A DAY IN A SHADOW OF HIGH-RISE – 3D PARAMETERIZATION AND USE OF PUBLIC SPACE AROUND PŻM / HOTEL RADISSON BUILDING COMPLEX IN CENTER OF SZCZECIN

Adam Zwoliński

West Pomeranian University of Technology, the Faculty of Civil Engineering and Architecture,
50 Piastów Ave, 70-311 Szczecin, Poland

Abstract
The paper is related to issues of application of advanced computer techniques applied to analyses of public space use in urban areas. The particular interest is directed towards 3D city models and possibilities of urban analysis of street life using such environment. It is also focused on public spaces located nearby tall buildings in key areas of city centers. The article presents a daily analysis of street life beneath one of several tall buildings in city center of Szczecin, Poland. Further on, it presents possibilities and process of parameterization using computer techniques, both 2D and 3D. The sample results focus on patterns of use and their relation to urban environment of public space it occurs. The presented sample results are the opening of wider advanced research to be applied to more complex systems of public spaces.

Keywords: public space; tall buildings; 2TaLL; 3D city models; parameterization

INTRODUCTION

A common day. A life in urban space is awaking. A daily game of urban activities begins again – some places remain still in silence, some are becoming a real hot spots of the city. Three-dimensional spaces between buildings are being filled with more and more users, objects and movement – the life between buildings is just reviving.

Szczecin is a case of city, where the hierarchy and system of public spaces is not clear in sense of connections between different public areas, spatial continuity and accessibility for users. The public spaces are scattered in the city, only few are connected in some continuous spatial and functional system. The other remarkable feature of Szczecin is fact, that apart from historical towers of churches, castle[1] and some old public buildings[2], it is basically the city of two new high-rise buildings[3]. One of such hot spot spaces in the city appears directly at one of those buildings - PŻM / Hotel Radisson high-rise complex at Rodła Square in part of the city center (Fig. 1.). The presented Visibility range analysis (using 3D city model[4]) for the high-rise complex shows importance of the localization for the entire city center area (Fig 2.). The relation between localization of tall buildings in cities and system of public spaces is a part of scientific interest in the ongoing EU project at WPUT[5] in Szczecin. The 2TaLL

[1] Castle of Pomeranian Dukes in Szczecin
[2] Maritime Academy, National Museum, City Hall etc.
[3] One of them is the mentioned PŻM / Radisson Hotel Complex and the other is local TV building.
[4] 3D model and analysis developed by team: prof. Waldemar Marzęcki, PhD Klara Czyńska, PhD Paweł Rubinowicz at WPUT, Cyber Urban Center (CCU)
[5] West Pomeranian University of Technology Szczecin

Fig. 1. Rodła Square in Szczecin – view towards PŻM complex
Source: www.mmszczecin.pl / Google Street View

Fig.2 Visibility range analysis of PŻM complex
Figure by Klara Czyńska, WPUT, CCU

project[6] relates in priority to high-risers in cities – dominating, shaping cityscape, attracting public spaces – but also enabling views and visual observation of the urban space beneath.

1. RECOGNITION AND OBSERVATION

The essential for concept of this paper is understanding public space as three-dimensional void between built-up structure of the city, with implication of fourth dimension, which particularly is movement of users in certain time (Fig. 3). The other fundamental observation is the ongoing process of application of more and more computer techniques to urban analysis of cities. The especially interesting and promising seems to be application of 3D city models to advanced urban analyses of different cityscape issues. The application of such techniques is not novel itself, the pioneer and most advanced techniques have been developed and presented mainly by Space Syntax. "*Space Syntax is a set of theories and tools used for spatial morphological analysis with particular applications in urban science*"[7] – this principles have initiated a number of various advanced analyses introduced to urban space of cities, also using 3D environment in some extent. The spatial cognition and axial map issues have been raised for example by Alan Penn[8], the advanced ABM (Agent-Based Modelling) is being developed by Crooks and Batty[9], some advanced quantitative methods have been presented early in 2000 by Turner[10], also issues of social logic of space have been raised early in the 80's by mentor of Space Syntax – Bill Hillier[11]. There are much more issues developed in form of advanced urban analyses applied with computer techniques and it only enlightens a platform for integration of different analytic problems in 3D city models environment. The parameterization in understanding and exploring urban environment is a common and ongoing process in the face of new urban challenges and development.

