2TaLL

APPLICATION OF 3D VIRTUAL CITY MODELS IN URBAN ANALYSES OF TALL BUILDINGS

Architects Gallery “Forma” | Galeria Architektów Forma
Szczecin, February–April 2016 | luty-kwiecień 2016

Landeshauptstadt Dresden
February 2016 | luty 2016

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Exhibition of the research project 2TaLL

Application of 3D Virtual City Models in Urban Analyses of Tall Buildings

PhD Architect **Klara Czyńska**
PhD Architect **Paweł Rubinowicz**
PhD Architect **Adam Zwoliński**

West Pomeranian University of Technology, Szczecin
Zachodniopomorski Uniwersytet Technologiczny w Szczecinie

ABOUT PROJECT

PROJECT FACTS

Title of the project: Application of 3D Virtual City Models in Urban Analyses of Tall Buildings
Project acronym: 2TaLL
Project type: Small Grant Scheme 2012 Polish-Norwegian Research Program
Project Promoter: West Pomeranian University of Technology in Szczecin
Principal Investigator: dr inż. arch. Klara Czyńska
Key Staff: dr inż. arch. Paweł Rubinowicz, dr inż. arch. Adam Zwoliński
Project duration: 2,5 years (2013.09.01 – 2016.02.29)

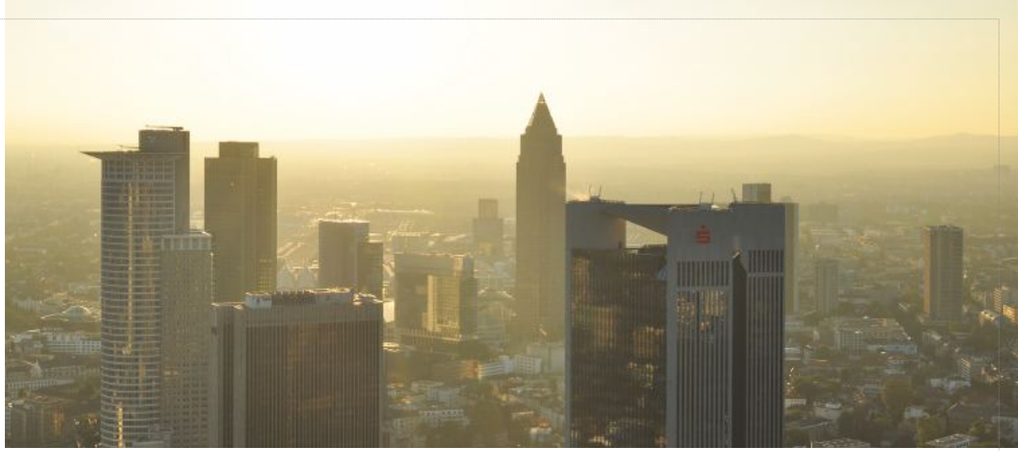
PROJECT SUMMARY

Determining the location of tall buildings is an important and actual issue of contemporary spatial development planning in numerous European cities. In many instances, negative consequences of an inappropriate location of a tall building result from inability to foresee its spatial impact. The project examines possibilities and limitations of application of virtual models of cities (3D) to provide advanced computer urban analyses in this area. The project aims to develop computer methods of urban simulations of tall buildings impact on city landscape including protection of city panoramas and historically originated urban interiors. The project is focused on introduction of guidelines for 3D Urban Analysis Systems for simulation of visual impact of tall buildings, possible for application in spatial planning process.

ABOUT EXHIBITION

The exhibition presents selected results of research by the 2TaLL project: Application of 3D Virtual City Models in Urban Analyses of Tall Buildings, under the Polish-Norwegian Research Programme by a team of researchers from the West Pomeranian University of Technology of Szczecin, implemented in 2013-2016. The team consisted of PhD Architects: Klara Czyńska (Principal Investigator), Paweł Rubinowicz, and Adam Zwoliński. The authors of the exhibition want to move visitors to the world of digital urban analyses developed by the 2TaLL project, show possibilities of virtual modelling using latest technologies and highlight the significance of tall buildings for the contemporary development of skylines of European cities. The exhibition has been divided into 5 theme groups, such as leading research methods, computer aided tools and in situ analysis of tall buildings in selected cities in Europe. Major research methods included Visual Impact Size (VIS) based on application for specific location of a tall building in Warsaw; Visual Protection Surface (VPS) based on a landscape study in Dresden and study on structures of public spaces using 3D-Negative.

Jakub Gołębiewski
Galeria Architektów Forma / Architects Gallery "Forma"



Foreword: on the spatial analysis methods documented in the catalogue

Findings of the 2TaLL research project present a series of new analysis methods that facilitate studies on the impact of new buildings on a city. In particular, visibility studies based on Visual Protection Surfaces provide new opportunities for an urban planning practice that respects historical urban heritage. For example, the protection of urban skylines in historical cities can benefit much from the new possibilities offered by the analysis. Beside the visibility, the authors also examine qualities of public spaces and the shadowing effect produced by tall buildings in their surroundings. The megatrend of progressing urbanization and the growing need for built-up structures of high density will strongly influence urban development in Europe in the next decades. This emphasizes the necessity for modern digital planning tools as those developed in the 2Tall project.

The integration of the third dimension in the visibility analysis of urban areas enables new and innovative systematical view analyses. The most important one is the comprehensive analysis of buildings visibility which combines the height of a building with its visual impact, namely the Visual Impact Size method. The innovative visualization method is capable of delivering a quantitative analysis in the form of an informative map which shows the visual impact of a building on its urban surrounding as well as its magnitude. A huge advantage is that the analysis is not restricted to selected standpoints but covers all possible points of view in an urban area. For this reason, the visibility analysis is considered comprehensive.

Case studies of such cities as Dresden, Brussels, Munich, Berlin, Frankfurt, Rotterdam, Delft and others provide very good examples of how advanced 3D-city models (including semantic information) can be used. In the years to come, such models will be created for a number of cities all around the world. The architectural research group has not only harnessed astonishing technical skills necessary to develop software for the computation of Visual Protection Surfaces, they also resolved challenges related to various input data types and formats such as Lidar data and CityGML.

The examples provided by the authors of the 2TaLL research project are visually appealing and illustrate the practical application of the method and consequently the huge potential of analysis methods developed. Hopefully, the research team can continue and further their work in this field.

Reinhard Koenig, *Junior-Professor Dr.*
Bauhaus Universität Weimar, Technische Universität München, ETH Zurich

INTRODUCTION BY AUTHORS

Tendency towards developing tall buildings in Europe

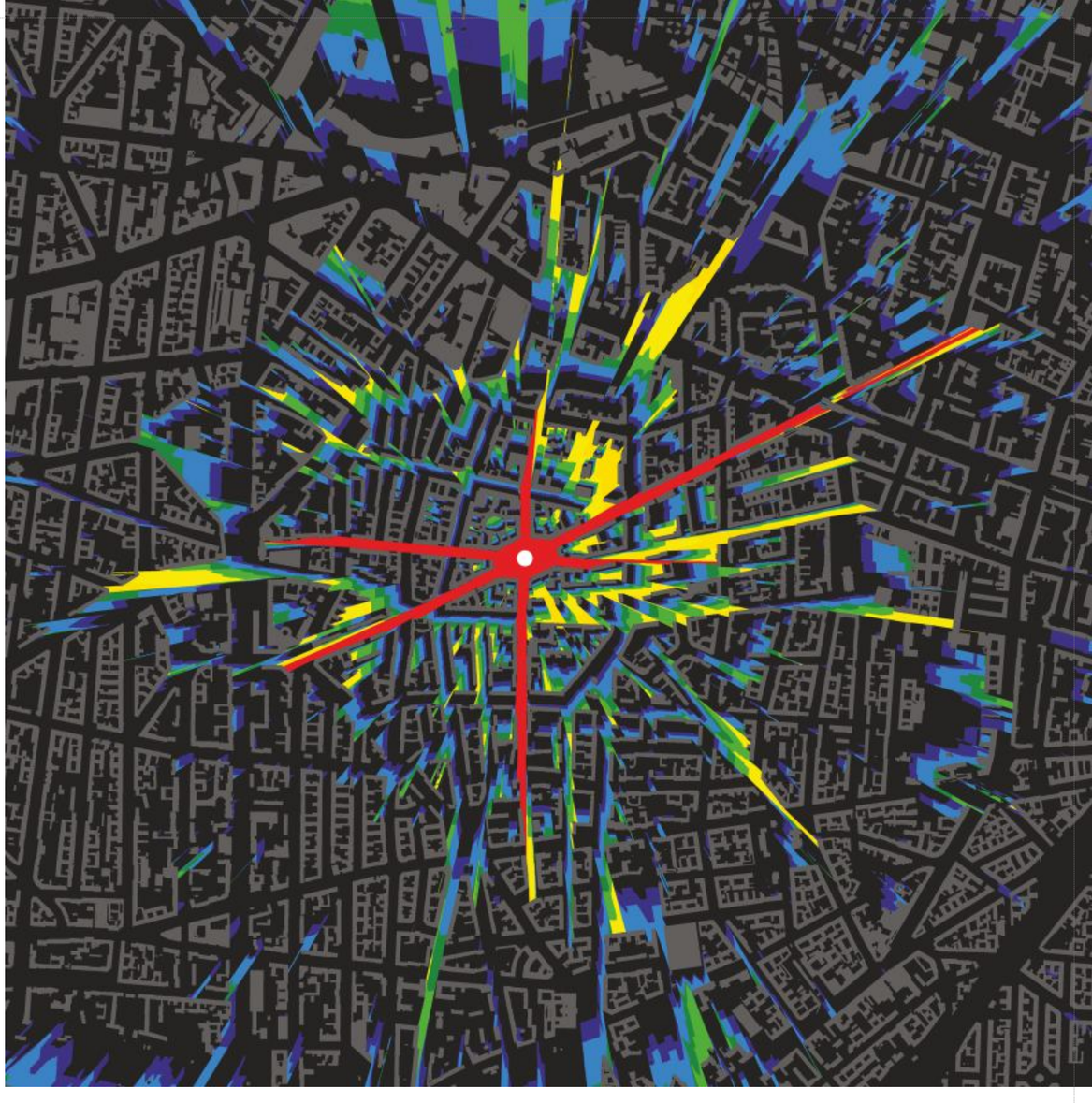
In the past two decades, tall buildings have become increasingly popular on the European continent. Not only did the number of tall buildings increase, but also their average height (acc. CTBUH Council on Tall Buildings and Urban Habitat). This had a major impact on the historical landscape of many cities. Contrary to Asia or America, European cities developed through a gradual and rather slow evolution. Effects of the incremental development can be seen in the urban structure, typical spatial compositions and building silhouettes. Historical dominants have been well recognized and rooted in the public awareness as elements of the landscape, whereas contemporary tall buildings rapidly change that having its frequently random impact on important urban areas.

Examples of unfavourable changes to historical areas are many. Earlier, well known, examples include the axis of Champ-de-Mars in Paris ended with the Montparnasse tall building which disturbed this symmetrical and showpiece development in the city. While referring to developments in Poland we may give an example of the recently completed ING building at the Unia Lubelska Square that can be seen above the roof of the Belweder Palace from Łazienki Królewskie, Warsaw. Additionally, the view of the Tomb of the Unknown Soldier is interrupted by the Warsaw Trade Tower. It seems that no one has foreseen the impact of those buildings on the city, whereas such strategic views should be particularly protected. According to those examples, previous planning techniques do not provide an efficient protection. On the one hand, it is crucial to eliminated unfavourable visual interactions with historical buildings and, on the other, it is equally important to create an attractive city skyline with tall buildings as new spatial value and determining a proper location for such dominants in line with the urban arrangement of the city. Therefore, we need new techniques that in an objective and comprehensive manner help determining spatial consequences of tall buildings development in various locations.

