PROCEDURAL FACADE SCENARIOS AS A SUPPORTIVE TOOL FOR MODERNISM HERITAGE PROTECTION

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Abstract

Cities in Europe face a question of modernism legacy protection. Facades of buildings characterising the communal and the modular nature of modernism housing seem to be a key to the discussion. Changes in the facades highly affect the quality of urban landscapes. New colours, materials and patterns appear and the old ones dissolve. The difference between an official conservation practice and the deeds of the inhabitants reveals many conflicts in renovating modernism housing estates. A new digital tool called procedural modelling of architecture allows comparing various visions with an original building appearance. The paper presents an experimental method based both on procedural modelling and survey research. The method enables analysis of modernism building facade transformations. It was originally designed for and applied in ZUS housing estate in Lodz, Poland, and it seems to be a good tool for supporting decision making in the process of modernism architecture protection.

Streszczenie

Istotnym zagadnieniem w europejskich miastach staje się kwestia ochrony architektonicznej spuścizny modernizmu. Kluczowym elementem w toczącej się obecnie dyskusji wydają się być fasady budynków, które najpełniej świadczą o wspólnotowym i modułowym charakterze architektury modernistycznej. Zachodzące przekształcenia tychże fasad istotnie oddziałują na jakość krajobrazów miejskich. Coraz częściej na modernistycznych fasadach pojawiają się nowe kolory, materiały oraz wzory, starsze zaś bezpowrotnie zanikają. Różnice pomiędzy oficjalną praktyką konserwatorską a postępowaniem użytkowników unaoczniają konflikty związane z renowacją modernistycznych fasad. Tymczasem, nowe narzędzie, jakim jest proceduralne modelowanie architektury, umożliwia porównywanie różnych wizji tej samej fasady z jej oryginalnym stanem. Artykuł prezentuje eksperymentalną metodę analizy przekształceń modernistycznych fasad, wykorzystującą modelowanie proceduralne oraz dane pozyskane drogą badań sondażowych wśród mieszkańców. Metodę tę zastosowano na przykładzie osiedla mieszkaniowego ZUS w Łodzi. Zdobyte na tym polu doświadczenia wskazują, że opracowana metoda może być wartościowym narzędziem, wspomagającym podejmowanie decyzji w procesie ochrony dziedzictwa epoki modernizmu.

Keywords: **Procedural modelling; Modernism; Heritage protection; Survey research; Facade transformations.**

1. INTRODUCTION

The paper presents an experimental method of analysing modernism building facade transformations for protecting its original valuable appearance. In the conducted research original design solutions used by architects and secondary solutions used by inhabitants were transposed into procedural rules and presented as the three-dimensional model of different facade scenarios. The paper starts with the consideration of architecture life division into three phases. Next, the ZUS housing estate in Lodz, Poland is presented in the wider European and Polish context. Finally, the paper deals with a nature of procedural modelling and a nature of modernism architecture pointing out similarities between them. In the final part of the paper the conceptual framework and its outcomes are described and set to wider academic discussion.

2. THREE PHASES OF MODERNISM ARCHITECTURE LIFE

Modernism housing estates, which are the best example of urban development ideas from the beginning of the 20th century, have reached a phase of the renovation needs. The major voice in a discussion about their appearance is the voice of their inhabitants. Their decisions may result in loss or maintenance of modernism facades original appearance.

Architecture has three phases of its life [1]. In the first two phases – "conceptual" & "physical formation" – architects design and construct buildings, what makes them the main stakeholders. The third phase – "long-term existence" – cedes the decision making onto users or owners of the buildings. Usually, this phase is described as a process of adjusting a building to requirements of its inhabitants and it may be a distortion of original architects' intentions. Furthermore, architecture is the best reflection of social and economic changes [2]. Buildings and their appearance carry plenty of information. Facades become a record

of buildings life, a collection of succeeding users' decisions, an image of people's attitude towards architecture. Since the appearance of multifamily house is a result of many factors and many activities its facade analysis may give fruitful results.

In this context, modernism housing estates from the first part of the 20th century have already reached the third phase of their life. Moreover, they were designed to meet needs of mass societies and therefore standardised assets were used, but today they function in a reality driven by an omnipresent individualism. These factors force a Europe-wide trial of saving communal and modular nature of initial modernism housing estates. The research project presented in the paper had focused on the third phase of architecture life and it deals with social transformations of modernism housing estates appearance. The object of studies was ZUS housing estate built in Lodz, Poland in 1930s. Being related to the CIAM idea of "The Minimum Dwelling" ZUS housing estate is well-fitted for the analysis of the inheriting modernism legacy process.

