Visual Perception of Architecture According to the Theory of Juliusz Żórawski

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Abstract. Visual perception is the most important psychological process which allows to perceive an architectural object. Drawing on the principles of human perception, Juliusz Żórawski - a graduate of the Faculty of Architecture at the Warsaw University of Technology and a famous Polish architect of the interwar period - formed his theory during World War II. The purpose of this article is to introduce the main assumptions of his theory. According to Żórawski, every person perceives the world in an individual and unique way. Transmission of the perceived images to another person requires working out a simplified perception code. This code is not based on the meaning of context but on the sequence of perceptual decoding, common for all people. The most important element in this code is the arrangement of characteristic points, called “communication points,” which hold the viewer’s attention. Decoding the points as a sequence of glances, which move from a point to a point creates a set of straight lines. This set of straight lines is the code for reading the spatial structure of an architectural object. Therefore, an important element of any architectural design is to propose a set of highly explicit focal points. In conclusion, the essence of Juliusz Żórawski’s theory lies in the characteristics of the human psyche like the search for straight lines, trying to understand what is being seen, the perception of the outside world as a set of arrangements against the surrounding background. It should be emphasized that the main elements of his theory are confirmed by contemporary neuropsychological findings. This shows how many disciplines of science the art of architecture comprises.

1. Introduction
Architecture is perceived above all with the help of sight. Based on the observed perception principles resulting from the psychology of vision, a theory has been formulated by Juliusz Żórawski, one of the most important creators of the Polish avant-garde modernist architecture of the inter-war period. The purpose of this article is to approximate the assumptions of this theory. J. Żórawski presented his ideas regarding the perception of form in his doctoral thesis defended in 1943, during the Nazi occupation, as a part of the secret activity of the Warsaw University of Technology. A book edition of the work entitled "On building architectural form" [1] appeared almost 20 years later, in 1962 J. Żórawski developed his theory in an unfinished work regarding visual communication in architecture, elaborated in the form of a typewriting in 1966, and found only in 1998. A book edition of the work entitled "Simple grid. On the over-individual architecture "]2] was published in 2012 under the scientific supervision of J. Krzysztof Lenartowicz.
2. An outline of biography and the character of the architectural creativity of Juliusz Żórawski

Juliusz Marian Żórawski was born on October 2, 1898 in Krakow. He was a son of the eminent mathematician Kazimierz Żórawski (1866-1953), among others, professor of Jagiellonian University and the Warsaw University of Technology [3]. He started studies at the Faculty of Architecture at the Warsaw University of Technology in 1919. In 1927 he obtained the degree of a certified architect. After graduation, he worked as an assistant at the Faculty of Architecture of the Warsaw University of Technology under prof. Czesław Przybylski at the Department of Monumental Design and prof. Karol Jankowski in the Department of Rural Design. He belonged to the avant-garde of architects of the inter-war period. He was a declared modernist in the direction of structuralism and functionalism, applying 5 principles of Corbusier's architecture. The main period of his design activity was in the 1930s XX. During this time he participated and won numerous competitions for public objects. His first project was the Atlantic cinema in Warsaw, built in 1929-30. He designed many residential buildings with innovative form and technical solutions as well as buildings with exclusive finish. One of the implementations of this type was the Apartment House in Warsaw at 28, 6 sierpnia street (currently 4 Nowowiejska street). It was erected in 1933-35 as the first functionalist apartment building in Warsaw with 62 small, luxuriously furnished flats for rent. Another building of a similar character is the Wedel tenement house at 28 Puławska street, erected in 1935-36. It has an experimental half-skeletal structure, allowing for the implementation of modernist principles: leaving the open ground floor, an independent and extended elevation, and a flat roof with a recreational terrace. The most avant-garde implementation of the residential house according to J. Żórawski's project is a five-floor tenement house at 3 Al. Przyjaciół street, designed for the "Ciechanów" Sugar Factory. It has a skeletal structure, a retracted face on the first and last floors, and a completely glazed façade and a flat roof with a recreational terrace. This building gives the impression of an extremely light and elegant "apartment machine". J. Żórawski also designed housing development for poorer communities. An example could be the "Glass house" erected in 1937-39 at 34/36 Mickiewicza street in Warsaw for the Mutual Insurance Institution. This five-floor L-shaped building has a long, modernist façade, over 100 meters long, with banded windows, a low ground floor and a flat roof with a terrace. Another object serving to meet social needs is the school complex at Różana street dated 1934-35. J. Żórawski also participated in the implementation of large-scale projects, for example, he worked in a team under the direction of Zygmunt Plater-Zyberk on the urban planning and architectural foundation of the Horse Racing Track in Służewiec, Warsaw, in the years 1937-39.