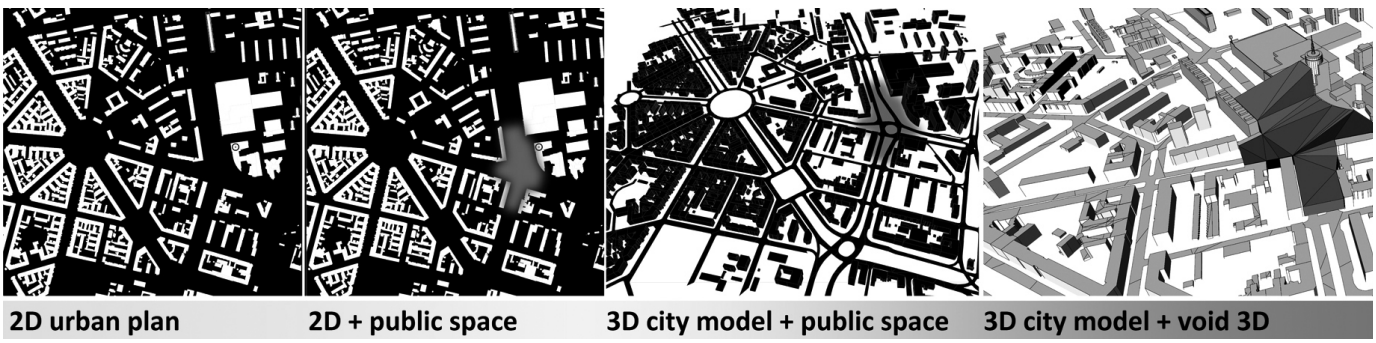

Fig. 3. Fundamentals of approach: a shift from urban plan to 3D city model and 3D void spaces. Selection, recognition and conversion into 3D solid geometry; source: by author based on 3D city model of Szczecin by CCU

The other crucial aspect of cityscape and urban life is observation of users. Simply saying, how all this shapes on plans, solids in three-dimensional urban space, are functioning? The most important approach to observation of users' nature in public spaces was initiated by Jan Gehl[12]. The common language of observation – using notes, drawing patterns of movement, counting people in public spaces and all elementary techniques have surprisingly indicated the most interesting conclusions on urban life and social behavior in urban space.

The area of Szczecin selected for the observation combines both of the mentioned aspects. The use of high-rise building complex has two reasons: firstly the PŻM / Radisson Hotel complex, together with adjacent commercial shopping centre Galaxy, is the strongest attractor for users in sense of functions offered (intensive office / administration area and shopping centre) – secondly, the high-rise building becomes a tool for observation and recording of urban life from above. The fundamental of basic observation of space use is inviolable itself, but introduction of computer techniques (such as automating the process of pedestrian count from sequence of static pictures or interactive system of spatial monitoring of urban space) could contribute to advanced computer database useful for observation and transformation of cityscape. In the following section, some ideas of analytic approach and directions for implementation of 3D city models for analysis of public spaces will be introduced.

2. FROM A MANUAL SCRATCH TO COMPUTER SYSTEM

Combination of two different techniques and approaches (manual recording of pedestrian movement supported by sequential photography and 3D interpretation of space between buildings as spatial solids) was used to prescribe some concept of using environment of 3D city models for creation of general 3D maps and systems of pedestrian flow (streams, hot spots) and urban attractors / barriers for larger areas of city (Fig 4a).

Analysis of sequential photos from a daily observation of urban life at the high-rise complex has just proved that, there is a clear and direct relation between functional attractors and patterns of movement. The presented patterns are just a sample of large data from observation. The observation has also delivered data on cyclic and repeatable pattern types strongly determined by public communication system in the area. The collected data also proves the observation about scattered and unlinked public spaces – the recording of pedestrian flow show that 'streams' to other public spaces are barely unused on foot. The public communication delivers systematically huge number of users moving just only towards the main urban 'attractors' of the area. The simplified example of presentation of system of streams and hotspots for pedestrian pattern of use shows possible process of converting data from manual techniques to 3D environment (Fig. 4a.). The 3D solid of space between buildings (Fig 4b.) has also potential of mapping functional attractors of public spaces (red – commercial / grey – residential functions).

