Multi-Level Viewing Points in the Urban Structure of a City

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Abstract. The authors of this research substantiate the statement that the proportional capture of the visual plane of the city panorama will be in constant dynamics in the context of both the planar expression and 3D observation of the volumetric solution of the spacial combination. A constant change of the viewing angle provides for the limitless quantity of viewing points concentrating on a cumulative picture of the angular perception. The article covers applied aspects of design and perception of the vertical and horizontal sector of capturing of the viewing panorama allowing obtaining multi-proportional correlations of the diagonal perspective and plane that in its turn impacts the general perception of the urban structure as a whole. The paper shows the importance of the spherical and angular range of the visual location that impact the psychological aspect of perception of the architecture as a whole, describes the dimensional and scale comparison of the main functional zones of a city, activation and concentration of accents of its mass with respect to the area of the general layout with addition of angular aspects of gravitational laws and identification of fundamentals of the linear and tonal perspective.

Introduction
The significance of viewing points in the city planning is conditioned by enrichment and diversity of visual perception of the overall panorama of the city. Diversified unexpected perspective angles bring an intrinsic urbanized effect to the structure of the city. Each separate viewing point invites to contemplate inimitable perspectives and views and allows avoiding the monotony and sameness in perception of the visual space. The urban environment that is saturated with viewing points substantially enriches the urban structure of the city and opens opportunities for the aesthetic meaningfulness of the horizon. This paper looks into the issues of the visual value of viewing points and their angular panoramic perception.

Analysis of recent publications on the subject
In their work, the researchers Kuzmych V., Petrovska Y. touch the issue of the harmony of a city image, design of urban planning elevations giving the possibility to obtain maximally harmonious correlations and proportions at the visual level by using software applications for development of the project documentation in the sphere of urban science (Kuzmych, Pavliv and Petrovska 2018). The researcher H. Koznarska describes the importance of viewing points for perception of the image of a city, identifies principles of their location and importance in perception of the image of a city (Koznarska, 2012). The analysis of the scenery opening of views of the landscape park in Kyiv by means of investigation of three pedestrian routes was covered by I.O. Sydorenko and V.V. Minder.
The researchers compiled schemes of the interchange of various types of spaces with identification of the amount of interchanges of the light and shade (Sydorenko, Minder, 2018). In his work, Ye. Vodzynskyi discussed the issue of the analysis of visual perception of architectural monuments, underlines the importance of quantitative assessment and described instruments of such assessment (Vodzynskyi, 2010). The researcher Donatella Scatena considers the perception as an important element in the process of formation of an architect or city planner. The action of perception is crucial for understanding and formation of an environment they work in. This ability is acquired by a specialist by way of study and research, experience and observation that allows him or her to shape architectural spaces in future (Scatena D. 2018). The researcher Dalia Dijokienė offers insight into the problem of the urban design as a component part of the art and architectural science and an indisputable direction of activity of a specialist in architecture. She assumes that cities play one of the most crucial roles in the state economy, while the urbanization offers a variety of prospects for a state (Dijokienė, D. 2013). At the same time, issues of the large-scale comparison of the main functional city zones with the total area and understanding of the panoramic layout in the urban science still remain unexplored. As well, the issue of formation of the architectural environment in conditions of a large city is still not covered.

Author contributions
This publication is written by two co-authors who expanded the existing materials of the research in the area of the urban science. Vasyl Kuzmych developed a compositional scheme of the interchange of the level of angular observations using the example of the observation wheel, as well as the scheme of spacial location of settlement objects. He covers the issue of the role of viewing points in multi-level angular perception of the urban environment. The researcher Yulianna Petrovska describes the notion of the panoramic layout on the urban science and the development of the architectural environment in conditions of a large city.

Basic Theory Part
The angular horizontal perception of a human takes place within the limits of the visual location that comprises 150 degrees. A human can examine the surrounding objects both in the horizontal and vertical planes. The best example of this is the observation wheel, where one can see a quick change of the above ground level within a short time and observation of panoramic views with account for viewing angles (Figure 1-2).