Main project objectives

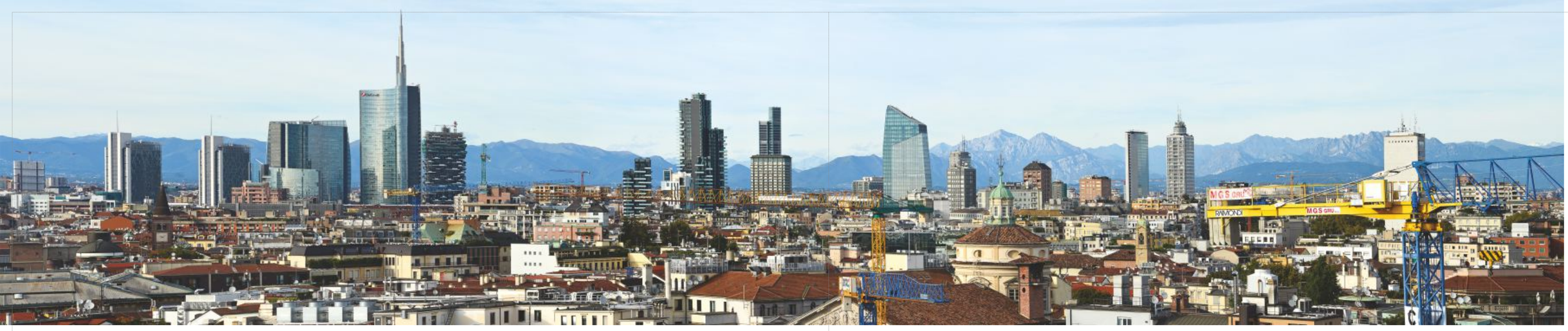
The tall buildings research under the 2TaLL project were two fold. On the one hand, the project research aimed at documenting selected examples of locations of tall buildings in European cities and analysing their impact on the landscape. On the other, the project focused on creating tools and computer-aided methods of simulating impact tall buildings have on space. New methods enable diagnosing the visual impact of a building in a city (VIS) and protecting important landscape clusters against the impact of new building (VPS). Additionally, the project developed analyses of public space (3D-Negative), shadow effect, Sky View Factor (SVF), and axial views (AXV). The new techniques are based on using digital 3D city models (CityGML, DSM / LiDAR).

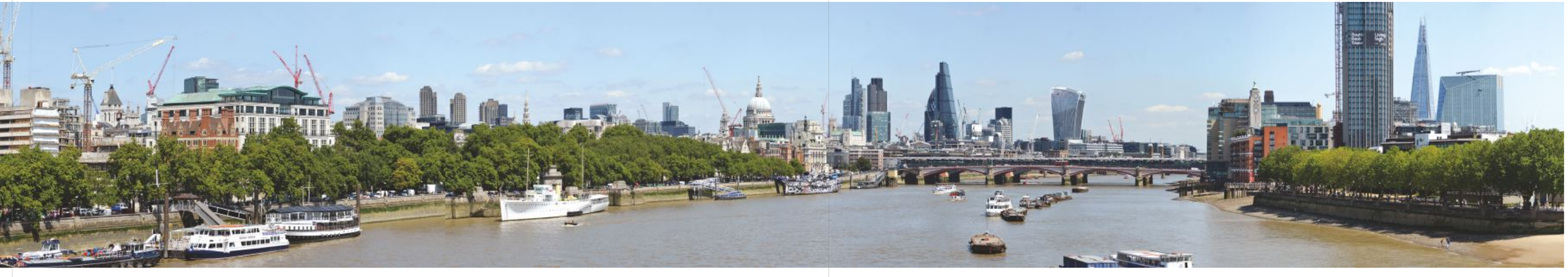
One of the key objectives of the 2TaLL project was to examine and analyse the impact of tall buildings in selected European cities. Field studies took place in 13 cities of various size and spatial arrangement, including Amsterdam, Brussels, Dresden, Frankfurt, Koln, London, Milan, Munich, Nurnberg, Paris, Vienna, Warsaw and Wrocław. The analysis aimed at documenting and assessing the impact of tall buildings on the landscape. The following factors were



VIS analysis for a part of Berlin

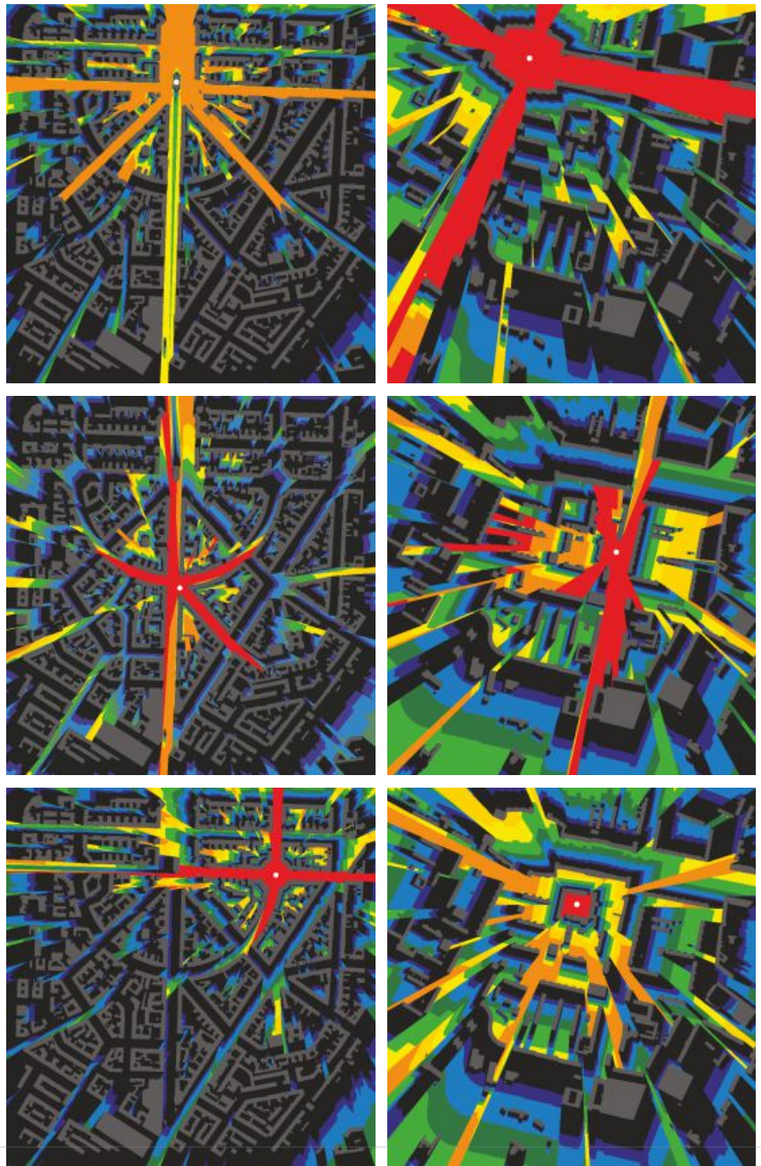
Visual Impact Size (VIS) method enables identifying all locations in the city from which the planned tall building can be seen and showing its real visual impact range as well as assessing its strength. The analysis presents the scope and range of impact a planned tall building may have in the centre of the Victoria-Luise Square, Charlottenburg, Berlin. The study uses the CityGML model at LoD2. The area examined is 9 km^2





New tall buildings in panoramas of European cities

Tall building developments is a subject of discussions, arguments and controversies which frequently reflect a dilemma between developing a new image of a city and restrictive protection of its historical landscape. Panorama of Milan – view from top of cathedral St. Maria Nascente di Milano towards north, with cluster of tall buildings in business district against mountainous background (2014-09) and (below) panorama of London containing latest skyscrapers (incl. "20 Fenchurch Street", "The Shard") – view from Waterloo Bridge (2015-07)



Tall building absorption capacity

The impact of tall buildings on the city landscape depends on its spatial structure. The analysis presents sample simulations regarding visual impact range using the VIS method for different types of the urban structure in Berlin. Each area is 1 km2

considered: impact on the surrounding, impact on major axes and urban interiors and impact on a wider landscape (city skyline). Comparisons led to drawing general conclusions regarding specific nature of tall buildings described in other publications[1].

The study of selected European cities showed the scale and relevance of the issue of tall buildings, as well as an urgent need to find new analytical methods that can be used in spatial planning. Of course, the visual impact of planned investment is one of several factors to be considered (other include profitability, transportation, shadow effect, functionality, etc.). However, for external recipients of the finished architectural facility, the impact on the location and appearance from different angles are most tangible. In Germany, the development of mock-ups of controversial buildings (temporary constructions) is a common practice. The general public is then able to assess the scale of the planned investment. The 2TaLL Project attempts to meet those needs. While using digital tools, it is possible to foresee the spatial impact of planned facilities and their relations with historical parts of the city.

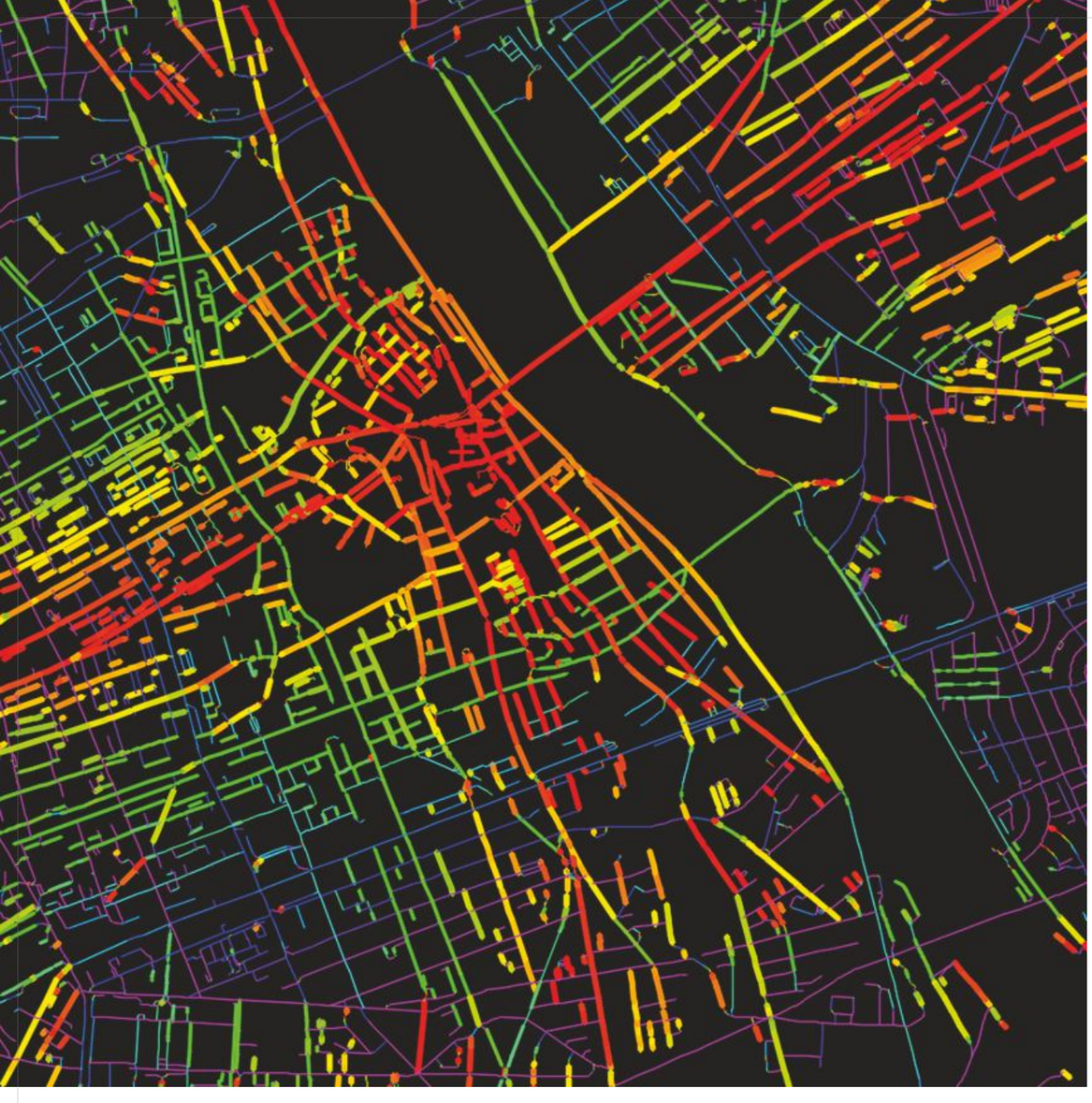
Analytical methods

The Visual Impact Size (VIS) method was developed for comprehensive assessment of the visual impact range of a given tall building. It enables determining which public locations in a city remain under the influence of a tall building. A single calculation process defines the range of the impact, namely whether we can see the building in whole or a major or minor part of it. The method enables measuring the visual impact of a building at various heights. The results are generated automatically in the form of a 2D map. The interpretations of findings may be crucial for determining further directions of future planning. The VIS map enables determining important expositions of a new building, including those that pose a threat to the integrity of the most important spatial development (e.g. old towns, symmetrical arrangement). Viewpoints examined based on the VIS analysis can undergo simulation against height lines to show the actual scale of a facility in space.

The VIS method has been used in various studies since 2007. However, the 2TaLL project developed and harmonized it. The project developed new algorithms and software solutions that enable emulating VIS maps based on various spatial city models (including CityGML, DSM). They promoted scientific development of the isovist 3D theory. Measuring the impact area, or comparing VIS maps for different urban structures created a basis for developing the theory related to the landscape absorption capacity in cities, which was referred to in various publications[2]. The major application potential, however, needs to be emphasized, as proved by a number of cases. In the latest study for Warsaw (by team of prof. Marzęcki, 2015), the VIS method was used to analyse the visual impact of a planned building in the seminar garden at Skarpa Warszawska[3]. The VIS map became the foundation of the study as well as a basic tool for assessing the impact on the city landscape. It also helped identifying important exposition points of a building in the historical context of Warsaw.