The three sample patterns of pedestrians in the space show a kind of cycle of flow pattern and clearly indicates the difference between small and dispersed number of users while there is no incoming people by public transport (left side of Fig. 5), and intensive flow towards main attractor of PŻM complex and commercial centre while public communication comes to the area (right side of Fig. 5). Using such data on patterns of flow as combination with 3D model of public spaces and analysis of so called attractors could bring useful system of observation and recognition city areas predestined for different type of urban interventions to strengthen and improve system of public spaces.

3. CHALLENGES FOR 3D ENVIRONMENT

Adaptation of fundamental manual techniques of observation of urban life to more parameterized and computational environment of 3D city models seems to be possible and achievable challenge. Once, programming 3D model – it can recognize and define typology

---

[6] The 2TaLL Project is funded by Norway Grants scheme and presently is in the implementation stage at WPUT, Szczecin. The project subject is Application of 3D virtual city models in urban analyses of tall buildings. The author is in the project team together with PhD architect Klara Czyńska, WPUT, Szczecin and PhD architect Paweł Rubinowicz, WPUT, Szczecin – within the newborn Cyber Urban Center (CCU) at WPUT. The 2TaLL has been initiated in 2013.

[7] Jiang B., Ccaramount Ch., Klaraquist B., *An integration of space syntax into GIS for modelling urban spaces*, JAG, volume 2, issue 3/4, 2000, p. 162

[8] A. Penn, *Space Syntax and Spatial Cognition or, why the axial line?*, University College, London

[9] M. Batty, A. Crooks, Ch. Castle, *Key challenges in Agent-Based Modelling for Geo-Spatial simu*lation, CASA Working Papers 121, London 2007

[10] A. Turner, *Angular analysis: a method of quantification of space*, CASA Working Papers 23, London 2000

[11] B. Hillier, J. Hanson, *The Social Logic of Space, Cambridge University Press*, Cambridge 1984

[12] J. Gehl, *Space between buildings. Using public space.,* The Danish Architectural Press, Copenhagen 2003

