

## Summary

**Manfred Sonnleithner**

**Melinda Benkő, Hlib Antypenko, Anna Kornélia Losonczy**

**Veronika Krausková, Henrich Pifko**

**Ľubica Vitková, Olena Lemak**

**Vladimír Šimkovič, Ivan Kulifaj**

### **NEW OPPORTUNITIES FOR INCREASING THE RENOVATION RATE OF BUILDINGS**

**Manfred Sonnleithner**

*Keywords: building heritage, renovation rate, population identification, revitalization, conflict of goals, CO2 emissions, Renovation Wave*

*A Renovation Wave for Europe – greening our buildings, creating jobs, improving lives* is the message of the European Commission of 14 October 2020. This initiative was already announced in “The European Green Deal” in December 2019 and confirms the urgency of the issue. With every old building that has not been used or is already in the process of substantial deterioration, the questions arise again and again about the reasons for this situation and why it had got to that point at all. If we then take into account the alarmingly low renovation rates, which have been decreasing for years, we can find definitive confirmation that the existing building fabric has been preserved and renovated only to a rather limited extent and is therefore partly lost to the society.

The European Commission wishes to counter this development with “The European Green Deal” and, in particular, with the “Renovation Wave”. These regulations follow the trends that have been set in recent years. Standards have been raised, technical requirements are more strictly defined and limit values for energy consumption have been further lowered with the aim to increase energy efficiency and to reduce CO2 emissions.

A tested and proven pattern for bridging the past and the future is followed here. This positive statement applies to the quality of remedial measures in the European Union and its member states. However, the renovation rates of existing buildings, which have been low for years, show that the opposite is true with respect to the quantity of renovation projects. The past has shown us that ambitious technical specifications and legal regulations alone might not be the right path to success. Obviously, other factors and parameters are also important, and, so far, they have been given too little consideration.

These previously neglected factors should be identified in the work, together with the reasons for the neglect. Finally, possible solutions should be formulated; however, their focus on certain topics might limit the content-related field of action. Future in-depth discussions and the subsequent implementation of the results in an overall package will increase the chances for legal regulations such as “The European Green Deal” to achieve the ambitious theoretical goals and specifications in practice. An increase in the renovation rate of existing buildings is the quantitatively measurable outcome. Even the ambitious goals and the necessary annual renovation rates of the individual member states for the year of 2050 are thus realistic.

As the first step, approaches have been explored in various areas of interest that may be related to the problem of low renovation rates. This may also be done through the examination of various concrete or potential target conflicts, based on which the actual obstacles can be identified and solutions can be developed. In

the first stage of the research, the focal points were determined such as climate-relevant aspects, values of architectural heritage and the identification of the population with the aforesaid heritage, learning from the past and utilization of the knowledge thus gained when dealing with old building fabric.

In these specific areas, various conflicting goals were identified, four of which were selected and examined in more detail: renovation versus new construction, use versus maintenance, user demands versus property-appropriate use and building maintenance versus climate protection.

On the basis of a description of the background to the problem, the first possible solutions were defined. A focused analysis shows that they are based on common principles: the affinity for the irreplaceable values of the existing building and its surroundings, a “sensitization” to the complexity of climate and environmental issues as well as the identification of the population with the architectural heritage. It can be assumed that the majority of the population is not aware of the special quality of older buildings and that they have no desire to live in historical buildings. The low renovation rates in the past indicate that in the end neither the financing, nor the legal requirements or any other difficulties are the decisive obstacles hindering a decision to actually implement a building renovation project.

Ultimately, more fundamental reasons related to personal identification and ideology are decisive. The rejection lies partly in the subconscious and trapped subjective resentment, which in turn is based on unresolved questions. These facts are confirmed by the formulated solutions and show the urgency to “sensitize” the population with regard to the values of the architectural heritage and the human and object-related environment. The human factor is also of great importance in relation to the renovation and maintenance of existing buildings and should therefore be given priority from the outset when strategies and legal regulations are developed. Then, not only ambitious programs like the “Renovation Wave for Europe” from “The European Green Deal”, but also small initiatives in regions or town centres can be given a chance to actually achieve their goals, to the benefit of our environment and our architectural heritage.

