DOI: 10.23817/2024.defarch.5-3

MARCIN GŁUCHOWSKI
ORCID: 0000-0002-8959-5375
Cracow University of Technology, Poland

ARCHITECTURE INFLUENCED BY TECHNOLOGY

ARCHITEKTURA POD WPŁYWEM TECHNIKI

Abstract

The research topic is concerned with the current situation and future of architecture at the scale of a building or a group of buildings, conditioned by considerations of technology together with predictions about the possibilities of its development. The aim of the research is to categorise the technologies affecting architecture and to identify the problems that may be associated with them. The research methods are mainly analysis of materials on the latest techniques used in design, analysis of the impact of algorithms, analysis of interviews with system developers and with architects using them in practice, and our own design experience. The result of this article is, first of all, to classify and characterise the techniques that influence architecture. The main conclusion is that an object designed with artificial intelligence in terms of the concept of form and aesthetics cannot be called architecture.

Keywords: architecture, art, technology

Streszczenie

Temat badań dotyczy aktualnej sytuacji i przyszłości architektury w skali obiektu, bądź zespołu obiektów, uwarunkowanej względami techniki wraz z przewidywaniami na temat możliwości jej rozwoju. Celem badań jest skategoryzowanie technik wpływających na architekturę oraz określenie problemów, jakie mogą się z tym wiązać. Metody badawcze to przede wszystkim analiza materiałów na temat najnowszych technik stosowanych w projektowaniu, analiza efektów pracy algorytmów, analiza wywiadów z twórcami systemów i z architektami stosującymi je w praktyce oraz własne doświadczenia projektowe. Rezultatem artykułu jest przede wszystkim dokonanie podziału i scharakteryzowanie technik, pod których wpływem znajduje się architektura. Wyniki badań prowadzą głównie do stwierdzenia, że obiektu zaprojektowanego z udziałem sztucznej inteligencji w zakresie koncepcji formy i estetyki nie można nazwać architekturą.

Słowa kluczowe: architektura, sztuka, technika

1. INTRODUCTION

The extremely dynamic development of technology means that architects often rely solely on technological innovation when seeking originality in their designs. Technology can be an asset to architecture, but it should not be the determining factor. Architecture is characterised by principles that can be applied to any period of technological development. Architecture is about these principles, principles that we currently know and principles that we are searching for. Of course, the development of technology over the centuries has enabled many architects to change the way they approach design, but at the moment we are probably at a stage where further developments in this field, such as autonomous

aircraft or cities on the water, will not change the perception of architecture. In this case, architecture, understood as form, composition, proportion, play of light or aesthetics, will be the same architecture whether we are designing a skyscraper with air taxi access or a small family house near the city.

This reflection is the third article written as part of the Defining Architectural Space research conferences and, like the previous two, deals with the future of architecture. The first, entitled *The next avant-garde of architecture (Następna awangarda architektury)*, reflected on the possibility of changes of a scale and nature in the near future that could influence the emergence of a new avant-garde in architecture.[1] The second article *Architecture in the city of tomorrow (O architekturze w mieście przyszłości)* explored the meaning and significance of architecture in future urban environments.[2] This written statement, the third in the series, deals with the current situation and the future of architecture on the scale of a building or a group of buildings, conditioned by technical considerations together with predictions about the possibilities of its development. The content and order of the articles reflect the principle of moving from the general to the specific. The aim of the research is to categorise the technologies affecting architecture and to identify the problems that may be associated with them. The research methods are mainly analysis of materials on the latest techniques used in design, analysis of the impact of algorithms, analysis of interviews with system developers and with architects using them in practice, and our own design experience.

2. TECHNOLOGIES AFFECTING ARCHITECTURE

When analysing the contemporary possibilities of techniques influencing architecture, two groups can be clearly distinguished. The first are the physical elements, which include all contemporary materials that represent techniques to improve the quality of a building's performance and energy saving aspects, such as photovoltaic panels, heat pumps or wind turbines. The second group are artificial intelligence techniques, which need to be considered in two contexts: the management of building operations and the direct impact on the design of the building. IT structures that enable additional solutions for buildings and improve their use and operation are a great convenience and help for users, especially when it comes to large buildings with advanced technology. Importantly, they do not directly affect the architecture. The second way of using artificial intelligence, on the other hand, involves the direct use of algorithms in design, which undoubtedly has an impact on the appearance of the designed object. Some of the most popular tools that process the words entered by the user, i.e. prompts, and generate images based on them are Midjourney, Stable Diffusion and DALL-E. The resulting software output provides a visualisation of the form and aesthetics of the designed object, which can then be used by architects in the subsequent stages of their design work.

