bit competitive manner between the teams since one of the goals was to result with more than one answer to the task. Therefore, each team worked separately to produce a final output. They started with site visits in order to be acquainted with all sensorial aspects of the place. Then, more information was gathered by studying maps, plans and documents concerning the urban area. A variety of collected data, in terms of types and also formats, and, moreover, resulting analyses were to be transformed in order to achieve an integrated view of data. At the end, students were asked to prepare presentations that would visualise the multiple sets of data in a compact yet comprehensive way. The results of the task appeared multifaceted and imposed a question: what can be learnt from the project and put forward

as guidelines or recommendations for future work?

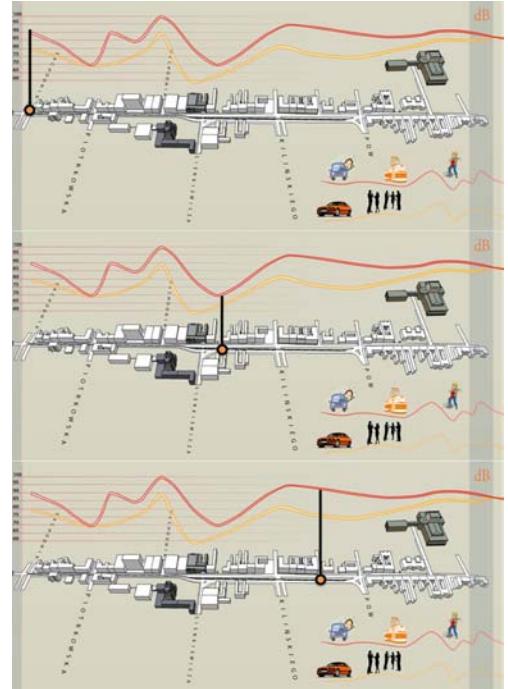
Completing the task involved exploration of various digital tools and techniques to describe, visualise and communicate discovered values of an urban tissue in a clear and explanatory way. Participants investigated sensorial aspects, like visual, sound, smell, tactile and kinaesthetic. What is innovative and valuable about the experiment, is the way the task was defined: no design, no further purpose to focus on after having analytical part done. Students were asked to go and just watch, observe, take some notes, be concentrated on perception of the place. Such approach made the work of analysing different to a typical preparation process preceding planning or design and resulted with very interesting outcomes. The message behind is that when a designer collects purpose-focused data it is very often affected by his/her intention and by that it becomes not neutral. In other words, it is not the raw data any more.

The following paragraphs focus on description of different approaches of each team.

### **Team 1.**

So, the first team decided to base Narutowicza Street analysis on the information that they gathered by means of four senses: vision, hearing, smell and touch. They agreed that the vision helped identifying the basic 'shape' (morphology) of the urban tissue and enabled them to locate that space in the city. Students put forward an argument that it supplies us with the most important information and is crucial in our functioning. On the other hand, hearing, smell and touch are giving us the additional information only that decide if we feel safe and comfortable in the environment. As to the touch itself, according to the studies, the group investigated that people perceive textures in the urban space more by their feet than by hands, because usually they do not touch each texture, but perceive it by using a sense of vision. Apparently, pedestrians constantly touch textures by feet when they walk.

Students prepared a diagram simulating the movement from the start point, which was Kosciuszki Street, to the endpoint (Dabrowskiego Square) recording all information on the way (figure 1). To achieve that, they supplied the final presentation not only with high resolution images of textures - to make the picture more tangible in a way - but they also added a soundtrack to strengthen a holistic impression of the places along the route.



### **Team 2.**

The second team was asked to make the same route but, comparing with the first team, in opposite direction. So, they started their walk on Dabrowskiego Square and finished it at the crossing of Zielona and Kosciuszki Street. During the walk they paid attention to many aspects, namely: history of the place, textures of surrounding surfaces,

Figure 1  
A diagram  
simulating the  
movement with a  
record of collected  
information.

smells, noises, safety, revitalised areas, road quality and general advantages or disadvantages. What is more, they defined a goal: to focus on the perception of the overall atmosphere of the place and how it influenced pedestrians. In order to achieve that students decided to recall history of the place and present it in a visual mode. They came up with an idea to compare photographs of particular buildings or Narutowicza Street perspectives taken in different periods (figure 2).