## **CONTEMPORARY FOOD MARKETS WITHIN BUDAPEST’S LARGE HOUSING ESTATES: FACTORS INFLUENCING THE DESIGN PROCESS**

**Melinda Benkő, Hlib Antypenko, Anna Kornélia Losonczy**

*Keywords: food market, housing estate, urban renewal, design theory, Budapest, contemporary architecture*

Markets – as physical areas for trading goods and food, and for social interactions – have always played an important role within the urban fabric. Budapest is well-known for its public market halls in the historic city center; however, this paper focuses on three contemporary market projects implemented within large prefabricated housing estates in the outskirts zone.

In Újpest Center, the new food market was only one element of the complex renewal of the district’s historic center, not far from one of the biggest Hungarian housing estates. The Main Square program started in 2007 and – based on an ambitious urban concept submitted in 2018 – a compact big building hosting not only the food market but also a cultural centre on the upper floors was opened. In Békásmegyér, the objective of the food market project was to create a new building in the centre of the mass housing neighbourhood and, at the same time, to reshape the open space system. The renewal process started in 2012, the market was opened in 2019, and the open space renewal was finalized by 2020. The third example presented in the paper is a temporary market in the Havanna housing estate. This small-scale 2020 award-winning project reused the former marketplace while introducing contemporary architectural values into this stigmatized modern neighbourhood of Budapest.

Budapest’s mass housing estates were built between 1960 and 1990, and their social and physical context has changed a lot in the last thirty years. However, the real renewal process with technical renovation of residential buildings, open

space renewal, social programs, and public building construction or reconstruction projects only started in earnest after Hungary's admission into the EU in 2004. During the state socialism era of the Central and Eastern European countries, the architects' freedom in the planning, design and construction process of the large, prefabricated housing estates was strictly limited. The most important determining factors of design were the socialist norms, the types related to urban infrastructure - building, flat, constructive detail, and the location and the personalities of the professionals and political players involved. The research attempts to explore how this situation changed and what the actual influencing or determining factors of a public project process regarding the renewal of a modern housing estate are.

The three case studies from Budapest, i.e. the new markets opened in the last few years, provided an opportunity for a comparative approach. The data is based on the fieldwork, analysis of the relevant plans and publications and online surveys with the prominent architects of the contemporary markets. The questions focused on the budget, the main "players", references, physical context (built and natural), social context, program, structure, materials, and technology. It is important to recognize that all three architects described their projects and the whole process as successful. The concept plan provided the essential input for the final project, and during the construction, the concept of the architectural project did not change significantly. Nevertheless, besides the short analyses of these three housing estates and their new market areas, our research concentrated on the complex context of these architectural interventions. How are the contemporary markets positioned in relation to the existing modern urban fabric? How was the architectural design process influenced by the surrounding urban physical and social context? What architectural and urban qualities do these new markets offer to the housing estates?

Even though the design of these neighbourhoods was mostly determined by the socialist norms and the prefabricated technology, contemporary architects working at the edge or within these modern heritage areas consider the existing social and physical context to be one of the most important factors influencing the design. Based on the surveys conducted with the architects of the markets, we could say that in these cases, the professionals surpassed the typical functionalist approach of the modern mass architecture worldwide that disregards the local context and focuses on the structure, the function, and the form. In consequence, we could argue that the global products of the 20th century urbanism, the mass housing neighbourhoods, have also local attributes and future-oriented designs use them as a fundamental basis. At the same time, it is important to highlight the responsibility of all the people involved (the designers, decision makers, and residents), because depending on the program, the building and the open space design are relatively unrestricted. Although the architects had no special requirements to meet regarding the structure, materials, technology, colours, etc., their contemporary design reflects the local "will" by the scale of the program. In this way, they introduce not only new aesthetic but also new meanings and new potential for the everyday use of the intervention area, both outdoors and indoors. The aim of these food markets is to offer not only good shopping opportunities but also a possibility to meet, socialize, and enjoy a large "well-designed" functionalist housing estate.