---

[1] M. Głuchowski, *The next avant-garde of architecture* [in:] T. Kozłowski (ed.), *Defining the architectural space – Avant-Garde Architecture*, vol. 3, Oficyna Wydawnicza Atut, Wrocławskie Wydawnictwo Oświatowe, Wrocław 2022, pp. 47–54.

[2] M. Głuchowski, *Architecture in the city of tomorrow* [in:] A. Mielnik (ed.), *Defining the architectural space – Architecture and the City*, vol. 4, Oficyna Wydawnicza Atut, Wrocławskie Wydawnictwo Oświatowe, Wrocław 2023, pp. 15–22.

3. ARCHITECTURE INFLUENCED BY TECHNOLOGY

An architect working on his work always draws to some extent on existing knowledge and experience. The use of technology is therefore a standard process and, by definition, not a problem. Both physical techniques and artificial intelligence are common human achievements and can of course be used. Streamlining the operation of certain processes or using contemporary technology elements to build the form of facilities is a natural thing. As long as these relationships are merely a tool in the hands of the architect, the problem does not arise. Unfortunately, a worrying phenomenon can often be observed where these techniques are used as an excuse to create architecture. The structure of new spatial assumptions often depends on the figures, indicators or parameters that the developers want to achieve, which becomes the guiding objective of the project. Also, the use of specific ecological elements and systems sometimes becomes the leaven for the shape of the facilities. It is clear that these elements are essential in contemporary design, but they should not, as a rule, be the direct basis or pretext for the shape and aesthetics of the objects designed. Another aspect is the unskilled and haphazard use of such techniques in architectural design, which manifests itself in a lack of planning and consideration of the use of these solutions in the context of the entire architectural project. Photovoltaic panels, air-handling units, heat pumps or wind turbines are all physical elements whose need for integration into the architectural design should be considered at the concept development stage. As a general rule, space should be provided for these technical solutions, while eliminating or minimising the impact of these techniques on the architecture. Otherwise, they usually become elements that are added to the architecture, spoiling the idea of the project and often being exposed. Unfortunately, in such a situation it is difficult to speak of the coherence of the whole spatial arrangement, which is certainly one of the characteristics of architecture. As an aside on the issue of renewable energy sources in the context of integrating these techniques into the facility, it can be pointed out that this is an issue that could be addressed on a broader scale, not just within individual facilities. The production of energy from renewable sources could easily take place within the framework of larger, publicly accessible investments dedicated to these purposes, with the owners of individual installations fulfilling their obligation to use these sources at a specific installation as part of their participation in such projects. However, this is a separate and rather complicated subject, which should be the subject of a separate academic paper for a better understanding of the matter.

A much more worrying development in this area is the direct impact of artificial intelligence on architecture. This manifests itself in the fact that some architects are already using algorithms to generate the shape of objects and develop visualisations. Appropriately selected words in a given set of so-called prompts are sufficient input for the data entered into the artificial intelligence system, with the help of which we obtain the final result, i.e. an image representing the desired assumptions. These techniques are not yet so advanced that what is generated is fully a design, but it is the starting point for the most important design stage in architecture, the search for form. So is there a surrender of design direction to artificial intelligence? In such a situation, if an architect continues to execute a design based on the basic conceptual assumptions generated by the artificial intelligence software, it can unfortunately be said that architecture is to some extent influenced by technology. Someone might say that artificial intelligence algorithms use human labour and materials. Of course it is, but technology is already responsible for the way these materials are used and processed. It has been