To prepare further analyses they decided to make the most use of colours. For example, to distinguish valuable buildings on a map they marked them in dark grey. They also gave two other categories, viz.: buildings of medium value, and buildings not suitable for surrounding and without any significant value. To show the road quality they used different blue tones (figure 3).

In order to highlight negative aesthetic values, like: blind walls, height differences, excess of advertisements, distorted building line, random and not composed greenery, poor quality fences, crooked pavement, rugged parking, space disorder, empty plots (figure 4) students applied red colour to the pictures taken during the walk, showing by that their attitude to the problems very strongly.

Although the team found very interesting aspects of the analysed area, and tried different techniques to present them, finally they prepared a linear presentation with a basic method of showing singular aspects separately. They did not succeed in terms of coming up with a presentation integrating all layers of collected data in a holistic way.

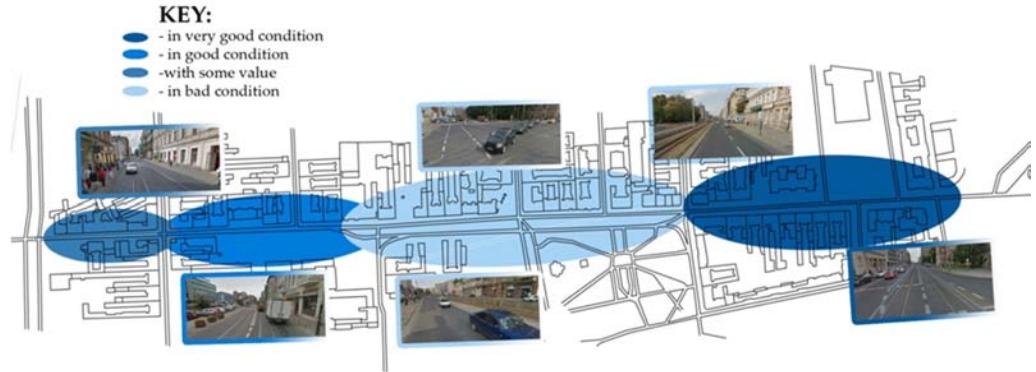
### **Team 3.**

The third team approach to the task was different. They divided the whole area into six parts: five segments of Narutowicza Street, separated by nodes (crossroads), and Dabrowskiego Square - and decided to analyse them separately. What is more, they divided collected information in two main groups: objective values and subjective values. The objective values covered elements of the city structure, such as: buildings, greenery, people, sounds while the latter referred to the values recognised and interpreted by senses. According to students' assumptions it meant things which influenced their senses and emotions, which were interpreted individually. They assigned light, atmospheres, colours and smells to this group.

Actually, there are some doubts concerning the methodology since sounds can be also understood as subjective values whereas light can be analysed as the urban structure characteristic. So, some elements do not fit entirely the group they were assigned to. This team made the most use of text comparing to others and, by making use of graphic programs they achieved a kind of poetic atmosphere of the images related to the topics discussed. Unfortunately, what was the most surprising, those images did not present the analysed place! Although students tried to create a matrix of various information,

Figure 2  
Historical and  
contemporary  
views of  
Philharmonic Hall in  
Lodz.

Figure 3  
Road quality  
analysis.



the final presentation was composed of single tracks of observations reflecting six parts of the analysed route. Since the outcome was not reflecting the true image of the analysed area it was difficult for the audience to derive the objective data or conclusions from it.

Figure 4  
Highlighting  
negative aesthetic  
values.



#### **Team 4.**

The fourth team was not able to work out one common solution, and, eventually, they split into three smaller teams. The first sub-team idea was to analyse selected issues most important for them and then, present them in the volumetric form. So, they decided to study the car intensity, pedestrian intensity, light and safety. Actually, they used 3D modelling digital tools, basically used for buildings modelling, to present outcomes (figure 5).