## **USE OF ARTIFICIAL INTELLIGENCE IN THE FIELD OF SUSTAINABLE ARCHITECTURE: CURRENT KNOWLEDGE**

**Veronika Krausková, Henrich Pifko**

*Keywords: artificial intelligence, AI, building information model, BIM, generative adversarial network, GAN, architecture, sustainability*

There is a trend that artificial intelligence (AI) is a direction to take in various scientific disciplines. The idea of AI originated before the 1960s, and with the development of computer technology, the capacities of AI have multiplied. It currently affects many areas of everyday life where we may not even realize that we are already using AI. We are certain that AI is a challenge in the field of architecture

and the entire construction industry, where sustainability is one of the current issues.

A notable technological shift in the field of building design is BIM. The participants in the process of design are effectively informed about the current state of the project, but the BIM model should be used for further actions, such as utilising information as interactive tool in the construction, operation or renovation phase.

The objective of the study is to acquire knowledge about AI usability in the optimization of sustainable design BIM processes in architecture. The aim of the study is knowledge of the applicability of AI in the conceptual solution for reducing the carbon footprint in the BIM model of the building of Faculty of Architecture and Design STU. An assumption for formulating the hypothesis is to use AI to predict the pattern of users' behaviour. Due to need in the older buildings, where massive refurbishment is not possible or appropriate because of the historical or cultural value. So, it is nearly impossible to meet current requirements for energy-efficient buildings.

The article provides a brief overview of AI usability. The base knowledge is presented with terminology in the field of information technology, the processes of artificial intelligence and their applicability to the field of architecture. The context of historical development refers to the considerations of Stanislas Chaillou, who evaluates the connection between the work of an architect and AI as a logical step in technical development. As examples and sources of information studies of application AI in architecture and building industry were used.

1. The study by Stanislas Chaillou is about architecture and AI, where it focuses on the ways and processes of using GAN (Generative Adversarial Network) in floor plan design.

2. The optimization of design processes in BIM is presented by a study that tries to use BIM and artificial intelligence in the design process of buildings. It creates a project called BIMBOT, which generates solutions based on defined priorities for a specific project.

3. The most discussed part of the article is the work of Ekaterina Petrova. Aim of the study is: Integrating knowledge discovery and semantic data modelling for support of evidence-based design decisions. Suggesting a solution to systematization of building design using the BIM-based design, she draws attention to BIM building models, which contain a lot of information that will eventually remain unused.

Petrova develops the architecture of a comprehensive software "consultant" system using AI and the cooperation of experts in the field of information technology and the building industry. The result of the study will be a "consultant" which collects information from real buildings throughout their life cycle into a robust database. AI methods are used for re-evaluation and sorting of information to gain new knowledge for sustainable building design processes. The main goal of Petrova research is to transfer the acquired knowledge from real constructions back to the design process, in order to create a connection between relevant factual and data-based knowledge within the initial phase of the design of new buildings.

In her work, Petrova also dealt with obtaining specific data from case studies. Based on the statistics, she processed a database of collected information. The data was taken from measurements of two case studies of erected buildings, where she had to find a system categorizing information.

The issue of sustainable building designing with AI in the study is proposed from the perspective of the functionality of information technology rather than from the architect's point of view. The study addresses the challenges of data collection, processing of information in databases and its compatibility. However, this is the point of utilising knowledge, because it clarifies the idea of correct data and outputs when working with a database which consists of many BIM models.