invented and programmed by humans, but humans have no direct influence on the detailed effect of the operation. When an architect works on a project, he usually starts with a sketch and a model, which are the physical expression of the first ideas, concepts or thoughts. As the work progresses, revisions are made, new inspirations come, considerations are made, the work is continued, interrupted, partially erased, continued and developed. The creative process is therefore the result of many interdependencies reflected in the architect's mind and external circumstances. These arguments allow us to come closer to the statement that architecture is creativity and the result of artificial intelligence is reproducibility. On the concept of creativity, we read from Wladyslaw Tatarkiewicz: "In modern understanding, creativity is a very broad concept: it includes all kinds of human activities and creations, not only artists but also technical scientists."[3] In the context of this statement, the invention and design of an artificial intelligence technique can be called creativity, but the effects of artificial intelligence are no creativity. All the more so when it comes to architecture, i.e. creativity within art. We are, of course, talking about the artificial intelligence algorithms responsible for generating forms and visualising objects. In other cases, where the capabilities of the algorithms do not apply to the aspects mentioned above, AI is an extension of the design process and the architecture is not influenced by it. This is particularly true when it comes to carrying out different types of analysis, looking for clashes in designs, or optimising construction costs and the process of selecting the materials to be used. This has a positive impact on the entire design and construction process, allowing architects to devote more time and attention to issues of concept, form and aesthetics.

Architecture should be considered not only in the context of the periods in which the works in question were created, but also as projects within the work of a single architect or architectural studio. "The studios of architects who have an uncompromising, exploratory and at the same time modestly ambitious approach to their craft usually express the personality of the architect and his or her dedication and respect for their own work. They represent the story of a lifetime of hard work and belief in one's mission."[4] Juhani Pallasmaa's words draw attention to a very important point, namely the direct relationship between the work and the creator, understood not only in terms of a single work, but also in terms of a broader scope of creativity. This approach to architecture can be obscured in the context of the use cases of artificial intelligence algorithms in the early design phases. The shaping of architects' work over the course of their professional activity may then be divergent and random, depending on the specific modes of operation of the algorithms used for the projects. It will also depend on the artificial intelligence software used, as each system will certainly operate on slightly different principles and thus produce different results. Another thread in this issue will be the evolution of the above systems, i.e. how the development and refinement of the algorithms will affect the results of the work. Given the current situation and the predictions for the future, we can assume that the design trends of artificial intelligence, if it can be described that way, will certainly depend on the version changes of a particular software, i.e. they will be random from the point of view of art. There may then be completely uncontrolled turbulence in the methods of generating the form and aesthetics of an object. When analysing

[3] W. Tatarkiewicz, *Dzieje sześciu pojęć, sztuka, piękno, forma, twórczość, odtwórczość, przeżycie estetyczne*, Państwowe Wydawnictwo Naukowe, Warszawa 1976, p. 302.

[4] J. Pallasmaa, *Myśląca dłoń, Egzystencjalna i ucieleśniona mądrość w architekturze*, Instytut Architektury, Kraków 2015, p. 57.

the effects of artificial intelligence programmes, it is also likely that the works will become more and more similar over time. Artificial intelligence uses freely available materials in the generated results. Logically, more and more of these materials will only be produced by the above systems. The conclusion is therefore that a unification of labour effects may be taking place. Although it may seem that there will be more and more source works, they will have less and less value in terms of role model and originality.

Inspiration is an essential part of an architect's training and work. It is extremely important which materials are considered, analysed and modelled. Do we go back to the iconic works of the great masters, or is it just the popularity of the designs that counts. The use of social media gives us a very good picture of such activity, well, the more people are interested in an issue, the more important that issue potentially becomes. In addition, the method of drawing people's attention to certain topics also comes from a system. The great unknown is therefore the accuracy and reliability of the selection of specific examples and patterns. The inspiration for a study or a particular piece of work does not have to be another project; it can be an element of another art form, such as sculpture, painting or music. It can also be a combination of several types of inspiration, in other words – the right sequence of events leading to architecture. Artificial intelligence algorithms certainly do not take full account of this kind of factor, which is extremely important for architecture. It also constitutes what is known as good continuity, building a sequence of events and stories. Without this, there will be a shallowing of essential values and a failure to transmit cultural and artistic output in a way that is open to contemporary solutions while respecting tradition and history.