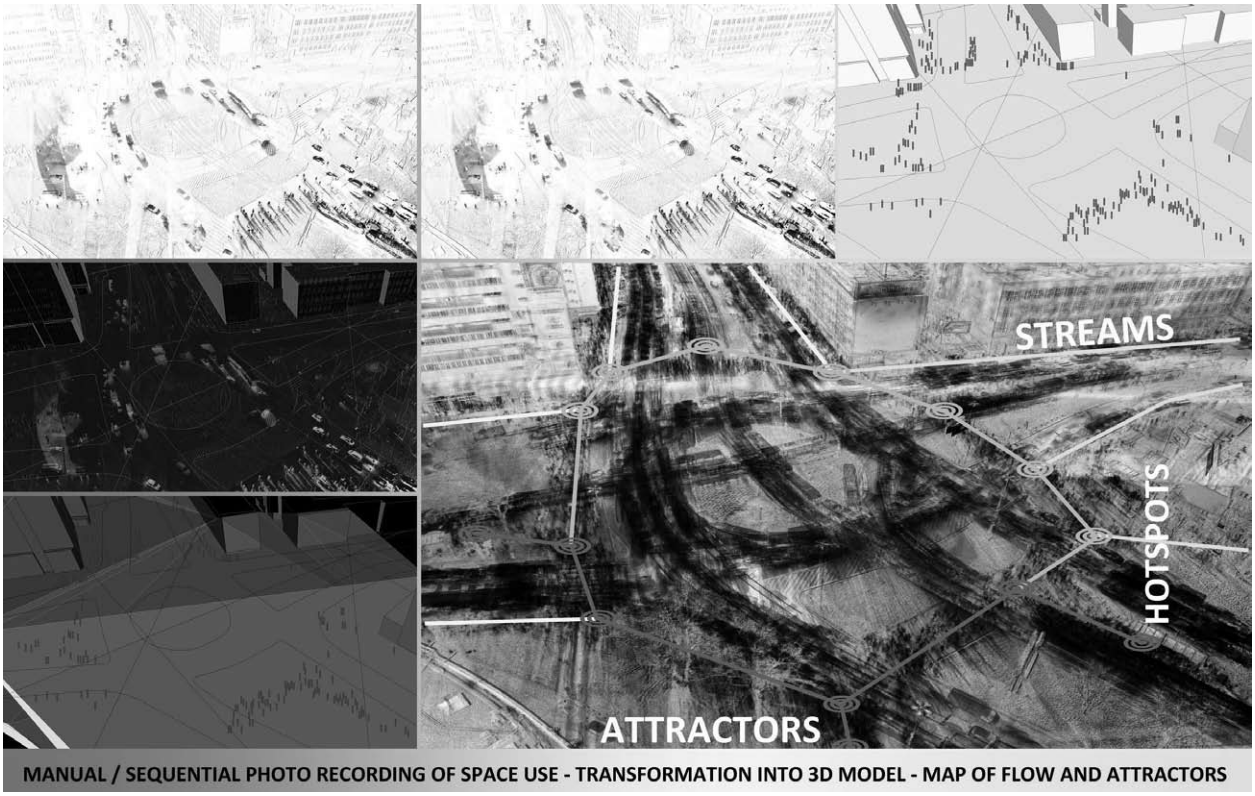

Fig. 4a. Shift from manual observation supported by sequential photography towards combination with 3D environment of city model – with possible introduction of animated schemes. Sample map of streams / hotspots / attractors in 3D model; source: by author

of spaces between buildings. Following, it is still a kind of difficulty, but definition of 3D map of public spaces is also achievable. Then, while adding system of attractors and hotspots, and using computer techniques to transfer manual photographs into real count of users – the 3D city model could become a spatial database of parameterized answers to the primary question of how the urban life goes on?, either in direct shadow of high-rise commercial and office complex, either in calm urban square linked by viable street or neighborhood. The main challenge is to build with support of computer programmer an algorithm for conversion of data and to create common platform of models to apply.

The day in a shadow of high-rise has brought answers on urban rules determining pedestrian patterns, has delivered extended data for processing, but has just only opened mind and prescribed challenges and opportunities of parameterization using 3D city models.

REFERENCES

1. **Batty M. (2001)**, *Exploring isovist fields: space and shape in architectural and urban morphology*, in: *Environment and Planning B: Planning and Design*, vol. 28, London, pp.123-150.
2. **Batty M., Crooks A., Castle Ch. (2007)**, *Key challenges in Agent-Based Modelling for Geo-Spatial simulation*, CASA Working Papers 121, London.
3. **Czyńska K. (2010)**, *Tall buildings and harmonious city landscape*, "Space and Form", no. 13, Szczecin, pp. 267-280.
4. **Czyńska K. (2009)**, *Using a model of virtual city for research on visibility range of panoramas of the city*, "Space and Form", no 12, Szczecin, pp. 111-114.
5. **Gehl J. (2003)**, *Space between buildings. Using public space* / J. Gehl - Copenhagen: The Danish Architectural Press.
6. **Hillier B., Hanson J. (1984)**, The Social Logic of Space, Cambridge University Press, Cambridge.
7. **Jiang B., Claramunt Ch., Klarquist B. (2000)**, *An integration of space syntax into GIS for modelling urban spaces*, JAG, volume 2, issue 3/4, p. 162.
8. **Moser, J., Albrecht, F., & Kosar, B. (2010)**, *Beyond visualisation – 3D GIS analyses for virtual city models*, ISPRS 5th International 3D GeoInfo Conference, Berlin; International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences.
9. **Pal Singh S., Jain K., Mandla V.R. (2013)**, *Virtual 3D city modeling: techniques and applications*, ISPRS 8th 3DGeoInfo Conference, Volume XL-2/W2, Istambul.