A dramatic science fiction for which AI is often taken, may be sometimes true. The article outlines challenges and directions of AI development. Some of them are still unrealistic in the current state of scientific knowledge. However, working

with AI itself is advancing in various scientific disciplines, such as medicine and disease diagnosis. AI is currently able to find connections in the data based on statistics of the occurrence of a certain phenomenon. AI is also able to recognize that phenomena. To decide based on abstraction, whether to put phenomena in context, AI is still in its infancy and needs the help of a human expert.

AI and humans acquire skills through experience. Some knowledge is very difficult to transform so that AI can "understand" it. If we use AI as a chatbot, it is able to learn concepts based on experience, but does not fully understand the meaning. These issues of working with AI are also transferred to the use in the construction industry or architecture. The article outlines some of these possible problems. Few of them have already been named in studies as specific problems for that case. Other problems are of a general nature or related to the overall development of work with AI. Finally, the study evaluates the potential of working with AI in architecture and ideas about future research.

## **INTERACTION OF LANDSCAPE AND SETTLEMENT STRUCTURES IN THE DANUBE REGION**

**Ľubica Vitková, Olena Lemak**

*Keywords: town, city, sustainability, Danube, genius loci, identity, image*

When evaluating the quality of urban structure and especially urban spaces, urban planners and landscape architects observe the following aspects: location, type of urban space, its importance, aesthetic character of the place, functional use, but also accessibility, spatial orientation, its historical and cultural values. An important psychological aspect that needs to be taken into account is the perception of urban and landscape structure. Genius Loci (Spirit of the city) is not a new phenomenon, but in the time of globalization and the transfer of model solutions that are implanted in the urban structure without any consideration for the context and peculiarities of the locality, its importance and value have increased.

Several foreign and domestic authors have explored the issue of the genius of loci in their theoretical works. Christian Norberg Schulz, Kevin Lynch and Christopher Day are among the pioneers who have consistently developed this theory. Rem Koolhaas also addresses the issue of the city's image in his article Generic City. There are also Alain Theirstein and Agnes Förster who have examined and evaluated it in various contexts, strategies and levels, from region through city and to its parts. In Slovakia, Silvia Bašová focuses on the image of a city and its parts, while Ľubica Vitková studies the topic of genius loci or the image of a city, especially in relation to public spaces. The importance of the genius loci in landscape creation has been assessed by A. Dobrucká. The individual regions, landscape and cities that make it up make the genius loci special. The character of the territory and place thus defines its uniqueness that distinguishes it from other regions and settlements. In this context, Christian Norberg Schulz's monography "Genius loci" (Norberg-Schulz, 1981) is a pioneering work: "Space is certainly not a new concept in architectural theory. But space can mean a lot."

The purpose of this research was to examine a settlement as an object that is largely defined by natural conditions. In the process of its development, the settlement structure closed or opened to the outer wild nature, it grew and acquired a character influenced by the natural conditions of the given place. This is also reflected in the person's relationship to the place. The basic preconditions, which are orientation and identification, help to anchor a person in the world and in space. These terms are mentioned by Schulz, but Kevin Lynch uses them too. Orientation is a natural need of man, part of his existential anchor. A structured, clearly legible space in which points of orientation such as path, boundary, node, area and landmark can be defined as something that, "... gives the individual a choice and is the starting point for obtaining further information". In the context of Schulz's approach, "identifying" means "making friends" with a certain space.

The aim of our paper was to evaluate the identity, genius loci (spirit of the city) of the selected Komárno settlement in the Danube region using two presented

methodologies: the methodology of landscape evaluation as described by Schulz and the methodology of evaluation of urban structures used in Lynch's theory.

The first methodology helped us to find the starting points (basics of the current structure) and to define them correctly; determine the relationship of the settlement to local and global landscape structures, its openness to the surrounding country. Lynch's methodology helped us identify the strengths and weaknesses of the urban structure. The analyses carried out on the basis of the above-mentioned evaluation have revealed the potential of individual locations of the settlement and made it possible to determine the basic building elements (natural and urban-architectural) and their parameters to strengthen the genius loci—a harmonious and sustainable urban structure of the 21st century.

