

# Smart and Emotional – the City as a Work of Art

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## 1 ABSTRACT

Designing a city or its part as a work of art comes up against the need to understand two circumstances - the method of depicting the artistic space in the real physical space of the city and the programming method of perceiving the urban environment in the process of spatial orientation of a person in the city. This article discusses the concept of the project method under the conditional name "ART-space", which allows you to form a structural diversity or reconstruct the building of part of the city as an artistic work.

Keywords: method, composition, perception, space, dimension

## 2 DEVELOPMENT OF THE METHOD

### 2.1 Language for describing urban space

A prerequisite for adequate project programming of the perception of the urban environment from the perspective of the architect and from the perspective of the potential resident is the verbal representation of stable spatial relationships related to the human body positions, as well as the ability of a person to recognize, memorize and translate using language similar and contrastingly various objects, properties, relationships. Graphic modeling of spatial situations with the help of positioning prepositions: “in”, “inside”, “on”, “between”, “outside”, “before”, “on the one hand”, and denoting movement: “from-to”, “along”, “through”, “around”, “past”, allowed to conclude that they all reproduce the general structure of mental space, including the center of space, the axis-path and the boundary of space, which cannot exist without each other. In order to unambiguously orientate in space a person must always be on the axis-path of the space leading from one border to another through the center, along one border to the opposite border past the center. Each verbal notation marks a specific structural element of the mental space. Since a person cannot physically be simultaneously in the center and on the border of one space, the missing elements, when oriented, are constructed on the mental level.

### 2.2 Basic mental structures of space and dimensions

A feature of urban space as an environment is its fundamental heterogeneity, its filling with a variety of objects, buildings, structures, surfaces. Mentally recreated from within the city space is a topological set, which is fundamentally different from the homogeneous metric space in the visual perception of the city from a bird's eye view. A well-organized, diverse space on the layout of the area may turn out to be chaotic and monotonous in the perception of an already constructed area. In the latter case, the problem of inadequate perception of the project and reality is the problem of ignoring the regularity of the spatial orientation of a person in an urban environment and the patterns of binding in certain compositions of a building located on the route of a person at different time intervals. The physical meaning of a person's spatial orientation consists in determining his distance from key points, from landmarks in space. Such distance or dimension of space is measured simultaneously in two ways - metric and topological. The first dimension is based on the ratio of the dimensions of a part of the space and the whole, for example, the size of a building and the length of the building of a street or just the length of a segment of the path and the psychological feeling of the duration of movement. The second dimension is determined by the variety, the number of sets of buildings, parts of the area, which differ by man depending on his position in space and form the information and content potential of space. The image of the mental center of space on the plan assumes equal distance between the intersection of the paths and the center itself from the boundaries of the given space, and in topological terms the center of the spatial set should always be within the boundaries of this set. The image of the axis is provided by linking and marking the opposite boundaries of space. The image of the boundary of space implies a looping of the path from the exit point to the arrival with the designation of this place as a control point. If a person is located in the center, then four parts are uniquely recognized, four sets as at an intersection of roads; if on an axis, then two parts are on one and the other side of the path of movement; if on the border, then the perceived space consists of one set of buildings, which

can be walked around on the border of this set. Thus, using linear metric and planning topological sets and measurements, an image of distance, dimension and diversity of urban space is formed. Tying together the logic of the orientation of a person in urban space and the dimension of space, it can be stated that any flat topological space of a city and any part of it can be comprehensively perceived by linking together a system of landmarks denoting the center, axis and boundary of space determined by the distance of the current location of the observer and the location of the potential target of movement (Fig. 1). These categories should ensure the integrity of the reading of the structure of the city and in this they are functionally similar, but structurally fundamentally different from the length, width and height of the architectural visual space, which ensure the integrity of the perception of the architectural work. With that said, the meaning of the composition of the development of a district or city is to reproduce with the help of streets, buildings, the landscape, the visual design of the main categories of urban space — the center, the axis, and the boundaries of space. Structures that reproduce each of these categories on the project plan are called focused, linear, and circular. In contrast to the simplest model of space, each of the structures has its own complete set of center, axis-path, and borders, which differ in the location of the center with respect to the boundaries of space. In the linear and ring structure, the center is shifted in one direction to its borders. Since the displaced centers are located at the intersection of the paths and do not coincide with the boundaries, they will be mentally read as “correctly” located centers. Taking into account the requirement of orientation of space, in each typological structure intersecting paths must be formed by different sets or have different compositional significance.