In the end, we obtain the ability of volumetric and spacial spherical perception of surrounding panoramas. However, the zone of the spherical perception is partially limited by the blind zone at the angle of 30 degrees. Thus, a human obtains the maximum visual information about the architecture within the observation range of 90 degrees. The sector of perception within the framework of the horizontal plane is more important for the human living. The aspect of the vertical angular perception impacting the locative function of the gravitation is also important. The mechanism of the spherical perception functions constantly and gives possibility of the spatial orientation. As a result of the acquired experience, the vertical angular aspect impacts the psychological perception of the panorama. A human organism feels the basic instinct of feeling of the foundation as a land plane in the balanced state. Basically, this feeling will depend on the dimension and area of the support foundation, where a human feel safe. Later on, humans adapted and mastered these factors on such construction elements as balconies and terraces. They are psychologically perceived by us as foundations of stability and balance. The angular perception of the space is no less important. In case of a change of the vertical perception angle, a feeling of stability can be retained irrespective of the level of observation subject to preservation of the body balance.
Figure 1. The London Eye from across the River Thames (Khamtran, 2009).

Figure 2. Compositional scheme of the change of the level of angular observations by the example of the observation wheel. I – top view, plan, master plan; II – bird’s-eye view; III – panoramic view; IV – axonometric view; V – level view; VI – horizontal view; VII – ground-level view; VIII – zero-level view; IX – sub-level view (the scheme was developed by Kuzmych).

These parameters also include characteristics and features of types of the space. Increase of the area of the vertical capturing of the panorama by the human eye adds a certain monumentality, grandeur and sacral character to the layout. An important role in synchronization of the visual apparatus is played by the collaboration of cleido-mastoid neck muscles and extraocular muscles that keep the body in the state of equilibrium. Therefore, the level of the angular perception which differs from the usual one that retains the horizon line will be characterized by different psychological characteristics of perception of the environment. If we present it in the form of the received signal, the wider range of the tonal load of reflected flows will be perceived better. Functional and ergonomic factors are also appended by visual and psychological factors that jointly provide for the complex perception of the architecture as a whole. The perception of the architecture on the rugged relief has essential visual advantages over the plain territories. Enrichment of an object by deeply spatial surroundings gives it positive energetic advantages enlarging the range of perception.

Closeness of the space negatively impacts the human activity. In this case, the distance from the object or the point of perception of the environment also matters. The optimal structure of urban development must take into account not only the functional and planning structure, but also the visual and spatial one. The free scheme of scanning of spaces will always be the most comfortable option. Enclosed confined spaces of the short signal character are used as a mechanism of negative psychological pressure.

Analyzing various schemes, options of angular interchanges and panoramic views, we should mention that the composition of horizontal, vertical and diagonal character of perception envisages amplification of the diversity and development of building of architectural objects (Figure 3).
Respectively, the diagonal development in the context of the visual perception is more expressive than the combination of horizontal and vertical ones. Going of visual stimuli of the human eye outside the horizon level gives the image a certain degree of monumentality and sacral character. This factor was taken into account in the process of construction of sacral or temple buildings. For intensification of effects of perception of these objects, the builders also used the dominant landscape, where the groundwork was laid. A typical example of this is represented by mounds, pyramids, ziggurats.

Comparing objects in different systems of settlement or planning structures, we should note the fact that these options are characterized by various results of visual perception of the environment. In case of a horizontal low-rise housing system, the density and visual distances are relatively small. Such compositional approach was imposed, first of all, by the development of construction and climatic conditions. The modern construction technologies allow building of vertical systems of settlement giving the preference to large-distance perspectives. In case of a vertically horizontal option of construction, unequally distant perspectives are resolved depending on panoramic observations. In case of a horizontally terrace scheme of construction, the mechanism of visual perception is activated that is characterized by a broad range of the visual location.