The second sub-team focused on sounds related to urban zones. With devices available nowadays it is easy to record sounds, but the problem posed was of different nature: how to represent them visually and inform the positive and the negative to extract conclusions. So, transformations of sounds into geometry were tested with the application of a couple of programs to get an animated picture of the streetscape. As a result, the notes were represented by circles, the size of which corresponded to the length of the notes. The notes of each part (a part understood as a unique track/channel combination) were connected sequentially by lines (figure 6). And then, with the picture of the sounds of cars, trams, people, vehicles on a building site, it was possible to create a video showing the evaluation of the urban zone in terms of the quality of life.

The last sub-team decided to focus on the analysis of accessibility of services in the area in terms of their variety and in terms of a distance to public transport nodes. They understood this issue as one of the most crucial in the context of urban environment analyses. So, they applied Quantum GIS to create a database related to a map of the area (figure 7) and, finally, to be able to perform a number of queries. What they discovered and appreciated while learning the digital tool, that the chosen software allowed not only for effective and reliable visual representation of the outcomes but appeared very useful for fur-

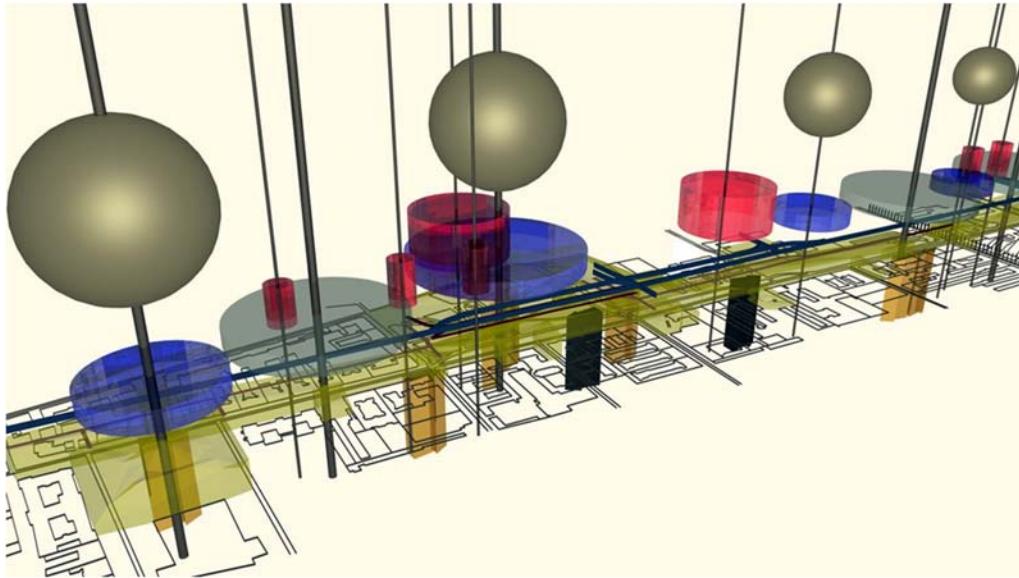


Figure 5  
A volumetric  
visualisation of  
collected data.

ther studies. They noticed, that in a contrast to the solutions provided by their colleagues, it was a tool for conducting deep studies and a comprehensive research, due to the capacity for numerous spatial analyses.