The possibilities of modern technology make it possible to design buildings and even entire cities in a completely new way and on a completely new scale. The scale of The Line's linear smart city is both awe-inspiring and unsettling. Saudi Arabia's implementation focuses almost exclusively on technological innovation, relegating other aspects to a secondary role. History teaches us that it is not scale or technology that defines architecture. If we look at the old buildings in the centre of New York, for example, we see large buildings, but it is not the technology that attracts attention, although it was certainly very important in the construction of such large structures, but the atmosphere of the place, which does not depend on technical elements, but is influenced above all by the architecture.

The above arguments lead us to ask another very important question, namely whether an object designed on the basis of the results of artificial intelligence in terms of generating form and aesthetics can be called architecture at all? "In order to serve architecture, it is not enough to be proficient in 'the disciplines that adorn it'. It is necessary to have a vocation or, through persistent work on oneself, to obtain the grace to serve it honestly."[5] The words of Lech Niemojewski, although written many years ago, are certainly very useful here. We can also look at Herbert Read's statement that "Art is the ability given to man to extract form from the chaotic whirl of his impressions and to contemplate that form in its uniqueness."[6] At the time when these books were written, no one could have imagined the development of modern techniques as we know them today. However, the meaning of the statements made deals with the strength, properties and qualities of the human mind, which nothing can replace in the context of architecture as an art. The activities of artificial intelligence technology

[5] L. Niemojewski, *Uczniowie Cieśli (Rozważania nad zawodem architekta)*, Trzaska, Evert i Michalski, Warszawa 1948, p. 24.

[6] H. Read, *O pochodzeniu formy w sztuce*, Państwowy Instytut Wydawniczy, Warszawa 1973, p. 13.

reduce architectural design to a product. Of course, from a formal point of view, the result of an architect's work is to a large extent a product, but the arguments and quotations cited above confirm that there is even more value than that. Therefore, it is safe to conclude that an object designed with artificial intelligence in terms of formal concept and aesthetics cannot be called architecture.

4. CONCLUSION

What can the design of modern forms of development, including architecture, which is built primarily to use ever more modern technology, lead to? Well, this can lead not only to a lack of understanding of architecture – the art of designing space – as the purpose of buildings, but also to a spiral of innovation. The drive to invent more and more advanced techniques as an end in itself can have a negative impact on product quality and the environment, as insufficiently thorough development, verification, testing and implementation of advanced techniques can be extremely cumbersome to repair or change in the future. Results that look very good at the time of a particular solution may not be so after a few or several years. When introducing such significant solutions for architecture, construction and the environment, the process of implementing specific techniques should be much longer and carried out on a smaller scale first. It is clear that the development of technology is necessary for architecture as well as for other areas of life. However, this must not be the overriding goal. We must not be slaves to technology.

Modern technical solutions that make it possible to construct large buildings and complexes are influencing the creation of a completely new aesthetic, which is of course a natural phenomenon. However, it is important for architects to have a significant influence on this new type of aesthetic. Unfortunately, technology itself, including artificial intelligence, very often plays an important role in this. The development of artificial intelligence is so dynamic that it is difficult for us to imagine where it will be in five or ten years' time. Probably due to the fact that the design market is too unprofitable for companies to invest in AI due to the small number of potential customers, the development in this industry, although very significant, is different in terms of sophistication from other areas of life where the level of AI involvement is very high. We are talking, for example, about the production of cars using artificial intelligence robots, or the creation of various types of films… This may confirm predictions that when the sophistication of AI algorithms in our industry reaches or exceeds these levels, the degree of AI involvement in the design process may lead to near-autonomous design generation. Developments in the sophistication and combination of capabilities of the various algorithms will lead to the possibility of a finished design once basic data about the location, scale and function of the building to be designed and aesthetic expectations have been entered. Interestingly, such instructions fed into the software will probably no longer need to be entered by the designer. The small amount of information required is likely to be able to be gathered by the investor himself, without any connection to the design industry. The role of the designer in such a situation may be reduced to arranging the relevant paperwork and carrying out the administrative process. It is clear that even if this happens, it will not be exclusive to the design industry. This is likely to be one of the options offered to clients as part of the services provided