Figure 1.
Modernism housing estates from 1920s and 1930s. Source: Author (2010-2013); (a) Karl Marx-Hof, Vienna, Austria; (b) Weiße Stadt, Berlin, Germany; (c) Montwiłła-Mireckiego, Łódź, Poland; (d) Kiefhoek, Rotterdam, The Netherlands

3. ZUS MODERNISM HOUSING ESTATES IN POLAND

Their past and presence in the European context.

In 1920s and 1930s young European architects and urban designers were fascinated with the new ideas of shaping modern cities popularised by Le Corbusier and his followers. Their diagnosis of the 19th century Europe was simple: overcrowded cities as a result of the industrialisation age should have become more green and spacious, providing better living conditions for masses. This conviction caused many experimental investments [3].

New housing estates – as the laboratories of the expected new better world – were built mainly in the Central Europe (Fig. 1). Frankfurt am Main became the city of the widest European public housing policy. A place of such activities was also Berlin, which faced a great demand for affordable housing. Vienna governed by a social democracy is a well-known example of public housing projects of this time. Furthermore, Dutch architects and urban designers also tried to construct modern housing estates in Amsterdam and Rotterdam [4].

A lack of cheap flats providing good quality of living was one of the most visible problems of young newly

Figure 2.
Current state of ZUS modernism housing estates from 1930s. Source: Author (2011-2014). (a) Przybyszewskiego Str., Poznan, Poland; (b) Biskupa Dominika Str., Gdynia, Poland; (c) Bednarska Str., Łódź, Poland; (d) Prusa Str., Krakow, Poland

independent Republic of Poland in this period. A trial for solving this problem was a nation-wide investment programme for public and affordable housing. Finally, an association of regional insurance companies – ZUS – became project organisational body. This institution provided founds and a team of designers for one simple task: a construction of as many affordable flats as possible. Consequently, despite locations in different cities each of the ZUS housing estates had a similar architectural expression achieved by similar visual solutions [5].

Nowadays, the consistent architectural expression of these estates is no longer clearly visible. Almost each of them were modified by their users. These changes destroyed the original appearance of the buildings, because of the chaotic use of new painting colours, new shapes of windows or doors and new finishing materials – to point out the most common transformations. Fig. 2 presents blocks of flats from four of ZUS housing estates after nearly 80 years of their existence. To avoid the further destruction many of these housing estates have recently received a status of cultural heritage.

4. THREE PHASES OF ZUS HOUSING ESTATE LIFE IN LODZ, POLAND

An analysis of the architectural design of the units, which constitute ZUS housing estate in Lodz, reveals its key attributes. First of all, the image of the housing estate is not monotonous. Every building (a unit) consists of segments purposely interspersed. Secondly, architecture details relate to the visually dynamical streamline trend. Finally, housing estate received an architectural icon (a habitable water tower) defining its identity. On the other hand, it must be remembered that the design guidelines, the assets (e.g. windows, doors) and the finishing materials were coherent to those used in other estates of ZUS initiative [6].

The third phase of life of modernism architecture started here with a strict control of its designed appearance. Majority of changes took place in 1990s and 2000s without respecting the conservation guidelines. A small number of the original windows and doors have survived till today. The most common transformations are the changes of the material (PCV instead of wood) and modifications of the original subdivisions of windows and doors. Moreover, new window blinds and lattices have appeared, mainly on the ground floor. Vertical concrete faces on the

balconies have been removed, making the balconies more transparent. Some of the original wall plasters have been hidden under the layer of styrofoam and new plasters. Fig. 3 presents some of the original and the secondary design solutions found on the walls of Lodz ZUS housing estate units.

The survey research – mentioned in the introduction to the paper – conducted among the local community of ZUS housing estate in Lodz had one main aim: a verification of an acceptance of both original and secondary design solutions in eyes of the local community. A case study of the survey research was one unit of the given housing estate (26 Bednarska Street), whose inhabitants became the target population. Representatives of 41 households (53% of unit's capacity) participated in the survey research between June and July 2013.

The level of households appreciation of the modernism architecture in general was quite low. Using the Fig. 3 as a method of visual preferences, the analysis of the described transformations key aspects were socially judged. The survey research showed that majority of the inhabitants prefer new, yellowish painting (Fig. 3b) than saving original colour of a plaster (Fig. 3a). At the same time they preferred original brick plinths (Fig. 3c), instead of hiding them behind a styrofoam layer (Fig. 3d). It was the only case, when the original architectural solution received more votes than the new one. It means, that people prefer also new windows (Fig. 3h), doors and balconies (Fig. 3f). The survey results proved the conflict between preferences of the inhabitants and modernism heritage preservation guidelines.

5. NATURE OF PROCEDURAL MODELLING AND ITS IMPLICATION FOR MODERNISM FACADE DESIGN

A nature of a procedural modelling means that everything, what user wants to shape is done not by a manual use of a computer mouse, but it is automatically generated by previously typed text rules. These procedural rules contain a queue of operations. Using them in defined order shapes a building iteratively. Nowadays, procedural techniques of modelling are widely used in the entertainment industry [7].