Another option of the visual location is the scheme envisaging overlaying of multi-faceted, combined views and perspectives. A combined ziggurat and horizontal system of construction can be an example in this case. This scheme can be characterized by monumentality, grandeur and sacral character. For a long time, architects use this technique in pyramids, ziggurats and sacral buildings. This option of the urban development is rather popular and actively enriches the visual panorama of a city.
Diversification of angles of perception of the visual panorama

On the example of the observation wheel, a viewer can better understand the differentiation of viewing points in the process of perception of the urban environment. Typical characteristics of viewing points are their location above the ground, at the ground level or under the ground level as a plane. All these positions will have interim levels that will differ by the angular position relative to the ground level. The basic position of viewing points is characterized by the level of height at which a human visually perceives the surrounding environment. The conventional average level comprises 1 meter 60 centimeters. Such constant is used for the level of drafting of architectural plans. At this level, a viewer typically observes the environment. An important factor of this level is a natural feeling of gravitation ensured by the vestibular apparatus. We should draw pay attention to the angular feeling of the horizon line. According to the theory of evolutionary development, a human body clearly perceives and controls the verticality of its position. This ability is ensured by the gravitational attraction of the Earth. The next unchanging factor is the mechanism of perception of the horizontal axis expressed in the visual feeling of the horizon line. Therefore, the most important factor is the feeling of verticality and horizontality of the human body position. In case of a change of the height above ground, a viewer receives more axonometric or 3D picture as opposed to the frontal or facade projection. These axonometric views will differ from the height above ground, so architects introduced a notion of “bird’s-eye view”. Of course, the height of the bird’s-eye view is rather conventional. In the context energy viewing flows, the range of tonal correlations increases greatly thus enriching the overall perception of the situation. Since the axonometric perception from the bird’s-eye level is atypical and uncharacteristic for humans, in these cases the mechanism of visual therapeutic action is activated. For example, mountain trips and observation of the horizon from dominant surfaces are accompanied by certain positive signals based on non-standard positions and emotions. We recourse to certain abstraction for perception of the axonometric-angular view of the environment with conventional characteristics that partially ignore the feeling of gravitation. Wide panoramic and angular reach includes a large angle of the horizontal range. Layering of tonal layouts combines a summary panoramic view. Apart from that, sub-level types of the urbanized industry became widely popular owing to the current construction possibilities. Subways, underground parking lots, shopping and entertainment centers and other technological buildings are based on the principles of angular-and-altitude character. Looking at such objects, people must lift up their heads and change the viewing angle, thus creating non-standard visual signals that are not typical for the biologic nature of a human. The typical techniques of use of viewing points as tools of the architectural approach include the stylobate scheme of the viewing monumentality, creation of podiums, scenes, terraces, using semi-basement parts of buildings. Such techniques provide a possibility of higher angle of perception that improves visual qualities and adds monumentality. In many situations involving gatherings or concentrations of people, such as in concert, cinema or sports complexes, such tools provide a possibility of a targeted programmed observation. Elevations of surfaces of the angular perception ergonomically ensure uninterrupted high-quality perception of observed objects in exhibition complexes or lecture and audience halls. At the same time, these observed objects are placed above the horizon level.

The role of viewing points in multi-level angular perception of urban environment

Viewing points are inseparably connected with conditions of the gravitational stability. Standing of a human on different surface levels or artificial created constructions leads to different perceptions of the linear-and-outline contour and tonal-and-coloristic filling of the environment. Therefore, a change of the multi-level gravitational association leads to a change of the tonal perception of the environment. Accordingly, the set of short distance signals received at the level of the current area will be replaced by energy flows of long-distance perspectives of the open space. Such change of the height and angular observation of the panorama will provide for a change of energy viewing points, thus amplifying and enriching the general impression. In conditions of the existing urban structure, we can observe attempts of changing and amplifying of angular points and heights of the overall...
perception of the environment. Using the existing landscape dominants, architects try to maximally expand the horizon panorama. Development of technological and constructive possibilities of the construction industry provided visually new horizontal urban panoramas, thus enriching the energy chord of the surrounding environment. All this leads to increase of therapeutic energy flows. From the ancient times, people organized viewing points that were non-standard from the point of view of the angular perception, which received the heightened attention of viewers.