Yet another example is the Visual Protection Surface (VPS) method which focuses on protecting the background of important city skylines. The method enables determining height limits for certain buildings. Input data comprises coordinates of expositions points for strategic views that need to be protected (which is in line with policy of spatial landscape protection and development in many cities, e.g. London[4]). The computation process generates a surface above the city determining the maximum height of buildings, buildings which are not seen from protected viewpoints. VPS can be used to analyse the capacity of a city to absorb tall buildings. The method can also verify consequences of spatial strategies and changing the height of buildings in a city. VPS was used for the first time in studies on Dresden, a city of landscape values that are unique in Europe.

VIS and VPS are complementary methods as regards examining of urban landscape as well as planning applications. VIS has broader origin and is deeply rooted in previous research, whereas VPS has been studied in theory, however not yet developed in practice. Finally, the 2TaLL project research and the development of new programing tools enabled possibility of applying both methods to the same facilities (in vector model environment and city models based on cloud of points). Although, both methods are used for



analysing the city landscape, but the analysis focuses on two different issues: the impact of a building on the landscape, and protection of a view and its implications for developing buildings in a city. When applied together, both methods enable versatile and multifaceted analysis of the landscape and assessment of its absorption capacity as regards new investment, including tall buildings. The application of the methods in spatial planning can significantly improve the quality and reliability of decision making as regards their impact on the development of a city.

Tall buildings has a major impact not only on the landscape but also on the quality and functioning of public space in a city. The above was a subject of a separate research under the project. To a large extent, the urban structure is the effect of a game involving 'the positive and the negative', in other words buildings and space. The game also involves inhabitants of a city. The Positive takes the form of buildings, structures, facilities or elements of the natural landscape. The Negative is the world of invisible geometry determined by the structure of the Positive. The form and geometry of buildings can be seen directly, whereas the geometry of space between buildings is not measurable directly. This led to the development of the 3D-Negative method which enables (based on CityGML model) generating a 3D public space model, or the negative of a city, and then analysing its geometrical parameters: the spectrum analysis (CSP), angle typology analysis (TBS), dimension typology analysis and study of public space planes and surfaces (TBL, TBA)[5]. Research on public space also focused on the intensity of the shadow effect produced and obstructing the view by tall buildings. The study applied specialist software providing for calculation of sun exposure time and Sky View Factor (SVF), a tool that enables calculation of surface area obstructed.

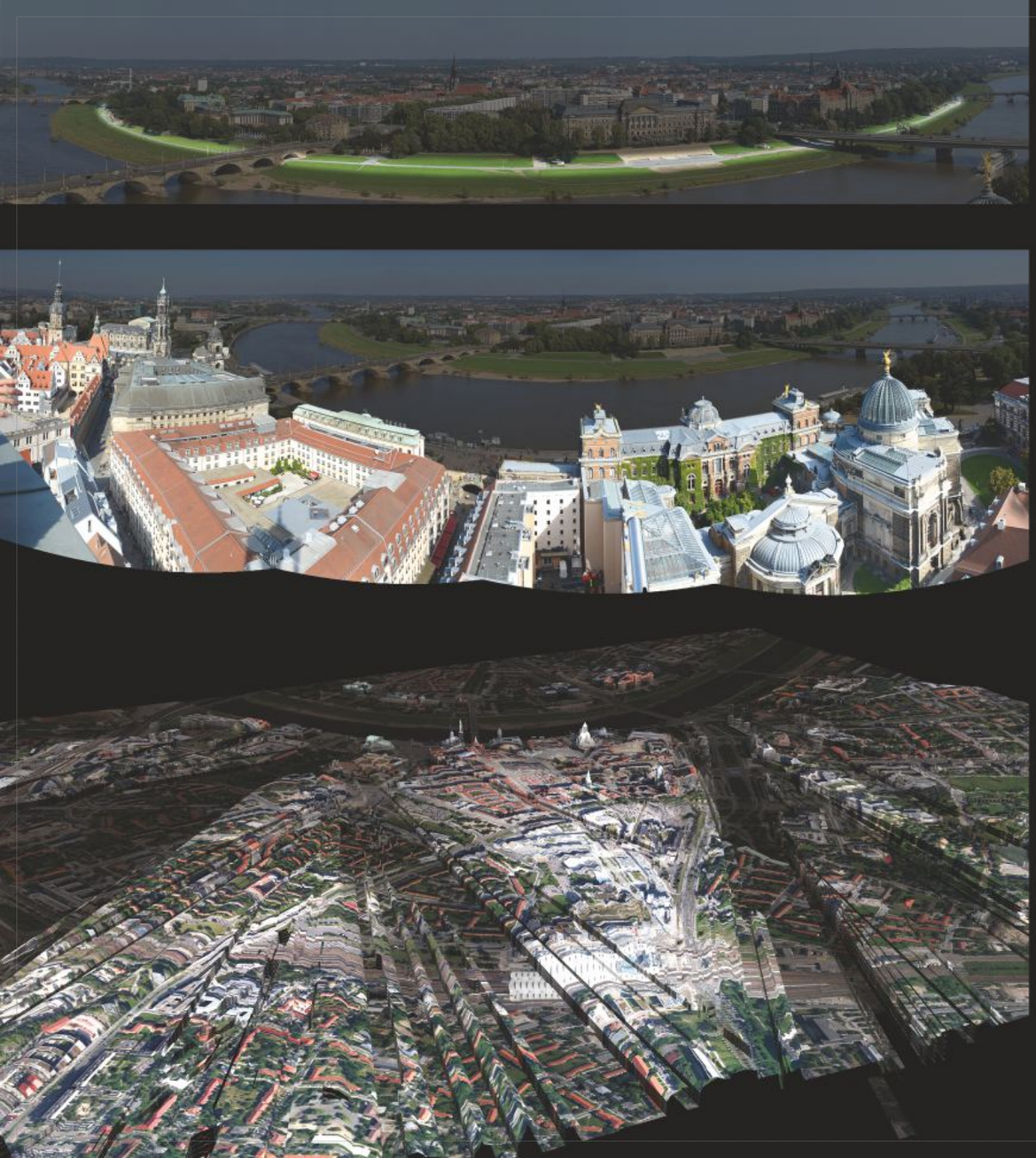
Possibilities and limitations for using 3D city models

The analysis of city landscape and the study of tall buildings impact are based on 3D city models. Accessing those resources was necessary to meet objectives of the 2TaLL project. A major issues was also adjusting the methods to current standards used while recording city models. A factor which helped implementing the project was the implementation of the EU INSPIRE Directive which required member states to facilities and improve access to spatial information. The advancement in terms of quality and accessibility of data was such that changes could be seen during the implementation of the project. Acquiring certain resources, however, required separate agreements (e.g. model of Berlin), which is today 'open source'.

In the first stage of the project, research used solely 3D city models in the CityGML standard. The term 'standard' is crucial. CityGML makes 3D data independent from the environment of the model, which is a major difference if compared to CAD models, in which data are linked with a specific program and their transfer to other programs usually involves certain loss. It is regrettable that still 3D city models are requested to be developed in CAD, e.g. a new 3D model of Warsaw. CityGML models are standard in Western Europe, in particular in Germany. They enable recording not only the geometry of buildings but also data semantics (description of mutual relations between elements of model). Thus, the format covers various classes of objects (e.g. buildings, water, tunnels, and bridges) and enables recording them in various precision scales (LoD). In practice, incompleteness of a model is a frequent drawback, which means that it does not reflect all elements of the actual city space. For the purpose of research under the 2TaLL project, CityGML models were acquired covering whole or parts of 8 Euro-

Axial views study on street grid in Warsaw

An important tall building perception factor, critical for interpreting the findings of the VIS analysis, is the urban composition of a city. The composition of a city is determined by the street grid which can be subjected to an objective analysis. The simulation of a 25km2 section of Warsaw, presents the impact of a tall building along street axes



pean cities, including Berlin, Frankfurt, Rotterdam, Delft and Dresden.

Different digital recording of space is used in city models based directly on Airborne Laser Scanning (LAS, DSM, DTM models). Aerial scanning data are a semi-processed product for developing vector models. However, unprocessed picture of a city in the form of a cloud of points can be a basis for using landscape analyses. Some major factors include cost, validity and access to data. In the case of Polish cities, CityGML models are virtually not available. However, the nation-wide flood protection programme ISOK[6] produced LAS, DSM and DTM high resolution models for all major Polish cities (much better than in German cities). The 0.5m DSM model enables reflecting basic architectural relations. A major advantage of the city picture produced is a complete presentation of all spatial elements with the same precision. In the second stage of the project, some of the methods, including VIS and VPS, were adjusted to process DSM models, which required other (recurrent) algorithms and software solutions. Research using DSM models covered 4 Polish cities: Warsaw, Szczecin, Lublin and Wrocław.

Exchange and dissemination of knowledge and prospects for further research

The 2TaLL project required an interdisciplinary approach, including integration of various scientific fields and reaching a number of research communities. A major achievement, important from the point of view of dissemination of findings and broadening knowledge of the researchers, was the participation and presentations delivered during three leading international conferences of various scientific profiles, such as geometry (ICGG16: International Conference on Geometry and Graphics, Innsbruck 2014), environment remote sensing (ISRSE36: International Symposium on Remote Sensing of Environment, Berlin 2015) and digital urban analysis (SSS10: Space Syntax Symposium, London 2015). Each of the conferences had its impact on the direction of research under the project. Contacts made resulted in further exchange of knowledge and presentations, e.g. in Croydon (City Planning Department, July 2015), London (Urban Design London, September 2015), Weimar (University of Bauhaus, January 2016) and Dresden (Planning Department, February 2016). During the project, in total 31 activities took place promoting exchange of knowledge in 20 European cities, including studies, conferences, presentations, exhibitions, etc.

For its successful implementation, the project required specialist training and consultations aimed at broadening knowledge and competences of project team members. A milestone development included a training on the CityGML standard and FME software organized by Virtual City System in Berlin (July 2014). The training helped developing skills of using CityGML models and enabled creating programs by project team members to process such data (crucial for e.g. 3D-Negative). Other training and consultations were held in Poland and focused on GIS techniques, programing and mathematics. The transfer of knowledge enabled developing the capacity of the team, new analytical methods and computer applications (C++). The process helped verifying suitability of city landscape analysis systems (e.g. ESRI).

The 2TaLL project aimed at supporting the process of harmonious landscape development in a city in the context of assessing locations and spatial parameters of tall buildings. Methods developed,

Exposition of the panorama on the Elbe River, Dresden

Dresden is a unique example of a city where the entire exposition of historical buildings has been preserved (or restored after war) unchanged for several centuries. Today, it is a crucial part of the city's cultural heritage. The panoramas can be observed from a several kilometre stretch of boulevards on the Elbe River. Below: a 3D visualisation of the VPS, encompassing the protection of the background of Dresden panorama seen from the southern 2 km boulevard of Elbe, between bridges of Marienbrücke and Albertbrücke. The surface determines the permitted building height

such as VIS, VPS, and 3D-Negative, create a basis for various urban analyses in the field concerned. The scope of the research covered the visual impact and erception which, in the opinion of the authors, is the most crucial factor for the development of a city. The methods were applied to various cities in Europe based on their 3D models. The purpose was to show visual interaction promoting objective geometrical examination. The precision of results achieved can be debatable, whereas the method itself not. Of course, even the most precise simulation can merely support decision making in urban planning. However, considering the complexity of the issue, such a support can be invaluable.

In the future, the 2TaLL team intends to promote project findings and develop software created to be further used in research and spatial planning. The team would also like to include landscape analysis and the use of various city models in education.

dr inż. arch. ***Klara Czyńska***
dr inż. arch. ***Paweł Rubinowicz***
dr inż. arch. ***Adam Zwoliński***

Footnotes:

[1] K. Czyńska (2015) Impact of tall buildings on the attractiveness of urban landscape – on the example of selected European cities, Space&Form no 24/2, pp. 131-144, e-ISSN 2391-7725. K. Czyńska (2014) Tall buildings and the cityscape of Milano, Space&Form no 22/1, pp. 107-122, e-ISSN 2391-7725.