The software ESRI® City-Engine™ is one of the most common consumer software for a procedural modelling and it was used in the presented case study. The authors of the software prepared a special programming language called CGA: Computer

Figure 3.
Examples of original and secondary design solutions from ZUS modernism housing estate in Lodz, Poland. Source: Author (2013).
a) original colour and pattern of plaster; (b) secondary colour and pattern of plaster; (c) original plinths; (d) secondary plinths; (e) original balconies; (f) secondary balconies; (g) original windows subdivides; (h) secondary windows subdivides

Generated Architecture [8]. A syntax of the proce-
dural rule files written in this language clearly relates
to the modular nature of the modernism architec-
ture. Knowing Le Corbusier's formulas of construct-
ing buildings reveals their similarities with procedur-
al modelling of architecture: rules shape initially gen-
eral elements of buildings and it allows constructing
more sophisticated objects. Details of buildings and
their facades are given in a rule file. Once written
rule is used as many times as needed, also in different
configurations.

A recipe of preparation of the CGA rule files for a
building facade is presented in Fig. 4. A rule divides
a facade into floors. A Floor is divided into tiles,
which become a place to insert assets e.g. a window or
a door. A rule of one tile can be consequently repeat-
ed to organise a structure of entire floor. A place-
ment of every asset, as well as floors and tiles pro-
portions, are specified in rules. Therefore, procedur-
al facade is a very flexible tool, making it easy to
change building height, length and other defined
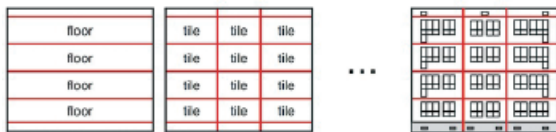attributes, e.g. wall colour [9].

Figure 4.
**Stages of procedural facade modelling in use of CGA rules.
Own work (2014) inspired by [9]**

6. CONCEPTUAL FRAMEWORK OF PROCEDURAL FACADE SCENARIOS

In the contemporary, post-modern world the aim of
successful heritage use is described as a complex
cooperation between different stakeholders. It is
believed that involvement of people with differentiat-
ed backgrounds into this process provides a durable
and a sustainable future of a built heritage and it
helps preserving it for next generations [10].

This approach was recognised as a key reason for
preparation of the given facade procedural scenarios,
which were conceived as a supportive element of
investment process both: for heritage preservationists
and for heritage owners. Due to the nature of proce-
dural modelling the scenarios were believed to be
easy available and adjustable allowing users doing
visual analyses of planned actions effects, e.g. reno-
vations. On-demand comparison between facade sce-
narios was intended as an opportunity for finding

common points between stakeholders and for helping
them to better understand each other. Achievement
of the presented aims required gathering detailed
data from each stage of building life to allow making
comparisons of facade appearance. Required were
the data about facade original design, the data about
its present condition and the information about local
community future plans for its transformations. To
sum up, original design decisions, behaviours of peo-
ple and their visual preferences were collected for
transposition into procedural rules and for generat-
ing them as a three-dimensional facade model.

7. ACHIEVED FACADE SCENARIOS

To catch a process of facade changes a depth analysis
was done. Firstly, original designs of the estate units
drawn in 1930 were used for preparation of the first
scenario called "Built". A use of private archives of
photographies (Fig. 5) and a use of ZUS association
publication from 1930s had an important contribu-
tion in a preparation of the first scenario. In this sce-
nario the facade consists only of original design solu-
tions. It means that windows and doors have specific
subdivisions and majority of them are equipped with
green flower pots. Moreover, balconies have charac-
teristic concrete surface and the plinths are made
from bricks (Fig. 6a)

Figure 5.
**Original design of the facade of 26 Bednarska Street in Lodz,
Poland. Source: Ryszard Bodalski's (housing estate inhabi-
tant) family photo archive (1930s)**

Secondly, existing image of the facade was presented
as the scenario called "Present". It was based on the
results of the architectural survey done in 2013 and it
summarises the deeds of the inhabitants. This scenario
is a reflection of the present stage of the building life:

the plaster and plinths remain mucky, but they still are made from original materials. Most of the windows and doors are replaced by new ones, which do not have a specific subdivisions. Above them antennas or blinds mechanisms are mounted (Fig. 6b). Finally, the "Future" bases on the mentioned survey and it presents building inhabitants expectations for future image of the facade. As a result, the third scenario consists of many secondary solutions. A number of their types is limited because of the inhabitants willingness to set the solutions in order (Fig. 6c).
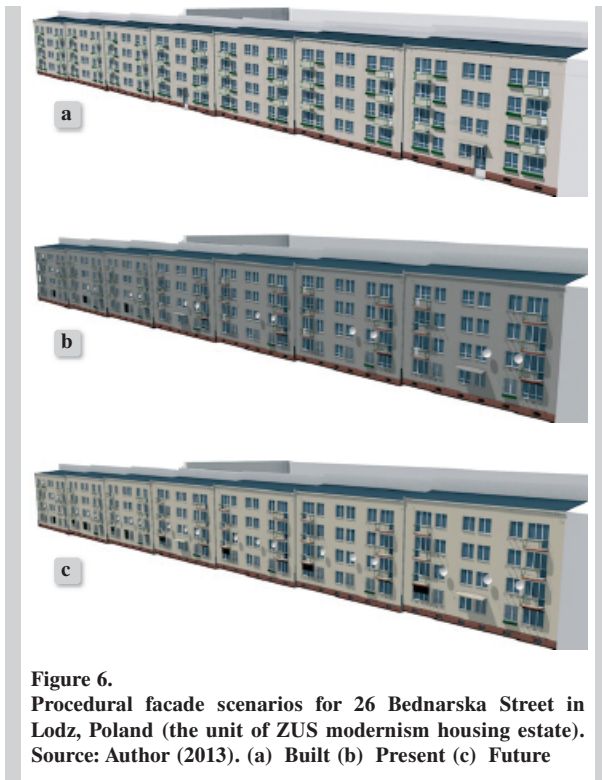

Figure 6.
Procedural facade scenarios for 26 Bednarska Street in Lodz, Poland (the unit of ZUS modernism housing estate). Source: Author (2013). (a) Built (b) Present (c) Future

Every scenario bases on detailed calculations. It means, that number of asset types (i.e. windows, doors, balconies, blinds and pots) visible on the final visualisations strictly relates to their real frequencies. None of the visualisations present a photorealistic image of the facade, but each of them capture the overall percentage of each asset in shaping the facade image. The software enables on-demand comparative analyses by different stakeholders and it is achieved by exporting the model into a CityEngine™ Web Viewer – a tool for discovering CityEngine™ models in a web browser (Fig. 7).
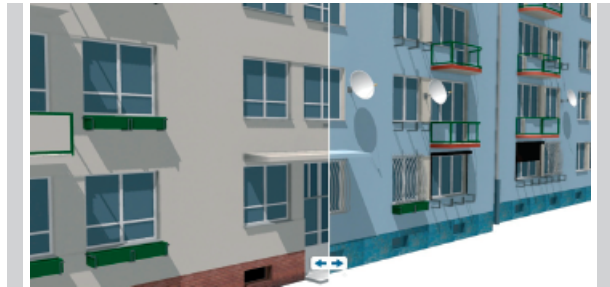

Figure 7.
ESRI® CityEngine™ WebViewer comparison mode of the prepared procedural facade scenarios. Source: Author (2013)

8. IMPLICATION OF PROCEDURAL FACADE SCENARIOS FOR MODERNISM HERITAGE PROTECTION. DISCUSSION AND CONCLUSIONS

The appreciation of modernism architecture and its values is still relatively rare. There is nothing surprising in this phenomenon: the attributes of modernism architecture are not associated with the heritage image rooted in human perception [11]. The preparation of the presented six procedural facade scenarios was a trial of presentation of the inhabitants' behaviour influence on the appearance of modernism architecture. Changes, which have already happened, and changes, which may happen in the future, were captured and compared with the original design of the given facade. The prepared scenarios can become an educational tool and can simplify explanation of each element role of the building facade in saving its original appearance. This use seems to be very important because of the lack of appreciation of facade original appearance in the eyes of the inhabitants. The identified visual preferences of inhabitants suggests that original facade assets will be replaced soon by secondary solutions. Therefore, it seems that proactive educational efforts will be required.

Worth to mention is a relatively wide use of the described procedural rules. Their flexibility suggests few more areas of their potential use. After some small modifications they can be used to do a digital a priori test of planned renovation works and other investments related to a building facade. Thus, it is possible to select the best solutions. Furthermore, the prepared procedural rules can be used for a dialogue between municipal heritage preservation office and the inhabitants of the ZUS housing estate in a search of the best aesthetic solutions. However, procedural modelling of architecture has been used mainly for fast creation of large urban structures

with less attention given to architectural details. In this context, inconsiderate use of procedural modelling could result in oversimplification of building facade, deepening the negative image of modernism architecture. Therefore, the careful preparation of procedural rules has to be preceded by detailed facade analysis.

Outcomes of the described analysis are a part of the wider discussion on the implementation of new technologies into the field of built heritage by presenting the results possible to achieve when applying the procedural modelling. The idea of a presentation of the facade as a result of human behaviours and inhabitants visual preferences seems a valuable contribution. Both aspects of the problem can be extended in further analyses.

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