Types of spaces and conditions of multi-level perception

Creation of multi-functional spaces is inseparably connected with the filling and structure of a city. The aspiration to persevering of maximally open spaces remains an important factor in designing of architectural environments. Closed or partially open spaces have a less positive impact on the biological rhythm of perception of energy and visual communications. In these cases, a change of the angle of visual adaptation will be helpful. Adjustment of the visual perception and focusing at an object can improve the overall image of perception. Rotating adjustments of the sector of perception of objects neutralize the monotony of signals of visual location. In this case, a technique of using transparent external elevators can become useful from the point of view of constructive decisions. This will neutralize the feeling of oppression in closed spaces. The speed of external elevators will help to diversify perception images, enriching the overall viewing flow and avoid the monotony caused by being in a closed space. High-altitude options of using of external elevators neutralize the impression of the closed interior space with re-orientation at open exterior signals. The factor of the peripheral viewing angle will be relevant, working as a factor of visual limitation of contours of the perception image. The lesser distance to objects provides for the more sharp and accurate “readability” of the architecture as a whole.

The notion of the panoramic layout in the urban science

The panorama provides for the layout of city viewing points summarizing different locations of architectural objects in the space or in the environment. The maximum angle of horizontal capturing is caused by availability and grouping of certain urban functional zones or complexes. The composition of a panorama is formed at the account of the planning structure of a part of a city that is directly connected with the unity of the functional structure and the master plan. Very often, the structure includes administrative, residential, manufacturing and recreational subgroups united in a single function and task of the settlement structure. The basis of the visual presentation is concentrated on the functional zoning of a city thus expressing the capturing angle, range of observation and significance of a certain group or housing complex. To provide better and more substantial information on a part of the urban structure of a city, a focus point and a vertical angle of master plan observation is chosen and adjusted. Each specific planning of the structure requires the most appropriate viewing point in order to maximally express the compositional character and function of a city. The panorama can capture both a partially fragmentary range and a summary layout that captures the most typical planning and high-altitude urban structures. Therefore, an architect includes into the panoramic presentation the accentuated objects that should be emphasized by expressing the character and height of the buildings in a city or residential group. As a rule, such compositional decisions are subordinated to and represent the functional and planning structure of a city that express not only the horizontally planar structure of the master plan, but also the altitude-and-level characteristics of planning objects. Due to its orthogonal character, the panorama gives a feeling of deeply structural correlations of objects in the urban environment. In other words, it expresses the scale and dimensions of a city.

Architectural environment in conditions of a large city or metropolis

The high density of the urban structure and creation of artificial open spaces essentially change the aspect of observation and perception of the environment. In this case, a human intuitively tries to look up, thus changing the feeling of staying in the closed dense space to the feeling of liberation by entering into an open space. On densely built streets, where focusing of a look at a certain object takes
place intuitively at the level of the psychological perception and obtaining of energy from the open space, a human eye looks for the energy of free flows. At the level of psychology, closed spaces and environments were always perceived with fear having a negative and depressive impact. Automatic search for larger distances is caused by the biological need to receive another range of frequency of energetic radiation inherent to humans.

**Conclusions**

In the current context, people become dependent on the density of construction caused by high prices for land and at the same time lost the battle at the visual and psychological level. Transfer from one closed space into another, more opened one, has become a characteristic feature of activity of the society. Attempts to partially solve the problem of space in the architecture began from using balconies, terraces, patios, penthouses, aerariums, and swimming pools. Analyzing the current architectural and construction industry, we can observe repeated transfers from one closed space to another. A window and a balcony are the best typical inventions. They give possibility to neutralize the feeling of the closed space by opening multi-distance views and ensuring the natural insolation. It’s typical for people to perceive visual characteristics of the open space, therefore they feel attracted by the leisure in the open recreational space with its energetically positive aspects. Communication schemes of transfer from the place of living to the place of work, as well as the technology of manufacturing are basically associated with closed environments. The natural need in the open space was artificially replaced by the necessity of the closed environment. Transfer from the closed space of a living space is accompanied by the existing necessity of communication constructions, such as corridors, elevators, escalators, with transfer to closed spaces of transportation vehicles. The mirror-like nature of commuting ways similarly limits the ability of being in open natural environments. It is very important to have a green recreational zone of the urban forest type that fundamentally changes the energetic base of viewing points broadening flows of the positive visual character.

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