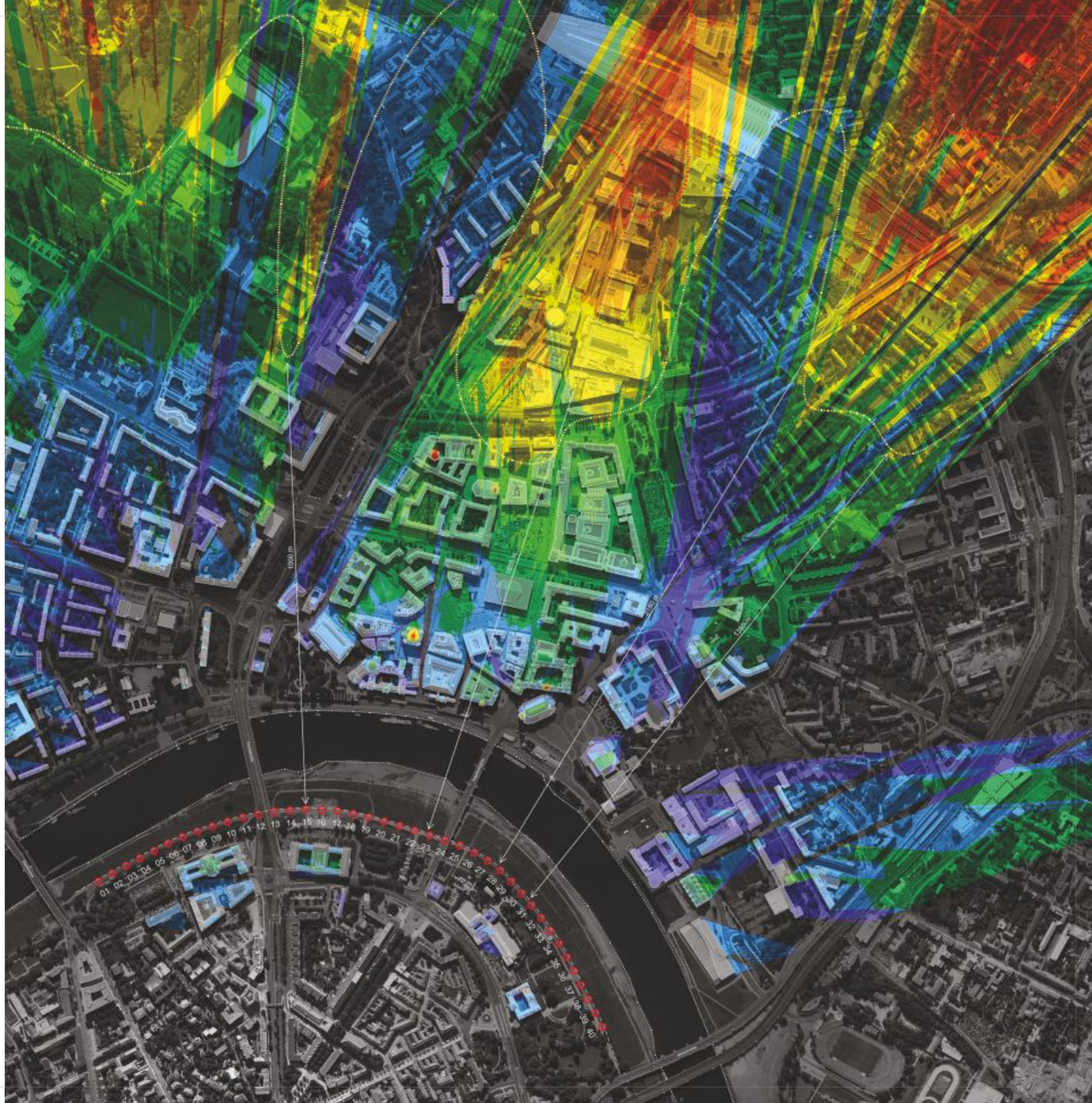
[2] K. Czyńska (2015) Application of Lidar Data and 3D-City Models in Visual Impact Simulations of Tall Buildings, Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci., XL-7/W3, 1359-1366, doi:10.5194/isprsarchives-XL-7-W3-1359-2015.

[3] W. Marzęcki, K. Czyńska, P. Rubinowicz, A. Zwoliński (2015) Impact study of the new library in seminar gardens in Warsaw. Urban study commissioned by Warsaw Archbishop.

[4] LVMF – London View Management Framework. Supplementary planning guidance, Study by Greater London Authority, Mayor of London 2012.

[5] A. Zwoliński (2014) Complexity of Public Spaces System Between Key Tall Buildings in City of Szczecin. Geometrical Aspect of Public Spaces in 3D City Model. In: Hans-Peter Schröcker and Manfred Husty, editors,Proceedings of the 16th International Conference on Geometry and Graphics, pages 175–186. Innsbruck University Press. ISBN 978-3-902936-46-2.

[6] ISOK – a project of system that improves the cover of the economy, environment and society against extraordinary threats, especially against flooding.

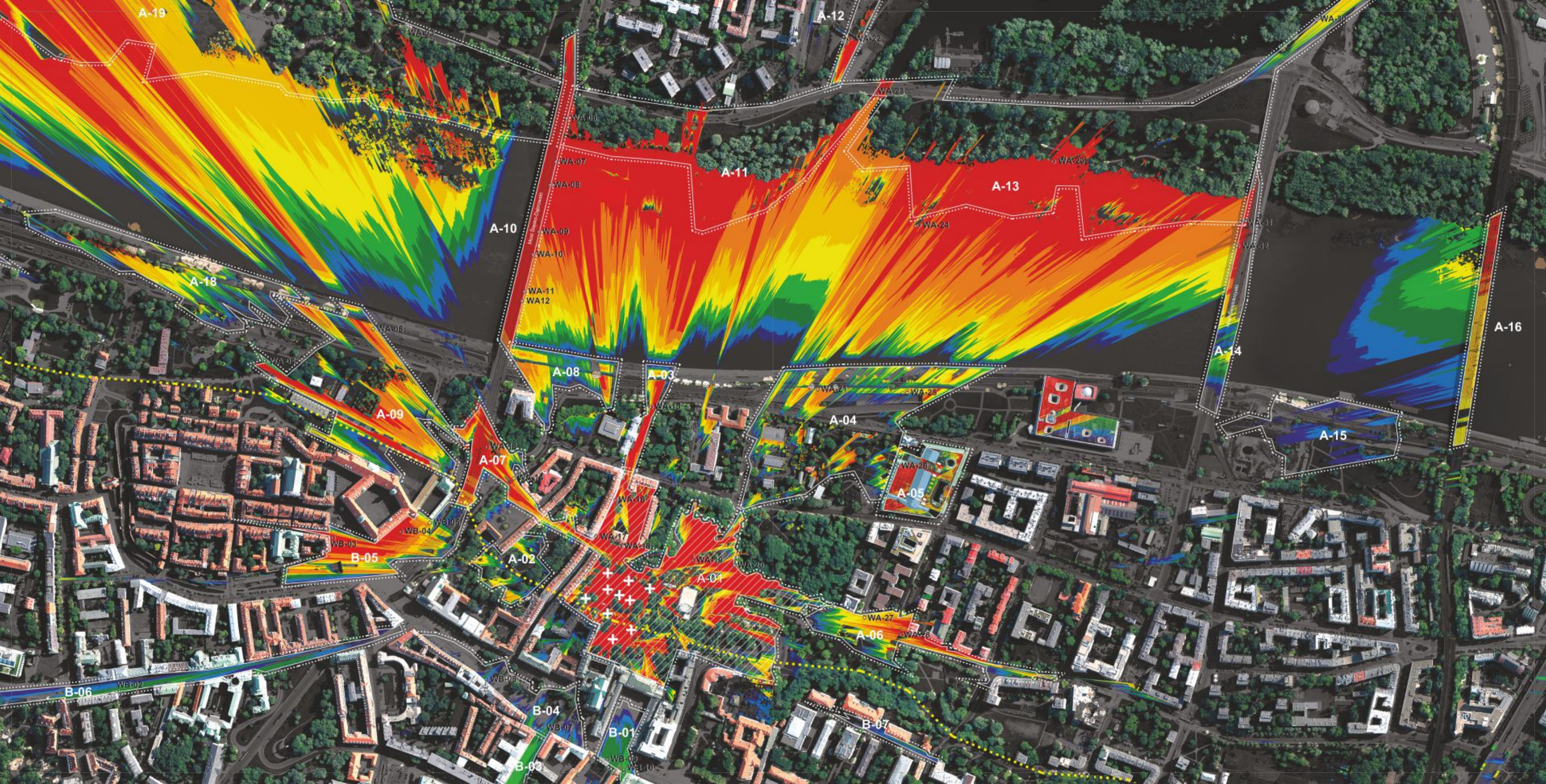


VPS analysis for protecting Dresden panoramas

Example of the VPS method application. The analysis covers a 6.25km2 section of the city and defines permitted heights of buildings in the area concerned to maintain visibility of those buildings from the Elbe River. The simulation used the CityGML model. It presents an approximation since it is not possible to include all buildings and other facilities, including tall greenery

> on the next page: VIS implementation in Warsaw

The example of using the VIS method for analysing the city landscape based on DSM / LiDAR data, used in planning, while developing: the Study of landscape impact of new buildings in seminar gardens of Warsaw, developed in 2015 by a team of prof. dr hab. inż. arch. Waldemar Marzęcki, dr inż. arch. Klara Czyńska, dr inż. arch. Paweł Rubinowicz, and dr inż. arch. Adam Zwoliński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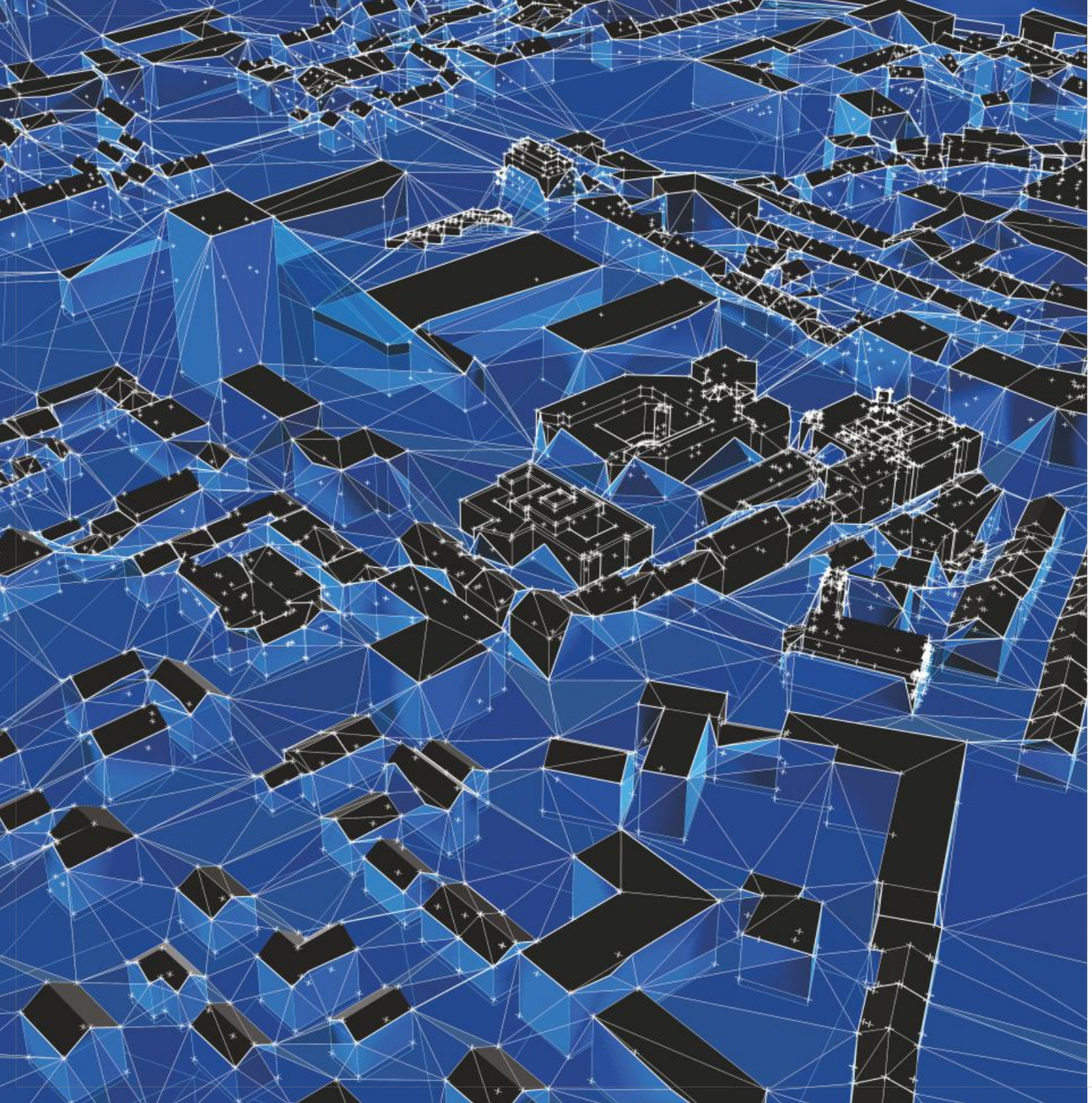


2TaLL – scientific background, achieved results and further prospects

Waldemar Marzęcki, prof. dr hab. inż. arch.