After participating in the defensive war of 1939, J. Żórawski spent the period of occupation in Zakopane, where he designed residential and leisure facilities. In the years 1941-43 he remained in contact with professors of the underground Warsaw University of Technology. He wrote his doctoral thesis under the supervision of prof. Władysław Tatarkiewicz and in July 1943 he defended it. It was entitled: "On the issues of architectural composition", concerning the contact point of the theory of architecture and aesthetics. After the war, he tried to join the group of educators at the Faculty of Architecture at the Warsaw University of Technology. Eventually he found employment in Kraków, at the Faculty of Architecture at the University of Science and Technology, created by Adolf Szyszko-Bohusz. Simultaneously with didactic work, he undertook a design work at the Central Office of Studies and Projects of Industrial Construction in Warsaw. The incompatibility of his functionalist views on architecture with the current doctrine of socialist realism caused that he gave up his job in Warsaw and in 1950 he moved permanently to Krakow. He continued teaching and worked in the Office of Industrial Construction Projects, was involved in the project of a large leather factory in Nowy Targ. In 1952 he devoted himself to pedagogical work, writing texts in the field of industrial construction, theory and history of architecture. In 1957, after a stroke, and as a result of partial paralysis, J. Żórawski focused on scientific work. In 1962 his book "On building architectural form" was published. In 1964 he became a professor of the Faculty of Architecture at the Cracow University of Technology. On November 24, 1967, after years of severe illness, he died in Krakow and on
November 28, he was buried in a family grave at the Powązki Cemetery in Warsaw. Juliusz Żórawski was a pioneer in teaching the psychology of architecture. The theory he developed is still taught at the Department of Environmental Architecture at WAPK, which is a continuation of the Department of Industrial Architecture Design that he set up [2].

3. Ideas included in the scientific works of Juliusz Żórawski

Juliusz Żórawski believed that sensations and the corresponding reactions constitute a continuous range of human experiences [1] [2] [4]. Sensations coming from explicitly formed spatial objects are easier to remember and last longer. An important factor influencing the remembered perceptual image is the emotional state of the observer. Perceived element, which evokes a stronger emotion, is perceived as more important, better remembered and returns in memories faster. It is also an important link in the chain of associations. A new spatial sensation, appearing in the field of consciousness, is classified based on previously acquired memories. It creates a new whole with the existing memory traces originating from previous experiences. Spatial perception according to J. Żórawski is an individual experience of every human being. The environment perceived as a result of perception is an internal image, a kind of individual interpretation that is not transferable to another individual. Communication between people can be based on signs and symbols, but not sensations. Only the general character of the environment can be defined, using for description supra-individual, or commonly experienced traits. The more supra-individual values the space arrangement will have, the easier and more unambiguously it will be interpreted. Therefore, according to J. Żórawski, architecture is all the more communicative, the more it has supra-individual visual elements. Hence the question arises about the principles of the language of communication used in the art of spatial creation. According to J. Żórawski, every man has an internal tendency to seek form in the perceived image. This tendency is not a learned trait, but exists in the inner "ego". What's more, J. Żórawski observes that there are no perceptual observations which would not refer to registration of form. Man has some internal inclinations to register geometrical objects: straight lines, figures and simplified geometric shapes. The understanding of the external world as a set of forms is a characteristic property of the human psyche. Man distinguishes forms based on similarity or differences in relation to internally defined geometric "mother forms". The cognitive apparatus is constantly practiced through the constantly inflowing spatial experiences. A person living among specific spatial structures receives information coming from the surrounding structures every time easier.

In the opinion of J. Żórawski, forms that can be perceived in an easy and understandable way are the natural forms for human perception. Out of the great variety of forms, some of them are interpreted clearly, while others are ambiguously understood. Therefore, J. Żórawski divided forms into two groups: "cohesive forms", characterized by unambiguity and "free forms", with weak internal connections. The categories of cohesion and freedom define the degree of internal organization of the components of the form. According to J. Żórawski, man has a natural tendency for cohesive forms. The consequence of this tendency is the necessity of unambiguous and strong formation of architecture. The second feature discussed by J. Żórawski is the strength of form. It depends on the texture, weight, size and scale, however, to the greatest extent, on its cohesion. The stronger the form, the more it is cohesive and easier to see. Such a form stands out in the foreground, and all parts serve to emphasize its role. When a form becomes a part of a larger whole, a new form is created that is more than the sum of its components. If the whole complex has free arrangement, a change in a fragment does not affect significantly the reception of the whole. However, if the whole is compact, addition of a new part deforms the structure of the whole. Forming of architecture is the process of composing of functional and structural parts in its entirety. Play with the very architectural form consists in applying such proportions between cohesion and formal freedom, which best corresponds to the designed function of the object. The simplicity of the architectural form, according to J. Żórawski, does not mean poverty in terms of the number of elements, but it defines the highest degree of unambiguity, that is, such forming that is the most precisely specified. Cohesive forms tend to
simplicity, which is a synonym of peace, certainty and decisiveness. J. Żórawski noticed that the property of the human mind is to perceive the form as separate from the background. To emphasize the coherence of the form, its background should be shaped more freely. Man has a limited capacity of the cognitive apparatus. Therefore, elements arranged in an orderly way are easier to perceive. The type of such ordering is the architectural rhythm, that is, location of repetitive elements with common formal features in one straight line, maintaining constant distances between them. According to J. Żórawski, combining of elements into repeated units with a specific rhythm causes the form to become more cohesive.