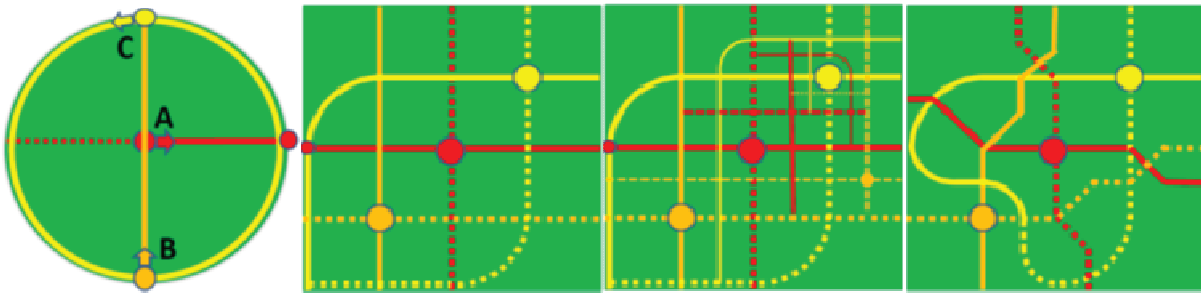


Fig. 1

Fig. 2

Fig. 3

Fig. 4

### 2.3 Derived mental structures and artistic space

In accordance with the above, any part of the city can be organized simultaneously by three compositional methods, three sets of buildings defining three topological dimensions based on the center, axis and boundaries of space and adequately recognized by man, both individually and together (Fig. 2). Accordingly, such a compositional action can be called the addition of basic mental structures and the derivation of a derivative of a more complex and more diverse structure. From this point on, the physical space receives a topological and artistic dimension, ensuring the freedom of spatial orientation of the person. Depending on the town-planning and compositional significance of each of the three structures and the position of the observer, the space of the same area will be perceived as either extended dynamic, or extensive ring-shaped, or dominant compact. Theoretically, in the area development plan, there are an infinite number of options for the mutual arrangement of the three basic structures among themselves, creating different readability and different interpretations of the spatial image. Modeling of various options for the addition of basic structures and their verbal description led to the conclusion about the principles of their optimal location, which is that any element of the structure should be located in the middle, between other closest reference points; be on the edge of the axis of another pair of landmarks; to be on the border of a closed contour-path between the third pair of landmarks. Such requirements are met by a metric lattice with an even number of cells, which “ideally” collects three basic mental structures.

The specificity of a particular composition, increase of expressiveness and diversity of space without loss of orientation quality, as well as the creation of additional artistic spatial effects can be achieved in the following ways: by depicting compression and stretching of space, dividing the structure into parts with these parts superimposed on each other (Figure 3), twisting space, the curvature of the paths of motion (Fig. 4), the formation of a fractal structure (Fig. 11). Taking into account the regularities of reading space using basic structures, the peculiarity of the composition can be achieved by violating these rules of reading and orientation, for example, by depicting a gap in the boundaries of space, creating uncertainty in the direction

of the axis, and the lack of reference points of the spatial center. All this creates the effect of local spatial-temporal uncertainty and can be considered as a plot intrigue of a town-planning work imitating the natural environment of a historical city that does not know the strict regulations of a modern construction plan.

The combination of compositional patterns with the help of basic and derivative mental structures can be called the ART-space method, which is similar to the perspective method in pictorial art, since both methods from a topological point of view increase the diversity of objects due to artistic space and ensure their coherence and compositional integrity.

### 3 APPLICATION OF THE METHOD

The use of combinatorics of mental spatial structures is possible at different stages of urban planning: 1) at the stage of reconstruction of the real urban environment as an artistic variety; 2) in the development of compositional regulations for the finished development project; 3) the use of combinatorics at the very beginning of the concept of planning and building up a large part of the city. Taking into account that pedestrian traffic is the main condition for an adequate perception of the city's territory as a work of art, for composite modeling the city area with a comfortable walking distance of 400-600 meters or an area of about 100 hectares can be optimal. The project of a Detailed Plan of a residential area on an area of 116 hectares free from building with a planned population of 12 thousand inhabitants on the outskirts of the town of Sarov, Russia was selected as an experimental composition object (Fig. 5). In accordance with the legislation, the Detailed Plan of the area approves the boundaries, parameters and functional use of the development of the plots, but does not establish requirements for the diversity of the architectural appearance of the development. Using the ART-space method while preserving the approved functional program of the district, modeling of the possible diversity of development was done in two ways: on the basis of the approved urban planning solution and on the basis of a new urban planning composite solution of the same territory.