Recently, we have witnessed a tremendous increase in the number of tall buildings erected in major urban agglomerations of the world. The same phenomenon has been observed in many European cities as well. While comparing the historical process of urban structure transformation and current changes in the urban space, the latest development seems to be particularly significant. Transformation of the urban space involves rather qualitative than quantitative changes. During their growth period, the majority of cities underwent far-reaching transformation or expansion. However, the impact of the then changes on the perception of urban space was smaller than it is today. When new facilities were built, they had rather limited impact on the urban landscape, since new buildings were more or less similar regarding their scale, proportion and architectural form to those already existing. In the case of tall buildings, the spatial situation of the city structure changes dramatically. A single tall building may have a major impact on the arrangement of the entire city.

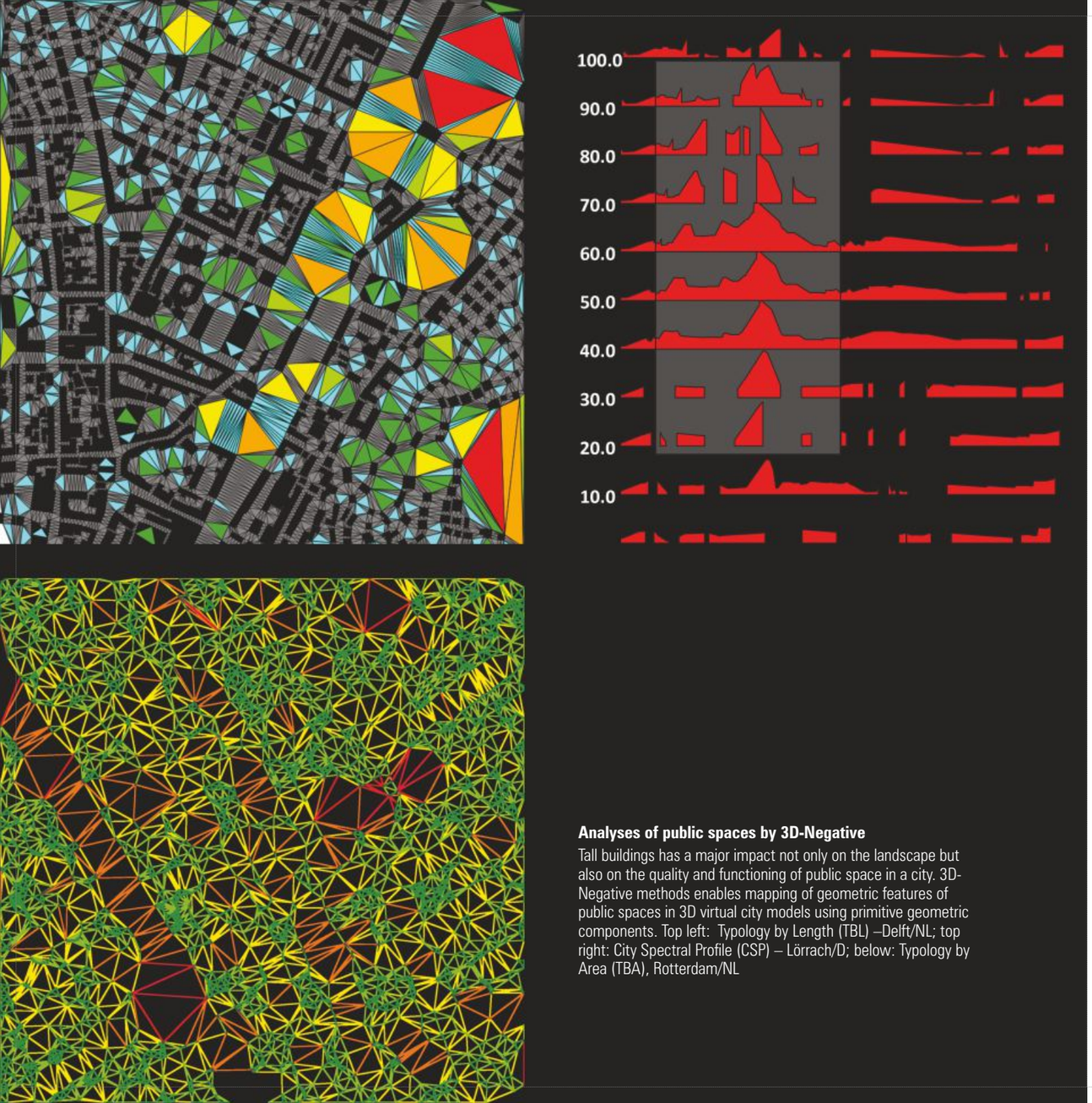
Traditional urban analysis methods seem sufficient while examining the potential impact of new buildings that have similar height to those situated in their vicinity or facilities that play the role of subdominants. The situation changes when we examine the impact of tall buildings on the existing urban development. Such buildings make a versatile impact on the spatial composition of a city. They can be seen at far ends of streets or stand out in the interior urban development, be exposed at the foreground, and in particular instances influence the skyline of a city. Therefore, protection or possibly evolution of the historical city space should be carefully considered.

While analysing the impact of tall buildings on the spatial structure of a city, it is necessary to develop new research methods that support the investment decision making process and facilitate multifaceted analyses. It seems obvious that particularly complex spatial relations between tall buildings and their surroundings as well as existing buildings should be considered in the context of the entire city. Thus, without a support of digital techniques, the implementation of a reliable study is virtually impossible. Results of this study extend beyond our imagination and even the best intuition of an urban planner is insufficient.

On the one hand, the authors of the exhibition, doctors Klara Czyńska, Paweł Rubinowicz and Adam Zwoliński, use latest digital analytical tools in their research, tools which simulate the earth surface and facilities located there, while on the other the three researchers develop new scientific theories and expand the variety of digital urban analysis methods by adding their own, such as VIS (Visual Impact Size), VPS (Visual Protection Surface), and public space 3D-Negative. It is worth emphasizing that the new methods are genuine and based on advanced software originally developed by the authors virtually from scratch. Their research topic is interdisciplinary and requires a combination of professional knowledge and skills in urban planning and digital city imaging, GIS, geoinformatics

3D-Negative model of Lörrach in Germany

The form and geometry of buildings can be seen directly, whereas the geometry of space between buildings is not measurable directly. The simulation presents 3D model of public spaces system in Lörrach generated form CityGML model by using 3D-Negative method



Analyses of public spaces by 3D-Negative

Tall buildings has a major impact not only on the landscape but also on the quality and functioning of public space in a city. 3D-Negative methods enables mapping of geometric features of public spaces in 3D virtual city models using primitive geometric components. Top left: Typology by Length (TBL) –Delft/NL; top right: City Spectral Profile (CSP) – Lörrach/D; below: Typology by Area (TBA), Rotterdam/NL

and informatics.

The position of the research team strengthened in 2014 with a grant from the Norwegian Financial Mechanism for implementation of the 2TaLL project on the 'Application of 3D virtual city models in urban analyses of tall buildings', a project headed by dr inż. arch. Klara Czyńska. In the group of 200 project applications competing for grants, the 2TaLL project received the largest number of points. The high project assessment confirmed significance of the research topic for the contemporary science!

The exhibition crowns the novel research on the urban space as well as tremendous dedication of the research team to solving real project issues. Since 2005, the research has been based on close relationship between architectural science and practice. The best example of its practical applicability are studies on the urban space of such Polish cities as Szczecin, Lublin and Warsaw. Scientific achievements and project findings provide a major contribution to developing innovative methods used for analysing urban structures.

The 2TaLL Project, implemented in 2014-2016 by a team headed by Klara Czyńska and involving doctors Paweł Rubinowicz and Adam Zwoliński, was crucial for the scientific development of the team. In particular, this applied to the project leader (Czyńska), but also individual team experts responsible for specific interactions in the project (Rubinowicz, Zwoliński).

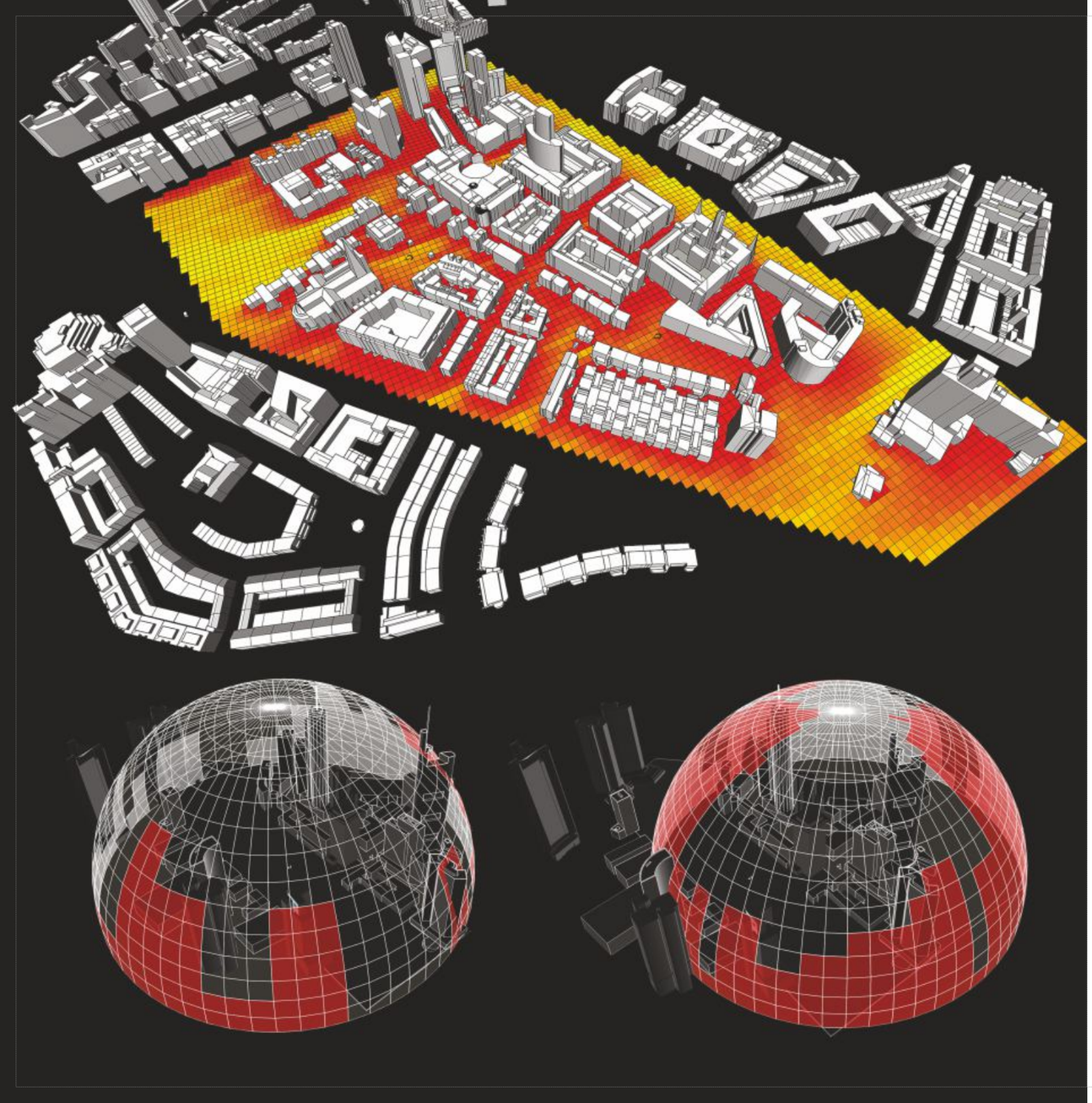
The attainments presented in the exhibition are a major contribution to innovative urban structure analysis methods so much valid and important for the contemporary development of cities in Europe. The research implemented and methods developed enable: a) better forecasting of spatial consequences of certain planning decisions as regards the development of tall buildings, b) defining their significance for the public structure in a city and c) examining the capacity of a city as regards tall buildings, while taking into consideration its historical landscape.

Findings of the 2TaLL project have a European dimension. This has been proved by the scope of activities under the project implemented in various cities in Europe. Considering project statistics (list of trips), activities such as in-situ landscape studies, scientific conferences, training courses, lectures, presentations, and exhibitions on the 2TaLL project took place in as much as 20 European cities (in alphabetical order: Amsterdam, Berlin, Białystok, Brussels, Dresden, Frankfurt, Gdańsk, Innsbruck, Köln, London, Milan, Munich, Nürnberg, Paris, Szczecin, Świnoujście, Warsaw, Weimar, Vienna, and Wrocław).

The strong position of the team has been confirmed by their participation in major conferences of diverse scientific profiles (ISGG16, SSS10, and ISRSE36), and numerous contacts with research centres (e.g. Bauhaus University of Weimar), planning centres (Croydon and Dresden) and the commercial sector (e.g. VCS Berlin). Landscape in-situ studies were implemented in several European cities, whereas 3D modelling focused on such cities as Berlin, Delft, Dresden, Frankfurt, Lörrach, Rotterdam and Warsaw. Methods developed by the research team are universal and can be applied in various virtual city models (from simple LiDAR/DSM 'point clouds' to semantic CityGML models).