According to J. Żórawski, operation of the perceptual apparatus primarily consists of perception of important points in the spatial structure system. Man can notice these points in a certain logical order. During the perception of the environment, the eyesight is moved from point to point along the shortest lines - straight lines. By crossing them a grid of straight lines is formed defining a spatial form. Thanks to the system of points and lines, the observed image is remembered with minimal use of elements. It is economical in terms of memory usage [4]. The important points interact - correspond between each other - become "corresponding points". In the opinion of J. Żórawski, the transfer of spatial values with the help of architecture consists in adding new points in such a way as not to disturb the balance between the correspondence points already existing in the environment. All point correspondences in a simple grid merge into constellations based on the simplicity of geometric relations (points in the vertical, points in the level, points in the corners of the square) or on the principle of quality of attributes (size of points, their color, special shape). The points of the straight lines grid that define the image of the perceived structure lie mostly on the edges and in the corners of the foreground elements. Since the human cognitive apparatus has its limited capacity, the growth of the number of correspondence points is allowed only within the limits of the cognitive and memory capabilities of the observer. Each subjective grid of lines by means of which a person orientates himself in the surroundings and obtains visual information about spatial structures always contains the most important point from which all correspondence begin. J. Żórawski called it the main point. Underlining the main point causes that the form is perceived as more cohesive, while accentuating of another point makes this form more free. More visually communicative are all those architectural systems and structures in which the main points are clearly defined. The architect's task is to logically emphasize all important places and elements using forms, in such a way that its architecture is most easily perceived and understood by the observer.

According to J. Żórawski, the straight lines grid, though subjectively perceived, is an objective record of the arrangement of correspondence points. This layout is a pattern carrier. It allows you to transfer a spatial matrix to the recipient's consciousness. This matrix evokes subjective memory traces of the spatial structure with a similar arrangement of correspondence points. In this way, it allows you to recall a series of sensations coming from the perception of a similar spatial configuration. Each view of the landscape is based on a galaxy of arbitrarily chosen points. Recalling the landscape, the observer remembers this very galaxy of points. In this way, the straight lines grid is a supra-individual way of communicating spatial values to internal subjective fields of consciousness. Slight shifts of the system of points constituting the skeleton of straight lines grid cause appearance of new correspondences between points. By setting the points in the spatial structures, you can impose on the viewer the way and the order of perceiving the points in the straight lines grid. It should be remembered that the clearer the link between points in the grid, the easier to remember is the spatial layout.

According to J. Żórawski, beauty - "the embodiment of disinterestedness" - does not come from either the strength of form nor its cohesiveness and uniqueness. The main task of the architect is not only to generate the objective beauty, but to shape an appropriate environment of human society.
4. Results and discussion

J. Żórawski's views on the subjectivity of human cognition and the difficulties in interpersonal communication refer to the basic and constantly recurring philosophical problems. The proposal to treat elements of spatial structure - "straight lines grid" as a simplified perceptual code used to convey objective, common for humanity information is an innovative approach to that problem. It is an alternative to postmodernist understanding of meaning, depending on the cultural context. The role of J. Żórawski in the application of the psychological theory of "form" in the field of architecture, first of all the rights of closeness, good continuity and good form should be emphasized. According to Władysław Tatarkiewicz [1], the basic component of the Gestalt theory, followed later by Żórawski, was treatment of perception not as passive observance but as active operations with holistic spatial forms. J. Krzysztof Lenartowicz pointed to the four main tendencies observed in human life, noticed by J. Żórawski and proved on the basis of psychological arguments: geometrization, limited number, strong form and cohesive form [2]. Recent studies in psychology and neuropsychology confirm some of these findings. Geometrization of the retinal image has been proved in the studies of Hubel and Wiesenad (Nobel Prize in 1981) regarding the favoring of certain directions of the line. Restrictions in the number of perceived elements are confirmed by Miller's studies on short-term memory capacity from 1956, which refer to the maximum number of 7 +/- 2 memorized components. Neisser's perceptual cycle from 1976 indicates to the large importance of the emotive attitude in facilitating access to memory data, which was also observed by J. Żórawski.

5. Conclusions

The theory of architectural perception developed by Juliusz Żórawski is an innovative study ahead of similar works in the field of the psychology of cognition. It should be emphasized that many of the original conclusions were formulated based on his own reflections resulting from the experience gained during the design practice. The main elements of the presented theory of Juliusz Żórawski find confirmation in modern discoveries of psychology and neuropsychology. This shows how many different disciplines of science are contained in the art of architecture.

References

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