10. **Penn A.**, *Space Syntax and Spatial Cognition or, why the axial line?*, University College, London.
11. **Rubinowicz P. (2013)**, *Cyber Urban Design*, "Archivolta" 3(59), Kraków, pp. 58-65.
12. **Rubinowicz P. (2012)**, *Various aspects of urban structure analysis while assessing the friendliness of a place…* in: *The Urban Landscape Renewal ULAR6*, Silesian University of Technology, Monograph, vol. 2, pp. 345-349.
13. **Teknomo K., Takeyama Y., Inamura H. (2000),** *Determination of pedestrian flow performance based on video tracking and microscopic simulations*, in: *Proceedings of Infrastructure Planning Conference*, vol. 23 no 1, Ashikaga, Japan.
14. **Turner A. (2000)**, *Angular analysis: a method of quantification of space*, CASA Working Papers 23, London.
15. **Zwoliński A.(2008)**, *Determinants of urban transformation of housing areas based on public space parameters. Case of large-panel housing in Szczecin*, A. Zwoliński – Wrocław: Politechnika Wrocławska.
Internet: www.spacesyntax.com, www.processing.org,ww.virtualcitySYSTEMS.de

Acknowledgments: Paper financed by the Norway Grants

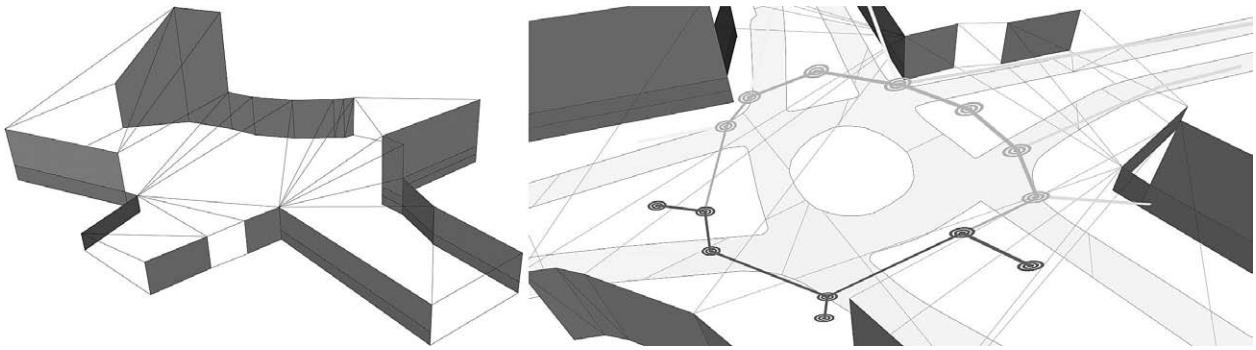

Fig 4b. Sample from 3D city model with example of 3D void between buildings presenting functional attractors on side surfaces /simplified scheme of streams / hotspots / attractors; source: by author

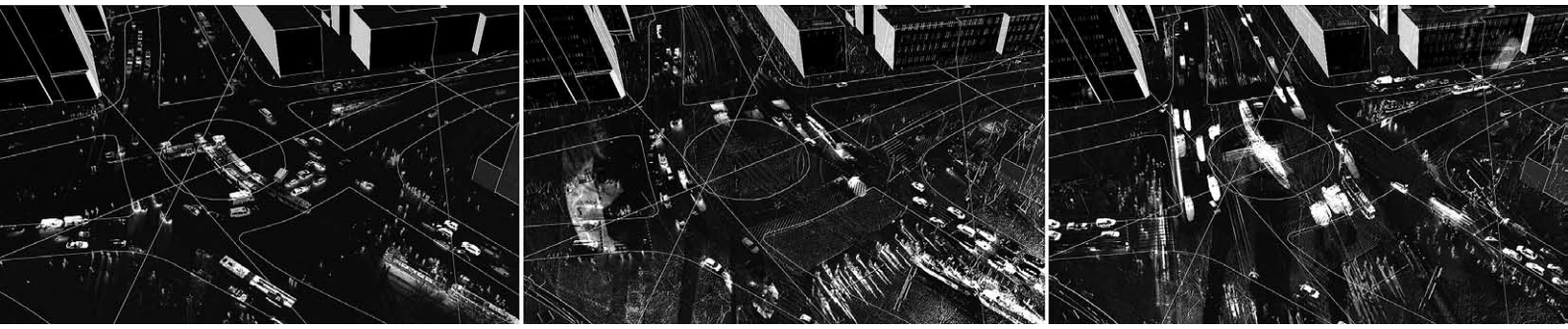

Fig. 5. Three sample types of pedestrian movement patterns due to incoming users by public transport. Visible intensive flow towards functional attractor – red color; source: author