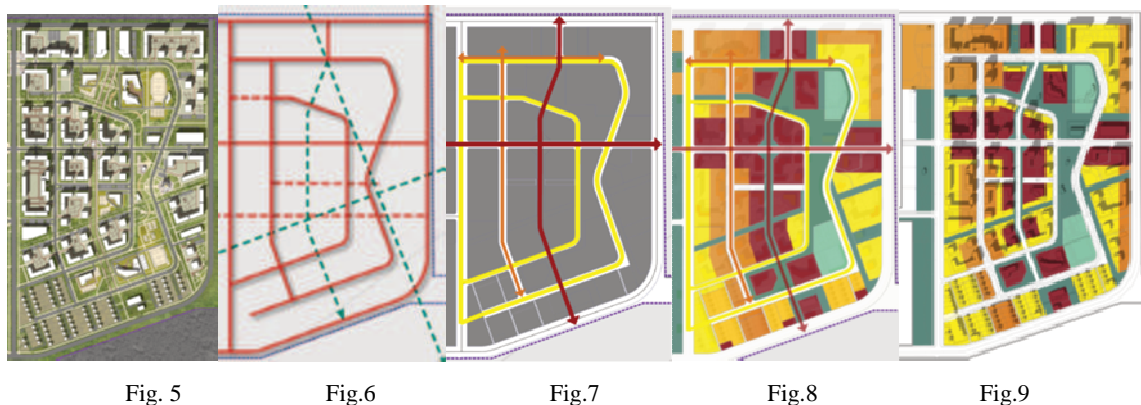


Fig. 5

Fig.6

Fig.7

Fig.8

Fig.9

#### 3.1 The development of compositional diversity on the concept of development in the approved Detailed Plan of the territory.

At the first stage, the metric grid defined by the streets and pedestrian connections, as well as the multiplicity of the spatial cells of the area (Fig. 6) are determined. Taking into account the approved spatial concept of the area, the possibility of projection of three basic mental spatial structures onto the grid of the street network of the area and the definition of the main basic structure of the three is estimated (Fig. 7). In this case, the focused structure (red color) with a pronounced center has the greatest urban planning and compositional importance. The ring structure (yellow color) with a weakly pronounced center consists of two contours connected by green areas. The linear basic structure (orange color) has a pronounced main axis adjoining the additional axis in the place of its center. But at the same time part of the linear structure is partially combined with a ring structure, which will lead to a decrease in the potential diversity of space. At the second stage of modeling, three contrastingly distinct compositional sets of territories, streets (fig.8) and buildings (fig.9) adjacent to the corresponding axes-paths of the three basic structures are formed. Each street in the area as a result acquires its own unique appearance of the building and landscape. Practically every quarter of the district is well oriented in space, having a contrastingly distinct architectural facade along the perimeter inside the courtyard space. At the third stage of modeling, the diverse structure of the district

formed at the second stage should be read by internal paths of movement. One of the tasks is to ensure the semantic orientation of straight sections of streets directed “from object A to object B” in order to achieve the architectural and functional uniqueness and utility of each pair of landmarks, united by a single scenario (Fig. 10). In our case, this task was compositionally solved by marking the building in a certain order and obtaining the effect of compression of all three typological structures (red, yellow and orange) towards their own main centers. This action ensures the free orientation of the person through the streets inside each of the three spatial systems of the area. In order to ensure free orientation and perception of the entire space of the neighborhood at each point, it is necessary to display the appearance of the building of external streets in relation to the building of each internal where the observer is. This compositional procedure is provided by the mutual marking of the development of a specific street with properties (color, architectural appearance) of the development of the nearest parallel streets. The “correctness” of the composition is achieved by creating the effect of folding the artistic space and its simultaneous compression or expansion when moving in the longitudinal direction, as well as creating the pulsating effect of the fractal space in the transverse direction, achieved using the same markers (Fig. 11). The third task at this stage of compositional modeling is to provide a visual and figurative confirmation of spatial compression and the severity of the compositional center from certain points on the plan due to the gradual terracing of the building silhouette towards the main center (Fig. 12). The considered compositions set only certain relations between the elements of the composition - the objects of construction, but do not dictate their specific architectural appearance. This is a scenario of a town planning work, but not the work itself. The integration of the three stages of the compositional modeling of a residential area is shown in Fig. 13.