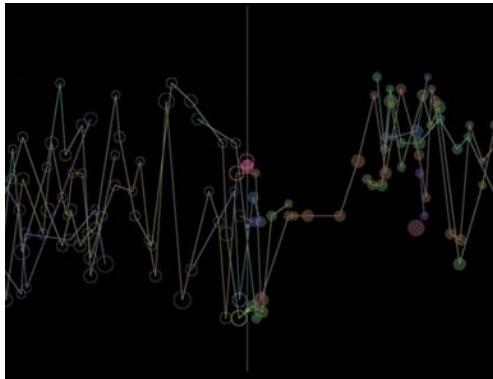


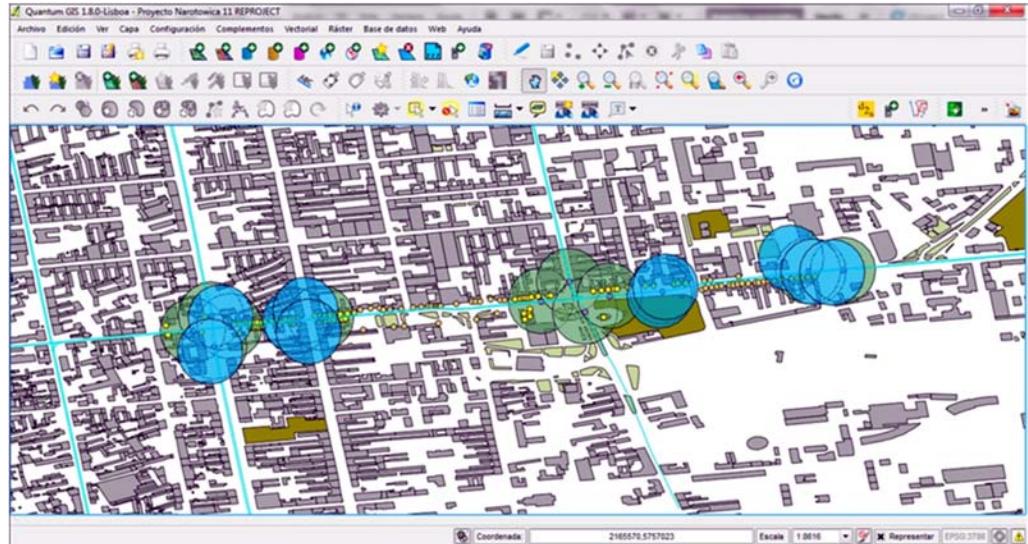
Figure 6  
A graphical  
interpretation of  
sounds.

## SUMMARY AND FINAL REMARKS

A fundamental problem posed in this paper is a spatial knowledge acquisition, and furthermore, transforming it into a visual and comprehensive representation. The focus on the description of urban environment perception and understanding made this project similar to Kevin Lynch and Kazimierz Wejchert approaches (the latter being commonly recognised by Polish architects as a reference in preliminary urban studies).

First, it is necessary to underline the independence of analytical process from any further purpose or design. The idea was to achieve "clear" results, liberated from any pragmatic prerequisites and assumptions. What is more, students were allowed to focus on diverse aspects of urban space according to their mindfulness and perception abilities. As result, a creative approach to the subject matter and experimenting with diverse representation methods were a commonplace among project participants. In this respect, it was observed that a variety of computer media played a prominent role in fulfilling the task. For

Figure 7  
A result of a query in Quantum GIS.



example, there were notable attempts to link visual representations with sound effects to provide more comprehensive information. Some students also decided to use video media and animated graphic illustrations of the outcomes.

Through all stages of the project there was not a single leading solution or supportive digital tool chosen. Since the groups worked separately, and on a competitive basis, it helped to keep separate tracks of progress and, what is more, to avoid one common method agreed. Additionally, by applying this pedagogical method students were enhanced to be involved in the problem solving process more deeply.

Such freedom of choice of representation means and computer programs allowed students for creative exploration, which results were not limited by the urban-analysis software. What is more, they depended chiefly on participants skills, engagement in new domains acquisition and personal sensibility. It is necessary to point out, that results of these experimentations were not always successful - in some cases the outcomes represented quite difficult to understand graphical forms that did not present the

collected data in a clear and legible manner. It also seems that the greatest difficulty for students was the meaningful integration of data from different disciplines and of different character. What is more, the linear nature of analysed urban space - i.e. a street - imposed the line graph representations reflecting changes over time of particular features, such as noise level or quality of space. It might be, therefore, interesting to repeat this project in relation to a space of different geometry, and compare the results.

Summing up, the project stimulated students' awareness of multifaceted quality of urban spaces. The methodology applied by each group while elaborating on the task and final presentations showed different approaches not only in terms of digital tools but also in terms of understanding the meaning of data integration. The author believes that the findings revealed in the paper will contribute to the discussion on the FUSION - the eCAADe 2014 Conference theme - and make its goal less elusive.

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