Findings of the research presented by the exhibition put the authors in the group of people who promote experimental science at the global scale. I should congratulate the team and cross my fingers for their future success!

Waldemar Marzęcki
prof. dr hab. inż. arch.
Mierzyn, 2016-02-09



Review & contribution to discussion on 2TaLL project

Robert Barełkowski, dr hab. inż. arch., prof. ZUT, UTP

In his essay on the beauty in science, and more specifically in rules discovered by the science that are applicable to the perceived material reality, Subrahmanyan Chandrasekhar states that frequently research leads a man to a conclusion that the truth can be expressed in both simplicity and beauty. The elegance of simple, however not primitive, solutions, and the complexity expressed using a transparent code reflect principles of mathematics, physics, genetics and several other disciplines.

For a number of years, a team, comprising dr inż. arch. Klara Czyńska, dr inż. arch. Paweł Rubinowicz and dr inż. arch. Adam Zwoliński, has been developing a concept of spatial analysis of an urban structure using digital techniques. In their research, members of the team found a simple formula and range of applications for the method, which are expressed in a modelling (simulation) analysis involving algorithms using highly advanced data and the reconstruction of the spatial environment concerned. Although the principle is simple, it does not translate into a simple application. The path from an idea to its efficient application is far from being uncomplicated, like impressions one may get from examining analytical models presented in the 2TaLL project exhibition.

The output of those three researchers evokes respect. Not only did they succeed in formulating a simple idea and showed the entire process of developing the analytical tool, which presents visual impact areas in a city involving shadowing and revealing of specific objects, but more importantly provided for a very useful application of the tool which does not happen too often. While referring to the project concerned, allow me to digress in passing on the absurd ways of distributing grants and qualifying project proposals which in the opinion of assessing parties should not have a practical application, for certain not a commercial one. This, however, completely neglects a specific nature of the discipline of architecture, where the application by architects and urban planners cannot and should not compete with the application by civil engineers in such areas as those covered by the 2TaLL project. In fact, the research should be supported and promoted if findings of the research are going to be commercialized later on. In the discipline concerned, it is the only way of achieving a breakthrough while integrating academic and professional spheres, so much emphasized by those who attempt to improve the effects of research findings.

The 3D simulation of a city, representing its real environment, with its potentially crucial locations that accumulate urban processes, is an example of a scientific achievement that can be practically used in designing. I believe that the issue of spatial analysis should be considered in a broader context.

Czyńska, Rubinowicz and Zwoliński have built an analytical tool as the first very important step that highlights aspects of the urban space which escapes human senses and imagination before it is too late. This is an instrument for anticipating effects of operations in that space, which are far reaching and durable, operations of irreversible effects once they are implemented. Although the tool has a narrow application, it plays its role wisely and in a comprehensive and complete manner. The result of the research is capable of producing immediate results and has high value and utility by determining a very specific impact on the urban space. It can be a component of an urban space management system, and much more.

As mentioned earlier, it is the first step indeed, since a city is a sort of a biotic structure that depends on life cycles and specific metabolism, and the analogy to an IT being can be solely seen as an elementary simplification of very specific and controlled principles. As expressed by Michael Weinstock and Mehran Gharleghi in their essay on Intelligent Cities and the Taxonomy of Cognitive Scales, the

Public space and tall buildings – shading & screening

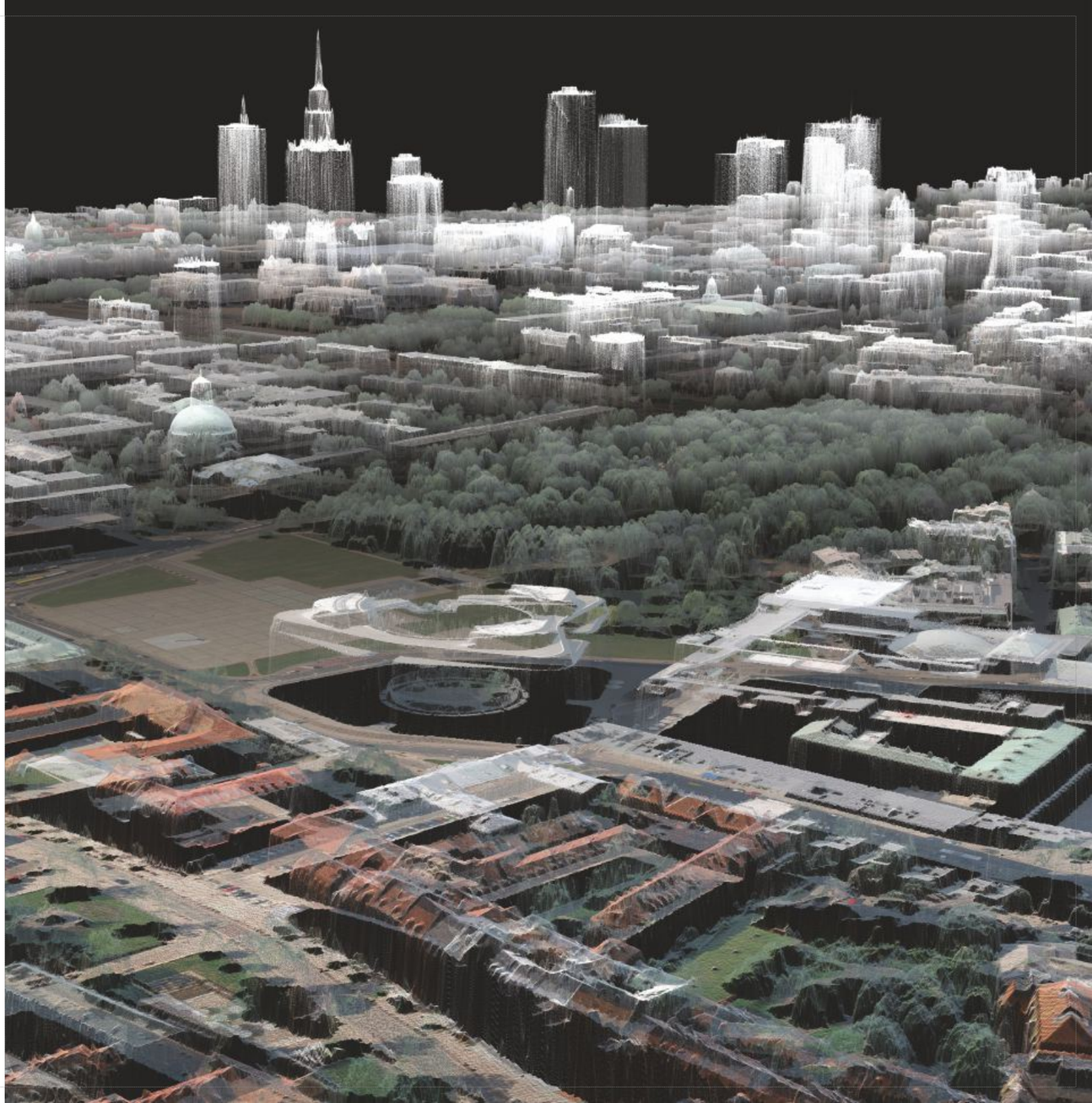
Tall buildings direct impact assessment by analysis of shadow cast to public spaces around. The impact was measured and simulated by using SunHours tools for calculation amount of sunlight received by public spaces during daytime.
Below: Analysis of screening effect by tall buildings using Sky View Factor tools in virtual city model of Frankfurt

development of IT techniques is sufficient so, from a conceptual point of view, people and the civilization should start considering a reasonable integration of collective social awareness. In this awareness and inter-subjective experience, the urban space is a key habitat with its digital dimension such as the system city management. And it includes vibrating and fluctuating electronic interaction between users and urban facilities, an integration which at least partly has its own identity. The authors rightly indicate that cities were created in result of interaction between the collective intelligence of inhabitants, who managed to combine a specific nature of a place, its hard infrastructure and administrative mechanisms invented by that society to control efficiently the direction for the city evolution. Considering the above, the work by the three researchers virtually does not touch upon the issues raised by Weinstock and Gharleghi. It seems that it rather focuses on the analysis of the form or possibly the structure.

Such approach to the issue concerned as comprehensively covered by the 2TaLL application would be too superficial. Suffice it to say, the direction for the development of research on the architectural space, and even more so the urban space, as expressed in Space Syntax conceived by Bill Hillier or certain architectural applications by Herman Hertzberger, which referred to a limited perspective of the phenomena of space (and I do not mean by any chance phenomenological perspective!). In fact, it boils down to the relationship between a man and his self, awareness of experiencing and feeling, for which the empirical sphere translated into emotional co-development of living conditions is particularly important. The comfort of sensing the space, including public and generally accessible one, and its quality and harmonious, however not necessarily unified, development have direct impact on human wellness. Christian Derix referred to such issues when formulating a postulate of a bottom-up development of space. The process involves relations between a kinetic perception, awareness of space and phenomenological generation and perception of spatial phenomena and physical objects independent from a man and those which he created. It can be described as an anthropocentric process in which not only functional but also formal requirements (not mentioning aesthetic requirements) constitute a premise for developing architectural or urban solutions, and the environment and its user gain direct and indirect ways of influencing the shape of the habitat regardless whether they are architect's clients. Whether it happens consciously through participation or analytically through reflecting on human behaviour determined by the local cultural imprint is not important at this level of general description.

Psychology of space plays a tremendous role both for the urban as well as architectural dimension. The evolution of city structures is more complex than that of individual architectural facilities. An learned architect, in his/her capability of absorbing knowledge from the user of space, needs to remember about the triple nature of space representation, a space which he/she is would like to transform: explicit and implicit expectations of users and objective needs we are unaware of. The contradictory nature of the three modes in which space can be perceived, strictly correlated with each other, requires us to at least partially atomize the issue of urban space quality in order to develop efficiently the empathic picture of a city using suitable elements. The authors have developed one of such components – an individual calk of a complex picture, a calk which is valuable although limited to the visual sphere of human experience. The precision of the 2TaLL model simulation has become a source contributing to cautious shaping of space, a true parametric approach which does not negate the humanistic aspect. Although the authors use digital techniques, according to the methodology adopted, results of the research enable producing a wide variety of solutions. Moreover, in a mathematical and objective manner the research defines limitations transposed directly from human perception. I admire the work and hope its authors can continue equally fruitful research.

Robert Barełkowski
dr hab. inż. arch., prof. ZUT, UTP
Poznań, 2016-02-10



Visualization of DSM model of Warsaw

The city centre oriented view of Warsaw from the Hoover Square. The visualization was developed using digital height data based on ALS scanning: DSM model of 0.5m; DTM model of 1.0m and orthophotomaps of 10cm pixel. The quality of model enables reflecting basic architectural relations. Its major advantage is a complete representation of all spatial elements with the same precision

A picture of a city based on the cloud of points – example of Szczecin

Visualization of DSM model based on Airborne Laser Scanning data at density of 12 points per m2. Unprocessed image of a city in the form of a cloud of points can be a basis for using landscape analyses. In the second stage of the project, some of the methods, including VIS and VPS, were adjusted to process DSM models, which required other (recurrent) algorithms and software solutions

WPROWADZNIE – OPIS AUTORSKI

Tendencja do rozwoju zabudowy wysokiej w Europie

Przez ostatnie dwie dekady możemy obserwować gwałtowny wzrost popularności zabudowy wysokiej na kontynencie Europejskim. Wzrosła nie tylko ilość budowanych obiektów, ale również ich średnia wysokość (wg CTBUH Council on Tall Buildings and Urban Habitat). Wpływa to w dużym stopniu na uformowany przez wieki historyczny krajobraz wielu miast. W odróżnieniu od azjatyckich czy amerykańskich, miasta europejskie zostały ukształtowane w wyniku stopniowej i raczej powolnej ewolucji. Efekty tego procesu narastania są widoczne w strukturze urbanistycznej, charakterystycznych kompozycjach przestrzennych oraz w ich sylwetach. Historyczne dominaty tworzyły rozpoznawalne i utrwalone w społecznej świadomości motywy krajobrazowe. Współczesna zabudowa wysoka w szybkim tempie zmienia ten ustalony porządek wpływając, często w przypadkowy sposób, na ważne wizerunkowo założenia urbanistyczne.