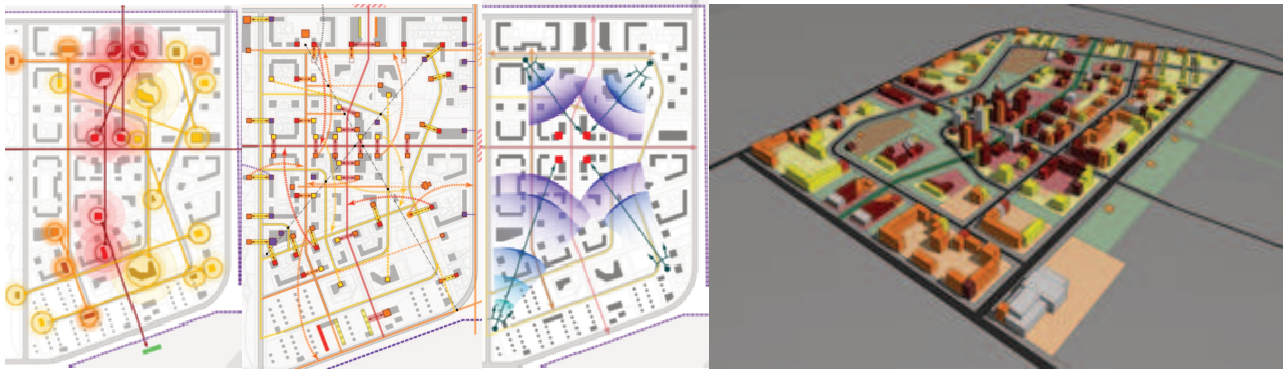


Fig. 10, 11, 12, 13

**3.2 Variant modeling of alternative compositions.**

The topological three-dimensionality of the city plan is not a limitation in the variants of composite solutions for the same territory. In fig. 14-16 shows the compositional models of the residential area of the city of Sarov with a different dominant structure, a different location of the main center, with elements of space compression already in the basic version, mutual overlapping, drawing sections on adjacent structures. At the same time, the external complexity of the layouts does not block a person’s ability to understand the internal organization of space and its orientation.

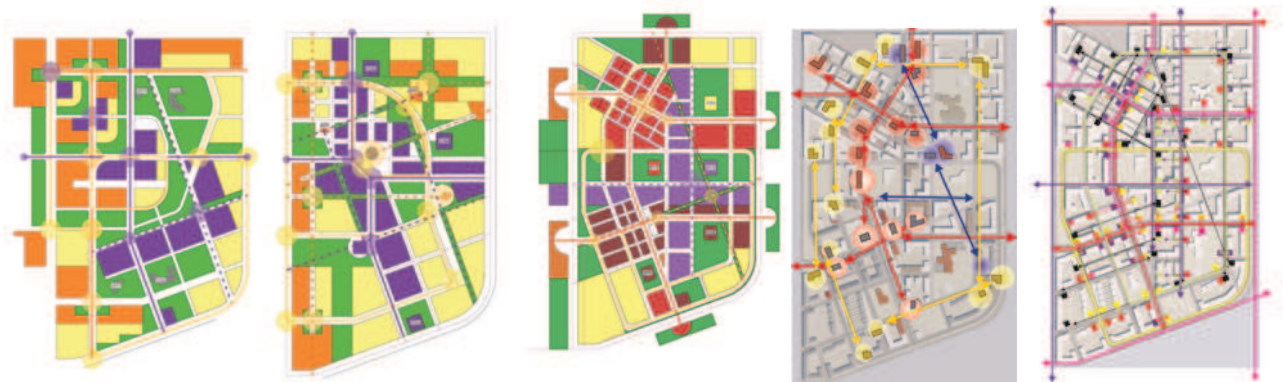


Fig. 14, 15, 16, 17, 18

In more detail, you can consider the development of the composition in Fig.16, based on a split, the imposition of two spaces as one whole. In contrast to the previous version, five types of buildings are immediately introduced here, two of which form a linear structure (red, brown), the focused structure is formed by purple buildings along with green areas, and the ring structure is indicated by two shades of yellow building. As in the previous version, the curvature of the street configuration is due to the existing engineering corridors, as well as the purely composite tasks of increasing the content of the spatial image due to the variety of landmarks formed on the axes of the movement paths (Figure 17). Compression and addition of artistic space in this variant (fig. 18) is indicated by a large number of markers in accordance with the number of basic structures — two linear, two circular, and one focused. Although the technology for marking buildings is similar to that in the previous version (Fig. 11), the degree of diversity of the composition is much higher here. Assembly of all designated composite layers, including five distinct sets of buildings, ensuring the readability of the center, axis, and boundaries (Fig. 16); three sets of landmarks on the streets inside the district (Fig. 17); and, finally, 5 sets of objects marking the artistic space that are essential for the dynamic perception of the entire space of the area in the process of movement (Fig. 18). As a result, the diverse composition of the district based on the “linear” scenario acquires the properties of the environment of a naturally developing city and does not sin with a “machine” assembly like some kind of new industrial city (Fig. 19).