by design studios. As we look further into this issue, it is likely that the price of this type of design will fall due to the low cost of production, so that its popularity will displace man-made designs. From the point of view of the development of artificial intelligence technology and its application in so many fields, the situation referred to here with regard to design and architecture will no longer come as a great surprise to society. Nevertheless, any kind of art, including architecture, which is to be replaced by algorithms of various kinds, raises questions about its new status: will it continue to be art, will it still be architecture. The research carried out in this article has led to the conclusion that in situations where artificial intelligence software generates the form and aesthetics of an object in a project based on the input of keywords, prompts, it will not be possible to speak of architecture. Such an instruction is not sufficient to detect a significant human influence on the object visualisation result produced by the system, so it is then the artificial intelligence that decides on the main assumptions in this respect. From the point of view of the features that make up the architecture, some of which have been presented in this article, the operation of the algorithms is random in this respect.

The predictions of visionaries from many years ago about the buildings and cities of the future, presented in books and films, are slowly coming true. One may wonder why, in such predictions, visions, scenarios, the world seems overwhelming, life unnatural, relationships lacking. Perhaps this is the dead end to which the dependence and subordination of everyday life to technology leads. Perhaps now is the time to consider the direction to which all this activity is leading and to find an intermediate solution that, while accepting the development of new techniques, preserves the essence of fundamental values, including art. Man needs art. "As today's consumer, media and information culture manipulates the human mind through multiple thematic environments, commercial conditioning and numbing entertainment, art has the task of defending the autonomy of individual experience and providing an existential foundation for the human condition. One of the primary functions of art is to safeguard the authenticity and independence of human experience,"[7] writes Juhani Pallasmaa.

Architecture under the influence of technology is certainly changing and will continue to do so. Physical elements that are the product of modern technology and influence its spatial expression should not be an end in themselves when it comes to designing buildings. Solutions that do not compromise the architecture should always be sought in this situation. Artificial intelligence affects architecture in two ways, depending on the extent to which it is used. If it improves the design process and building management, architecture is not affected and the process adds value. In the situation where the use of AI accompanies the creation of the project idea, where form and aesthetics are generated through verbal prompts in the form of visualisation, which is then continued in the project under development, then, as already said, one cannot speak of architecture, it is not creativity but reproduction. With this assumption, one might think that since such an activity would no longer be architecture, this technique has no influence on it. Well, it does, in this case not directly, but indirectly. This means that if there are more and more effects of artificial intelligence, which, according to the proposal, will no longer be architecture, there will be less and less architecture due to the influence of technology.

[7] J. Pallasmaa, *Myśląca dłoń, op. cit*., p. 164.

References

[1] Głuchowski M., *Architecture in the city of tomorrow* [in:] A. Mielnik (ed.), *Defining the architectural space – Architecture and the City*, vol. 4, Oficyna Wydawnicza Atut, Wrocławskie Wydawnictwo Oświatowe, Wrocław 2023, pp. 15–22.

[2] Głuchowski M., *The next avant-garde of architecture* [in:] Kozłowski T. (ed.), *Defining the architectural space – Avant-Garde Architecture*, vol. 3, Oficyna Wydawnicza Atut, Wrocławskie Wydawnictwo Oświatowe, Wrocław 2022, pp. 47–54.

[3] Niemojewski L., *Uczniowie Cieśli (Rozważania nad zawodem architekta)*, Trzaska, Evert i Michalski, Warszawa 1948.

[4] Pallasmaa J., *Myśląca dłoń, Egzystencjalna i ucieleśniona mądrość w architekturze*, Instytut Architektury, Kraków 2015.

[5] Read H., *O pochodzeniu formy w sztuce*, Państwowy Instytut Wydawniczy, Warszawa 1973.

[6] Tatarkiewicz W., *Dzieje sześciu pojęć, sztuka, piękno, forma, twórczość, odtwórczość, przeżycie estetyczne*, Państwowe Wydawnictwo Naukowe, Warszawa 1976.

Author's Note

Marcin Głuchowski, PhD, Arch.

Assistant professor at the Department of Architectural Design, Faculty of Architecture, Cracow University of Technology; Member of the Chamber of Architects of the Republic of Poland, partner in the GŁUCHOWSKI STUDIO sp. z o.o. architectural studio.

marcin.gluchowski@pk.edu.pl