According to the Schulz methodology, the main identifiers are: landscape structure, geomorphological structure, vastness of the city, climatic conditions, harmonization of natural and urban structure, orientation, identification, greenery in the city and cultural identity. According to Lynch's methodology, identifiers are: areas, edges, nodes, lines and landmarks. These help in defining the cultural and spatial values of the urban structure.

The indicators, on the basis of which the evaluation was carried out, simultaneously reflect socio-economic as well as environmental processes, both the ongoing and the past ones. This evaluation, which focuses on the qualitative assessment of urban and natural structures, and in particular on their mutual synergy, can help to better understand the potential of one's dwelling and the specificities that should be developed. Improving the urban space by strengthening the positive factors and eliminating the problematic areas indicated by the indicators will help contribute to the sustainable development of the settlement, thanks to its greater economic and social viability, thanks to its attractiveness, both for visitors and residents themselves.

## **APPERCEPTION: UNDERSTANDING AND ANTICIPATING THE USER IN SPACE BASED ON NEURAL AND BEHAVIOURAL RESPONSES**

**Vladimír Šimkovič, Ivan Kulifaj**

*Keywords: neuroarchitecture, architecture, human perception, artificial intelligence, psychology*

We are aware that it is not possible to include all theoretical psychological and neuroscientific starting points in the scope of the work, however, we are of the opinion the mentioned theories and research provide a solid basis for further research in the field of architecture and design. Furthermore, we also perceive the fact that the connection between neuroscience and psychology with design is still in its infancy, especially if we take into account studies originated in Slovakia and the Czech Republic. Therefore, drawing on psychology and neuroscience, we tried to establish a basis, which could be used in the future and modified and updated later on as appropriate. In this work, we have summarized several cognitive processes, which in our opinion are closely related to user experience, namely consciousness, memory, perception, decision-making, physiological arousal of the organism, attention and emotionality. In further theoretical research, we would certainly focus on other cognitive processes, such as learning, the ability to plan and anticipate events, motor coordination, and problem solving. We believe that these cognitive processes are also important in the user's interaction with space. Learning is largely related to our memory, including spatial memory, meaning that we can assume that user experience can also be influenced by how easy or difficult it is to remember a particular space. Alternatively, it can be affected by the way how the user may feel in similar premises (for example, the stores in the LIDL retail chain are arranged almost all the same). Planning and anticipating events is also an important cognitive factor, for example when designing spaces to be used for fast user actions, such as moving in the underground. Motor coordination can be a significant factor for people with various health (physical) disabilities, such as people using a wheelchair.

We realize that there are other psychological concepts, such as a typology of personality that could be measured in terms of user experience; still we believe that cognitive processes and emotionality are more crucial in this concept. When conceptualizing research design, we stemmed from the assumption of an increased development or developers' activity and its impact on the environment, as well as the mental world of users. At the same time, we are working with the fact that neuroscience(s) and artificial intelligence are among the most developing fields of today. The main goal is to deepen the understanding of the user's perception of space and thus push the method of design to a higher quality level. The basis of the research is a question arising from a futuristic concept, but the research findings are also applicable to today's static architecture, which is the main goal of our dissertation thesis. Today's application is mainly related to finding and offering the most ideal way to the construction market, or developers. In this case criticism would be justified if the only objective were to help the private sector earn more, however, it is not true. The primary and major goal is to find new ways and techniques of designing architecture that serves people. The goal is to connect all segments that are working together in order to develop the city and enhance the entire process. The expected benefit of the work is to achieve a greater adaptation of today's architecture. This is one of the few researches that addresses human perception both through the conscious and the subconscious side of the subject, and both theoretically as well as through experiment or research. The work thus brings a different, more accurate view of the information about the user in space. This is further guaranteed by an interdisciplinary team of professionals who will bring views from other crafts, from the perspectives of users, urban structure and investors.