Przykładów niekorzystnych przekształceń ważnych widoków historycznych wciąż przybywa. Wśród wcześniejszych, najbardziej znanych można przytoczyć oś Pól Marsowych w Paryżu z wieżowcem Montparnasse, który rozbił to symetryczne i szczególnie reprezentacyjne w skali miasta założenie. Odwołując się realizacji w Polsce można przytoczyć, niedawno ukończony budynek ING przy Placu Unii Lubelskiej jest widoczny ponad dachem Belwederu z Łazienek Królewskich. Z kolei widok na Grób Nieznanego Żołnierza jest zakłócony poprzez wieżowiec Warsaw Trade Tower. Wydaje się, że zasięgu odziaływania tych budynków na miasto nikt nie przewidział. Tymczasem tej rangi strategiczne widoki powinny podlegać szczególnej ochronie. Dotychczasowe techniki planistyczne, jak pokazują powyższe przykłady, nie stanowią skutecznego zabezpieczenia. Z jednej strony ważne jest wykluczenie niekorzystnych interakcji wizualnych z zabudową historyczną. Jednakże nie mniej istotne jest kreowanie atrakcyjnej sylwety miasta z zabudową wysoką jako nową wartością przestrzenną oraz odpowiednie osadzenie nowych dominant w zgodzie z układem urbanistycznym miasta. Potrzebne są zatem nowe techniki, które w obiektywny i kompleksowy sposób zobrazują skutki przestrzenne lokowania zabudowy wysokiej.

CityGML model of a city – example of Frankfurt

Visualization of the city centre of Frankfurt on a basis of CityGML model LoD2. CityGML models are commonly used in Western Europe, in particular in Germany. The standard describes not only the geometry of a city, but contains also semantic information about mutual relationship between elements. The format offers different classes of objects (like buildings, water areas, tunnels, bridges) and various level of details (LoD).

Realizacja głównych założeń projektu

Badania nad zabudową wysoką w ramach projektu 2TaLL prowadzone były dwutorowo. Z jednej strony zmierzały do udokumentowania wybranych przykładów lokowania budynków wysokich w miastach europejskich i analizy ich wpływu na krajobraz. Z drugiej strony, ukierunkowane były na stworzenie narzędzi i metod komputerowej symulacji skutków przestrzennych zabudowy wysokiej. Nowe metody umożliwiają diagnozę oddziaływania wizualnego obiektu w mieście (metoda VIS) oraz ochronę ważnych założeń krajobrazowych przed przypadkowym wpływem nowej zabudowy (metoda VPS). Dodatkowo rozwijane były zagadnienia analizy przestrzeni publicznych (3D-Negative), zacieniania, Sky View Factor (SVF), czy widoków osiowych (AXV). Nowe techniki są oparte o wykorzystanie współcześnie stosowanych cyfrowych modeli 3D miast (CityGML, DSM / LiDAR).

Jednym z kluczowych założeń projektu 2TaLL było rozpoznanie i przeanalizowanie oddziaływania zabudowy wysokiej w wybranych miastach Europy. Badania terenowe przeprowadzono w 13 miastach różnej wielkości i o różnej charakterystyce przestrzennej: Amsterdam, Bruksela, Drezno, Frankfurt, Kolonia, Londyn, Mediolan, Monachium, Norymberga, Paryż, Wiedeń, Warszawa i Wrocław. Analiza miała na celu udokumentowanie i ocenę wpływu zabudowy wysokiej na krajobraz. Brano pod uwagę: oddziaływanie na najbliższe otoczenie budynku, oddziaływanie na ważne osie i wnętrza urbanistyczne oraz na szerszy krajobraz miejski (linię sylwetową miasta). Przeprowadzone badania porównawcze doprowadziły do ogólnych wniosków w odniesieniu do specyfiki zabudowy wysokiej opisanych w osobnych publikacjach[1].

Badania wybranych miast europejskich unaoczniły skalę i aktualność problemu zabudowy wysokiej oraz pilną potrzebę znalezienia nowych metod analitycznych, które mogłyby być stosowane w planowaniu. Oczywiście, aspekty wizualnego oddziaływania przyszłej inwestycji są jednym z wielu wskaźników, które należy wziąć pod uwagę (obok rentowności przedsięwzięcia, powiązań komunikacyjnych, zacieniania okolicznej zabudowy, funkcjonalności itp.). Jednakże to, co dla postronnego odbiorcy ukończonego już dzieła architektonicznego ma namacalne znaczenie, to właśnie osadzenie budynku w mieście, jego wygląd w konkretnych ekspozycjach widokowych. W Niemczech powszechną praktyką jest budowanie atrap (tymczasowych konstrukcji) przyszłych budynków ocenianych jako kontrowersyjne. Opinia publiczna jest wówczas w stanie ocenić skalę przyszłej inwestycji. Project 2TaLL wychodzi naprzeciw takim potrzebom. Dzięki wykorzystaniu opracowanych narzędzi cyfrowych można bardzo dokładnie przewidzieć skutki przestrzenne projektowanych obiektów, również w ich relacji do historycznych części miasta.

Opracowane metody analityczne

Metoda Visual Imapct Size (VIS) została stworzona do kompleksowej oceny zasięgu oddziaływania wizualnego pojedynczego budynku wysokiego. Pozwala na precyzyjne ustalenie fragmentów przestrzeni publicznych miasta, na które nowy obiekt będzie mieć wpływ. W jednym procesie obliczeniowym definiowana jest jednocześnie siła jego oddziaływania na daną przestrzeń – to czy będziemy widzieć obiekt w całości, w dużym fragmencie, czy jedynie jako mały akcent przestrzenny. Metoda pozwala mierzyć całkowity wpływ wizualny budynku przy różnych pułapach jego wysokości. Wynik generowany jest automatycznie w postaci mapy 2D. Interpretacja otrzymanych wyników może mieć istotne znaczenie dla kierunkowania dalszych działań planistycznych. Mapa VIS pozwala przede wszystkim na ustalenie ważnych ekspozycji nowego budynku, w tym takich, które mogą zagrażać integralności ważnych założeń przestrzennych (np. obszarów staromiejskich, czy założeń symetrycznych). Rozpoznane na podstawie analizy VIS punkty widokowe mogą być następnie poddane dalszej symulacji np. z użyciem linijek wysokości, które pokażą prawdziwą skalę obiektu w przestrzeni.

Metoda VIS była stosowana w różnych opracowaniach studialnych od 2007 roku. Jednak dopiero podczas realizacji projektu 2TaLL została ona znacząco rozwinięta i ujednolicona. Przygotowane zostały nowe algorytmy i rozwiązania softwarowe, pozwalają na emulację map VIS na bazie różnych modeli przestrzennych miast (w tym: CityGML, DSM). Umożliwiają one również rozwój teorii isovist 3D na gruncie naukowym. Mierzenie powierzchni pól oddziaływania, czy porównywanie map VIS dla różnych tkanek urbanistycznych stwarza podstawy rozwoju teorii związanej z chłonnością krajobrazową miast, zarysowaną w publikacjach[2]. Na uwagę zasługuje jednak przede wszystkim duży potencjał aplikacyjny metody, który został już niejednokrotnie potwierdzony. W najnowszym opracowaniu studialnym dla Warszawy (przygotowanym w zespole z prof. Marzęckim w 2015 roku) metoda VIS została wykorzystana do analiz oddziaływania wizualnego planowanego obiektu na terenie ogrodów seminaryjnych na Skarpie Warszawskie[3]. Mapa VIS stała się fundamentem tego opracowania i podstawowym narzędziem ocen wpływu obiektu na krajobraz miasta. Dała też możliwość identyfikacji ważnych punktów ekspozycji budynku w historycznym kontekście Warszawy.

Metoda Visual Protection Surface (VPS) jest z kolei spojrzeniem na problem ochrony tła ekspozycyjnego ważnych widoków miasta. Pozwala ona na wyznaczanie granicznych wysokości nowej zabudowy. Dane wyjściowe zawierają koordynaty punktów ekspozycyjnych ważnych widoków strategicznych, które objęte są ochroną (co jest spójne z założeniami polityki przestrzennej ochrony i kształtowania krajobrazu wielu miast m.in. Lodynu[4]). W wyniku jednego procesu komputacyjnego otrzymywana jest powierzchnia nad miastem, która definiuje maksymalną możliwą wysokość zabudowy, tak by nie była ona widoczna z chronionych punktów widokowych. VPS może być stosowany do analizy chłonności miasta na zabudowę wysoką. Może być również narzędziem weryfikującym konsekwencje przestrzennych obecnie obowiązujących strategii kształtowania wysokości zabudowy w mieście. VPS został po raz pierwszy wykorzystany w studiach Drezna, miasta o unikalnych w skali Europy walorach krajobrazowych.

Zarówno dla potrzeb badań nad krajobrazem miejskim, jak też dla aplikacji planistycznych, kluczowym aspektem jest komplementarność metod VIS i VPS. O ile VIS ma szerszą genezę i umocowanie we wcześniej przeprowadzonych badaniach naukowych, to VPS był metodą od dawna oczekiwaną w teorii, ale w praktyce nieosiągalną. Dopiero na bazie badań przeprowadzonych w projekcie 2TaLL oraz w wyniku opracowania nowych programów komputerowych, powstała możliwość jednoczesnej aplikacji metod VIS i VPS na tym samym materiale badawczym (zarówno w środowisku modeli wektorowych, jak też modeli miast budowanych z chmury punktów-). Obie metody VIS i VPS służą analizie krajobrazu miasta, ale przedmiot analizy jest biegunowo różny: oddziaływanie budynku na krajobraz, a ochrona widoku i jej implikacje dla kształtowania zabudowy w mieście. Dopiero wspólne stosowanie metod pozwala na wieloaspektową i kompleksową analizę krajobrazu oraz ocenę jego chłonności na nowe inwestycje, w tym również wysokie. Zastosowanie metod w planowaniu może znacząco podnieść jakość i wiarygodność podejmowanych decyzji istotnych dla kształtowania miasta.

Zabudowa wysoka w istotny sposób wpływa nie tylko na krajobraz, ale również na jakość i sposób funkcjonowania systemu przestrzeni publicznych miasta. Stanowiło to odrębną dziedzinę badań prowadzonych w projekcie. Struktura urbanistyczna jest do pewnego stopnia rodzajem gry pomiędzy „pozytywem i negatywem" – zabudową i przestrzenią pomiędzy, której uczestnikami są użytkownicy miasta. „Pozytyw" przyjmuje formę budynków, struktur, budowli czy elementów krajobrazu naturalnego. „Negatyw" to świat niewidzialnej geometrii wyznaczonej przez otaczającą strukturę pozytywu. Forma i geometria zabudowy jest widoczna w sposób oczywisty, jednakże geometria przestrzeni pomiędzy budynkami nie jest mierzalna w bezpośredni sposób. W tym celu została opracowana metoda 3D-Negative, która umożliwia (na podstawie modelu CityGML) wygenerowanie trójwymiarowego modelu przestrzeni publicznych – „negatywu miasta", a następnie analizę parametrów geometrycznych: analiza widmowa (CSP), analiza typologii kątów nachyleń (TBS), analiza typologii wymiarów oraz powierzchni składowych przestrzeni publicznych (TBL, TBA)[5]. Badania nad przestrzeniami publicznymi, dotyczyły także intensywności ich zacieniania przez zabudowę wysoką oraz przesłaniania widoku z perspektywy człowieka przez budynki wysokie. W badaniach tych stosowano specjalistyczne oprogramowanie umożliwiające kalkulację czasu nasłonecznienia oraz narzędzie Sky View Factor (SVF) umożliwiające kalkulację udziału powierzchni przesłanianej w widoku.

Możliwości i ograniczenia stosowania modeli miast 3D

Podstawą cyfrowej analizy krajobrazu miasta i badania wpływu zabudowy wysokiej są modele miast 3D. Uzyskanie dostępu to tych zasobów było niezbędne dla realizacji założeń projektu 2TaLL. Istotnym progiem było również dostosowywanie metod do obowiązujących standardów zapisu modeli miast. Czynnikiem sprzyjającym jest bez wątpienia sukcesywne wdrażanie Dyrektywy Unii Europejskiej INSPIRE, która w ogólnym ujęciu nakłada na państwa członkowskie UE obowiązek ułatwiania i zwiększania dostępu do danych przestrzennych. Postęp zarówno względem jakości, jak też dostępności danych, jest na tyle duży, że zmiany były zauważalne nawet w czasie realizacji projektu. Część zasobów, które zostały pozyskane na drodze specjalnych umów i porozumień (jak np. model Berlina), dziś jest już dostępna jako „open source".