#### 4 CONCLUSION

The revealed three-dimensionality of the mental topological space, consisting of the spatial center, the axis and the border, can be considered as the basis of the compositional constructions in the urban design. The formation and mutual transformation of these categories according to the proposed method “ART-space” ensures the perception of environmental diversity in the process of spatial orientation of a person and allows the urban architect to consciously create emotional complex spatial images of town planning artwork. Many historical cities such as Vienna, Rome, Barcelona and others have artistic content that is worthy of an outstanding artistic work. The differences with respect to the technology considered are in the means and method. Creating a distinguishable imposition of historically different spaces - medieval buildings on the ancient, baroque and regular spaces on the medieval structure, the artistic relationship is naturally formed

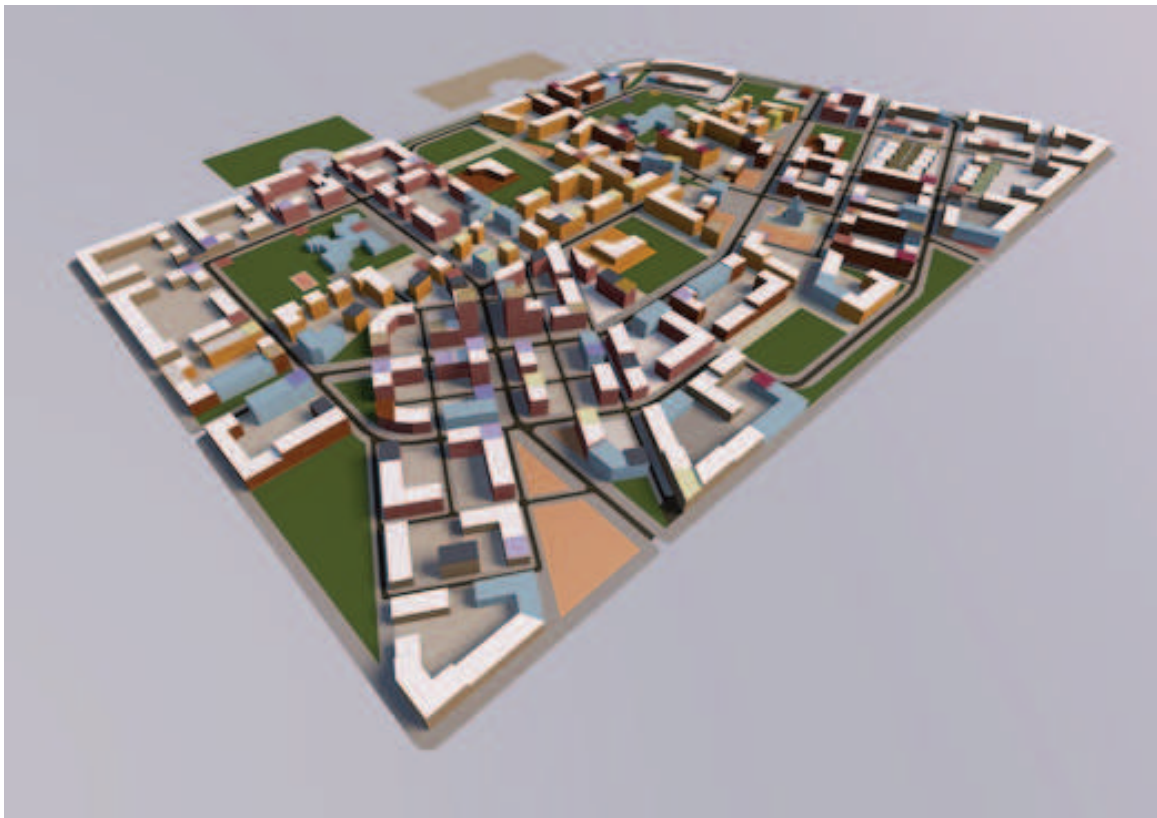


Fig.19

according to the principle of the figure and background. But for the "writing" of such town-planning works of art, centuries are needed. The implementation of a residential complex according to the considered methodology also cannot take place immediately. The digital compositional model does not determine the architectural appearance of a particular quarter and the construction of a specific street, but indicates parts of the district with which the quarter, street or building should be similar and with which they are opposite in their external and semantic qualities. Taking into account the developed system of spatial orientation, each feature placed will be constantly in the field of attention of residents and will fill the environment morphology with real utilitarian and socio-cultural content. Reading the composition of the mental space of the area, of course, implies a special type of behavior of the resident, the need for non-utilitarian perception and knowledge of their area. Awareness of the fact that a person is inside not just a comfortable residential area, but inside a town-planning artwork, can change for the better the relationship between a person and the environment.

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