W pierwszej fazie realizacji projektu badania były realizowane wyłącznie z zastosowaniem modeli miast 3D w standardzie CityGML. Najistotniejsze znaczenie ma tu słowo „standard". CityGML uniezależnia dane 3D od środowiska, w którym model został zbudowany – co jest kluczową różnicą względem modeli CAD, w których dane są powiązane z określonym programem, a ich transfer do innych programów jest zwykle stratny. Należy ubolewać na tym, że wiąż zamawiane są modele miast 3D w określonym środowisku CAD, jak choćby nowy model 3D Warszawy. Modele CityGML są standardem w krajach Europy zachodniej, a szczególnie w Niemczech. Umożliwiają zapis nie tylko samej geometrii zabudowy, ale również semantyki danych (opis wzajemnych relacje między elementami modelu). Format obejmuje różne klasy obiektów (np. budynki, wody, tunele, mosty) i umożliwia ich zapis w różnych skalach dokładności (LoD). W praktyce częstą wadą jest niekompletność modelu, a więc brak odwzorowania wszystkich elementów rzeczywistej przestrzeni miasta. Dla potrzeb badań ujętych w projekcie 2TaLL pozyskano modele CityGML całości lub fragmentów łącznie 8 miast europejskich w tym Berlina, Frankfurtu, Rotterdamu, Delft i Drezna.

Zupełnie innym sposobem cyfrowego zapisu przestrzeni miast są modele, tworzone bezpośrednio na podstawie laserowego skaningu lotniczego ALS (LAS, modele DSM, DTM). Dane pozyskane ze skaningu lotniczego są zwykle tylko pewnym „półproduktem" dla budowania modeli wektorowych. Jednak nieprzetworzony obraz miasta, w postaci chmury punktów, może być także podstawą dla aplikacji analiz krajobrazowych. Istotne czynniki to koszt, aktualność i dostępność danych. W przypadku miast polskich, modele CityGML są praktycznie niedostępne. Natomiast, jako pochodna realizacji ogólnokrajowego programu antypowodziowego ISOK[6], wszystkie większe miasta w Polsce mają opracowane modele LAS, DSM, DTM o bardzo wysokiej dokładności (znacznie lepszej niż np. w przypadku miast niemieckich). Model DSM o na siatce 0,5m umożliwia już zapisanie podstawowych relacji architektonicznych. Kluczową zaletą takiego „obrazu miasta" jest kompletne odwzorowanie wszystkich elementów przestrzeni ze stałą dokładnością. W drugiej fazie realizacji projektu część z metod, w tym VIS i VPS została dostosowana także do przetwarzania modeli DSM, co wymagało zupełnie innych (rekurencyjnych) algorytmów i rozwiązań softwarowych. Badania z użyciem modeli DSM były prowadzone dla 4 miast w Polsce: Warszawy, Szczecina, Lublina i Wrocławia.

Wymiana i rozpowszechnianie wiedzy oraz perspektywy kontynuacji badań

Realizacja projektu 2TaLL wymagała interdyscyplinarnego podejścia: integracji różnych dziedzin naukowych oraz dotarcia do różnych środowisk. Osiągnięciem, istotnym zarówno dla rozpowszechniania wyników przeprowadzonych badań, jak też dla poszerzenia wiedzy wykonawców, był udział i prezentacje na trzech wiodących konferencjach międzynarodowych o różnych profilach naukowych związanych kolejno z: geometrią (ICGG16: International Conference on Geometry and Graphics, Innsbruck 2014), teledetekcją krajobrazu (ISRSE36: International Symposium on Remote Sensing of Environment, Berlin 2015) oraz cyfrową analizą urbanistyczną (SSS10: Space Syntax Symposium, Londyn 2015). Każda z konferencji miała znaczenie dla kierunkowania badań w projekcie. Nawiązane kontakty zaowocowały dalszą wymianą wiedzy i prezentacjami m.in. w: Croydon (Wydział Planowania Miasta, lipiec 2015), Londynie (Urban Design London, wrzesień 2015), Weimarze (Uniwersytet Bauhaus, styczeń 2016) i Dreźnie (Wydział Planowania, luty 2016). W skali całego projektu, biorąc pod uwagę badania studialne, konferencje, prezentacje, wystawy itp. – zorganizowano łącznie 31 działań służących wymianie wiedzy w 20 miastach Europy.

Z drugiej strony, dla pomyślnej realizacji projektu niezbędne były specjalistyczne szkolenia i konsultacje, zmierzające do poszerzenia wiedzy i kompetencji zespołu 2TaLL. Kamieniem milowym, było szkolenie z zakresu standardu CityGML oraz oprogramowania FME zorganizowane w Berlinie przez firmę Virtual City System (lipiec 2014). Dało to podstawę dla opanowania możliwości obsługi modeli CityGML oraz w dalszej perspektywie pozwoliło na stworzenie autorskich programów umożliwiających przetwarzanie tych danych (co było kluczowe m.in. dla metody 3d-Negative). Inne szkolenia i konsultacje odbyły się w Polsce i dotyczyły technik GIS, informatyki oraz matematyki. Transfer wiedzy umożliwił rozwojów warsztatu – opracowanie podstaw nowych metod analitycznych oraz stworzenie aplikacji komputerowych (C++). Pozwolił również na weryfikację użyteczności dostępnych systemów analizy krajobrazu miasta (m.in. oprogramowania ESRI).

Projekt 2TaLL miał na celu wspomaganie procesu harmonijnego kształtowania krajobrazu miasta w kontekście oceny lokalizacji i definiowania parametrów przestrzennych zabudowy wysokiej. Opracowane metody: VIS, VPS, 3d-Negative, dają podstawę dla różnych analiz urbanistycznych w tej dziedzinie. Zakres badań dotyczy oddziaływania i percepcji wizualnej, który zdaniem Autorów, jest najistotniejszym i najbardziej trwałym dla rozwoju miasta aspektem. Metody były stosowane dla różnych miast europejskich w oparciu ich modele 3D. Ich celem jest obrazowanie interakcji wizualnych, w takim zakresie, który jest możliwy do obiektywnego pod względem geometrycznym rozpoznania. Dyskusji może podlegać jedynie dokładność wyniku, a nie istota metody. Oczywiście nawet najbardziej dokłada symulacja może być tylko wsparciem dla decyzji planistycznych. Jednak z uwagi na złożoność problemu wparcie to może mieć istotne znaczenie.

W perspektywie przyszłych działań zespołu 2TaLL rysuje się dalsza propagacja wyników projektu oraz rozwój wytworzonego oprogramowania, zmierzający do jego upowszechnienia zarówno dla potrzeb badań naukowych, jak też aplikacji w planowaniu. Ambicją zespołu jest również włączenie aspektów analiz krajobrazowych i wykorzystania różnych typów modeli miast w dydaktyce.

dr inż. arch. ***Klara Czyńska***
dr inż. arch. ***Paweł Rubinowicz***
dr inż. arch. ***Adam Zwoliński***

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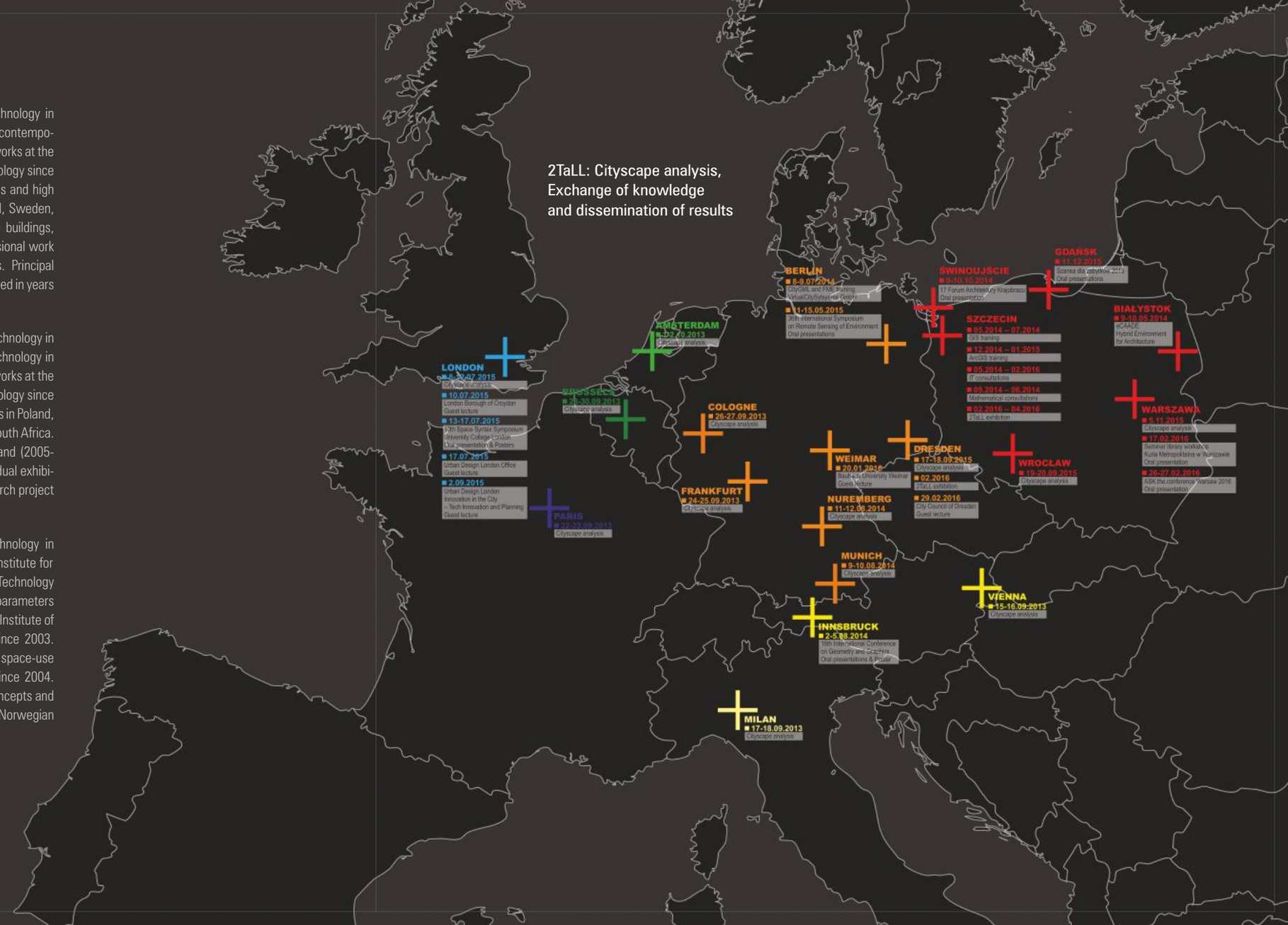
Klara Czyńska, PhD architect, studied at the West Pomeranian University of Technology in Szczecin. PhD at Wroclaw University of Technology in 2007: Methods for developing a contemporary skyline. Using virtual urban models for panorama monitoring and simulation. She works at the Institute of Architecture and Spatial Planning at West Pomeranian University of Technology since 2004. Author of scientific publications on issues such as urban development of cities and high building impact. Cooperation in EU projects under the program 'Culture2000' (Poland, Sweden, Lithuania, Estonia). Co-author of urban studies including analysis of the high-rise buildings, commissioned by the city councils of several cities in Poland (2005-2016). In professional work she use her individual computational methods based on virtual 3D city models. Principal Investigator of 2TaLL project founded by Polish-Norwegian research program and realised in years 2013-2016. Contact: kczynska@zut.edu.pl

Paweł Rubinowicz, PhD architect, studied at the West Pomeranian University of Technology in Szczecin and Fachhochschule Oldenburg (Germany). PhD at Cracow University of Technology in 2011: Chaos as the higher order in selected trends of contemporary architecture. He works at the Institute of Architecture and Spatial Planning at West Pomeranian University of Technology since 1999. Participated in numerous competitions, workshops and architectural conferences in Poland, Germany, Finland, Sweden, Lithuania, Spain, United Kingdom, the United States and South Africa. Author of scientific publications. Co-author of urban studies for several cities in Poland (2005-2016). Coordinator of European projects under the 'Culture 2000' (2003-2004). Individual exhibitions in 10 cities in Poland (2000-2014). In yeas 2013-2016 participant of 2TaLL research project (within Polish-Norwegian research program). Contact: pawel@rubinowicz.com.pl

Adam Zwoliński, PhD architect, studied at West Pomeranian University of Technology in Szczecin. MSc in Urban Housing Management at University of Lund in Sweden and Institute for Housing and Urban Development Studies in Rotterdam. PhD at Wroclaw University of Technology in 2008: Determinants of urban transformation of housing areas on the basis of spatial parameters of public spaces. The case of large panel system housing in Szczecin. He works at the Institute of Architecture and Spatial Planning at West Pomeranian University of Technology since 2003. Author of scientific publications on urban development, urban transformation and space-use problems. Professionally architect associated with FBA design office in Szczecin since 2004. Author and co-author of around 40 architectural and urban projects, competitions, concepts and studies. In yeas 2013-2016 participant of 2TaLL research project (within Polish-Norwegian research program). Contact: azwolinski@zut.edu.pl



West Pomeranian University of Technology, Szczecin
Zachodniopomorski Uniwersytet Technologiczny w Szczecinie

PhD Architect **Klara Czyńska**
PhD Architect **Paweł Rubinowicz**
PhD Architect **Adam Zwoliński**

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2TaLL

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Szczecin 2016

ISBN 978-83-7518-768-7